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ERRATA.

Contents of Vol. XXX, No. 1.

Page ii, line 4 from bottom, for *Eupodites* read *Eupodotis*.
„ 225, line 21, for *Eupodites* read *Eupodotis*.

Contents of Vol. XXX, No. 2.

Page ii, line 27, for *Pelicanus* read *Pelecanus*.
„ 253, „ 8, for *four* read *five*.
„ 312 „ 43, for *coramandus* read *coromandus*.
„ 313 „ 8, for *asiticus* read *asiaticus*.
„ 354, Legend of Plate IX, bottom line, for *edwarsii* read *edwards*
„ 370, line 28, for *edwarsii* read *edwardsi*.
„ 376 „ 5, for *gutteralis* read *gutturalis*.
„ „ „ 8, for *gutteralis* read *gutturalis*.
„ 378 „ 12, for *Dendronothus* read *Dendranthus*.
„ 379 „ 3, from bottom, for *blackistoni* read *blakistoni*.
„ 471, last line for *leucpchœus* read *leucophœus*.
„ 472, line 44, for *garulla* read *garrulus*.
„ 473 „ 26, for *aerdeola* read *ardeola*.
„ 474 „ 35, for *Corvus splendens splendens* read *Corvus splendens zugmayeri*.
„ 475 „ 23, for *bidulphii* read *biddulphii*.
„ 483 „ 29, for *Pelicanus* read *Pelecanus*.

In the Reviews Hume's initials are variously given; it should be A. O. Hume.

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ERRATA

Page ii, line 4 for *marilla* read *marila*.
,, 517 legend *for* fig. 4 *read* fig. 5.
,, 520 line 5 from bottom for *yarkandenisis* read *yarkandensis*.
,, 603 ,, 3 for *Tersephone* read *Terpsiphone*.
,, 604 legend for *Nycroca* read *Nyroca*.
,, 677 line 35 for *fusciphaga* read *fuciphaga*.
,, 682 ,, 21 for *xanthorhvnchus* read *xanthorhynchus*.
,, 688 ,, 11 from bottom for *Psitaacula* read *Psittacula*.
,, 688 ,, 32 for *Rostratulla* read *Rostratula*.
,, 703 ,, 2 for *marilla* read *marila*.
,, 703 ,, 3 ,, ,, ,, ,,
,, 726 ,, 33 for *Phaleropus* read *Phalaropus*.
,, 728 ,, 25 for *Hirunda* read *Hirundo*.
,, 729 ,, 35 for *Caladris* read *Calidris*.
,, 729 ,, 37 for *Phaleropus* read *Phalaropus*.
,, 787 plate illustrating *Kleothrips subramanii* should face page 789.
,, 798 line 4 from bottom for *garulla* read *garrula*.
,, 799 legend ,, ,, ,,
,, 893 line 6 from bottom for *ruficollies* read *ruficollis*.
,, 896 ,, 5 for *Accipier* read *Accipiter*.
,, 926 legend for *Epopa* read *Upupa*.

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BY

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PART XXXVIII.

(*Continued from page* 863 *of Volume XXIX.*)

TETRAOGALLUS HIMALAYENSIS HIMALAYENSIS.

The Himalayan Snow-cock.

? *Lophophorus nigelii* Jard. and Selb., Ill. Orn. pl. 141 (nec. id. pl. 76).

? *Tetraogallus nigelii* Gray, Ill. Ind. Zool. ii, pl. 46 (1834), (Himalaya Mts.); Vigne, P.Z.S., 1841, p. 6 (Kashmir and Tibet).

Tetraogallus himalayensis Gray, P.Z.S., 1842, p. 105 (Himalaya); Gould, B. of A., vii, pl. 30, text (1853); Adams, P. Z. S., 1858, p. 501, id, ibid, 1859, p. 186 (Kashmir and Ladak); Jerdon, B. of I., iii, p. 549 (1863); Beavan, Ibis, 1868. p. 382, (Simla); Hume, N. and E., p. 535 (1873); Hume and Marsh., Game B., India, i, p. 267, pl. (1878); Biddulph, S. F., ix, p. 358 (1880), (Gilgit); id, Ibis, 1881, p. 93 (Gilgit); Scully, ibid, p. 586 (Gilgit); Marsh., ibid, 1884, p. 433 (Chamba); Oates, Humes' N. and E., iii, p. 426 (1890); Ogilvie Grant, Cat. B.M., xxii, p. 106 (1893), (part); id, Hand-b. of Game-B., i, p. 86 (1895); Oates, Man. Game-B., i, p. 201 (1898); Blanf., Avifauna B.I., iv, p. 143 (1898); Oates, Cat. Eggs. B.M., i, p. 31 (1901); Buchanan, J. B. N. H. S., xv, p. 131 (1903), (Kashmir); Fulton, ibid, xvl, p. 62 (1904), (Chitral); Lonnberg, Arkiv, Zool. Band 2, No. 9, p. 9, pl. i (1905); Wood, J. B. N. H. S., xvii, p. 945 (1907), (Kashmir); Magrath, ibid, xviii, p.298 (1908), (Hazara); Whitehead, Ibis, 1909, p. 269 (Kohat); Perrau, J. B. N. H. S., xix, p.

920 (1910), (Chitral); Whitehead, ibid, xx, p. 969 (1911), (Kohat); Appleford, ibid, xxi, p. 1084 (1912), (Gilgit); Hingston, ibid, xxviii, p. 571 (1921), (Dharamsala).

Tetraogallus caucasicus Gray, (nec. Pall.) Cat. Hodgs. Coll. 1, p. 126 (1846), (Nepal).

Vernacular Names.—*Kullu, Lupu, Baera,* (W. Nepal); *Huinwai,* (Kumaon); *Jer-monal,* (Hills N. of Mussoorie); *Leep,* (Kulu); *Galaond,* (Chamba); *Kabuk, Gourkaqu,* (Kashmir); *Kabk-i-dara,* (Persian, Afghanistan); *Utar, ular,* (Turkestan).

Description.—Forehead and broad short supercilia buffy white, ill defined and merging into the grey of the crown and nape; a line from behind the eye deep chestnut expanding into a broad patch on the sides of the neck, forming a complete necklace below the fore-neck, and a broken collar on the hind neck; a second line of deep chestnut runs from the angle of the bill, or rather further back below the cheek, meeting the chestnut collar on the neck; upper back buffy grey, faintly vermiculated with darker grey and with darker shafts; back and interscapulars vermiculated with blackish-grey and buffy white; remainder of upper plumage and wing-coverts the same with bold streaks of buff on either web of each feather, becoming more rufous chestnut on the scapulars and wing-coverts: longest tail-coverts unmarked with buff; central tail feathers like the coverts, outer tail feathers more chestnut and with broad blackish sub-terminal patches on the inner webs; primaries ashy-brown,—dark-tipped and with the bases largely white on both webs; outer secondaries with but little white at the base and the grey vermiculated with buff, this colour increasing in depth and extent until the innermost secondaries have broad pale chestnut edges and rich chestnut buff vermiculations as extensive as the blackish-grey ones; sides of head and neck, chin, throat, foreneck, and breast white, the head more or less suffused with grey and the breast next the chestnut necklace blotched with black; lower breast and upper abdomen vermiculated dark grey and buffy white; flanks and lower abdomen grey, with obsolete vermiculations and broad marginal streaks of blackish, replaced by chestnut on the posterior flanks; vent and thigh coverts dark grey and buff; under tail coverts white; lesser and medium under-wing coverts dark grey, greater coverts pale grey; ascillaries vermiculated grey-buff with black and rufous margins.

The plumage varies considerably in tone, some birds being more buff and less grey above and much more buff below with the marginal streaks more chestnut and less black; the amount of black spotting on the breast also varies greatly, young birds apparently having far more than very old ones. In young birds also the sides of the head and neck are all grey and the chin, throat and foreneck much suffused with grey whilst in many cases the grey cheeks and sides of the head seem to be always retained.

Colours of Soft Parts.—Iris dark hazel-brown; the edges of the eyelid slaty-blue; bill pale horny-brown, or horny slate; the membrane over the nostril and cere bright orange-yellow; orbital skin pale yellow; legs and feet orange to bright red; claws black.

Measurements.—Wing 280 to 212 mm., tail 173 to 193 mm., tarsus 62·0 to 64·0 mm.; culmen 28 to 33 mm.

The males are much bigger than the females. The former weigh from about 4 lbs. to 6 lbs. 8 ozs., the latter only from 3 lbs. to a little over 4 lbs.

Young birds are like the adult but much paler and duller, the white is everywhere replaced by dull grey; the crown is mottled grey with dark margins to each feather; the lower back is more definitely barred with blackish and buff; the whole lower plumage is much duller, many of the feathers being margined at the tip with pale buff; the chestnut collar and bands are absent in the very young birds and but ill defined in half grown birds.

Chick in Down.—Mottled above with brownish-black and pale dull fulvous, the black more pronounced on the head, especially in the centre of the crown; a well defined eye-streak dark blackish-brown; a second similar line from the base of the bill dividing into two below the ear-coverts; below dull greyish-white.

Distribution.—The Western Himalayas from Tian-schan, The Pamirs, Eastern Afghanistan to Ladak, Kashmir and the Garhwal Hills, where Mr. Whymper found it breeding between fourteen and fifteen thousand feet.

Nidification.—The Himalayan Snow-Cock breeds between twelve thousand and fifteen thousand feet, occasionally even as high as 17,500 feet. Apparently under no circumstances does this bird ever make a nest, merely scratching a hole in the ground in which to lay her eggs. A very favourite place is on the extreme crest of a hill just on the leeward side, and invariably sheltered by a rock, boulder, or tufts of scrubby grass. Apparently the eggs are never laid in ground covered by bushes or even by really dense grass. Preferably they seem to select almost barren sides of hills well covered with stones and boulders great and small and with short grass. The hen bird is a close sitter and frequently will not leave the nest until she is almost trodden on, especially if the person approaching is coming up against the wind. The cock bird seems to be a very devoted husband, staying constantly in the vicinity of the nest where it often may be seen perched on some elevated rock, keeping a watch against intruders, and warning the female with a loud whistle when any such approach. The eggs number only four or five as a rule, but Mr. H. Whistler and others have taken as many as seven and the hill men assert that it sometimes lays as many as a dozen. In colour the ground varies from a very pale yellowish-stone colour to a rather rich reddish-buff. In a few eggs there is a faint tinge of

green or an equally faint tinge of grey. The markings consist of small blotches and specks of reddish-brown, sparsely scattered over the whole of the surface. In a few eggs the markings are rather richer and darker, and occasionally an egg may be seen practically without any markings whatsoever. In shape they are long broad ovals; the texture hard and rather coarse-grained, though occasionally with a fair amount of gloss. One hundred eggs average 67·2 × 45·7 mm. The maxima are 72·8 × 47·0 mm. and 69·2 × 49·0 mm. The minima are 63·6 × 46·6 mm. and 67·2 × 44·0 mm. It is said that the eggs take 31 days to hatch. The courting attitude of the male is not unlike that of some of the Grouse. He crouches low down to the ground with wings slightly spread, tail depressed and feathers slightly ruffled. In this attitude, he runs backwards and forwards in front of the hen or in circles round her; the lady in the meantime, as with most other birds, looking on with silent contempt at his foolish behaviour. According to Mr. A. E. Osmaston, the breeding call is a prolonged whistle, uttered with great persistence.

General Habits.—In Summer, the habitat of this fine bird seems to be above the limit of the forest, at whatever height this may be. It ascends as high as eighteen thousand feet, though probably not often much above sixteen and, according to Mr. A. E. Osmaston, it not uncommonly descends as low as eight thousand feet, never, however, entering forest of any description. Mr. Osmaston remarks as follows on this bird's range in the Garhwal Hills :—"It is never found away from these spurs, which diverge from the main Himalayan Range, though a few birds annually frequent the bare slopes above Kheta in the Pindar Valley during the winter months. I have never seen it in any numbers except in the tract lying north of Malari and Niti, where it is fairly common and a great source of annoyance to anyone attempting to approach the wary Burhal. In the early Spring, I found it feeding on a small grass-like herb, *Gager lutea*, which grows in large quantities round deserted habitations and old camping grounds." This agrees well with what Mr. Whymper has told me about the Snow-Cock, although he appears never to have found it as low as eight thousand feet in Summer. It is essentially a bird of the open country and it seems to prefer ground on which even the grass and plants, the seeds of which it eats, are but scanty. It is a gregarious bird, and often collects in flocks of considerable numbers. Baldwin records having seen as many as 50 together below the Niti Pass and Hume adds that he himself saw, in one morning's march along the Parang-la, about 200 birds in parties of from 10 to 20. The flocks seem to form very shortly after the young birds are hatched, and several pairs of old birds may be seen together with their chicks in company. In a letter to me, Colonel A. E. Ward writes of having seen a flock, evidently consisting of three or four families, all sunning

themselves on the side of an almost bare rock hill. Chicks and old birds alike were lying on their sides with their limbs stretched out, so as to get as big a share as possible from the warmth of the sun. According to Wilson, the Snow-Cock does not descend to its winter quarters until it is driven down by actual falls of snow and other observers have, since his time, confirmed this fact and they also observed the birds still lingering in tracts already more or less covered by these falls. Seven thousand feet is practically the lowest elevation to which they ever descend, though a very large number of birds remain all the year at considerably greater heights than this. Possibly there are more birds in Winter above nine thousand feet than under it. As a bird for the table they are quite satisfactory but they give very poor sport. The flocks invariably keep one bird on sentry duty, which perches on some conveniently high rock so that he can see well all round and give the alarm before an approach is made within gun-shot. When, however, they have been left entirely alone—these places are not numerous nowadays—they are sometimes very tame, and will allow the sportsman to approach within easy shot before attempting to fly. If disturbed from a distance and not actually on the crest of a hill, the Snow-Cock almost invariably first runs up the hill until he reaches the summit or a ridge, when he and his covey take to wing. When running, they carry the tail rather high, exposing the rather conspicuous white under tail coverts. On the wing, when fairly launched, the flight of the Snow-Cock is strong and rapid, and when disturbed they will often fly considerable distances before again dropping to earth.

Referring to the enemies of the Snow-Cock, Mr. Wilson states that the Golden Eagle "is an inveterate annoyer of these birds; inhabiting such exposed situations where there is nothing to conceal so large a bird from his sight, as he steals along the hillside above them, they at once arrest his attention and are driven backwards and forwards by this unrelenting tormenter all day long. On the appearance of one of these birds, which fortunately for them are not very numerous, they seldom wait till he makes a stoop, but on his making a wheel near the spot where they are, immediately fly off to another quarter of the hill; the Eagle never flies after or attacks them on the wing, so that while he allows them little quietude while near their resort, he only occasionally succeeds in securing one."

Wilson describes their call as a "low, soft whistle, occasionally heard at intervals throughout the day, but more generally at daybreak. It is more common in cloudy weather. The first note is considerably prolonged, and followed by a succession of low rapid whistles, and it is by far the most agreeable song of all our Game Birds. This note is only heard when the bird is at rest; when alarmed and walking away, it sometimes utters, at short intervals, a single low whistle, and when it gets on the wing the whistles are shriller and

very rapid. However, far it flies, the whistling is continued until it alights and for a few seconds afterwards."

Their food seems to be almost entirely vegetarian. In addition to the herb referred to by Mr. Osmaston, they graze on young shoots of grass and on moss roots and seeds generally, but apparently grass forms the main portion of their diet. Where there is any young wheat, it is said sometimes to cause considerable damage by eating off the young blades as they appear.

TETRAOGALLUS TIBETANUS TIBETANUS.

The Tibetan Snow-Cock.

Tetraogallus tibetanus Gould, P. Z. S., 1853, p. 47 (Tibet); id, B. of A., vii, pl. 32 text (1853); Jerdon, B. of I., iii, 554 (1863), (part); Hend. and Hume, Lahore to Yarkand, p. 281 (1873), (part); Scully Str. Feath. iv, p. 182 (1876), (Sanju Pass, E. Turk), (part); Rowley, Orn. Misc., ii, p.427 (1877). (Kansu, S. Kokanor and N. Tibet), (part); Hume and Marshall, Game B. India, i, p. 275, pl. (1878). (part); Hume, Str. Feath., vii., p. 430 (1878), (part); Sharpe, Second Yark. Miss. Aves., p. 123 (1891); Ogilvie-Grant, Hand-b. Game Birds I., p. 84 (1895), (part); Oates, Man. Game Birds Ind. p. 205 (1898), (part); Blanf., Faun. Brit. Ind., iv, p. 144 (1898), (part); Branchi Ann. Mus. Zool. Acad. Imp. Sci., iii, p. 118 (1898), (part).

Vernacular Names— *Utar Utar* (Turki); *Hailik*, (Mongols); *Ganmo* (Tanguts).

Description: Adult Male.—Lores and edge of forehead buffish-grey; chin, throat and posterior ear-coverts white; crown, nape, hind neck and extreme upper back dark-grey, very finely vermiculated with buffy-white; back, rump, and lesser wing coverts like the back but with the pale vermiculations more prominent, a lunar band across the back and shoulders paler, looking as if the darker colour had been rubbed out; the rump and lower back with pale buffish margins to each feather; upper tail-coverts and central tail feathers rufous with narrow wavy bands of blackish-grey, the rufous strongly predominating; outer tail feathers chestnut or brownish-black with chestnut tips, scapulars, innermost secondaries and wing coverts like the back but with broad white or fulvous-white margins to each feather; primaries brown with pale tips increasing in size inwardly; outer secondaries broadly tipped and edged with white, forming a conspicuous white wing patch; breast white, divided from the rest of the lower parts by a band of grey feathers, edged blackish and obsoletely vermiculated with white; remainder of lower plumage white with black edges to the feathers forming streaks, broadest on the flanks and posterior abdomen; the feathers of the vent and thigh coverts principially dull pale vermiculated grey and buff with white tips.

Colours of Soft Parts.—Iris brown to red-brown; bill horny purple, the base and membrane over the nostril orange red; orbital skin and eyelid slaty-blue, legs and feet dull orange-red to deep red.

Measurements.—Total length about 500 mm.; wing 255 to 276 mm.; tail 170 to 192 mm.; tarsus 62 to 65 mm.; culmen 28 to 32 mm.

Female.—Similar to the male but with the grey pectoral band much vermiculated with pale fulvous and generally with the breast and foreneck more or less mottled with the brown fulvous barred feathers of the young bird. These latter are possibly all lost in the very old female, but there are no specimens in the British Museum without such traces.

The female is a little smaller than the male, but most skins available for examination are unsexed and the measurements given above for the male include both sexes.

Young Bird.—Similar to the adult in general character. The white supercilium, entirely concealed in the old bird, is conspicuous; the sides of the head and neck are boldly barred with buff; the feathers of the back have pale mesial streaks and the dorsal band is wanting; the feathers of the wing are mottled black and buff with white drops at the tips; below the chin and throat are white; the breast is grey, vermiculated with whitish and mottled with dark brown and buff in varying extent; the abdomen and flanks are streakless white.

Distribution.—Pamirs, Yarkand, Kashgar, through Northern Tibet to Ladak, thence probably through Northern Tibet to the boundaries of extreme North-Eastern China. Exactly where this form meets *T. t. prjevalskii* in Southern Tibet is not known, but in the East the form found at Szetchuan is *T. t. henrici*, a still darker form.

Nidification.—The Tibetan Snow-Cock breeds in Ladak and Northern Tibet during June and the early part of July, possibly a few eggs being laid in the end of May. There is practically nothing on record about the nesting of this bird. Two eggs from the Hume collection in the British Museum are exactly like those of the Himalayan Snow-Cock and measure 61 × 42·8 mm. and 63·7 × 42·2 mm. A clutch of three and a single egg in my own collection are decidedly smaller and vary between 58·8×42·4 mm. and 60·5×41·1 mm. These latter four eggs were said to have been taken in June from two nests scratched in the shelter of a boulder high up on a rocky hill, covered with scanty coarse grass, but not very far above a valley in which there was some young wheat cultivations. These eggs were all fresh. Prjevalski says: "We did not succeed in finding any eggs; only on one occasion my companion discovered a nest with some broken shells in it that evidently belonged to the present species.

"The number of young belonging to a nest varies from five to ten; and we found young ones early in August. They were very small, about the size of a Quail; whilst others were quite as large as their parents.

"Both parent birds accompany the brood whilst the young are small. They crouch on the approach of danger, or try to hide themselves between the loose stones, whilst the old ones keep on running about twenty paces from the sportsman; but when they are full grown, they try to escape by running."

General Habits.—The Tibetan Snow-Cock is a bird of even higher altitudes than the previous species. It is found up to 19,000 feet and is quite common in Summer up to 17,000 feet, wherever the snow-line melts to that height. Hume speaks of them as occurring in thousands during October in the Sanju Pass, evidently making their way to lower levels on the approach of Winter. Even at this season, however, they appear to keep, for the most part, between 10,000 and 14,000 feet, whilst in the valleys of the interior of extreme Northern Tibet, they are said to wander somewhat lower. Like the other birds of this genus, they collect in flocks immediately the young are hatched, sometimes two, sometimes more, coveys joining force. According to Scully, Prjevalski and Henderson, although the birds thus keep to the most desolate regions, they are not shy, and until repeatedly fired at and frightened, are easy to approach. As usual with Game Birds, when it is possible they prefer to run up-hill when disturbed, instead of flying and will not take to wing until pressed to the top of the mountain or hill. They are strong, quick flyers, but for their size are not hard to knock over. They get very fat in the Autumn and are then good eating.

Prjevalski gives a full but rather extraordinary description of its notes. "The voice of this Sand-partridge varies in the following ways: (*a*) when at rest it utters a note resembling that of the female Barndoor fowl, only louder, occasionally interrupted by a peculiar whistle, something like that of a Snipe; (*b*) when alighting, it calls several times in succession, sounding like *click, click, click*; (*c*) when settling down on the ground it makes a noise that sounds in this way *Goooo, goooo*, several times repeated; and (*d*) when collecting its frightened young it whistles in a manner which is quite distinct from the above mentioned sound."

Tetraogallus tibetanus przewalskii.

Prjevalskii's Snow-Cock.

Tetraogallus tibetanus Rowley, Orn. Misc., 11, p. 427 (1877), (Kansu); Oates, Cat. Eggs. B. M., i, p. 31 (1901); Walton, Ibis, 1906, p. 63, 248 (S. Tibet); Dresser, ibid, 1906, p. 346; Bailey, J.B.N.H.S., xix, p. 523 (1909), (Gyantse, Tibet); id, ibid, xii, p. 178 (1911); id, ibid, xxii, p. 367 (1913), (S. E. Tibet); id, ibid, xxiv, p. 78 (1915), (S. Tibet).

Tetraogallus tibetanus przewalskii Bianchi, Aves. Exped. Mong. Tibet, p. 165 (1907), (E. Tibet).

Vernacular Names.—*Ular, Utar* (Turki); *Hailik,* (Mongols); *Cunmo,* (Tanguts); *Hrikpa,* (Bhutea); *Lhapcha Kengmo,* or *Kongmo* (S. Tibet); *Pi-mo-chi,* (Chinese).

Description.—Prjevalskii's Snow-Cock differs from the typical bird in being very much darker both above and below, and in being, generally speaking, much more olivaceous in general tint.

Colours of Soft Parts.—As in the previous bird.

Measurements.—Wing 260 mm. to 275 mm.; tail 171 to 182 mm.; tarsus 61 to 62 mm.; culmen 28 to 30 mm.

Distribution.—South Tibet, West to Kansu and Nanschan. South this bird is found in Sikkim and must wander into Bhutan, where it is well known to the Bhuteas.

Nidification.—This fine Snow-Cock breeds in very great numbers in Southern and Central Tibet, at all elevations between 12,000 and 17,000 feet, possibly in some cases even higher than this. It is extremely common above the Gyantse Plateau, breeding here probably at 14,000 feet, but by no means uncommonly down to about 12,000. Like other birds of the genus, it makes no nest, merely scratching a small hole in the shelter of a rock or boulder near the summit on the leeward side of the crest of a hill or ridge. It is said never to make its nest in any place where there is any real cover and it is never found breeding on these plains of Gyantse which are covered either with fairly thick grass or with a low but very dense thorny bush. In preference it selects the bleakest and barest of hillsides, where the half-burnt vegetation is of the scantiest. Like the Himalayan Snow-Cock, the hen is a close sitter and when the cock is away feeding, can be approached very closely before it scuttles away off its nest. As a rule, however, the cock bird keeps watch from some advantageous position close by the sitting hen and gives her due warning of approaching danger, leaving himself as he utters his warning, to be followed very closely by his wife. The eggs number 3 to 6 and possibly, according to the Tibetans, sometimes as many as 7 or 8, but Colonel Bailey, Dr. Stein, Mr. Macdonald, etc., have never succeeded in finding more than half a dozen, and in most cases only 4 or 5 are laid. The eggs are exactly like those already described of the Himalayan Snow-Cock but they are much smaller and possibly average a little darker, one or two of the clutches in my collection being almost a warm reddish-buff in ground colour. Eggs on which the spottings are most numerous at the smaller end seem to be very numerous with this species. One hundred eggs average 61·2 × 43·2 mm., maxima 65·4 × 42·9 mm, and 63·0 × 44·5 mm; minima 57·7 × 40·6 and 60·2 × 40·3 mm.

The birds breed principally from the last week of May to the first week in July but Mr. Macdonald has taken eggs, possibly the second brood, as late as the 25th August.

General Habits.—There is little to record about the habits of this bird differing in any way from those of the last two. It appears to be quite a common bird from 12,000 feet up to about 18,000 feet in Summer and, even in Winter, seems very seldom to descend very much below the former elevation, though a few birds may struggle down to 10,000 or even 9,000 feet. Its highest elevation is merely restricted by deep snow, whilst, on the other hand its lowest elevetions are always above forest limits. Where the grass-covered plateaux and ridges descend into and intersect the forest areas, this bird may be found in greater or less numbers, but under no circumstances does it ever enter forest or even bush-clad mountain sides. Slight snow seems to have no terror for it and, throughout the year birds may be found scratching about and hunting in the snow for their food near the snow-line. Where it has not been hunted, it is an apparently bold bird, and can be approached with ease to within 30 or 40 yards, so that shooting it offers little sport and little difficulty. Like the rest of the genus, if possible, when first disturbed it always runs up-hill and on its feet is a fairly active though rather clumsy looking bird. When it arrives at the top of the ridge, it at once launches into flight, or, if approached from above, it seeks the same method of escape and on the wing it is a fast fine flyer, though its soft plumage does not offer very much resistance to heavy shot. Few sportsmen among the rare visitors to its haunts seem to have taken much interest in the pursuit of this fine Snow-Cock, but probably the reason for this is, that wherever the Snow-Cock is found, there also may be obtained finer Game in the shape of *Ovis ammon*, Burhel or other Big Game.

Like its nearest relations, Prjevalskii's Snow-Cock is very gregarious and Colonel Bailey tells me that he has seen them in flocks numbering as many as 30, whilst Mr. Macdonald says that in the more remote parts of Tibet and in places where they are specially numerous, flocks numbering 50 may be met with. As soon as the chicks hatch, the families seem to unite in coveys and in the same flock may be found chicks of a few days old, partly fledged birds capable of flight, and other young ones almost as big as their parents. When feeding and moving about this Snow-Cock does not seem in the habit of posting sentries, but during the heat of the day when the birds are enjoying a siesta in the sun, one or more of their number are always to be found perched on some post commanding a good view of the surrounding country for some distance. At the approach of danger the sentries utter a loud prolonged whistle, apparently very similar, as indeed are all their other notes, to those of the preceding two birds.

Very different opinions have been expressed as to whether they form good eating or not. Some sportsmen say that they are excellent, others say that they are only fair, whilst one or two have declared

them to be dry and insipid. Possibly the time at which they are killed may have something to do with their flavour. They appear to be almost entirely vegetarian in their diet, feeding on leaves, shoots, moss and also upon young crops, where these are obtainable. No one appears to have ever found insects to have been eaten by these birds, but it seems incredible that they should never do so, and we shall almost certainly find that the very young chicks are fed mainly upon an insect diet.

They are said to be very easy to rear and keep in captivity, and the Tibetans occasionally keep them thus.

(To be continued.)

A HAND-LIST OF THE SNAKES OF THE INDIAN EMPIRE.

By

F. Wall, C.M.G., K.H.S., C.M.Z.S., F.L.S., F.A.S.B., H.C.Z.S.I., Colonel, I.M.S.

(*Continued from page* 878 *of Volume XXIX.*)

Part IV.

Family.—COLUBRIDÆ—(*Continued.*)

Series.—PROTEROGLYPHA.

Sub-family.—HYDROPHIINÆ.

Genus.—Hydrus *Schneider.*

255. (491) Hydrus platurus (Linné.) *Linné's Sea Snake.*

Russell, Ind. Serp. Vol I, 1796, *Pl XLI.*
Pelamis bicolor. *Daudin, Rept.* 1803, *Pl LXXXIX*; *Gray, Cat.* 1849, *p* 41; *Fayrer, Than. Ind.* 1874, *Pl XVII*; *Günther, Rept. Brit. Ind.* 1864, *p* 382; "*Kesical*," *Bomb. N. H. J. Vol II, p* 174; *Murray, Vert. Zool. Sind.* 1883, *p* 397.
Pelamis ornata. *Gray, Zool. Misc.* 1842, *p* 60; *Cat. p* 43.
Pelamides platurus. *Blyth, Andaman Islanders, p* 365.
Hydrus platurus. *Annandale, J. A. S., Beng.*, 1905, *p* 176; *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 397; *Cat. Vol III*, 1896, *p* 267; *Ferguson, Bomb. N. H. J. Vol X, p* 75; *Wall, Bomb. N. H. J. Vol XVI, p* 310; *l. c. Vol XXIII, p* 374; *l. c. Vol XXVI, p* 808; *l. c. Vol XXVII, p* 406; *Mem. A. S., Beng.*, 1906, *p* 280; *Spol. Zeylan.* 1907, *p* 166; *Oph. Tap.* 1921, *p* 420.
Lepid.—Costals. Two heads-lengths behind the head 40 to 54, midbody 41 to 61, two heads-lengths before the vent 41 to 61. Ventrals. 284 to 339.
Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Malay Peninsula. Malay Archipelago. Formosa. Japan. Loo Choo Islands. N. Australia. New Zealand. South Africa. N. America. Pacific Coast. S. America. Pescadores.*

Genus.—Microcephalophis *Lesson.*

1802 Hydrus. (*non Schneider*, 1799.) *Shaw, part, Gen. Zool. III, pt* 2, *p* 560.
1820 Enhydris. (*non Latreille*, 1802.) *Merrem, part, Tent. Syst. Amph., p* 140.
1826 Disteira. (*non Lacepede*, 1804.) *Fitzinger, Neue. Class. Rept., p* 55.
1827 Hydrophis. (*non Latreille*, 1902.) *Boie, Isis, p* 554.
1834 Microcephalophis. *Lesson, Belang, Voy. Ind. Or. Rept., p* 321, *Pl III.* [*type M gracilis* (*Shaw*)].
1842 Liopala. *Gray, Zool. Misc. p* 60 [*type L gracilis*=*Microcephalophis gracilis* (*Shaw*)].
1852 Thalassophis. *Schmidt, Abh. Nat. Ver., Hamburg, II, Pt* 2, *p* 78, *Pl II* (*Substitute for Hydrophis Daudin*).

256. (502) Microcephalophis gracilis (Shaw.) *John's Sea Snake.*

?*Russell, Ind. Serp. Vol II*, 1801, *Pl XIII.*
Hydrus gracilis. *Shaw, Zool.* 1802, *p* 560.
Microcephalophis gracilis. *Gray, Cat.* 1849, *p* 46; *Wall, Oph. Tap.* 1921, *p* 325
Liopala gracilis. *Gray, Zool. Misc.* 1842, *p* 60.

Hydrophis gracilis. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 404; *Cat. Vol III*, 1896, *p* 280; *Günther, Rept. Brit. Ind.* 1864, *p* 373; *Murray, Vert. Zool. Sind*, 1884, *p* 395; *Wall, Mem. A.S., Beng.*, 1906, *p* 283; *Spol. Zeylan.* 1907, *p* 167; *Bomb. N. H. J. Vol XXIII*, *p* 375; *l. c. Vol XXV*, *p* 602.

Hydrophis guentheri. *Murray, Vert. Zool., Sind*, 1884, *p* 396.

Distira gracilis. *Wall, Mem. A. S., Beng.*, 1909, *p* 198.

Lepid.—Costals. Two heads-lengths behind the head 17 to 21, midbody 26 to 32, two heads-lengths before the vent 27 to 35. Ventrals. 215 to 302.

Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Malay Peninsula to S. China. Malay Archipelago.*

257. (503) **Microcephalophis cantoris** (Günther.) *Cantor's Sea Snake.*

Hydrophis fasciata. *Gray, Cat.* 1849, *p* 50 (*part*).

Hydrophis cantoris. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 405. *Cat. Vol III*, 1896, *p* 281; *Wall, Mem. A. S., Beng.*, 1906, *p* 284; *Bomb. N. H. J. Vol XXIII*, *p* 375; *l. c. Vol XXV*, *p* 604.

Distira cantoris. *Wall, Mem. A. S., Beng.*, 1909, *p* 99.

Distira gillespiæ. *Boulenger, Bomb. N. H. J. Vol XII*, *p* 642; *Wall, Bomb. N. H. J. Vol XV*, *p* 723; *l. c. Vol XVI*, *p* 310.

Microcephalophis cantoris. *Wall, Oph. Tap.* 1921, *p* 330.

Length.—1,855 mm. (6 feet, 1 inch).

Lepid.—Costals. Two heads-lengths behind the head 21 to 25, midbody 27 to 36, two heads-lengths before the vent 36 to 46. Ventrals. 377 to 474.

Distn.—Coasts of India. From Karachi to Chittagong. *Malay Peninsula.* Penang. (Brit. Mus.)

Genus.—Porrecticollis *Wall.*

1803 Hydrophis. (*non Latreille* 1802.) *Daudin, part, Rept. VII*, *p* 375.
1820 Pelamis. (*non Daudin* 1803.) *Merrem, part, Tent. Syst. Amph. p* 138.
1921 Porrecticollis. *Wall, Oph. Tap., p.* 335 [*type P obscurus* (*Daudin*)].

258. (497, 498) **Porrecticollis obscurus** (Daudin.) *Russell's Sea Snake.*

Russell, Ind. Serp. Vol. I, 1796, *Pls. VII and VIII.*

Hydrophis fasciata. *Gray, Cat.* 1849, *p* 50 (*part*).

Hydrophis coronatus. *Annandale, Mem. Ind. Mus.* 1915, *p* 170; *Boulenger, Faun. Brit. Ind.* 1890, *p* 402; *Cat. Vol III*, 1896, *p* 279, *Wall, Mem. A. S., Beng.*, 1906, *p* 282; *Bomb. N. H. J. Vol XXIII*; *p* 375.

Hydrophis latifaciatus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 401; *Cat. Vol III*, 1896, *p* 279; *Wall, Mem. A. S., Beng.*, 1906, *p* 281.

Distira obscura. *Wall, Bomb. N. H. J. Vol XIX*, *p* 201.

Porrecticollis obscurus. *Wall, Oph. Tap.* 1921, *p* 335.

Length.—1,220 mm. (4 feet).

Lepid.—Costals. Two heads-lengths behind the head 19 to 23, midbody 25 to 32, two heads-lengths before the vent 26 to 33. Ventrals. 277 to 354.

Distn.—Coasts of India. From Karwar to Tenasserim.

Genus.—Dolichodira *Wall.*

1864 Hydrophis. (*non Latreille*, 1802.) *Günther, part Rept. Brit. Ind.*, *p* 373, *Pl XXV, fig S.*
1921 Dolichodira. *Wall, Oph. Tap., p* 340 [*type D. diadema* (*Günther*)].

259. (500) **Dolichodira diadema** (Günther.) *Günther's Sea Snake.*

Hydrophis diadema. *Gunther, Rept. Brit. Ind.* 1864, *p* 373.
Hydrophis obscurus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 403; *Cat. Vol III*, 1896, *p* 284; *Wall, Mem. A. S., Beng.*, 1906, *p* 286.
Distira lapemidoides. *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 346 *and* 615.
Distira torquata: *Wall, Mem. A. S., Beng.*, 1909, *p* 229.
Dolichodira diadema. *Wall, Oph. Tap.* 1921, *p* 340.
Length.—1,055 mm. (3 feet, 5⅛ inches).
Lepid.—Two heads-lengths behind the head 32 to 41, midbody 37 to 54, two heads-lengths before the vent 36 to 46. Ventrals. 374 to 460.
Distn.—Coasts of India. From the Sunderbunds to Tenasserim. *Gulf to Siam. Borneo.* (Boulenger.)

Genus.—MICROMASTOPHIS *Wall.*

1799 Hydrus. *Schneider, part, Hist. Amph. I, p* 240 [*type H bicolor=Hydrus platurus* (*Linné*)].
1820 Pelamis. (*non Daudin*, 1803.) *Merrem, part, Tent. Syst. Amph., p* 139.
1826 Disteira. (*non Lacepede*, 1804.) *Fitzinger, part, Neue, Class. Rept., p* 55.
1837 Hydrophis. (*non Latreille*, 1802.) *Schlegel, part, Phys. Serp. II, p* 507.
1842 Aturia. *Gray, part, Zool Misc., p* 61 [*type A. ornata* (*Gray*)].
1921 Micromastophis. *Wall, Oph. Tap.* 1921, *p* 344 [*type M fasciatus* (*Schneider*)

260. (501) **Micromastophis fasciatus** (Schneider.) *Schneider's Sea Snake.*

Hydrus fasciatus. *Schneider, Hist. Amph.* 1799, *p* 240.
Hydrophis chloris. *Anderson, P. Z. S.* 1871, *p* 191; *l. c.* 1872, *p* 396; *Fayrer, Than. Ind.* 1874, *Pl XXVII*; *Günther, Rept. Brit. Ind.* 1864, *p* 370; *Murray, Vert. Zool, Sind*, 1884, *p* 392.
Aturia lindsayi. *Gray, Zool. Misc.* 1842, *p* 61.
Hydrophis lindsayi. *Anderson, P. Z. S.* 1871, *p* 191; *l. c.* 1872, *p* 396; *Gray, Zool. Misc.* 1842, *p* 50; *Günther, Rept. Brit. Ind.* 1864, *p* 371; *Murray, Vert. Zool., Sind*, 1884, *p* 392.
Hydrophis atriceps. *Günther, Rept. Brit. Ind.* 1864, *p* 371.
Hydrophis fasciatus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 404; *Cat. Vol III*, 1896. *p* 281; *Wall, Mem. A. S., Beng.*, 1906, *p* 285; *Bomb. N. H. J. Vol XXIII, p* 375; *l. c. Vol XXV, p* 604.
Hydrophis leptodira. *Boulenger, Cat. Vol III*, 1896, *p* 285.
Hydrophis cantoris. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 64 (*part*, No 8232).
Distira fasciata. *Boulenger, Ann. and Mag. N. H.* 1900, *p* 306; *Wall, Mem. A. S., Beng.*, 1909, *p* 203.
Micromastophis fasciatus. *Wall, Oph. Tap.* 1921, *p* 344.
Length.—1,042 mm. (3 feet, 5 inches).
Lepid.—Costals. Two heads-lengths behind the head 25 to 33, midbody 37 to 57, two heads-lengths before the vent 37 to 57. Ventrals. 376 to 513.
Distn.—Coasts of India. From Malabar to Tenasserim. *Malay Peninsula. S. China. Malay Archipelago.*

Genus.—LEIOSELASMA, *Lacepede.*

1802 Hydrus. (*non Schneider*, 1799.) *Shaw, part, Zool. III, p* 564, *Pl CXXV.*
1803 Hydrophis. (*non Latreille*, 1802.) *Daudin, part, Hist. Rept. VII, p* 383.
1804 Leioselasma. *Lacepede, Ann. Mus. IV, p* 198. [*type L. striata* = *L. cyano cincta* (*Daudin*)].

1820 Enhydris. (*non Latreille*, 1802.) *Merrem, part, Tent. Syst. Amph, p* 140.
1890 Distira. (*non Lacepede*, 1804.) *Boulenger, part, Faun. Brit. Ind. Rept., p* 410.

261. (496, 507) Leioselasma spiralis (Shaw.) *The Narrow-ringed Sea Snake.*

Hydrus spiralis. *Shaw, Zool.* 1802, *p* 564.
Hydrophi piralis. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 401; *Cat. Vol III*, 1896, *p* 273; *Ferguson, Bomb. N. H. J. Vol XIV, p* 348; *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 348; *Wall, Spol. Zeylan.* 1907, *p* 166; *Bomb. N. H. J. Vol XXV, p* 601; *l. c. Vol XXVI, p* 430.
Hydrophis brugmansi. *Wall, Bomb. N. H. J. Vol XXIII, p* 375.
Hydrophis alcocki. *Wall, Mem. A. S., Beng.*, 1906, *p* 288.
Hydrophis longiceps. *Boulenger, Cat. Vol III*, 1896, *p* 275; *Günther, Rept. Brit. Ind.* 1864, *p* 375.
Hydrophis subcinctus. *Gray, Zool. Misc.* 1842, *p* 63; *Cat.* 1849, *p* 52; *Günther, Rept. Brit. Ind.* 1864, *p* 368.
Hydrophis bishopi. *Murray, Vert. Zool, Sind*, 1884, *p* 391.
Hydrophis robusta. *Fayrer, Than. Ind.* 1874, *Pl XXI*; *Gunther, Rept. Brit. Ind.* 1864, *p* 364; *Murray, Vert. Zool., Sind*, 1884, *p* 394.
Distira robusta. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 409; *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 615.
Distira spiralis. *Wall, Mem. A. S., Beng.*, 1909, *p* 208; *Bomb. N. H. J. Vol XX, p* 858.
Distira brugmansi. *Boulenger, Cat. Vol III*, 1896, *p* 292; *Wall, Mem. A. S., Beng.*, 1906, *p* 290; *Bomb. N. H. J. Vol XXII, p* 403; *Spol. Zeylan.* 1907, *p* 169.
Distirasubcincta. *Boulenger, Cat. Vol III*, 1896, *p* 292.
Lioselasma spiralis. *Wall, Oph. Tap.* 1921, *p* 353.
Length.—2,745 mm. (9 feet).
Lepid.—Costals. Two heads-lengths behind the head 25 to 31, midbody 30 to 36, two heads-lengths before the vent 27 to 36. Ventrals. 282 to 373.
Distn.—*Coasts of India.* From the Persian Gulf to Tenasserim. *Siam? Malay Archipelago.*

262. (508, 509) Leioselasma cyanocincta (Daudin.) *The Chittul.*

"*Chittul.*" *Russell, Ind. Serp.* 1801, *Vol II, Pl IX.*
Hydrophis cyanocinctus. *Daudin, Rept.* 1803, *p* 383; *Fayrer, Than. Ind.* 1874, *Pl XXIII*; *Günther, Rept. Brit. Ind.* 1864, *p* 367 (*part*); *Malcolm-Smith, Bomb. N. H. J. Vol XXVI, p* 682; *Murray, Vert. Zool., Sind*, 1884, *p* 391; *Wall, Bomb. N. H. J. Vol XXIII, p* 376; *l. c. Vol XXV, p* 754.
Leioselasma striata. *Lacepede, Ann. Mus.* 1804, *pp* 198 *and* 210.
Hydrophis crassicollis. *Anderson, J. A. S., Beng.*, 1871, *p* 19.
Hydrophis sublævis. *Wall, Bomb. N. H. J. Vol XVI, p* 388.
Hydrophis phipsoni. *Murray, Bomb. N. H. J. Vol II, p* 32.
Hydrophis taprobanica. *Haly, Taprobanium*, 1887, *p* 107.
Hydrophis tuberculata. *Anderson, J. A. S., Beng.*, 1871, *p* 18; *Murray, Vert. Zool., Sind*, 1884, *p* 393.
Distira cyanocincta. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 410; *Sclater, J. A. S., Beng.*, 1891, *p* 247; *Wall, Mem. A. S., Beng.*, 1906, *p* 291; *Spol. Zeylan.* 1907, *p* 171; *Bomb. N. H. J. Vol. XX, p* 1040; *l. c. Vol XXV, p* 605; *l. c. Vol XXVI, p* 833.
Lioselasma cyanocincta. *Wall, Oph. Tap.* 1921, *p* 361.

Length.—2,135 mm. (7 feet). (Murray.).
Lepid.—Costals. Two heads-lengths behind the head 27 to 36, midbody 33 to 44, two heads-lengths before the vent 34 to 43. Ventrals. 281 to 398.
Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Further East to China. Japan. Papuasia.*

263. (510) **Leioselasma bituberculata** (Peters.) *Peters's Sea Snake.*

Distira bituberculata. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 411 *Cat. Vol III*, 1896, *p* 296 ; *Wall, Mem. A. S., Beng.*, 1909, *p* 228.
Lioselasma bituberculata. *Wall, Oph. Tap.* 1921, *p* 367.
Length.—1,090 mm. (3 feet, 3 inches).
Lepid.—Costals. Round the neck 26 to 27, round the greatest girth 48 to 49. Ventrals. 278.
Distn.—Ceylon.
Note.—Known from a single specimen now preserved in Berlin.

264. (495) **Leioselasma mamillaris** (Daudin.) *The Broad-banded Sea Snake.*

Hydrophis mamillaris. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 401; *Cat. Vol III*, 1896, *p* 277 ; *Wall, Bomb. N. H. J. Vol XXIII, p* 374 ; *l. c. Vol XXVI, p* 866.
Distira lapemidoides. *Sclater, List. Sn. Ind. Mus.* 1891 (*part, No* 13392).
Distira mamillaris. *Wall, Mem. A. S., Beng.*, 1909, *p* 207.
Lioselasma mamillaris. *Wall, Oph. Tap.* 1921, *p* 349.
Length.—832 mm. (2 feet, 8¾ inches).
Lepid.—Costals. Two head-lengths behind the head 25 to 29, midbody 31 to 40, two heads-lengths before the vent 34 to 41. Ventrals. 316 to 367.
Distn.—Coasts of India. From Bombay to Vizagapatam.

265 (512). **Leioselasma lapemidoides** (Gray.) Blanford's Sea Snake.

Distira lapemidoides *Boulenger Faun. Brit. Ind. Rept.* 1890, *p* 412; *Cat. Vol III.* 1896, *p* 297. *Wall. Mem. As. Soc. Bengal.* 1909, *p.* 227 ; Oph. Tap. 1921, *p* 366.
Length.—940 mm (3 feet, 1 inch.)
Lepid.—Costals. Two heads-lengths behind the head 30 to 33, midbody 40 to 46, two heads-lengths before the vent 37 to 48. Ventrals. 300 to 387.
Distn.—Coasts of Ceylon and India. From Baluchistan to Puri, Orissa.

Genus.—ATURIA *Gray.*

1842 Aturia. *Gray, part, Zool. Misc., p* 61 (*type A. ornata*).
1849 Hydrophis. (*non Latreille*, 1802.) *Gray, part, Cat. p* 53.
1849 Chitulia. *Gray, Cat. p* 56 (*type C. inornata, = Aturia ornata*).
1852 Thalassophis. *Schmidt, part, Abh. Nat. Ver. Hamburg, II, p* 83, *Pl V*, (*substitute for Hydrophis, Daudin*, 1803).
1890 Distira. (*non Lacepede*, 1804.) *Boulenger, part, Faun. Brit. Ind. Rept., p* 411.

266. (511). **Aturia ornata** Gray. *Gray's Sea Snake.*

Hydrophis ornatus. *Wall, Bomb. N. H. J. Vol XXIII, p* 375 ; *l. c. Vol XXV, p* 605 ; *l. c. Vol XXVI, p* 867.
Distira ornata. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 411; *Cat. Vol III*, 1896, *p* 290 ; *Ferguson, Bomb. N. H. J. Vol X, p* 75; *Wall, Mem. A.S., Beng.*, 1906, *p* 289; *l. c.* 1909, *p* 232; *Spol. Zeylan.* 1907, *p* 168.

Distira andamanica. *Annandale, J. A. S., Beng.*, 1905. *pp* 174 *and* 176.
Aturia ornata. *Wall, Oph. Tap.* 1921, *p* 369.
Length—1,245 mm. (4 feet, 1 inch).
Lepid.—Costals. Two heads-lengths behind the head 33 to 41, midbody 38 to 45, two heads-lengths before the vent 33 to 42. Ventrals. 218 to 290.
Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Ceylon. Andamans. Malay Peninsula to Indo-China. Malay Archipelago. New Guinea. North Australia. Loo Choo Islands.*

Genus.—POLYODONTOGNATHUS *Wall.*

1802 Hydrus. (*non Schneider*, 1799.) *Shaw, part, Zool. III, p* 561.
1820 Enhydris. (*non Latreille*, 1802.) *Merrem, part, Tent. Syst. Amph.*, 140.
1842 Hydrophis. (*non Latreille*, 1802.) *Gray, part, Zool. Misc., p* 62.
1921 Polyodontognathus. *Wall, Oph. Tap., p* 375 [*type P. cærulescens.* (*Shaw*)].

267. (493). **Polyodontognathus cærulescens** (Shaw.) *Merrem's Sea Snake.*

Hydrophis cærulescens. *Boulenger, Faun. Brit. Ind. Rept.* 1890, p 400; *Cat. Vol III*, 1896, *p* 275; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 62; *Wall, Bomb. N. H. J. Vol XXII, pp* 373 *and* 374; *l. c. Vol XXV, p* 308; *l. c. Vol XXVI, p* 866.
Hydrophis obscurus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 63 (*part, Nos* 11498 *and* 11499).
Hydrophis cyanocinctus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 66, (*part, No* 8242).
Hydrophis torquatus. *Wall, Bomb. N. H. J. Vol XXII, p* 638.
Distira cærulescens. *Wall, Mem. A. S., Beng.*, 1909, *p* 231.
Polyodontognathus cærulescens. *Wall, Oph. Tap.* 1921, *p* 375.
Length.—737 mm. (2 feet, 5 inches).
Lepid.—Costals. Two heads-lengths behind the head 36 to 45, midbody 42 to 53, two heads-lengths before the vent 36 to 46. Ventrals. 277 to 339.
Distn.—Coasts of India. From Bombay to Tenasserim. *Malay Peninsula. Siam.*

Genus.—POLYPHOLOPHIS *Wall.*

268. (*Nil.*) **Polypholophis neglectus** (Wall.) *Wall's Sea Snake.*

Hydrophis obscurus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 63 (*part No* 8598).
Hydrophis neglectus. *Wall, Mem. A.S., Beng.* 1906, *p* 288
Distira neglectus. *Wall, Mem. A. S., Beng.*, 1909, *p* 206.
Polypholophis neglectus. *Wall, Oph. Tap.* 1921, *p* 380.
Length—About 610 mm. (2 feet). Not measured.
Lepid.—Costals. Two heads-lengths behind the head 48, midbody 54, two heads-lengths before the vent 45. Ventrals. 440 to 450 (damaged).
Distn.—The type is from Rangoon.

Genus.—MELANOMYSTAX *Wall.*

1803 Hydrophis. (*non Latreille*, 1802), *Daudin, part, Rept. VII, p* 380.
1820 Enhydris. (*non Latreille*, 1802). *Merrem, part, Tent. Syst. Amph., p* 140.
1827 Hydrus. (*non Schneider*, 1799). *Boie, Isis, p* 553.
1921 Melanomystax. *Wall, Oph. Tap., p* 381 [*type M. nigrocinctus* (*Daudin*)

269. (494). **Melanomystax nigrocinctus** (Daudin.) *Daudin's Sea Snake.*

Hydrophis nigrocinctus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 400; *Cat. Vol III*, 1896, *p* 277; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 63 (*part, Nos* 8239 *and* 8240); *Wall, Mem. A.S., Beng.*, 1906, *p* 281.

Distira lapemidoides. *Sclater, List Sn. Ind. Mus.* 1891, *p* 66. (*part, No* 8235).

Distira cyanocincta. *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 346.

Distira hendersoni. *Boulenger, Bomb. N. H. J. Vol XIV, p* 719; *Wall Mem. A. S., Beng.*, 1906, *p* 294.

Distira nigrocinctus. *Wall, Mem. A. S., Beng.*, 1909, *p* 224.

Melanomystax nigrocinctus. *Wall, Oph. Tap.* 1921, *p* 382.

Length.—1,055 mm. (3 feet, 5½ inches).

Lepid.—Costals. Two heads-lengths behind the head 27 to 32, midbody 36 to 43, two heads-lengths before the vent 36 to 42. Ventrals. 305 to 339.

Distn.—Coasts of India. From the Sunderbunds to Tenasserim. *Straits of Malacca.* (Boulenger.)

Genus.—KERILIA *Gray.*

1847. Hydrus. (*non Schneider*, 1799.) *Cantor, part, Cat. Mal. Rept., p* 129, *Pl XL, fig* 8.

1849. Kerilia. *Gray, Cat. p* 57 (*type K. jerdoni Gray.*)

1864. Hydrophis. (*non Latreille*, 1802) *Günther, part, Rept. Brit. Ind., p* 362, *Pl XXV, fig B.*

1890. Distira. (*non Lacepede*, 1804.) *Boulenger, part. Rept. Brit. Ind., p* 408.

270 (506) **Kerilia jerdoni** Gray. *Jerdon's Sea Snake.*

"*Shiddil.*" *Russell, Ind. Serp. Vol II*, 1801, *Pl XII.*

Kerilia jerdoni. *Gray, Cat.* 1849, *p* 57; *Wall, Oph. Tap.* 1921, *p* 386.

Hydrophis jerdoni. *Ferguson, Bomb. N.H.J. Vol XIV, p.* 386; *Wall, Bomb. N. H. J. Vol XXIII, p* 376; *l. c. Vol XXV, p* 606.

Distira jerdoni. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 408; *Cat. Vol III*, 1896, *p* 299; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 65; *Wall, Mem. A. S., Beng.*, 1906, *p* 293; *l. c.* 1909, *p* 241; *Spol. Zeylan.* 1907, *p* 172.

Length.—915 mm. (3 feet).

Lepid.—Costals. Two heads-lengths behind the head 17, midbody 19 to 21, two heads-lengths before the vent 19 to 21. Ventrals. 219 to 248.

Distn.—Coasts of India. From Travancore to Tenasserim. *Malay Peninsula. Siam.*

Genus.—THALASSOPHIS *Schmidt.*

1852 Thalassophis. *Schmidt, part, Abh. Nat. Ver. Hamburg, II, p* 79, *Pl III*, (*substitute for Hydrophis, Daudin* 1803). (type *T. gracilis* Shaw.)

1854 Disteira. (*non Lacepede*, 1804) *Dumeril and Bibron, part, VII, p* 1331.

1856 Hydrophis. (*non Latreille*, 1802.) *Fischer, Abh. Nat. Ver. Hamburg, III, p* 56.

271. (513) **Thalassophis viperinus** Schmidt. *Schmidt's Sea Snake.*

Hydrophis viperina. *Günther, Rept. Brit. Ind.* 1864, *p* 378; *Wall Bomb. N. H. J. Vol XXVI, p* 867.

Hydrophis nigra. *Anderson, P. Z. S.* 1872, *p* 399; *Boulenger, Cat. Vol III*, 1896, *p* 274.

Hydrophis guttata. *Murray, Bomb. N. H. J.* 1887, p 34.

Hydrophis jayakari. *Boulenger, Abh. and Mag. N. H.* 1887, *p* 408.

Distira viperina. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 413 ; *Cat. Vol III*, 1896, *p* 298; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 66; *Wall, Mem. A. S., Beng.*, 1906, *p* 292; *l.c.* 1909, p 239.

Distira lapemidoides. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 66 (*part, No* 8269).

Thalassophis viperinus. *Wall, Oph. Tap.* 1921, *p* 391.

Length.—920 mm. (3 feet, and $\frac{1}{4}$ of an inch).

Lepid.—Costals. Two heads-lengths behind the head 27 to 34, midbody 39 to 50, two heads-lengths before the vent 35 to 45. Ventrals. 235 to 276.

Distn.—Coasts of India. Persian Gulf to Tenasserim. *Further East to South China. Malay Archipelago.* As far East as Java.

Genus.—ASTROTIA *Fischer.*

1802 Hydrus (*non Schneider*, 1799.) *Shaw, part. Zool, III, p* 558.
1852 Hydrophis. (*non Latreille*, 1802.) *Schmidt, part, Abh. Nat. Ver. Hamburg, I, p* 166, *pl XV.*
1856 Astrotia. *Fischer, Abh. Nat. Ver. Hamburg, III, p* 38.
1890 Distira. (*non Lacepede*, 1804.) *Boulenger, part. Faun. Brit. Ind. Rept. p* 408.

272. (505) **Astrotia stokesi** (Gray) *Stokes's Sea Snake.*

Hydrophis stokesi. *Günther, Rept. Brit. Ind.* 1864, *p* 363.

Distira stokesi. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 408 ; *Cat. Vol III*, 1896, *p* 288; *Ferguson, Bomb. N. H. J. Vol X, p* 75 ; *Wall, Spol. Zeylan.* 1907, *p* 168.

Astrotia stokesi. *Wall, Mem. A. S., Beng*, 1909, *p* 250; *Oph. Tap.* 1921, *p* 396.

Length.—1,474 mm. (4 feet, 10 inches).

Lepid.—Costals. Two heads-lengths behind the head 41 to 48, midbody 48 to 59, two heads-lengths before the vent 41 to 50. Ventrals. 230 to 267.

Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Ceylon. Malay Peninsula. China Sea ? North Australia.*

Genus.—ENHYDRINA *Gray.*

273. (492, 504) **Enhydrina valakadien** (Boie.) *The Jew's-nosed or Boie's Sea Snake.*

"*Hoogli pattee*" *and* "*valakadyn*". *Russell, Ind. Serp. Vol II*, 1801, *Pls X and XI.*

Hydrophis schistosa. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 399 ; *Cat. Vol III*, 1896, *p* 274 ; *Daudin, Rept.* 1803, *p* 386.

Hydrophis bengalensis. *Gray, Zool. Misc.* 1842, *p* 62.

Enhydrina bengalensis. *Gray, Cat.* 1849, *p* 48 ; *Günther, Rept. Brit. Ind.* 1864, *p* 381.

Enhydrina valakadyen. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 406 ; *Cat. Vol III*, 1896, *p* 302 ; *Ferguson, Bomb. N. H. J. Vol X, p* 75; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 64 ; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 347 *and* 616 ; *Wall, Bomb. N. H. J. Vol XVI, p* 311 ; *l.c. Vol XX, p* 1041 ; *l.c. Vol XXIII, p* 377 ; *l. c. Vol XXV, p* 607 ; *l. c. Vol XXVI, p* 803 ; *Mem. A. S., Beng.*, 1906, *p* 296 ; *l. c.* 1909, *p* 192 ; *Spol. Zeylan.* 1907, *p* 172 ; *Oph. Tap.* 1921, *p* 401.

Length.—1,398 mm. (4 feet, 7 inches).

Lepid.—Costals. Two heads-lengths behind the head 47 to 61, midbody 50 to 70, two heads-lengths before the vent 50 to 70. Ventrals. 230 to 361.

Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Malay Peninsula, Siam, Cochin-China. Malay Archipelago. Papuasia. New Guinea.*

Genus.—LAPEMIS *Gray.*

1802 Hydrus. (*non Schneider*, 1799.) *Shaw, part, Zool. III, p* 562.
1820 Enhydris. (*non Latreille*, 1802.) *Merrem, part, Tent. Syst. Amph., p* 140.
1834 *Lapemis. Gray, Ill. Ind. Zool. II, pl LXXXVII, fig* 2 (*type L hardwickei*).
1837 Hydrophis. (*non Latreille* 1802.) *Schlegel, part. Phys. Serp. II, p.* 488.
1856. Pelamis. (*non Daudin*, 1803.) *Fischer, part. Ath. Nat. Ver. Hamburg, III, p* 61.
1861 Pelamydoidis. *Fitzinger, Sitz. Berl. Akad. Wien. XLII, p* 409 [*type H pelamidoides, Schlegel=Lapemis hardwickei (Gray).*]

274. (489) **Lapemis curtus** (Shaw.) *Shaw's Sea Snake.*

Hydrus curtus. *Shaw, Zool.* 1802, *p* 562.
Lapemis curtus. *Gray, Zool. Misc.* 1842, *p* 60.
Hydrophis curta. *Fayrer, Than. Ind.* 1874, *pl XXIV*; *Günther, Rept. Brit. Ind.* 1864, *p* 379; *Stoliczka, Proc. A. S., Beng.*, 1872, *p* 91.
Enhydris curtus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 396; *Cat. Vol III*, 1896, *p* 300; *Ferguson, Bomb. N. H. J. Vol X, p* 75; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 62; *Wall, Bomb. N. H. J. Vol XVI, p* 310; *l.c. Vol XXIII, p* 376; *l.c. Vol XXV, p* 606; *l. c. Vol XXVI, p* 94; *Mem. A. S., Beng.*, 1906, *p* 295; *l.c.* 1909, *p* 246; *Spol. Zeylan.* 1907, *p* 172; *l. c.* 1921, *p* 406.
Lapemis curtus. *Wall. Oph. Tap.* 1921, *p* 410.
Length.—846 mm. (2 feet, 9½ inches).
Lepid.—Costals. Two heads-lengths behind the head 29 to 36, midbody 30 to 45, two heads-lengths before the vent 30 to 42. Ventrals. 151 to 219.
Distn.—Coasts of India. From the Persian Gulf to Tenasserim. *Malay Peninsula. Malay Archipelago.*

275. (490) **Lapemis hardwickei** Gray. *Hardwicke's Sea Snake.*

Lapemis hardwicki. *Gray, Ind. Zool.* 1834, *pl LXXXVII, Cat* 1849, *p* 44.
Hydrophis fayreriana. *Anderson. J. A. S., Beng.*, 1871, *p* 19.
Enhydris hardwicki. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 397. *Cat. Vol III*, 1896, *p* 301; *Günther, Rept. Brit. Ind.* 1864, *p* 380; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 62; *Wall, Mem. A. S., Beng.*, 1906, *p* 296; *l. c.* 1909, *p* 247.
Lapemis hardwickei. *Wall, Oph. Tap.* 1921, *p* 416.
Length.—915 mm. (3 feet).
Lepid.—Costals. Two heads-lengths behind the head 25 to 33, mid-body 27 to 40, two heads-lengths before the vent 27 to 37. Ventrals. 130 to 214.
Distn.—Coasts of India. From Puri to Tenasserim. *Malay Peninsula to China. Malay Archipelago.* Java. *Philippines. New Guinea.*

Genus.—LATICAUDA *Laurenti.*

1758 Coluber. *Linne part, Mus. Ad. Frid. p* 31, *pl XVI, fig* 1 (*type C. berus=Vipera berus*).
1768 Laticauda. *Laurenti, Syn. Rept., p* 109 [*type L scutata=L laticaudata Linné.*)]

1799 Hydrus. *Schneider, part, Hist. Amph. I, p* 233 [*type H bicolor=H platurus (Linné)*].
1802 Platurus. *Latreille, Hist. Nat. Rept. IV, p* 183 [*type P. fasciatus=Laticauda laticaudata. (Linné)*].
1837 Hydrophis. (*non Latreille*, 1802.) *Schlegel, part, Phys. Serp. II, p* 488.

276. (487) **Laticauda laticaudata** (Linné.) *Linné's Sea Krait.*

Coluber laticaudatus. *Linnè. Mus. Ad. Fred.* 1754, *p* 31.
Platurus fischeri. *Fayrer, Than. Ind* 1874, *pl XIX; Gunther, Rept. Brit. Ind.* 1864, *p* 356.
Platurus affinis. *Anderson, P. Z. S.* 1871, *p* 190.
Platurus laticaudatus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 395; *Cat. Vol III*, 1896, *p* 307; *Sclater, List. Sn. Ind. Mus.* 1871, *p* 61; *Wall, Mem. A.S., Beng.*, 1906, *p* 297; *l. c.* 1909, *p* 185.
Laticauda laticaudata. *Wall, Oph. Tap.* 1921, *p* 427.
Length.—1,093 mm. (3 feet, 7 inches).
Lepid.—Costals. Two heads-lengths behind the head 19, midbody 19, two heads-lengths before the vent 19 or 17. Ventrals. 210 to 246.
Distn.—Coasts of India. From Calcutta to Tenasserim. *Malay Peninsula. Indo-China. S. China. Loo Choo Islands, Philippines. New Guinea. S. Pacific Islands. Australia.*

277. (488) **Laticauda colubrina** (Schneider.) *Schneider's Sea Krait.*

Platurus scutatus. *Günther, Rept. Brit. Ind.* 1864, *p* 356.
Platurus colubrinus. *Boulenger, Faun. Brit. Ind.* 1890, *p* 395; *Cat. Vol III*, 1896, *p* 308; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 62; *Wall, Mem. A. S., Beng.*, 1906, *p* 298; *l. c.* 1909, *p* 186.
Laticauda colubrina. *Wall, Oph. Tap.* 1921, *p* 431.
Length.—1,270 mm. (4 feet, 2 inches).
Lepid.—Costals. Two heads-lengths behind the head 21 to 25, midbody 21 to 25, two heads-lengths before the vent 21 to 23. Ventrals. 195 to 240.
Distn.—Coasts of India. From the Burmese Shores to Tenasserim. *Malay Peninsula. Indo-China. S. China. Loo Choo Islands. S. Pacific Islands. Australia. New Zealand.*

FOOTNOTE.

No. 499—*Hydrophis torquatus*, Günther (Fauna, Brit. Ind. Rept. 1890, p 402) as not been included in this list because I have never seen a Sea Snake conforming to this description from Indian Seas. The types are from the "East Indies" and presented to the British Museum by the Honourable the East India Company. East Indies in those days was a very indefinite term, and there is nothing to prove that these specimens came from the Indian littoral.

Sub-family 8.—ELAPINÆ.

Genus.—BUNGARUS (*Daudin.*)

278. (*Nil*) **Bungarus flaviceps** Reinhardt. *Reinhardt's Krait.*

Megaerophis flaviceps. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 57.
Bungarus flaviceps. *Boulenger, Cat. Vol III*, 1896, *p* 371; *Wall, Bomb. N. H. J. Vol XVII, p* 60; *Pois., Sn. Brit. Ind.* 1907, *p* 12; *l. c.* 1908, *p* 14; *l. c.* 1913, *p* 14.
Length.—1850 mm. (6 feet, 1 inch).
Lepid.—Costals. In 13 rows in the whole body. Ventrals. 193 to 230.
Distn.—Burma. Tenasserim. (Mergui. Ind. Mus.) *Malay Peninsula. Indo-China. Malay Archipelago.* Sumatra. Borneo. Java.

279. (480) **Bungarus fasciatus** (Schneider.) *The Banded Krait.*

Russell, Ind. Serp. Vol I, 1796, *pl III.*

B. fasciatus. *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 56; *Annandale, Rec. Ind. Mus.* 1911, *p* 218; *Boulenger, Cat. Vol III,* 1896, *p* 366; *Evans, Bomb. N. H. J. Vol XIV, p* 599; *l. c. Vol XVI, p* 519; *Kinnear. Bomb. N. H. J. Vol XXII, p* 636; *Martin, Bomb. N. H. J. Vol XXII, p* 635; *Primrose, Bomb. N. H. J. Vol XII, p* 589; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 142; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 57; *Smith, Bomb. N. H. J. Vol XXI, p* 284; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 344 *and* 612; *Wall, Bom. N. H. J. Vol XV, p.* 524; *l. c. Vol XVII, p* 61; *l. c. Vol XVIII, p* 714; *l. c. Vol XIX, p* 835; *l. c. Vol XX, p.* 933; *Ind. Med. Gaz. Aug.* 1909; *Pois., Sn. Brit. Ind.* 1907, *p* 12; *l. c.* 1908, *p* 15; *l. c.* 1913, *p* 15.

Length.—1,955 mm. (6 feet, 5 inches. Malcolm-Smith).

Distn.—North-East Peninsular India. As far South as the Godavery Valley. (Narsampet. Lat. 18°. Long. 80°. Chanda.) Mahanadi Valley. (Raipur. Bilaspur. Sambalpur.) Orissa. (Berhampore. F.W.) Behar. (Champaran. Bettiah. Segowlie. F. W.). *Bengal. Assam. Burma. Malay Peninsula. Siam. Indo-China. S. China. Malay Archipelago.* Sumatra, Java.

280. (481) **Bungarus ceylonicus** Günther. *The Ceylon Krait.*

Abercromby, Sn. of Ceylon, 1910, *pp* 48 *and* 80; *Spol. Zeylan.* 1911, *p* 206; *Boulenger, Cat. Vol III,* 1896, *p* 367; *Green, Spol. Zeylan.* 1905, *p* 158; *Pearless, Spol. Zeylan.* 1909, *p* 54; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127; *Wall. Bomb. N. H. J. Vol XV, p* 24; *l. c. Vol XVII, p* 65; *l. c. Vol XVIII, p* 714; *Spol. Zeylan.* 1910, *p* 37; *l. c.* 1911, *p* 157; *l. c.* 1921, *p* 402; *Pois., Sn. Brit. Ind.* 1907, *p* 16; *l. c.* 1908, *p* 20; *l. c.* 1913, *p* 19; *Oph. Tap.* 1921, *p* 451; *Willey, Spol. Zeylan.* 1906, *p* 233.

Lepid.—Ventrals. 219 to 236. Subcaudals. 32 to 41.

Distn.—Ceylon.

281. (482) **Bungarus candidus** (Linné). *The Common Krait.*

B. arcuatus. *Phipson, Bomb. N. H. J, Vol II, p* 247; *Traill, Bomb. N. H. J. Vol IX, p* 499.

B. cæruleus. *Bannerman, Bomb. N. H. J. Vol XVI, p* 743; *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 388; *Cholmondeley, Bomb. N. H. J. Vol XVIII, p* 921; *Ferguson, Bomb. N. H. J. Vol X, p* 74; *Millard, Bomb. N. H. J. Vol XIV, p* 395; *Pitman, Bomb. N. H. J. Vol XXVI, p* 636; *Prater, Bomb. N. H. J. Vol XXVI, p* 684; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 58 (*part, except Nos* 13244 *and* 13245); *Smith, Bomb. N. H. J. Vol XX, p* 864; *l. c. Vol XXI, p* 283; *Wall, Bomb. N. H. J. Vol XVIII, pp* 20 *and* 716; *l. c. Vol XIX, p* 268; *l. c. Vol XX, p* 1041; *l. c. Vol XXII, pp* 19, 401 *and* 808; *l. c. Vol XXVI, p* 575; *Oph. Tap.* 1921, *p* 437; *Willey, Spol. Zeylan,* 1906, *p* 233.

B. candidus. *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 55; *Boulenger, Cat. Vol III,* 1896, *p* 368 (*part*); *Wall, Bomb. N. H. J. Vol XV, p* 706; *l. c. Vol XVI, p* 312; *l. c. Vol XVII, p* 65; *l. c. Vol XVIII, p* 122; *l. c. Vol XIX, p* 268; *l. c. Vol XX, p* 1041; *Spol. Zeylan.* 1907, *p* 174; *Pois., Sn. Brit. Ind,* 1907, *p* 16.

B. sindanus. *Bomb. N. H. J. Vol XI, p* 73; *Cholmondeley, Bomb. N. H. J. Vol XVIII, p* 921; *Pitman, N. H. J. Vol XXII, p* 636

Sarasin, Zool. Jahr. Jena. 1910, *p* 145; *Wall, Bomb. N. H. J. Vol XVII, p* 68; *l. c. Vol XVIII, pp* 18, 24 *and* 716; *l. c. Vol XX, p* 1041; *l. c. Vol XXII, pp* 22, 401 *and* 808.

Length.—1,398 mm. (4 feet, 7 inches).

Lepid.—Costals. Usually 15 (rarely 17) rows in the whole body. Ventrals. 195 to 218. Subcaudals. 37 to 50.

Distn.—*Ceylon. Peninsula India.* To the Himalayas. North-East to Bengal. North-West to Sind and Baluchistan. *Western Himalayas.* Up to 5,000 feet. (Almora. Bakloh. F. W.)

Note.—*sindanus* Boulenger can no longer be considered a species distinct from *candidus.*

282. (*Nil.*) **Bungarus multicinctus** Blyth. *Blyth's Krait.*

Bungarus cæruleus. *Annandale, J. A. S., Beng.,* 1905, *p* 176; *Boulenger, Cat. Vol III,* 1896, *p* 368 (*part*); *P. Z. S.* 1899, *p* 165; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 58 (*part,* No 2891); *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 343 (*part*).

Bungarus semifasciatus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 58; *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 612.

Bungarus multicinctus. *Wall, Pois. Sn. Brit. Ind.* 1908, *p* 19; *l. c.* 1913, *p* 18; *Bomb. N. H. J. Vol XVIII, p* 715.

Length.—Exceeds 990 mm. (3 feet, 3 inches).

Lepid.—Ventrals. 194 to 221. Subcaudals. 44 to 52.

Distn.—*Burma.* Rangoon. Meiktila. Toungoo. S. Shan States. *S. China Formosa.*

283. (*Nil.*) **Bungarus magnimaculatus** Wall and Evans. *The Large-spotted Krait.*

Bungarus cæruleus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 58. (*part, Nos* 13244 *and* 13245).

Bungarus magnimaculatus. *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 343 *and* 611; *l. c. Vol XVIII, p* 715; *Wall, Rec. Ind. Mus.* 1909, *p* 147; *Pois., Sn. Brit. Ind.* 1908, *p* 18; *l. c.* 1913, *p* 17.

Length.—1,309 mm. (4 feet, 3½ inches).

Lepid.—Costals. In 15 rows in the whole body. Ventrals. 213 to 228. Subcaudals. 43 to 48.

Distn.—*Burma.* Meiktila. Monywa. Minbu. Pyawbwe. Shwebo.

Note.—I have seen thirteen examples.

284. (484) **Bungarus lividus** Cantor. *The Lesser Black Krait.*

Bungarus lividus. *Boulenger, Cat. Vol III,* 1896, *p* 370; *Wall, Bomb. N. H. J. Vol XVII, p* 64; *l. c. Vol XVIII, p* 714; *l. c. Vol XIX, pp* 355, 838 *and* 900; *l. c. Vol XXI, p* 281; *Pois., Sn. Brit. Ind.* 1907, *p* 15; 1908, *p* 15; *l. c.* 1913, *p* 15.

Length.—1,041 mm. (3 feet, 5 inches).

Lepid.—Ventrals. 209 to 217. Subcaudals. 35 to 42.

Distn.—*Bengal* Jalpaiguri Dist. *Eastern Himalayas.* Sikkim. *Assam.*

Note.—No 11419 of Sclater's list (1891, p 58) was no longer in the Indian Museum when I examined the specimens.

285. (*Nil.*) **Bungarus niger** Wall. *The Greater Black Krait.*

Bungarus lividus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 58. (*Nos* 3941 *and* 4013.)

Bungarus niger. *Wall, Bomb. N. H. J. Vol XVIII, p* 715; *l. c. Vol XIX, pp* 355 *and* 838; *Pois., Sn. Brit. Ind.* 1908, *p* 19; *l. c.* 1913, *p* 18.

Length.—1,232 mm. (4 feet, and ½ an inch).
Lepid.—Ventrals. 216 to 231. Subcaudals. 47 to 57.
Distn.—*Eastern Himalayas.* Sikkim. *Assam.* Dibrugarh. Sadiya. Jaipur. Sibsagar. Garo Hills.

286. (483) **Bungarus bungaroides** (Cantor.) *Cantor's Krait.*

Bungarus bungaroides. *Annandale, J. A. S., Beng.*, 1904, *p* 210, *Boulenger, Cat. Vol III.* 1896, *p* 370, *Sclater, List. Sn. Ind. Mus* 1891, *p* 58 (*part. Nos* 2898, 7742 *and* 8692); *Wall, Bomb. N. H. J. Vol XVII, p* 61; *l. c. Vol XIX, p* 355; *Pois. Sn. Brit. Ind.* 1907, *p* 12; 1908 *p* 14; *l. c.* 1913, *p* 14.
Length.—1,181 mm. (3 feet, 10½ inches).
Lepid.—Ventrals. 220 to 238. Subcaudals. 43 to 51.
Distn.—*Eastern Himalayas.* Sikkim. *Assam.* North Cachar.

287. (*Nil.*) **Bungarus walli** Wall. *Wall's Krait.*

Bungarus walli. *Sarasin, Zool. Jahr. Jena.* 1910, *p* 146; *Wall, Bomb. N. H. J. Vol XVII. p* 608; *Vol XVIII, p* 122; *l. c. Vol XIX, p* 267*a*, *Pois. Sn. Brit. Ind.* 1907, *p* 19; *l. c.* 1908 *p* 24; *l. c.* 1913, *p* 22.
Bungarus sindanus. *Annandale, J. A. S., Beng.*, 1905, *p* 213; Proc. A. S. Beng. 1911, *Vol VII*, New Series. No 7.
Type.—In the British Museum from Fyzabad.
Length.—1,511 mm. (4 feet, 11¾ inches).
Lepid.—Costals. In 17 rows in the whole body. Ventrals. 192 to 207. Subcaudals. 46 to 55.
Distn.—*Peninsular India.* Ganges Valley. (Fyzabad, U. P.) Bengal (Purnea. Midnapore. Gaya. Alipore. Ind. Mus.)

(to be continued.)

TERMITE MOUNDS.

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(With 4 text figures.)

(A lecture delivered at the eleventh meeting of the Indian Science Congress, Bangalore : January 15th, 1924.)

You all are familiar with the earthen mounds commonly called ant-hills, which form so conspicuous a feature of the landscape in some parts of India (1). In spite of their popular name these mounds are built not by true ants but by termites, which are popularly called white-ants. The names, however, are misleading, for in structure and life-history the termite differs from the ant almost as much as either does from a beetle or a butterfly ; its internal anatomy is different, its mouth-parts and legs are differently constructed, its body is not covered with a hard integument like that of the ant and its wings, if it has wings, are of quite a different pattern, the so-called veins never forming a network as they do in the ants and their allies. Moreover, the ant comes out of its egg as a helpless grub and undergoes a complete metamorphosis, whereas the termite is hatched active and not unlike the adult.

Ants and termites, nevertheless, have been confused in many countries, mainly on account of a curious similarity in their social systems. Both live in large communities in which the great majority of individuals are without wings, but numbers of winged individuals are produced periodically and issue from the nest in swarms. This fact, to the superficial observer at any rate, is perhaps the most striking point in the life-history of ants and termites, for their social system differs from that of any human community in that different individuals are adapted for different services, not by training or descent but by profound anatomical differences. The offspring of a single female are not all alike but differ in shape, size and structure to such an extent that it is often difficult to believe them in any way related one to another. The winged forms are the young males and females, which leave the nest to found new communities. In each community the service of replenishing the population is confined to a few individuals, often to a single pair, while the vast majority of the population are practically sexless. In most termites and in many ants these neuter individuals, which never have wings, are further subdivided into two castes, that of the workers and that of the soldiers. Things are often still more complicated and there may be two or more subcastes of workers, while among the most primitive termites there is little or no difference between workers and females. Further, in these primitive forms (and also in some of higher grade) the soldiers and even the workers are at least potential males and females.

All termites do not build mounds. The primitive forms to which I have alluded eat passages and galleries in dead wood and apparently have no permanent abode. Other species burrow in the earth, construct nests in dead logs or affix them to trees. The number of species which do build mounds in India is apparently small and all of them seem to be closely related and to belong to the genus *Odontotermes*. This is not so, however, in other countries.

In all our Indian mound-builders the three castes—the royal caste as it is called, the working caste and the military caste—are quite distinct, each physically incapable of performing any function but its own. The sole duty of the

(1) The absence of termite mounds from the neighbourhood of Calcutta and other parts of the lower Gangetic delta is a noteworthy fact. It is possibly due to the high level of the sub-soil water.

royal caste is the production of fertile eggs, the sole duty of the military caste is to guard the community and its abode against external enemies, while the workers build and forage and cultivate, act as scavengers and tend their parents and the young of their common mother. It is impossible here to give any account of the strange complexities which occur in some termite communities, but we may consider the three castes of the mound-builders in a little more detail.

The wings of the young males and females when they issue from the nest are ample but rather feeble. The two sexes differ little in external characters and are often hard to distinguish. Both males and females are at first active and apparently able to feed and look after themselves. Feeble as are their wings in appearance and delicate in structure, they are often capable of a flight of several miles. After one flight their wings drop off. The vast majority of the winged individuals of each community perish within a short time of leaving t, falling victims by the thousand to insectivorous birds and lizards, toads, jackals, cockroaches and especially predaceous ants, all of which devour them greedily. Only a few pairs, which have survived the perils of their flight and been able to mate, survive and, concealing themselves in crevices or burrowing under ground, proceed to found new communities. In their retreat a curious change comes over the female. She grows more and more unwieldy and her body swells up until it is altogether disproportionate to her head and legs and enormously greater than that of her mate, who retains his elegant shape with little alteration. The only work the pair are capable of doing is that of reproduction and the female pours out her eggs literally by the million, guarded by her soldier children and fed and tended by the proletariat of which she is the mother. Her offspring often equals or exceeds the population of a great city.

There is one point I should make clear before going any further. We call the male and the female termite the king and queen, but there is no evidence of any kind that they rule or govern the community : they are merely its father and its mother in the most literal sense. In all the Indian mounds I have examined I have found a single king and queen or sometimes a queen alone whose mate had died, but in some species there are commonly several pairs of true males and females, while in some the workers possess the mysterious power of raising up from among the young of their own caste supplementary queens, which never have complete wings but are capable of laying eggs, should any accident happen to their mother. This power, however, is not possessed by the common mound-builders of India. I have found by repeated experiment (1) that if the mound be destroyed and the royal pair removed, the workers reconstruct the edifice, and that this may be done at least once again if the new structure be again destroyed. The life of the community, however, is only that of the workers and never lasts for more than eight or nine months, although the queen if undisturbed continues to live and lay eggs for much longer, probably for at least ten years in some forms, and as long as she remains productive the community persists. The so-called king and queen of each mound are prisoners for life, quite incapable of looking after themselves and dependent on their children for food.

The majority of these children are workers condemned to a life of toil, blind, soft, much smaller even than their father, but with all their instincts concentrated on their work and possessed of a communal sense of responsibility far beyond that of the most altruistic human society. They feed their parents, carry away the eggs laid by their mother ; they build, repair and enlarge the mound, they tend the gardens of the community, they forage abroad, they work

(1) This refers particularly to *Odontotermes obesus*, both the typical form and the variety *oculatus*.

n perfect unison and build up structures that seem to exhibit the most advanced knowledge of mechanics ; but there is no one to give them orders, no one standing over them with a whip, no apparent means of communication, even, between them. Their jaws are their only tools, their saliva their only means of consolidating their work.

The soldiers of a large mound, though less numerous than the workers, form a huge army. Their weapons are their jaws, their defence the hard integument of their head ; their bodies are soft as those of their sisters the workers, and they take good care to keep them under cover. In different kinds of termites the jaws of the soldiers are developed differently ; in the Indian mound-builders they form a pair of powerful forceps, fit for decapitating an insect foe or for wounding larger enemies.

So much for the inhabitants of the mounds, the structure and object of which we must now consider. Some have believed them to be mere rubbish heaps and this I think is true of one type of mound. On a recent visit to the Andaman Islands(1) I noticed on the jungle-floor numerous heaps of yellow clay which contrasted strongly with the black leaf-mould. They were not more than three feet high, had about the same diameter and were mere formless masses. On investigation I discovered that they were formed by termites, which had brought up the unctuous clay from below the deep layer of leaf-mould. The mounds were nearly solid with only a few narrow passages and contained no large chambers of any sort. They did not differ essentially except in being more solid from the rubbish heaps of earth often made among the roots of fig trees by *Odontotermes feæ*, one of our commonest burrowing forms in Peninsular India.

It is not of simple mounds of this sort that I wish to speak to-night, but of the much more complex structures which serve primarily as forming houses for certain species of fungi cultivated by the termites.

I will first describe the structure, external and internal, of the type of mound commonest in India. It is that built by Redemann's Termite (*O. redemanni*), a species common in Ceylon and South India. Externally its figure is that of a sharply pointed cone with or without supplementary pinnacles of the same shape. The cross-section is thus circular, often with smaller circles round a large central circle. The height may be six feet or more. The external surface is rough, but, so far as my own observations go, there are never any apertures in it when it is fresh, except at swarming-time when special vents are opened for the egress of the winged adults, and closed again immediately they have come out. This, however, is a point to which I will have to return later. If we break open the mound, we find that it is extremely hard. The mass as a whole is solid, but scattered through it are numerous domed chambers connected together by elaborate but narrow passages. Broader vertical shafts can also be distinguished, connected with these passages but blind at their upper extremity. The internal walls of the domed chambers are beautifully smooth, almost polished, and each contains a brown, spongy mass. This, as we shall see, is the actual fungus-garden. Low down in the mound, a little above ground-level and as a rule a little to one side, there is a single chamber, also domed, but lower and narrower and with rougher walls. It is, moreover, surrounded by a more elaborate system of passages. This is the royal chamber in which the king and queen are imprisoned. The passages round it are far too narrow for their exit and are used partly for the removal of the eggs, partly to allow the workers to approach the king and queen and partly as guard-chambers in

(1) Professor Silvestri has identified workers and soldiers of this termite as *Odontotermes obesus*. This is remarkable in view of what I have to say later on about the two types of mounds built by two different varieties of this species. Possibly males and females of the Andaman form would show some racial peculiarity.

which a large body of soldiers is always on duty. By far the greater part of the mound is thus devoted to cultivation, which is carried out in numerous small plots or gardens.

Sometimes mounds of this type are solitary, but the commonest of all our Indian mound-builders (*O. obesus*) as a rule builds a little group of smaller but otherwise similar mounds (fig. 1), which may coalesce into a single conical mass as the community increases in numbers and extends its building operations. The different mounds in the group are connected together under ground and the royal chamber is in one of them.



Fig. 1.

Mounds of *Odontotermes obesus typicus* (from the "Records of the Indian Museum").

Although the typical *O. obesus* builds a conical mound with many internal fungus-gardens, there is another variety of the species which builds a totally different kind of mound. The only physical difference that has been observed between the two varieties is that the males and females of the one which builds a conical mound have smaller eyes. No difference at all has been detected between the blind workers and soldiers.

The mound (fig. 2) of the large-eyed variety of this species is not conical but consists of a comparatively small central mass of somewhat irregular shape and surrounded by vertical buttresses as high as itself but very narrow. The cross-section is, therefore, star-shaped instead of circular. Each of the buttresses ends above in a sharp peak or in several peaks and the mound as a whole is usually of much the same size as that of *O. redemanni*.

The internal arrangement is, however, quite different. The buttresses are hollow and empty, while the central core is mainly solid but contains wide vertical passages, which are also empty. This part of the mound is regularly patrolled by bodies of workers and soldiers but is not used for cultivation. The whole of the base, however, is one great garden-chamber, shaped something like a limestone cave with stalactites and stalagmites and partially separated into two or several storeys by incomplete horizontal floors. This chamber contains a single large fungus-garden of much the same shape as itself.

We may call mounds of this type unilocular, while those of the typical *O. obesus* and of *O. redemanni* may be called multilocular.

Some observers have maintained that the mounds of Indian termites are ventilated by a complex system of air-shafts opening on the surface by funnel-shaped apertures, but, so far as I have been able to see myself, this is a complete error of observation. Apertures and shafts (fig. 1) often appear in old mounds, especially in those of conical form, but they are always due to accident and will

be found on examination to be carefully blocked up below and to have no communication with the rest of the nest. Any hole in the external surface of the mound is, in fact, a danger as giving access to predaceous ants, which seem to be the chief enemy of the termite, and it is of the utmost importance in the cultivation of fungi that the temperature and moisture should be kept equable inside the mound, an end achieved by the solid earthen walls, which are bad conductors of heat, and possibly by the cushions of air in the vertical shafts and buttresses.

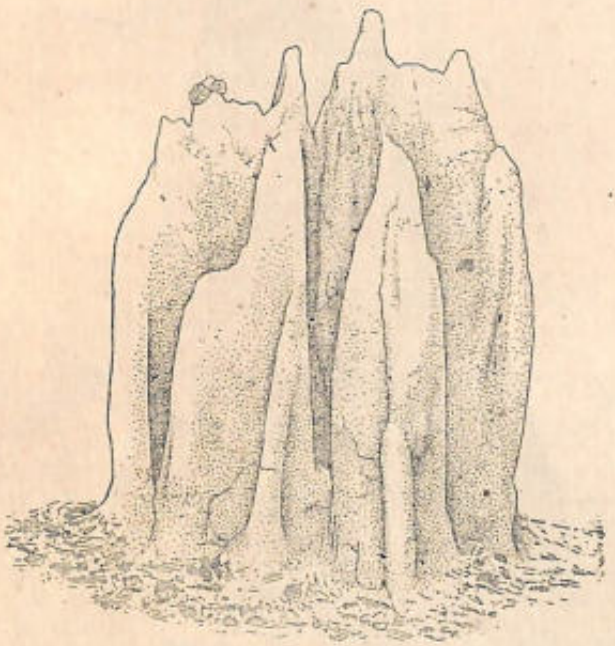


Fig. 2.

Mound of *Odontotermes obesus oculatus* (from the "Records of the Indian Museum").

So far as I can discover from the literature of the subject (which, however, is not very detailed), the great majority of termite mounds in all tropical countries belong in their internal structure to one or other of the two types described above, the multilocular being much more common than the unilocular. Mounds of the former type often reach a gigantic size. These are of course differences, and in detail, and some of the smaller kinds of mounds appear to be mere nests, containing chambers and passages devoid of gardens; for all termites are not cultivators.

In external shape the mounds of different species of termite exhibit great variety, though in each species or variety shape seems to be fairly constant. In India, so far as I can discover, only the conical form and the buttressed form have been figured or described, but, especially in tropical Africa and Australia, there are many peculiar exotic forms. One of these, which is probably (at any rate in some species) a mere nest, is that of a mushroom or umbrella, sometimes many-tiered like the ceremonial umbrellas of the potentates of the Far East. Mounds of this form are rarely of any great size. They are constructed by widely different termites in both Africa and Australia.

Another form of mound is that of a pillar or column, sometimes of great height. It appears to be merely a modification of the conical mound.

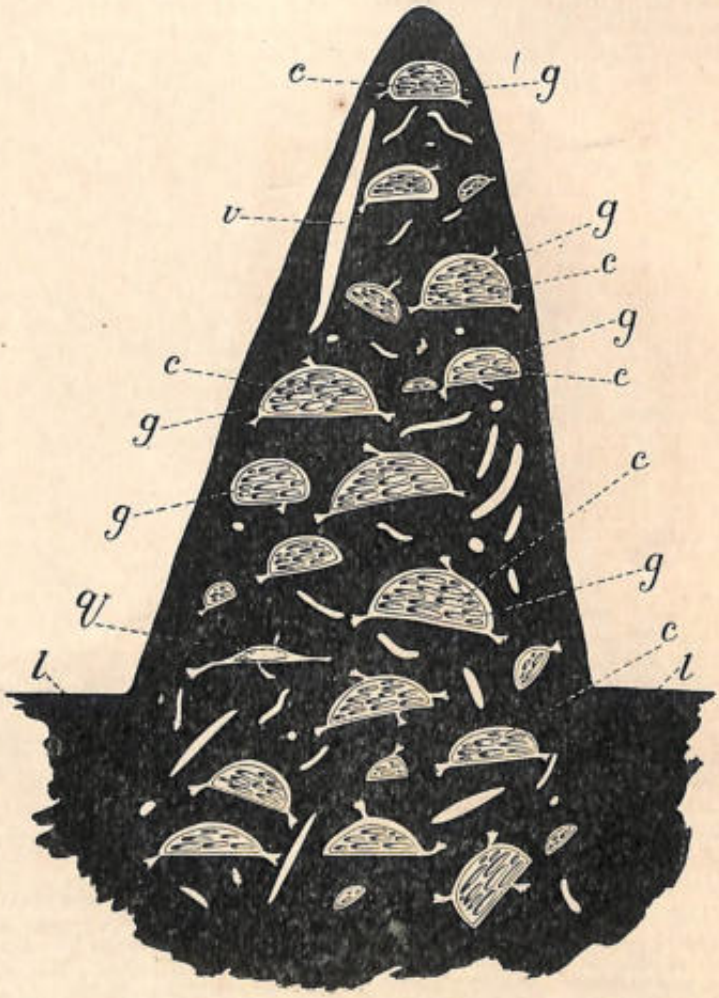


Fig. 3.

Vertical section of a mound of *Odontotermes redemanni*(Conical, multilocular Diagrammatic).

c, fungus-comb. *g*, garden-chamber. *l*, ground-level.
q, queen in royal chamber. *v*, vertical shaft.

Strangest of all, however, is the "meridian" mound built in Australia by *Hamitermes meridionalis*. This termite inhabits the hot, dry, open plains of Northern Queensland. Its mound has the form of a high, narrow dyke, compressed in one direction and with a single long horizontal axis. One face is

convex, the other concave. The convex face is exposed to the rising sun, the concave face to the setting sun, for the long axis always points due north and south, so that the full force of the midday sun never strikes any part of the mound except the narrow ridge-like summit.

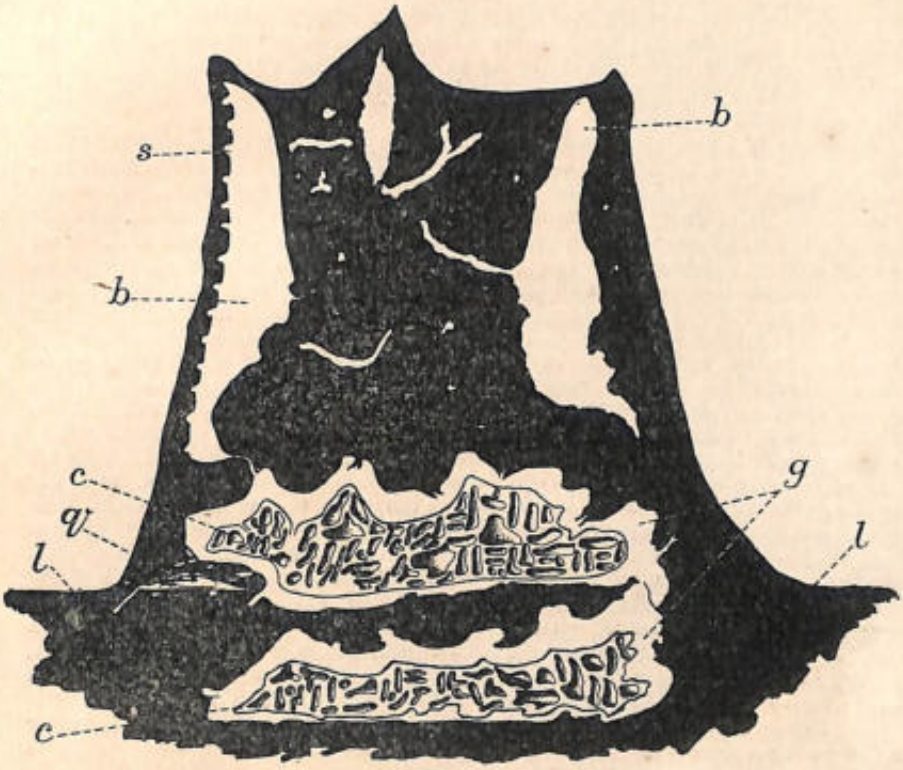


Fig. 4.

Vertical section of a mound of *Odontotermes obesus* var. *oculatus* (Buttressed, unilocular Diagrammatic).

b, hollow of buttress. *c*, fungus-comb. *g*, garden-chamber. *l*, ground-level. *q*, queen in royal chamber. *s*, cavity for soldier on guard during the building of the mound.

It is clear that the shape and orientation of the meridian mound is correlated with meteorological phenomena. This mound is constructed and placed in such a way that moisture is conserved so far as possible and that over-heating is avoided. I believe that the form of the mound in different species has always some significance of the kind. I cannot suggest any particular advantage of the high columnar form of some mounds, unless it be to enable the upper parts to emerge from dense surrounding vegetation. The umbrella form probably has the function its name suggests, the hemispherical cap or caps on the top preserving the nest from heavy rain. Both the conical form and the buttressed

form have certainly this function, which is better served in the latter. Rain runs off easily from a cone but the water is apt to lodge in small cavities on the surface and especially in the burrows of various insects (1) and spiders with which the outer wall of termite mounds is often pitted. Funnel-shaped openings are thus produced giving entrance into garden-chambers, but as these chambers are numerous and can be readily isolated by blocking up the narrow passages leading to them, no great harm is done. In the buttressed mounds on the other hand definite passages for the removal of rain-water are formed between the buttresses and it is only in very old and dilapidated mounds of this shape that breaches are formed by the action of water on the surface or in the burrows in the wall.

The next point we have to consider in this rapid survey is the way in which the mound is built. My own observations on this point refer to the two varieties of *Odontotermes obesus*, but there is no reason to think that there is any fundamental difference in other species. New mounds are constructed as a rule only in the wet season, at the beginning of which, in eastern India, *O. obesus* swarms. They are built mainly at night and work ceases shortly after sunrise, unless the weather be dull and damp. The first evidence that a new mound is in the building is the appearance of a crater-shaped hole in the ground, but this can only be seen at night. Before the crater appears the community has been formed underground and the progeny of its queen are already numerous. Round the hole a rampart is rapidly built up by the workers, each of which carries up in its mouth a minute pellet of earth, which it lays in position and cements with its saliva. As the rampart grows in height it contracts gradually in circumference and assumes a conical form; finally a roof is added, but if the roof be not complete before conditions become unfavourable for work, the orifice is left open above but blocked up at the base of the crater until next evening, to prevent the entry of enemies or rain. The wall and roof are at first very thin, consisting of a single layer of the pellets brought up from underground by the workers. It is, moreover, porous, small interstices being left in a fairly regular arrangement between the pellets. Behind each pore a soldier is on guard. If the observer waves a hand within a few inches of the surface, a kind of shudder passes over the whole structure. This is due to the fact that, as the hand approaches each pore, the soldier behind it thrusts out his head and snaps his jaws. As the soldiers are blind they must either act in response to movements of the air or changes of temperature or else be guided by some such sense as that of smell. They cannot see the possible aggressor.

The process of construction can be observed most easily by breaking down a part of the mound in dull, damp weather. The workers near the breach at first retreat but the soldiers remain, snapping their jaws. Then, in a few minutes, a crowd of workers and soldiers wells up from below. All is apparent confusion, but imperceptibly the soldiers take up their position round the aperture, each with its jaws pointing outwards and its soft body under cover. Each of the workers carries in its jaws a pellet of earth, which it deposits in exactly the right place, secreting a little drop of saliva upon it as it does so. Thus the new wall rises rapidly as a fragile shell, and as it rises, more and more soldiers come on guard, one behind every little pore it contains. Should the new roof have too wide a span to be constructed without support, a pillar rises simultaneously from below to meet it, built by other workers. The whole work is perfectly co-ordinated, but there is no apparent reason how or why the little blind, hurrying workers produce between them a perfect whole. Once the outer shell is complete, or even before its higher parts are finished, workers begin to strength-

(1) The chief of these, at any rate in eastern peninsular India, is the larva of the tiger beetle, *Cicindela hæmorrhoidalis*, which always burrows in the walls of termite-mounds.

en and thicken it from within, depositing more earthen pellets inside the first outer layer. The soldiers still remain on guard, however, and the wall is built round them, leaving each in a little cavity with an opening on both the outer and the inner surface. In the outer walls of the hollow buttresses of the mound of *oculatus* these little sentry-boxes remain even when the whole structure is complete. The external opening of each is finally closed by a thin film of earth, so thin that it is often quite translucent.

This is what takes place in damp weather. When repairs become necessary in dry weather the wall is built thicker from the beginning and there are no pores left for the soldiers. When the mound has to be enlarged or altered, the old wall is eaten away from within by the workers and a new one constructed in the manner described, but I have noticed on Barkuda Island in the Chilka Lake that in years in which the monsoon rainfall is scanty or late very little reconstruction takes place and repairs are reduced to a minimum. In years of scanty rainfall, moreover, few new mounds are built.

The building of the termite mound is a subject which I would commend to the attention of any naturalist in search of something to study. There are many points still obscure which could be cleared up with a little application by any careful observer who lived in a country where these mounds were abundant.

We will have time to-night to consider only one further aspect of the mound, namely the cultivation of fungi in it. In each garden-chamber, as I have already pointed out, there is a spongy mass formed of a brownish material. This consists of the excrement of workers which have been feeding on wood or other vegetable matter. It remains damp in suitable conditions and is disposed in such a way as to form numerous small cells or chambers, which are usually of an oblong shape. On the analogy of the honeycomb the structure is called a fungus-comb, but the resemblance is remote. The whole of the external surface and the inner walls of the cells are covered with a network of very fine white threads on which numerous little round fruit-like bodies of an intense white colour are scattered. The threads are the mycelia, what we may call (somewhat loosely) the roots, of a fungus, while the round white bodies are peculiar masses of fungus-tissue. They are not in any sense the fruit of the fungus but are known as food-bodies or termite truffles. They seem to be produced in some way almost like galls by the action of the termites, for similar bodies are not known in other fungi, but surprisingly little has been discovered as to their origin (1).

The nature, moreover, of the fungus which produces these bodies is still disputed. Dr. Petch, the great authority in Ceylon, believes that it is a peculiar phase of a mushroom-like species called *Collybia albuminosa*, which in certain circumstances undoubtedly arises in the fungus-comb and, piercing the wall of the mound, appears on the surface. This fungus is edible and is often collected on termite mounds for human food. It is found only on the mounds and can always be traced down to combs in which the termites are active. It has been found in association with termites in many tropical countries but in comparatively dry localities appears seldom, only when the rainfall is unusually heavy.

Under all conditions of artificial culture, however, an entirely different fungus springs up from the combs. If they are removed from the nest and placed under a bell-jar on damp blotting-paper numerous little white processes appear, apparently from the network of mycelia, after a few days. These gradually become consolidated into black, fibrous, bodies like leather bootlaces, which are

(1) An interesting parallel is to be found in the cultivation of fungi by certain American ants. See Wheeler's *Ants*, chap. XVIII, p. 318 (New York : 1910).

the fruit of an entirely different kind of fungus, called *Xylaria nigripes*. This fungus is also peculiar to termite mounds and whenever found in nature can be traced to deserted combs. It has also a wide range in the tropics in association with various species and genera of termites. It differs, however, from the mushroom-like *Collybia* in that it appears only after the termites have been removed or died in the comb. Dr. Petch regards this *Xylaria* of which allied species are often found growing on dead wood, as a mere weed which the termites are unable to eradicate completely from their gardens, though they keep it under control as long as they are active themselves; while he accepts the *Collybia* as the actual reproductive body of the mycelia on the combs; but the evidence he brings forward is indirect and the matter must still be considered as obscure. To me it appears as if the *Xylaria* grew directly from the mycelia in the cells.

The same system of cultivation, whatever it may be, is apparently followed by some termites which are mere burrowers and do not build mounds, but their combs are always few and small and rarely if ever have the same complexity of structure as those of the mounds. Sometimes, indeed, they are little more than masses of excrement with imperfectly formed depressions on their surface, whereas in *Odontotermes* at any rate the combs have a "cellular" structure from the beginning of their formation. The cultivation of the mound-builders is thus more highly developed in every respect than that of the burrowers.

We know nothing of how the termites cultivate the fungus or fungi, and very little of why they do so. It has been assumed rather than proved that they eat the food-bodies produced by it, but these bodies certainly do not form the main sustenance of the workers, which have a great majority in the population of the mound. The very existence of the combs proves, indeed, that this is not the case, for they are formed of the excrement of the workers and contain the woody fibres of the substances onwhich the workers feed. Moreover, the workers of many mound-builders make long excursions from the mound in search of dead wood and other decaying vegetable substances. I have known them go over eighty yards to feed on dead weeds at the edge of the Chilka Lake. They approached these weeds from the nest partly by underground passages and partly by little road-ways on the surface which they roofed in with a fragile covering of clay, as is their custom when foraging above ground.

It is certain that the eggs are removed to fungus-combs soon after they are laid, and that the combs near the royal chamber are frequently full of young insects. It seems probable, therefore, that the young termites feed on the food-bodies, which may also be carried by the workers to the king and queen in their royal prison-chamber. The winged adults also remain in the combs, awaiting favourable weather to emerge often for some weeks after their metamorphosis.

This is all that I can say profitably to-night about termite mounds, but I would again invite your attention to the many interesting problems they offer to the naturalist.

SOME REFERENCES.

ANNANDALE, N. .. .. "The Habits of the Termites of Barkuda." *Rec. Ind. Mus.* XXV, pp. 233-252, pls. v, vi (1923).

BOSE, S. R. .. .. "The Fungi cultivated by the Termites of Barkuda." *Rec. Ind. Mus.* XXV, pp. 253-258 pl. vi (1923).

DOFLEIN, F. .. .. "Termite Truffles." *Spol. Zeyl.* III, pp. 203-209 (1906).

ESCHERICH, K. .. .. *Termitenleben auf Ceylon*, 3 pls. and many text-figures (Jena: 1911).

HEGH, E. .. .. .. *Les Termites*, one plate, 460 figs. in text (Brussels: 1922).

HOLMGREN, N. .. .. "Termitenstudien. 1 Anatomische Unterschungen." *Kungl. Svensk. Vetensk.-Akad. Handl. XLIV*, No. 3, pp. 1-215, 3 plates and many text-figures (1909).

" .. .. "Termitenstudien. 2. Systematik der Termiten." *Kungl. Svensk. Vetensk.-Akad. Handl. XLVI*, No. 6, pp. 1-86, 6 plates (1911); 3 *ibid. XLVIII*, No. 4, pp. 1-166, 4 plates and many text-figures (1912).

" .. .. "Termites from British India (Bombay) collected by Dr. J. Asmuth, S.J." *Journ. Bombay Nat. Hist. Soc. XXI*, pp. 774, 793, plates A-D (1912-1913).

" .. .. Monographie der Termiten der Orientalische Region (1913).

" .. .. "Termites from British India (near Bombay in Gujrat and Bangalore) collected by Dr. J. Asmuth, S.J." *Journ. Bombay Nat. Hist. Soc. XXII*, pp. 101-117, plates E. G. (1913-1914).

IMMS, A. D. .. .. "On the Structure and Biology of *Archotermopsis*, together with Descriptions of New Species of Intestinal Protozoa, and General Observations on the Isoptera" *Phil. Trans. Roy. Soc.* 209 B, pp. 75-180, pls. 3-10, and many text-figures (1920).

KENT, W. S. .. .. *The Naturalist in Australia*, chap. IV "Termites (White Ants), pp. 102-131, pls. xv-xxii, many text-figures (London: 1897).

PETCH, T. .. .. .. "The Fungi of certain Termite Nests," *Ann Roy. Bot. Gard. Peradeniya*, IV, pp. 185-270 pls. v-xxi (1906).

" .. .. .. "Termite Fungi: a Resumé," *Ann. Roy. Bot. Gard. Peradeniya* V, pp. 303-341 (1913).

NOTES AND DESCRIPTIONS OF INDIAN FISHES.

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The following fishes were submitted to me for examination by Mr. James Hornell, late Director of Fisheries, Madras, India, in the summer of 1922. All are labelled Calicut and were sent from the Research Laboratory, West Hill, Calicut, South Malabar. I am, therefore, greatly indebted to Mr. Hornell for this opportunity to study these interesting species. One is described as new and notes are given for the others, of which but few are represented in American museums.

CLUPEIDÆ.

Sardinella longiceps Valenciennes. "Mathi."

Head 2⅞ to 3; depth 4⅛ to 4¼; D. iv, 13 or 14; A. ii, 13; scales 46 or 47 in lateral series to caudal base and 5 more on latter; 12 or 13 scales transversely at dorsal fin; 14 to 16 predorsal scales.

Body strongly compressed, slenderly ovate, deepest about midway in pectoral. Head strongly compressed, width 2⅛ to 2⅓ its total length. Snout conic, width 1⅛ to 1⅜ its length, which 3⅞ in head measured from snout tip. *Eye*—moderate, high, front pupil edge at first third in length of head, diameter 1⅓ to 1⅜ in length of snout, 1 in interorbital, 5⅛ to 5⅓ in head. Adipose eyelid well developed. Mouth small, superiorly terminal, closed mandible slightly protruding and upper jaw with slight median notch. Maxillary extends about first third in eye, expansion 1⅓ to 1⅔ in eye, length 2⅞ to 2¾ in head. No teeth. Interorbital broadly convex. Branch of arborescent striæ or venules from preorbital to preopercle above, venules also spreading out horizontally on opercle above and branch extends forward to supraorbital; cluster spreads over cheek; cluster radiating also at lower angle of preopercle; humeral venules well developed over at least 3 scales. *Gill-rakers*—158×200, finely lanceolate, little longer than gill-filaments, equal eye. Notch above and below bony knob along inner edge of gill-opening. *Scales*—firmly adherent, narrowly imbricated; 2 to 4 incomplete or more or less broken vertical parallel striæ and dozen or more irregular horizontal apical marginal lines, mostly connected or obsolete; circuli vertically parallel, fine.

Fins—dorsal origin little nearer mandible tip than caudal base, first branched ray 2⅔ to 2¾ in total head length. Anal inserted about midway between base of last dorsal ray and caudal base, first branched ray about long as eye. Caudal peduncle well compressed, least depth 1⅓ to 1¼ its length or 4⅓ in head. Caudal well forked, slender lobes pointed, 1⅝ to 1⅞ in head. Pectoral small, pointed, 2 in head, reaches 1⅓ to ventral. Ventral opposite middle of depressed dorsal, 4 in head, 2¾ to ventral. *Colour*—back slaty sides and lower surface pale to whitish. Fins all pale. Two examples, 157 and 166mm.

Sardinella dayi Regan. "Tholiquan Mathi."

Head 3; depth 2⅝; D. iii, 13 or 14; A. iii, 17; scales 38 in lateral series to caudal base and 4 more on latter; 13 scales transversely at dorsal fin; 12 predorsal scales; abdominal scutes 16 or 17×12 to 14.

Body strongly compressed, rather deeply ovoid, deepest at dorsal origin, profiles about evenly convex; predorsal scales extend forward nearly to occiput. Head strongly compressed, deep, width 2⅓ to 2⅔ its total length. Snout obtuse, compressed, width 1 to 1⅛ its length, latter 4 in

head measured from upper jaw tip. *Eye*—moderate, high, hind edge about midway in head length ; 4 in head. Adipose eyelid broad. Mouth small, terminal, lower jaw slightly projecting and upper jaw with slight median notch. Maxillary small, reaches first third to midway in eye, expansion $1\frac{1}{3}$ to $1\frac{2}{3}$ in eye, length $2\frac{1}{6}$ to $2\frac{1}{3}$ in head. No teeth. Interorbital broadly convex, median ridge pronounced. Branch of arborescent striæ or venules from preorbital to preopercle above, spreading backward above over opercle horizontally; large cluster on cheek ; small wider-set venules radiate down flange of preopercle and few along humeral edge of gill-opening horizontally. *Gill-rakers*—68×90, finely lanceolate, about long as eye. Gill-filaments $\frac{2}{3}$ length of gill-rakers. Inside edge of gill-opening with single notch below. *Scales*—firmly adherent, narrowly imbricated ; 2 vertical wide-spaced parallel striæ ; about 20 to 25 marginal striæ apically ; circuli fine, vertically parallel.

Fins—Dorsal origin midway between mandible tip and base of last anal ray, first branched ray $1\frac{1}{6}$ to $1\frac{1}{8}$ in total head length. Anal low, begins entirely behind dorsal or little nearer caudal base than dorsal origin, first least depth 4 in head. Caudal peduncle strongly compressed, long as deep or least depth $2\frac{2}{3}$ in head. Caudal strongly forked, slender lobes pointed, slightly less than head. Pectoral reaches $\frac{2}{3}$ to ventral, $1\frac{2}{3}$ to $1\frac{5}{6}$ in head. Ventral inserted slightly before dorsal origin, reaches $2\frac{1}{6}$ to $2\frac{1}{4}$ to anal, length $2\frac{1}{3}$ to $2\frac{2}{3}$ in head. *Colour*—Back slaty-brown. On level from upper eye edge till nearly opposite end of depressed dorsal, 5 or 6 short obsolete vertical dark streaks ; sides of lower surface, pale to whitish. Dorsal and caudal tinted grayish, tip of former dusky, other fins whitish. Three examples, 105 to 106 mm.

Sardinella melanura (Bleeker). "Chooda."

Head 4 ; depth 3 ; D. iii, 12 or 13 ; A. iii, 15 or 16 ; scales 35 to 37 in lateral series to caudal base and 4 more on latter ; abdominal scutes 15 to 18×11 or 12.

Body with lower profile more convex forward than upper. Head strongly compressed, width $2\frac{1}{10}$ to $2\frac{1}{2}$ in its total length. Snout obtuse, very short, width equals its length, which 4 to $4\frac{1}{8}$ in head measured from its own tip. *Eye*—with hind edge midway in head ; adipose-lids wide ; diameter $3\frac{1}{3}$ to $3\frac{1}{2}$ in head. Mouth small, superior, mandible well protruded, without median notch above. Maxillary reaches first third in eye, expansion $1\frac{1}{3}$ to $1\frac{2}{3}$ in eye. No teeth. Interorbital broadly convex, $4\frac{1}{8}$ to $4\frac{2}{3}$ in head. Preopercle vertical. Opercle smooth. *Gill-rakers*—16×28, finely lanceolate, slightly less than gill-filaments or 2 in eye. *Scales*—rather firmly adherent, with 3 or 4 vertical parallel striæ, well spaced, fine circuli vertically parallel.

Fins—Dorsal origin midway between mandible tip and caudal base, first branched ray $1\frac{2}{3}$ in head measured from mandible tip. Anal begins midway between dorsal origin and caudal base, or entirely behind depressed dorsal, first branched ray $2\frac{2}{3}$ to $2\frac{7}{8}$ in head. Caudal peduncle well compressed, least depth equals its length or $2\frac{1}{10}$ to $2\frac{1}{3}$ in head. Caudal strongly forked, lobes sharply pointed, lower slightly longer, 3^1 to $3\frac{2}{3}$ in combined head and trunk. Pectoral reaches $\frac{2}{3}$ to ventral, length $1\frac{1}{4}$ to $1\frac{1}{3}$ in head. Ventral inserted very slightly before dorsal origin, reaches $\frac{2}{3}$ to anal, length 2 to $2\frac{1}{4}$ in head. *Colour*—Pale uniform brown with silvery reflections. Narrow dusky median streak down back. Fins pale, caudal tinted dusky terminally, especially near end of each lobe. Side of head and iris silvery-white. Edges of jaws sprinkled with few rather large dusky blotches. Inside gill-opening dusky. Three examples, 97 to 111 mm.

Day does not give the number of gill-rakers. He simply says they are "numerous, closely set and about $\frac{1}{3}$ as long as the eye." The related *Harengula kluneei* (Bleeker) appears to differ chiefly in its pale caudal. Its gill-rakers are given as 38 on the lower branch of the outer arch, according to Day.

Ilisha indica (Swainson). "Kamma Mathi."

Head 3 ⅓; depth 2¾; D. iii, 10 or 11; A. iii, 34; scales 38 in lateral series to caudal base and 4 more on latter; 13 scales transversely at dorsal fin; 14 predorsal scales; abdominal scutes 19 or 20×10.

Body strongly compressed, deeply ovoid, lower profile little more convex and predorsal keel distinct to occiput. Head deep, strongly compressed, width 2½ to 2⅔ its total length. Snout obtuse, rather swollen each side forward, length ⅘ its width or 4 to 4⅓ in head measured from snout tip. *Eye*—large, high, center midway in total head length, diameter 2½ to 2⅝ in head measured from upper jaw tip. Mouth small, superior, terminal, lower jaw protruding well in front, upper without distinct median notch. Maxillary extends about first third in eye, expansion 2, length 2 to 2 1/10 in head. Teeth obsolete or absent, only row of very indistinct ones along lower maxillary edge. Interorbital slightly convex, narrow, less than half of eye. Suborbital branch of rather coarse venules or striæ extend from preorbital to postocular; few striæ on flange of preopercle below; opercle with 2 or 3 weak radiating striæ. *Gill-rakers*—12×22, slender, lanceolate, 2½ in eye. Gill-filaments ¾ length of gill-rakers. Notch above and below broad bony knob in inner edge of gill-opening. *Scales*—firmly adherent, narrowly imbricated; 6 vertical evenly spaced parallel striæ, half of which may be broken medianly; 23 to 25 marginal striæ apically; circuli fine, vertically parallel.

Fins—Dorsal origin midway between mandible and caudal base, first branched ray 1⅘ to 1⅔ in total head length. Anal origin opposite base of last dorsal ray first branched ray 3 to 3¹ in head. Caudal peduncle strongly compressed, length ⅘ its least depth, which 2⅔ to 3 1/10 in head. Caudal strongly forked, lobes slender, pointed, long as head. Pectoral pointed, reaches nearly far as depressed ventral end, 1⅓ in head. Ventral inserted little before dorsal origin, reaches 2¼ to 2½ to anal, length 1⅔ to 2 in eye. *Colour*—Back pale brownish, with median pale dusky streak. Dorsal and caudal slightly pale brown, other fins whitish. Sides and lower surface silvery-white, also iris. Two examples, 93 to 110 mm.

My examples with fewer dorsal and anal rays than Day gives.

Opisthopterus tartoor (Cuvier). "Ambatta."

Head 4 to 4⅛; depth 3⅓ to 3⅔; D. iii, 9; A. iii, 50 or 51; scales 40 ? in lateral series to caudal base and 3 more on latter; abdominal scutes 27 to 30.

Body very strongly compressed, lower profile more convex forward than upper. Head strongly compressed, width 2¾ to 2⅞ in its total length. Snout very short, obtuse, length about ⅘ to equal its width or 4 to 4⅛ in head measured from its own tip. *Eye*—large, hind pupil edge very slightly before centre in head length, diameter 2¾ to 2⅞ in head. Mouth small, superior, mandible vertically inclined and protrudes, upper jaw without median notch. Maxillary reaches about first third in eye, expansion 1½ to 2 in eye. Teeth very minute, single row in jaws and along entire lower maxillary edge. Interorbital convexly elevated, 2 to 2½ in eye. Preopercle slightly inclined forward. Opercle smooth. *Gill-rakers*—10×22, finely lanceolate, little longer than gill-filaments or 2 in eye. *Scales*—very caducous, all fallen from trunk, rather small and narrowly imbricated.

Fins—Dorsal midway between pectoral origin and caudal base, about over first third in anal base, fin uniformly low, first branched ray about 1⅔ to 2 in eye. Caudal peduncle strongly compressed, length ¾ to 1 in its least depth, which 1 to 1⅓ in eye. Caudal small, forked, 1⅔ to 2 in total head length. Pectoral long, droops vertically, reaches ⅘ to vent, length 1 to 1⅛ in head. *Colour*—Pale uniform brown. Dusky-brown median streak downback. Fins pale. Pectoral and caudal with few dull dusky dots. Iris and side of head silvery-white. Top of head and ends of jaws sprinkled with dusky dots. Three examples, 69 to 74 mm.

DUSSUMIERIIDÆ.

Dussumieria hasseltii (Bleeker.) "Kolachi."

Head 3¼ to 3⅔; depth 5 to 5½; D. iv, 16; A. iii, 12; scales 45 in lateral series to caudal base and 4 more on latter; 12 scales transversely at dorsal fin; 24 predorsal scales.

Body well compressed, slender, long, edges all rounded convexly. Head attenuated, compressed, width 2⅔ to 2⅞ its total length. Snout conic, width 1¾ to 1½ in its length, which 3 to 3 1/10 in head. *Eye*—large, midway in head length, 1⅛ to 1⅛ in snout or 3⅓ to 3¾ in head measured from snout tip. Adipose eyelid moderate. Mouth terminal, moderate, lower jaw well protruded or equals half of head, measured from mandible tip. Upper jaw without median notch. Maxillary about reaches front eye edge, expansion 3 in eye, length 3 to 3½ in head measured from upper jaw tip. Row of rather long slender uniform teeth in each jaw, also extending along each maxillary edge on palatines and down tongue medianly. Interorbital broadly convex, width ⅘ of eye. Opercle and sides of head smooth. *Gill-rakers*—12 × 26, finely lanceolate, slightly longer than gill-filaments or 2 in eye. *Scales*—very caducous; 3 or 4 vertical parallel striæ; 8 to 11 basal radiating striæ; 15 to 20 apical marginal striæ; circuli fine.

Fins—Dorsal origin midway between eye centre and caudal base, first branched ray 2 in total head length. Anal inserted well behind depressed dorsal or about midway between ventral origin and caudal base, first branched anal ray 4 in head. Caudal peduncle well compressed, least depth 1 to 1⅛ its length or 2⅞ to 3⅓ in head. Caudal well forked, slender lobes pointed, equal, 1 to 1⅛ in head. Pectoral low, reaches 2 to 2⅓ to anal, 2 to 2 1/10 in head. Ventral inserted little behind dorsal origin, reaches 1⅞ to 1⅞ to anal, fin 2⅓ to 2⅔ in head. *Colour*—Pale brownish, back dusky above, also dusky line from shoulder to caudal base medianly. Iris and side of head silvery. Fins pale. Dorsal lobes dusky terminally. Two examples, 95 to 97 mm.

DOROSOMIDÆ.

Anodontostoma chacunda (Buchanan-Hamilton). "Kondati Mathi."

Head 3⅓ to 3⅓; depth 1/5 to 2⅓; D. iii, 15, i; A. ii, 16, i or ii, 17, i; scales 37 to 40 in lateral series to caudal base and 3 more in latter; 12 scales transversely at dorsal fin; 10 or 11 predorsal scales; abdominal scutes 17×11 or 12.

Body strongly compressed, deeply ovoid, predorsal keel distinct. Head deep, strongly compressed, width 1⅞ to 2 in its length. Snout obtuse, convex, length ½ to ⅔ its width or 4⅕ to 4⅓ in head. *Eye*—moderate, hind edge little before middle in head; diameter 3⅓ to 3⅞ in head. Adipose eyelid wide, extends well back over side of head. Mouth inferior, broad, rami forming obtuse angle. Maxillary extends about first third of eye. No teeth. Interorbital convexly elevated, width 3 to 3⅓ in head. Many radiating venules on cheek, opercles, postocular and humeral regions. *Gill-rakers*—about 65×83, finely lanceolate, 2½ in gill-filaments, which 1½ in eye. *Scales*—firmly adherent, narrowly imbricated; 5 or 6 vertical parallel striæ, only most apical one complete, others interrupted medianly; apically edges of scales with about 26 weak crenulations, points more or less extended, though narrow and tips rounded; circuli fine, concentric. Caudal largely scaly and broad basal band of scales along dorsal and anal.

Fins—Dorsal origin little nearer snout tip or midway between same and base of last anal ray; first branched ray 1⅔ in head; last branched ray 2½ to 2⅔ in first. Anal entirely behind depressed dorsal, about midway between ventral origin and caudal base, first branched ray 3½ to 4 in head. Caudal peduncle compressed, least depth 2 to 3¼ in head, length ⅔ its least depth. Caudal

strongly forked, lobes sharply pointed. Pectoral low, reaches slightly beyond ventral origin, $1\frac{1}{3}$ in head. Ventral inserted opposite first third in dorsal base, fin reaches $\frac{3}{5}$ to anal, $1\frac{1}{3}$ to $1\frac{2}{3}$ in head. *Colour*—Brownish above, sides and below whitish. Dark slaty humeral blotch about size of eye in depth, only width narrower. Iris shows through adipose eyelid largely slaty. Fins pale. Three examples, 145 to 155 mm.

ENGRAULIDIDÆ.

Engraulis dussumieri (Valenciennes). "Chala Mathi," "Cheruman Anku." Head $3\frac{2}{3}$ to $3\frac{4}{5}$; depth $3\frac{1}{2}$; D. iii, 9, i or iii, 10, i; A. iii, 29 or 30; scales 37 or 38 in lateral series to caudal base and 2 more on latter; 9 scales transversely at dorsal fin; 16 or 17 predorsal scales; abdominal scutes 15 or 16×7 or 8.

Head strongly compressed, width $2\frac{1}{2}$ to $2\frac{4}{7}$ its length. Snout conic, short, length $\frac{2}{3}$ its width or 5 to $5\frac{1}{3}$ in head. *Eye*—with hind edge about first $\frac{2}{5}$ in head: lids not free; diameter $3\frac{4}{7}$ to 4 in head. Mouth large, upper jaw projecting about half snout length. Maxillary slender, greatly prolonged, nearly reaching ventral origin. Teeth very fine, close-set, even, uniserial in jaws, extend along maxillary to its hind end. Interorbital convex, equals eye. Preopercle ridge oblique. Opercle smooth. *Gill-rakers*—16×16, slender. equal gill-filaments or $1\frac{1}{3}$ in eye. *Scales*—caducous, narrowly imbricated; 9 or 10 vertical parallel striæ; circuli fine, also vertically parallel.

Fins—Dorsal origin little nearer snout tip than caudal base, first branched ray $1\frac{1}{3}$ in head. Anal begins close behind dorsal base, $1\frac{3}{4}$ to 2 in head. Caudal peduncle strongly compressed, length $\frac{2}{3}$ its least depth, which $2\frac{1}{5}$ to $2\frac{1}{3}$ in head. Caudal deeply forked, slender pointed lobes equal, 1 to $1\frac{1}{5}$ in head. Pectoral reaches little beyond ventral origin, $1\frac{2}{3}$ in head. Ventral inserted before dorsal, reaches $\frac{2}{3}$ to anal, 2 to $2\frac{1}{3}$ in head. *Colour*—Pale brownish above, sides silvery white, without pale lateral band. Fins pale, edges of caudal lobes slightly dusky. Humeral venules slightly dusky and with obsolete dusky band crossing predorsal anteriorly to opposite humeral membrane. Five examples, 105 to 116 mm.

These examples differ a little from Day's account in that the caudal lobes are equal and the fin rays slightly fewer.

Engraulis purava (Buchanan-Hamilton). "Kavuchalla".

Head $3\frac{1}{3}$ to $3\frac{4}{5}$; depth 3 to $3\frac{1}{4}$; D. iii, 10, i or iii, 11, i; A. iii, 35, 1 to iii, 39, i; scales 35 to 40 in lateral series to caudal base and 3 more on latter; abdominal scutes 15 or 16×9.

Head strongly compressed, width $2\frac{1}{2}$ to $2\frac{2}{3}$ in its length. Snout obtusely conic, short, but very little projecting beyond mandible, width $\frac{2}{3}$ its length or 4 to $4\frac{1}{2}$ in head. *Eye*—with hind edge very slightly before centre in head length; lids not free; diameter $3\frac{1}{2}$ to $3\frac{2}{3}$ in head. Mouth large, upper jaw protrudes about $\frac{1}{3}$ snout length. Maxillary slender, prolonged slightly beyond gill-opening, not reaching pectoral. Teeth very small, uniserial in jaws, extend along maxillary to its hind end. Interorbital convex, equals eye. Preopercle well inclined. Opercle smooth. *Gill-rakers*—16×17, twice length of gill-filaments; $1\frac{1}{2}$ in eye. *Scales*—very caducous; 9 or 10 vertical parallel striæ, often incomplete, apical usually closer and even with few annectant branches; circuli fine, vertically parallel.

Fins—Dorsal origin midway between snout tip and caudal base, first branched ray $1\frac{1}{6}$ to $1\frac{2}{3}$ in head. Anal origin opposite sixth dorsal ray base, first branched ray $1\frac{4}{5}$ to $1\frac{7}{8}$ in head. Caudal peduncle well compressed, length $\frac{2}{3}$ to 1 in least depth, which $2\frac{1}{2}$ to 3 in head. Caudal deeply forked, slender pointed lobes equal, 1 to $1\frac{1}{2}$ in head. Pectoral reaches $\frac{2}{3}$ to ventral, $1\frac{1}{2}$ to $1\frac{2}{3}$ in head. Ventral inserted well before dorsal, reaches $1\frac{2}{3}$ to $1\frac{3}{4}$ to anal, $2\frac{1}{3}$ to $2\frac{2}{3}$ in head. *Colour*—Pale brownish generally. No silvery lateral band. Sides of head with silvery sheen. Fins pale, dorsal and pectoral dusted with dusky terminally, also

caudal edges behind. Small dusky blotch at crown and several pale dusky specks at snout tip. Humeral venules dusky. Iris silvery-white. Three examples, 79 to 96 mm.

Differs slightly from Day's figure and description in the shorter maxillary, he showing it nearly reaching pectoral base. Day gives a few more anal rays.

Engraulis hornelli, new species. "Cheruman Anku."

Head 4; depth $4\frac{1}{3}$; D. iii. 11, i; A. iii, 34, i; p. i, 12; v. i, 6; scales (fallen) 43 in lateral series from gill-opening above to caudal base medianly and 3 more on latter; 12 scales transversely between dorsal and anal origins; abdominal scutes 18×10.

Body elongately fusiform, profiles alike, deepest at dorsal origin, edges but slightly trenchant. Caudal peduncle strongly compressed, least depth equals its length or 3 in head. Abdominal scutes moderate, sharply pointed.

Head strongly compressed, moderately attenuated, flattened sides rather narrowly constricted below, width $2\frac{3}{4}$ its length. Snout short, obtusely conic, only about front fourth its length portruding beyond mandible; width $4\frac{1}{3}$ its length which 5 in head. *Eye*—with hind edge at first $\frac{3}{5}$ in head, diameter 4. Eye covered with adipose-lid, edges free. Mouth large, little inclined. Maxillary slender, prolonged beyond head until slightly beyond pectoral origin, expansion about $1\frac{2}{3}$ in eye. Teeth small, slender, uniserial, well spaced, even in jaws, extend whole length of lower maxillary edge. Single median row of teeth on tongue. Tongue small knob, adnate, forward in jaws. Nostrils small, adjoining, about last fourth in snout, before and level with upper edge of eye. Interorbital convex, equals eye. Preopercle oblique. Opercle smooth.

Gill-opening extends forward opposite front edge of pupil, connecting gill-membranes very short. *Gill-rakers*—10×15, slender, $\frac{1}{5}$ longer than gill-filaments or $1\frac{1}{2}$ in eye. Isthmus narrow trenchant keel.

Scales—very caducous, with 14 or 15 vertical parallel striæ; circuli very fine, also vertically parallel. Scales (fallen) form basal sheaths to dorsal and anal. Caudal base scaly. Axillary pectoral scale $\frac{2}{3}$ of fin, ventral scale about half of fin. Humeral venules moderate.

Fins—Dorsal origin about midway between front eye edge and caudal base, depressed fin $2\frac{1}{4}$ to latter, first branched ray $1\frac{2}{3}$ in head. Anal origin directly below last dorsal ray base, fin low, first branched ray $1\frac{2}{10}$ in head. Caudal deeply forked slender pointed lobes equal, $1\frac{1}{3}$ in head. Pectoral low, pointed, reaches first third in ventral, fin $1\frac{2}{3}$ in head. Ventral inserted before dorsal, fin $2\frac{2}{3}$ to anal or $2\frac{2}{3}$ in head.

Colour dull brownish generally, back slightly purplish gray. No silvery lateral band. Sides of head silvery white. Caudal with edges narrowly dusky, none of other fins dusted with dusky. Humeral venules dusky.

Length 130 mm.

One from Calicut.

Three others, same data, at "Namanaugu", are simply younger. They show the following: Head $3\frac{3}{5}$ to $3\frac{3}{4}$; depth $3\frac{2}{3}$ to $4\frac{1}{6}$; D. iii, 11 or 12; A. iii, 31 to 36; scales about 38 or 39 in lateral series from gill-opening above to caudal base medianly and 2 or 3 more on latter; abdominal scutes 17 to 19×10 or 11; head width $2\frac{1}{2}$ to 3 in its length; snout $4\frac{1}{4}$ to 5; eye $3\frac{1}{3}$ to $3\frac{3}{4}$; gill-rakers 12×14; length 80 to 90mm.

Related to *Engraulis setirostris* (Broussonet), but according to Weber and Beaufort that species has the maxillary reaching beyond the ventrals, often to the anal, but 12 gill-rakers in the lower branch and the scales with only 10 to 12 vertical striæ.

(Named after Mr. James Hornell, Director of Fisheries, Madras.)

(*to be continued*).

A SPORTING TRIP TO THE PINDARI GLACIER.

BY
W. H. O. SHORTT.

(With a plate.)

PART I.

This article is not a record of the personal doings of the writer, which, as a matter of fact, did not amount to very much, but is intended, rather, to be a guide to anybody who wishes to do the trip from either a scenic or sporting point of view, or both combined. I give a table of halting places, with their distances apart, and elevations, and other appropriate information, so that an interested person can select marches to suit his or her taste and length of holiday. Although I planned the trip in May, I had not succeeded in getting any definite information about the shooting possibilities by the time I left, which was the second of October 1923. Remarkably few people seemed to have done the trip, and those few had either done it so long ago that they couldn't give me any reliable information, or they had done it purely as a walking tour for the sake of the scenery. As I was desirous of going for both scenery and sport, with a decided bias towards the latter, I think that this article may be of interest and use to others who wish to do the trip, particularly to those who wish to know its sporting possibilities, with which, I may as well say now, this article mainly deals.

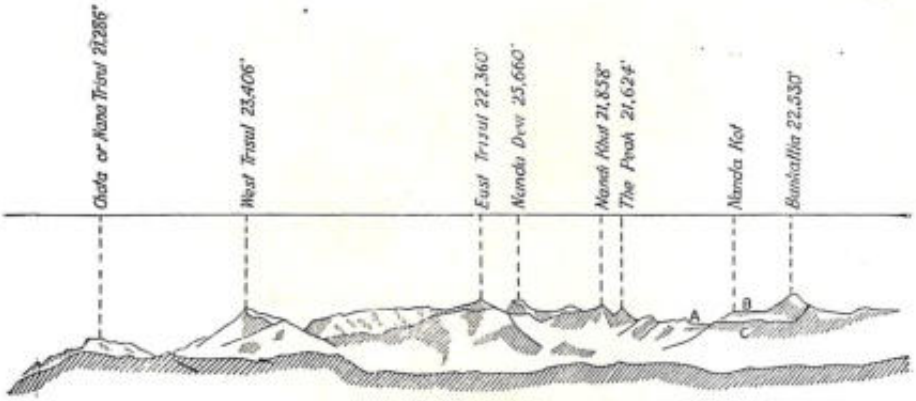
Information is required on several points such as transport, housing, commissariat, sport, scenery, and the time to go on the trip.

The first thing to decide is, of course, when to do the trip. Opinion differs here according to the object of the trip. This must be your deciding factor as to whether you go in the early summer or the autumn. May is about the earliest time you should select. If you go earlier you will probably find your road blocked with snow to such an extent as to render it difficult and even dangerous to proceed. In May the roads are passable though often partially blocked, and you get the finest views of the snow clad heights which later lose a fair proportion of snow from their lower slopes. The spring flowers will be out on the lower levels, where the snow has melted, and I believe in some places of they grow in profusion. On the other hand, in the earlier marches you will find the countryside bare and all the small hill streams dry. This may cause horses or dogs, if these are accompanying you, a little inconvenience. Shooting, also, is not open at this season.

After June you are certain to get bad weather and consequently very poor views of the snows as these will be almost constantly hidden in clouds. The scenery close at hand will, however, be very fine as all the trees will be smothered in leaves. The waterfalls, of which there are a large number, especially in the latter stages of the trip, will be at their very best, and as the height of some of these is very considerable, I think even an American would be compelled to sit up and take notice.

The sportsman, however, will have to go in October or later, as the close season precludes an earlier start, and I think, taking it all round, he has the best of it. October, I think, is the ideal month. Many of the deciduous trees develop most gorgeous colours at this time before shedding their leaves. The earlier marches are reasonably cool and you get water everywhere. The falls even are nearly all active, though with a diminished flow and you have no difficulty in fording streams, of which there are numbers, which you might experience during the rains. Shooting is generally open, though some deer are still closed. Details of the close seasons, however, can be obtained from the Forest Authorities. If you propose to combine sport and scenery and to do the sporting part thoroughly the trip will take about 50 days, but this can be cut down to less than half to suit your requirements, as can be seen from a study of the route table.

I would suggest the following time table for a combined shooting and sightseeing tour, starting from Kathgodam.



The main glacier lies at the back of A and the subsidiary one between B and C.

Profile of Snows as seen from Ranikhet.



SNOWS FROM KAUSANI, CLOSELY CORRESPONDING WITH DIAGRAM OF PEAKS.

Suggested Time-table for Shooting and Sightseeing.

From	To	Marching & Sight-seeing.	Shooting.	Total.
Kathgodam	Bhimtal	1	..	1
Bhimtal	Bhowali	1	1	2
Bhowali	Khairna*	1	2	3
Khairna	Ranikhet	½	..	½
Ranikhet	Majkali	1	..	1
Majkali	Arideo	1	1	2
Arideo	Someswar and on to Kausani ..	1	..	1
Kausani	Baijnath*	1	..	1
Baijnath	Bageswar	1	..	1
Bageswar	Kapkot	1	..	1
Kapkot	Loharkhet	1	..	1
Loharkhet	Khati	1	..	1
Khati	Diwali and on to Phurkhia	1	..	1
	Remain at Phurkhia 3½ days for trip to glacier and shooting	1	2½	3½
Phurkhia	Diwali (after morning shoot)	½	½	1
Diwali	Dhakuri	1	2	3
Dhakuri	Kapkot*	1	1	2
Kapkot	Bageswar*	1	2	3
Bageswar	Takula	1	..	1
Takula	Binsar	1	2	3
Binsar	Almora	2	..	2
Almora	Peora	1	1	2
Peora	Mukteswar	1	..	1
Mukteswar	Ramgarh*	1	3	4
Ramgarh	Nainital	3	..	3
Nainital	Kathgodam	1	..	1
	Total ...			49

Fishing may be partly or wholly substituted at places marked *. Bhimtal is noted for fishing.

As this article deals mainly with the sporting side of the tour, we will say you decide to start at the beginning of October. The first thing to do is to get your shooting permits. There are two types only you need consider, form C and form D. The former covers small game only and can be taken out for a month or a year costing Rs. 5 and Rs. 20 respectively. The latter covers all game and can be taken out for three months or a year costing Rs. 25 and Rs. 100. The tour extends through two districts, Nainital and Almora and separate permits are required for each district. You must obtain your permits according to what you propose to shoot. Application for permits should be made to the Divisional Forest Officer, Nainital, or Almora as the case may be. It is best to apply well before hand and to send the fee with your application stating the number of dogs and attendants you propose taking with you. Each person must have a separate permit. Limits as to the numbers that may be shot of certain animals are notified in the permits, but carnivora are unlimited: you are not likely, however, to reach infinity in the carnivora line, or any other in fact. Besides shooting permits, you require permission to use P.W.D. and Forest Inspection Houses. The latter may be obtained from the Forest Officers already mentioned and the former from the District Engineer of the district in which they are situated. When applying, dates of arrival and departure should be given, particularly for the former bungalows. Permission to occupy

Dak bungalows need not be obtained. If you propose doing the shooting thoroughly it is advisable to take a tent with you, as you will find it very convenient when the shooting ground is a good distance from the Dak bungalow or Inspection House. I now give a table showing the Dak, Inspection, and Forest bungalows in the route, with one or two additional ones, which may be visited, giving altitudes where possible, and distances, and the district they are in. Altitudes are mostly approximate but are not far out and there may be a little discrepancy as to the district in which one or two of the bungalows are situated, as I am not sure if Forest boundaries coincide with district boundaries.

List of Marches, Bungalows, Elevations, &c.

Name.	Type of Bungalow.	District in which situated.	Distance from last halt in miles.	Elevation.	Remarks.
Bhimtal*	D.B., H.	Naimtal ..	8	4,500	Shooting & fishing.
Bhowali	I.B., F.B., H.	,, ..	5	6,000	Shooting.
Khairna*	D.B., I.B.	,, ..	12	3,350	Shooting & fishing.
Ranikhet*	D.B., I.B., H.	Almora ..	15	5,983	
Majkali*	D.B.	,, ..	9	6,000	
Arideo	F.B.	,, ..	8½	6,900	Shooting.
Someswar*	D.B.	,, ..	4½	4,572	
Kausani	I.B.	,, ..	6½	6,000	
Baijnath	I.B.	,, ..	8	..	Fishing.
Bageswar*	D.B.	,, ..	13	3,200	Shooting & fishing
Do. from Someswar	..	..	15	,,	
Kapkot	I.B.	Almora ..	14	3,750	Shooting & fishing.
Loharkhet	I.B.	,, ..	9½	5,600	Shooting.
Dhakuri	I.B.	,, ..	6½	8,725	Shooting.
Khati	I.B.	,, ..	5	7,650	
Diwali	I.B.	,, ..	6½	7,967	Shooting.
Phurkhia	I.B.	,, ..	3½	9,900	Shooting.
Return as above.					
Bageswar to—					
Takula *	D.B.	,, ..	11	5,330	Shooting.
Binsar	F.B.	,, ..	6	7,500	Shooting.
Almora*	D.B.	,, ..	12	6,500	
Do. from Takula..	..	..	15	,,	
Peora*..	D.B.	Nainital ..	9½	5,900	Shooting.
Ramgarh*	D.B., I.B., H.	,, ..	10	6,000	Shooting & fishing.
Bhimtal	..	,, ..	9½	4,500	Shooting & fishing.
Ramgarh to Nainital...	H.	..	12	6,500	
Peora to Mukteswar ..	I.B.	Naimital ..	4	7,792	

* Bungalows have khansamas.

I should advise any one who proposes doing the trip to procure a map of the district. These may be had on application from the O.C., Map Record and Issue Office, 13 Wood Street, Calcutta. I recommend the scale of 1″ equal to 4 miles. It would be as well to ask the suppliers to join the different sheets together and mount them on cloth. I used four sheets joined together showing from Bhimtal to far north of the Pindari Glacier. I cut off a large piece at each side. The map I used and found most useful was the Indian Atlas, quarter sheets 66 N.E., 66 N.W., 66 S.E. and 66 S.W. on the scale of one inch equal to 4 miles. A larger scale 1″=to 1 mile may also be had, but this is much bulkier though there are more elevations given on it and it is certainly clearer. The names on both these maps are in many cases quite different to the names now in use.

Transport.

From Kathgodam there is a Motor Service to Nainital, Bhowali, Khairan, Ranikhet, Majhkali and Almora. Beyond Almora, or off this road all goods have to be carried by pack animals or coolies. There are cooly agencies at various places but the principal ones are at Kathgodam, Nainital and Almora. Their addresses and full details of rates may be obtained from the District Engineer of Nainital and Almora, but I will give a rough guide to rates here. The rates vary according to weights carried, and exact details should be obtained long before you start; from one or two days notice should be given according to the number of coolies and animals required, the latter also being provided by the agencies.

Roughly speaking a cooly will carry 25 seers for 1½ anna per mile, halts being paid for at a lower rate, with a minimum amount. Pack ponies or mules cost Rs. 2 a day including the driver, one driver will manage two mules. Riding ponies with saddles cost Rs. 3 a day. I believe a side saddle costs a little extra. The coolies employed by these agencies will only go a certain distance when they will return. This, however, is not important as the agencies have branches all over and the next branch will arrange for a fresh supply. I believe the riding ponies go all the way and back. If your demand is a large one, a little delay may be experienced in collecting coolies and it is advisable, in such a case, to send word ahead stating your requirements. If you can give the first agent a programme he will send word ahead.

A very much simpler, but slightly more expensive method,and one which I strongly recommend, is as follows:—In Almora there is an enterprising shopkeeper who is out to make money in any way he can. He is able to, and will, make all arrangements for you, and charge you nothing for it. He makes his own arrangement with the coolies to receive part of their pay or some such arrangement. He keeps a large general merchant's store in Almora, and besides oilman's stores, he hires out camp furniture of *all* sorts, including tents. He can also engage a cook, kit, dhobi, and sweeper for you: in fact, he is a "universal provider". Write to him at the undernoted address, tell him exactly what you want, and when you want it, and leave the rest to him. As regards stores, these are, naturally more expensive in the hills, and you will probably bring your own, but if time is precious, and you have to motor to Almora, it will probably come as cheap to buy your stores from him. You should give him timely notice, however, as October is the end of the season in Almora, and he is likely to have a very limited supply by then. His coolies will cost you Rs. 1-4-0 a day, no difference for halts. They will meet you at Kathgodam and bring you back to Kathgodam. He will send a mate with them, who will cost you Rs. 1-8-0 a day (and a blanket at Bageswar). This man will not carry loads, but he will carry your gun, haversack, waterbottle, etc., look after the coolies and make himself generally useful and touch you for Rs. 5 or so at the end of the trip. He will also expect to be paid 2 days wages for coming from and returning to Almora, but you should stipulate, when writing, that the coolies will only be paid from Kathgodam to Kathgodam. Pack and riding ponies will cost the same as from other agencies. If you ask this man, who, by the way, is not a cooly agent, he will procure a cook at Rs. 30, a khitmatgar at the same, and a sweeper or dhobi at Rs. 15. These personages will also have to be given a blanket. The name and address of this most useful person is Messrs. Shamlall & Sons, General Merchants, Almora. The coolies supplied by this man carry a maximum of 25 seers each. As a pack pony carries a maximum load of 2½ maunds, say 4 men's load, it is best to take pack animals *plus* one cooly per animal. In places the road is too narrow for loaded animals to pass, and the goods have to be man-handled across. Besides, you require some coolies for cutting wood, fetching water, carrying game, beating, and innumerable small odd jobs. During marches they can also carry loads, though these should be

light if you expect them to cut and bring in firewood and carry water, etc., in camp.

If you propose taking a dandy, there is a small charge of four annas per day for the dandy, and the ordinary charge for coolies to carry it, of whom you will require at least five. You will have to pay coolies their expenses only every three or four days, at eight annas a day, and the balance may be paid at Kathgodam. In the long run contractors' coolies will probably come cheaper, but there is always a possibility of not being able to collect enough coolies at the distant places at short notice, and you may thus get delayed considerably. As I have already said, if your requirements are considerable say over ten coolies, a few days notice is advisable.

SUPPLIES.

You can arrange for these as you please: bring them with you, or ask Shamlall & Sons to arrange it. The point to pay attention to, however, is this :— Beyond Almora and Ranikhet no oilman's stores are obtainable, and very little in the way of vegetables, so all stores must accompany you. Up to Loharkhet some vegetables and milk are obtainable, and grain, etc., for the use of your coolies and horses, but beyond this nothing at all is obtainable, as all produce grown is consumed locally. Milk is frequently greatly adulterated, and a good supp'y of tinned milk should be taken. At Loharkhet you will have to engage one or more extra coolies to carry the spare rations of the others, who will have to be told exactly how long they have to take provisions for, otherwise you will have to send back to Loharkhet for supplies. As regards fresh meat, this can always be had at Bageswar, and occasionally, if not always, at Kapkot. If you are not shooting and expect to be away some time, it is advisable to take a sheep with you for food, as at the high altitudes there is no fear of its going bad quickly. The meat problem is most important if you have dogs with you. In that case it is advisable to take about half a sheep along with you from Bageswar. It will keep good for a week. During your earlier marches a three days supply of dog's meat should be taken in case of accident.

EQUIPMENT.

Tents are not necessary, but may be taken if desired, and would be found useful for shooting. Sanitary furniture should be taken, as some bungalows are not provided with it on account of no sweepers being available. For the same reason, a sweeper should be taken. All bungalows are provided with lamps, but these,especially beyond Bageswar, are often broken or unserviceable, so it is advisable to take a lamp or candles. A couple of hand lanterns are essential. Oil is not procurable on the later stages. Enough should be taken from Bageswar to last till you get back there. Oil may be found at Kapkot, but the quality is likely to be inferior. If you are travelling light, candles may be used, but form a poor substitute. Tumblers should also be taken, as these are nearly always insufficient or altogether wanting. It is advisable, also, to take an emergency set of cooking utensils in case you happen to strike on a picnic party at one of the bungalows. Otherwise, they are always available, except at Phurkia, the last bungalow. The want may possibly be supplied now, as the District Engineer of Almora arrived there the day I left, and the next day had to send back to Diwali for some things, including, I believe, crockery, which is also wanting, or mostly so at Phurkia. A supply of old newspapers is found very useful. Beyond Loharkhet the bungalows, except Khati, are left without chowkidars during the winter; even in the season, unless the bungalow is occupied, the chowkidar stays at the nearest village. Hence a good deal of mischief is caused by passing hill people, who, through pure wantonness, break the window panes. You will usually find a number of broken panes and the paper will be found useful for closing the gaps, as at these elevations the wind, especially early and late, is of rather a searching character. A medicine chest and an axe are two other very useful adjuncts.

Bedding and Clothes.

I believe all the bungalows have at least 4 beds, some nawar, some diamond spring and some spiral spring. I have only come across three bungalows where mattresses were supplied, so allowance should be made for this. It is advisable to bring a thick quilt in lieu. You should have at least three blankets to cover with, and the same, or their equivalent, below you. I didn't know quite what to expect and took a flannel lined canvas sleeping bag and two blankets. The result was that at Phurkia I slept fully dressed except for my boots, and then only dozed on account of being unable to get warm. This was in spite of a bg fire, which, of course, only lasted a limited time, as logs are not procurableihere. The fire-place and walls in these bungalows are so massive that they absorubla the heat and radiate none. An oil stove kept burning all night will be fondl to be a great advantage.

As regards wearing apparel, if you start at the beginning of October, I should recommend a cotton shirt and vest with shorts for marching attire, and anything you like for the evenings. (I shall not attempt to describe a suitable outfit for a lady.) This will do as far as Loharkhet, when I recommend that the upper garments should be substituted by woollen ones. The shorts are alright up to Phurkia, but your visit to the Glacier should be performed in breeches, as you are likely to sit down for a rest now and again, and the ventilation obtained in shorts would probably be found somewhat too generous. If you propose going for a shoot, I very strongly advise you to wear breeches, although they are not so free and easy as shorts. You have a great deal of rough scrambling to do, and your knees always come off second best in their encounters with rocks and thorns. Also you should always have a man with a cardigan or jersey and a water-bottle. When shooting among these mountains, and at these altitudes you get very heated and thirsty, and when you sit down for a rest, you at once feel the cold. In the evening you will require, besides woollen underclothing, a warm suit. If you have not got a dhobi with you, you should leave all soiled clothes at Bageswar and pick them up on your return. You will, of course, under the circumstances, require a good supply of underclothing.

As regards footwear, a couple of pairs of hobnailed boots with iron heel and toe pieces are essential. Besides these it is advisable to take a pair of rubber soled boots for stalking and a pair of slippers. Don't wear shoes, as you are usually among loose stones and are very apt to sprain your ankle. There is one remaining point to be considered, *i.e.*, servants. One, of course, is essential, and it is equally essential that he should be able to cook, as beyond Bageswar there are no khansamas at the bungalows. It will add greatly to your comfort, however, if you take a bearer as well, and one who can do a little cooking. On a long march you feel you want something *en route*. I do not advise a regular lunch. Put some fruit and walnuts or a few sandwiches, in your haversack before leaving which you should not eat before you have done at least two-thirds of the total march. Send the bearer on ahead, at dawn, along with a coolie who knows the road and tell him to have tea ready for you at a particular time. By the time you reach camp you always feel as if you could trifle with a morsel or two, and a piled plate of these morsels vanishes like smoke. You always arrive before your coolies and a good hot cup of tea bucks you up wonderfully. In a short march, say up to ten miles, the coolies will do an average of 2½ miles per hour, but above that distance, it will work out at two miles an hour. I believe in starting early and getting to your next camp before the heat of the day sets in. Some people, however, like to take it easy in the mornings. If you are riding it does not make much difference, but you should always allow time, on the above mentioned scale, for the baggage which leaves the bungalow last, to get into the next camp before dark.

In the next part I shall describe my own trip in October 1923.

(To be continued).

NEW ADDITIONS TO THE ODONATE (DRAGONFLY) FAUNA OF INDIA.

BY

MAJOR F. C. FRASER, I. M. S., F. E. S.

(With a text figure).

Subfamily—LIBELLULINAE.

1. RHYOTHEMIS OBSOLESCENS Kirby.

This species previously only reported from Borneo, Sumatra and Singapore has now been taken in Burma, by Mr. J. Elton Bott, at King Island, Mergui. All specimens agree closely to type.

2. ORTHETRUM TRIANGULARE MELANIA Selys.

Mr. H. V. O.' Donel has sent me a pair of this race of *O. triangulare*, from Hasimara, Duars, 17. VI. 23. The species is a Chino-Japanese one and has been taken fairly recently in numbers by Professor Gregory in Yunnan. The new locality now given is probably its furthest extension southwards, it gradually replacing *O. triangulare triangulare* to the North-east. The basal spot in hindwing is smaller than in the specimens from Yunnan that I have seen. I note that it differs from *triangulare triangulare* by having only a single row of cells on either side of the midrib of loop.

3. NEUROTHEMIS TULLIA FERALIS Burm.

This species was mentioned in Part IV of Indian Dragonflies in this Journal, as doubtful from Burma. I have now received specimens from Dr. Laidlaw, labelled "Burma", but without date or locality.

4. NEUROTHEMIS DISPARILIS Kirb.

Specimens of this insect have been received from Nakachari, Sibsigar, Assam, collected, I think, by Mr. C. F. Beeson, 14. V. 21, this being its first record from within Indian limits.

5. NEUROTHEMIS INTERMEDIA ATALANTA ?

Dr. Laidlaw has sent me a pair of what is presumably a new race of *intermedia* but which is unknown to me. The specimens are labelled simply from "Burma" and bear a close resemblance to *disparilis*.

6. ONYCHOTHEMIS CULMINICOLA CULMINICOLA Forst.

A single male of this fine species has been received from Insein, Lower Burma, this being its first record from within Indian limits. Its distribution is Malacca, Sumatra and Borneo and it may easily be distinguished from *O. testacea ceylanica* by its ground colour, which is reddish brown with a metallic coppery reflection instead of dark green metallic.

7. TRAMEA VIRGINIA De Geer.

Two males of this Chinese and Indo-Chinese species have been sent to me by Mr. C. M. Inglis. They were taken at Kalaw, S. Shan States, Keng Tung, Upper Burma, 20. IX. 23. It is easily distinguished from *limbata* and *basilaris burmeisteri* by its larger size and by the great extent of the basal marking of hindwing.

8. SELYSIOTHEMIS NIGRA Van der Lind.

A common species up the Persian Gulf but not reported hitherto from within Indian limits. I have received a couple of specimens through the B. N. H. Society which were taken at Mirpur Sakro, Sind, 10. X. 22 and Mr. Bainbrigge Fletcher has taken a pair in Kashmir.

9. ANOTOGASTER GIGANTICA sp. nov.

Two males and one female received from Mr. C. M. Inglis, collected by Capt. Drummond, Kalaw, 20. IX. 23 and Siam Road, 8. IX. 23, S. Shan States, Burma.

Male—Abdomen 64 mm. Hindwing 49 mm.

Head. Eyes in contact for rather more than the antero-posterior diameter of occiput. Labium brownish yellow, labrum citron yellow broadly bordered with dark brown, black outwardly and a narrow vertical central stripe which almost cuts the yellow in two, anteclypeus black, postclypeus bright citron yellow very finely bordered with black, frons matt black, not nearly as broad as eyes, narrowing upwards, upper surface broadly and shallowly excavate, vesicle and occiput black, the latter on a level with frons and fringed with a dense bordering of coarse short black hairs.

Prothorax black with a narrow transverse line of yellow along posterior border.

Thorax black marked with very broad greenish yellow pyriform antehumeral stripes, broad and squared above, tapering to a point below.

Laterally a broad greenish yellow stripe just behind the humeral suture and the anterior three fourths of the metepimeron the same colour. Tergum marked with two large greenish yellow spots.

Legs black; trochanters of anterior two pairs yellow.

Wings hyaline, palely enfumed, reticulation close, costa very finely yellow; pterostigma dark brown, 4 to 4·5 mm., braced long and narrow; membrane white, nodal index:— $\frac{15\text{-}21}{15\text{-}15}\Big|\frac{20\text{-}14}{15\text{-}16}$.

Abdomen black marked with yellow as follows:—segment 2 with a broad oblique complete ring meeting the base at sides but narrowing and crossing middle of segment dorsally, a vestigial subdorsal apical spot and a similar lateral spot below it, segment 3 with a similar oblique stripe crossing dorsum just behind the jugal suture, 4 to 8 with narrow complete annules nearer base than apex and slightly notched behind on dorsum, on segment 8 the annule lies about middle of segment, segment 9 with a narrow basal subdorsal spot, 10 unmarked.

Anal appendages black, short. The superior tapering to a point, a little twisted on their longitudinal axis outwardly, bearing a robust basal spine beneath and another rather smaller beneath the junction of middle and basal thirds. Inferior two thirds the length of superiors, squared and slightly notched at apex which is very glossy and tumid.

Genitalia. Lamina broad and shallowly arched, its border everted and fringed with long sparse hairs, inner hamules broad foliate processes curling in on themselves and almost meeting like a pair of broad pincers, outer hamules long thin probe-like processes, lobe tumid at base, shortly truncate, its end viewed from below hollowed out, its edges everted somewhat like the extended tongue of a dog.

Female—Abdomen 80 mm. Hindwing 63 mm.

Markings almost exactly similar to those of the male. The labrum has the yellow completely divided by the medial fine black line and the postclypeus is broadly black along its lower border, this colour further invading the yellow at its middle. The 9th and 10th segments have been rather crushed so that it is difficult to make out whether marked or not. The abdominal markings are very obscure from decomposition but it is possible to make out that they are the same as in the male.

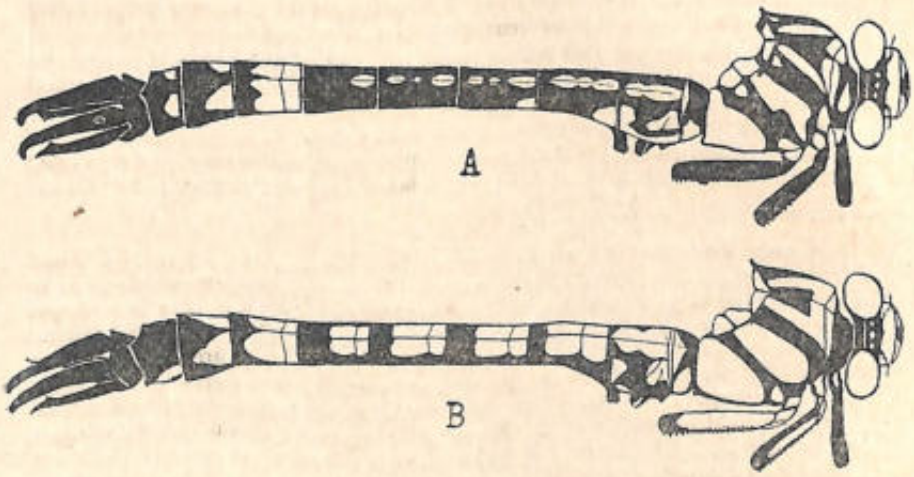
Ovipositor very long, black, 12 mm.

Wings similar to those of *A. nipalensis*, broadly and deeply saffronated at the base as far out as outer end of trigones. This marking in the hindwing not extending posterior to the hinder angle of trigone. Nodal index $\frac{17\text{-}24}{20\text{-}18}\Big|\frac{24\text{-}18}{18\text{-}19}$, membrane blackish brown.

The species bears a very close resemblance to *A. nipalensis*, but is easily distinguished by its much larger size and by the broad yellow band across postclypeus. Types will be lodged in the British Museum.

10. MEGALOGOMPHUS SMITHII Selys.

Concerning this species Mr. Herbert Campion of the British Museum writes to me as follows :—"I have been comparing your type of *Heterogomphus hannyngtoni* with the type of *H. smithii*, Selys, which we also have in this Museum. Both of them are males, and they agree so closely in the structure of the anal appendages that I am wondering if they can be specifically distinct. They are very similar, too, in size and general appearance. The Selysian specimen is an old one and has obviously undergone considerable changes in coloration. As it stands, there are fewer dark markings than in your specimen, and the black pattern on the clypeus is not so heavy."



EXPLANATION OF FIGURE.

Dorso-lateral views of:—*A Megalogomphus hannyngtoni. B. Megalogomphus smithii.*

As it was important that the distinctness of these two species should be set at rest, I wrote to Mr. C. M. Inglis whom I knew to possess a specimen of *M. smithii*, in order that I could compare it with specimens of *M. hannyngtoni* in my own collection. I had examined the type of *M. smithii* in the British Museum when at home in 1920, and made a sketch of it so felt sure that the two species were distinct, albeit nothing is so satisfactory as confronting a species with another when a careful comparison is needed. Mr. Inglis very kindly sent me on the specimen of *M. smithii* and I have been able to work out the following differences :—

M. smithii.	*M. hannyngtoni.*
Abdomen with appendages 52 mm.	Abdomen with appendages 58 mm.
Hindwing 45 mm.	Hindwing 48 mm.
Pterostigma well braced, over 6 cells, shorter and broader than *hannyngtoni*.	Pterostigma poorly braced, over 5 to 5½ cells, long and narrow.
Reticulation close.	Reticulation more open, hence pterostigma although longer, is over fewer cells.
Anal triangle of hindwing with 4 cells.	Anal triangle of hindwing with only 2 cells.

Apices of superior anal appendages straight to the end.	Apices of superior anal appendages turned down rather abruptly.
Apices of branches of inferior appendages curling strongly outwards, spine on inner side rather long, robust.	Apices of branches of inferior appendages less strongly turned out. Spine on inner side shorter.
Lobe of genitalia moderately projecting, its inner border markedly infolded at its middle.	Lobe of genitalia more projected, its border barely infolded.
Labium dark brown.	Labium bright chrome yellow.
Postclypeus yellow with a transverse elongate black spot at its centre not reaching lower border.	Postclypeus black with a large apple green triangular spot on either side.
Antehumeral stripes broadly confluent with the mesothoracic collar. No humeral upper spot.	Antehumeral stripes barely or not confluent with the mesothoracic collar. An upper humeral spot present, also an upper spot on medial lateral black band.
No upper lateral spot on medial black band.	
Dorsal marking on segment 2 very broad.	Dorsal marking on segment 2 narrow.
Dorsal markings on segments 3 to 6 wide and covering nearly the basal three fourths.	Dorsal markings on segments 3 to 6 a mere chain of small spots. 3 on segments 3 to 5, only a small basal dorsal spot on 6.

It will be seen from the above that the total differences are very marked, and that there can be no doubt of the specific value of each insect. The specimen from Mr. Inglis which comes from Dilkush, Cachar, is largely decolourized from decomposition but the markings can be quite easily made out in a good light. The insects are contrasted in the accompanying text figure.

11. MNAIS EARNSHAWI Will.

In specimens received from Mr. C. M. Inglis, from Loimwe, S. Shan States, Burma, I note that the pterostigma is well formed in the females, its bordering nervures stout and its colour brown. In the two females described by Williamson, the pterostigma in one is dull white and in the other all but wanting, a mere speck of tissue on either side of a postnodal nervure. In specimens that I have received from Annam, the pterostigma in any individual is very variable. Thus in one specimen it is absent altogether in one wing, minute and triangular in another, comparatively well formed and quadrate in a third wing and in the fourth represented by a thickened postnodal nervure with a shading of brown on its outer side. Mr. Inglis' female may be a representative of a distinct race with stigma true in all wings.

The male accompanying it does not differ from type.

12. RHINOCYPHA TRIMACULATA Selys.

Dr. Laidlaw writing in the Indian Museum Records suggests that this species is almost certainly from Assam and not from Thibet. The receipt of a number of specimens from Cachar collected by Mr. Antrim and kindly sent on to me by Mr. C. M. Inglis supports this suggestion. The species closely resembles *R. ignipennis* in colouring but differs in its markings and smaller size.

13. CACONEURA O'DONELI sp. nov.

Closely resembles *C. autumnalis* Fras.

Male—Abdomen 23·5 mm. Hindwing 14 mm.

Head, thorax and abdomen deep black, the thorax dark green dull metallic on dorsum and marked laterally with an obscure posthumeral pale yellow stripe and a similar coloured stripe on lower border of metepimeron. Legs black.

Abdomen with paired dorsal whitish basal spots on segments 3 to 7.

Wings hyaline, pterostigma blackish brown, its nervures bordered within finely with white. Anal bridge (*ab*) entirely absent in all wings of all specimens examined. Postnodal nervures 12 to 13.

Anal appendages pale brown to black, subequal. Superior equal in length to 10th abdominal segment, cylindrical tapering to a point at apex, directed straight back, bearing a very robust spine on the ventral side about its middle. Inferior sloping strongly down, very broad at base tapering rapidly to a blunt truncated point.

Female very similar to male. Abd. 28 mm. Hindwing 19 mm.

Head. Cheeks and labrum dirty white, a narrow creamy white stripe crossing head from eye to eye at level of anterior ocellus.

Prothorax with a longitudinal irregular creamy subdorsal stripe on either side.

Thorax with similar markings to male but the markings clear creamy white and there is an additional vestigial antehumeral stripe on lower part of thorax.

Legs yellowish, femora black distally and speckled with black proximally, tibiae bright yellow on extensor surface, black on flexor.

Wings similar but pterostigma paler brown and only 11 to 12 postnodals in hindwing.

Abdomen similar to male but indications of pale lateral stripes on segments 2 to 6.

Habitat. Hasimara, Duars, Bengal, 8-10. IV. 23. Two males and a female received from Mr. H. V. O.'Donel, after whom the insect is named.

From *C. autumnalis* and *C. nigra* it is at once distinguished by the total absence of the anal bridge (nervure *ab*), the postnodal nervures are fewer than in *nigra* and the size is smaller than both these species.

14. CACONEURA VERTICALIS ANNANDALEI (Fras).

Since I decribed *C. annandalei* three years ago, I have had the opportunity of examining a number of specimens of *Caconeura verticalis* Selys., and have been struck by the great similarity between the two.

C. annandalei is distributed throughout the whole length of the Western Ghats and also occurs in the low hills bordering the coast below Madras. No specimens have been taken in India to north of Bombay and none in Burma. *C. verticalis* is found from Borneo to Lower Burma but does not occur in India. Neither species have been reported so far from Ceylon. Thus a gap of some 1,000 miles of ocean separates the two species and we are faced with the problem as to how *annandalei* arrived in Continental India. As no specimens have been reported from Northern India we are left with the choice of two explanations, either the intervening forms in the North have died out and left a gap or this tiny insect has actually bridged a gap of a thousand miles of ocean ! The latter explanation, hard as it is to believe, is apparently the correct one for Dr. N. Annandale has recently secured a specimen from the Andaman Isles which shares about equally the characters of *annandalei* and *verticalis*, it is in short, a missing link.

C. annandalei differs from *verticalis* by not having the transverse red stripe on the head and also by its postnodal nervures being 13 in number instead of 17. The male specimen from the Andamans has the red stripe absent as in *annandalei* but has 17 postnodal nervures as in *verticalis*.

The distance between the Andamans and Lower Burma, the nearest point to *verticalis* is roughly 350 miles, and the distance from these islands to Madras the nearest point for *annandalei* is rather under 800.

I do not think these forms can be regarded as other than subspecies under the names of *C. verticalis verticalis, C. verticalis annandalei* and *C. verticalis andamanensis*.

15. COELICCIA POUNGYI sp. nov.

Male—Abdomen 39 mm. Hindwing 24 mm.

Head velvety black marked with azure blue as follows :—the cheeks, a minute comma-shaped spot on the outer side of each posterior ocellus and a short linear streak well back of each eye.

Prothorax black, the sides pale blue.

Thorax pale blue, almost white, the alar sinus and middorsal carina finely mapped out in black, a broad stripe of black lying between the humeral and first lateral sutures and a fine line on the postero-lateral suture.

Wings hyaline, pterostigma black, over rather more than one cell, almost square but slightly broader than long ; 3 cells between quadrilateral and level of subnode in all wings, costal side of quadrilateral in forewing one-fourth less than posterior side, *Miii* rises at the node, *Ms.* slightly distal, 18 postnodal nervures in forewing, 16 in hind.

Legs black, coxae pale blue, each with a well defined black spot on outer side.

Abdomen black, segments 9 and 10 bright chrome yellow, as also the anal appendages. Segment 1 with a large blue spot on each side, 2 with a linear stripe on the sides bifid basalward, 3 and 4 with minute blue basal paired spots on dorsum.

Superior anal appendages stouter than in *renifera* and with apex and inner edge curling inwards. A robust ventral spine situated nearer the base than in *renifera* and a still smaller one nearer the base. Inferior appendages directed straight back, much longer than superiors, apices curling in and meeting one another.

Habitat.—Gokteik, N. Shan States, Burma. A single male collected, 26. X. 21. Distinguished from all other species by the broad extent of blue on thorax, the whole of dorsum anterior to the humeral suture being immaculate save for the fine middorsal carina. From *flavicauda* it is distinguished by *Miii* being at the node instead of proximal.

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS.

By

Herbert Stevens, M. B. O. U.

Part IV.

(*With a plate.*)

(*Continued from page* 1030 *of Volume XXIX.*)

169. The Bay-backed Shrike. Lanius vittatus Val.

Recorded as ascending the Himalayas to 4,000′ or 5,000′.

I have no information in support of these distribution limits, which may refer to the North-West ; should it actually occur in Sikkim, it can only be as a rare vagrant. It is not represented from the Sikkim Himalaya in the National Collection.

170. The Indian Black-headed Shrike. Lanius nigriceps nigriceps (Frankl). "Bhadraya" Paharia, used for all Shrikes.

Commonly occurs as a breeding species from elevations of 3,500′-6,000′.

171. The Grey-backed Shrike. Lanius schach tephronotus (Vig).

Generally distributed at higher elevations than *L. nigriceps.*

Observed at Chungthang in the interior of Sikkim at 5,350′ in March, and occurs commonly around Gopaldhara during "the cold weather," though not much in evidence at the nesting season, yet observed in May, 13-5-16*,a solitary bird also, 18-4-23. Blanford found it common in Lachung 8,000′-9,000′ in the beginning of September, three weeks later all had disappeared. Nesting in Tibet at 14,000′, (Bailey).

172. The Brown Shrike. Lanius cristatus cristatus L.

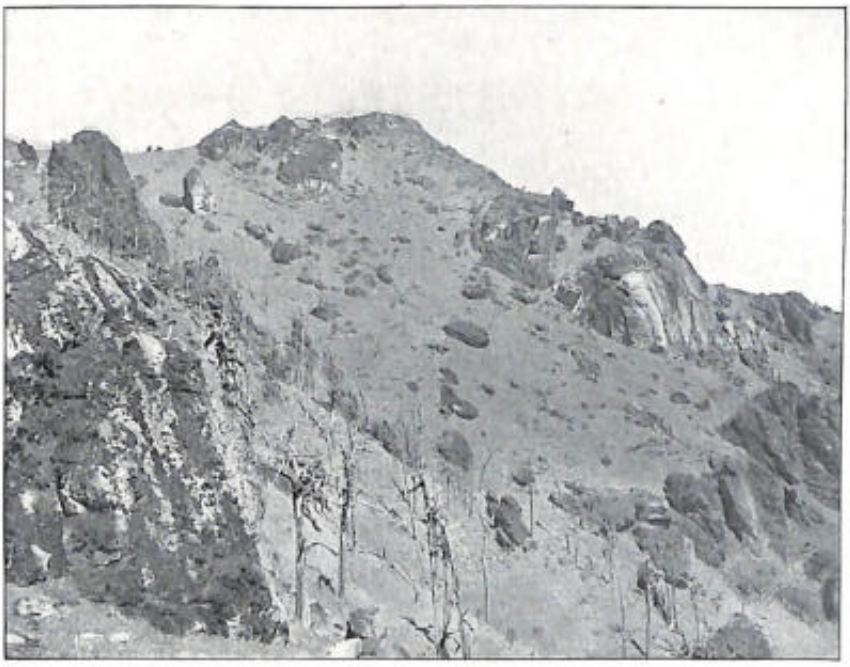
A cold-season migrant to the hills and valleys at moderate elevations on its descent to the plains. A few birds remaining in all probability, for brief periods in favourable localities. Obtained at an elevation of 1,600′ in the Tista Valley, (G. E. Shaw). Gopaldhara. 4,720′ and under. First arrivals noted 17-9-16,* 22-9-20*, 20-12-11* ; a male seen on several occasions hereabouts. All records refer to single birds.

173. The Brown-backed Pied Shrike. Hemipus picatus capitalis McClell.

This dainty, diminutive Shrike is beautifully adapted to an arboreal life, Occurs commonly at *all elevations up to 5,000′* or thereabouts ; frequenting the foliage of secondary-growth and lofty trees and found in small parties at all times, excepting at the breeding season.

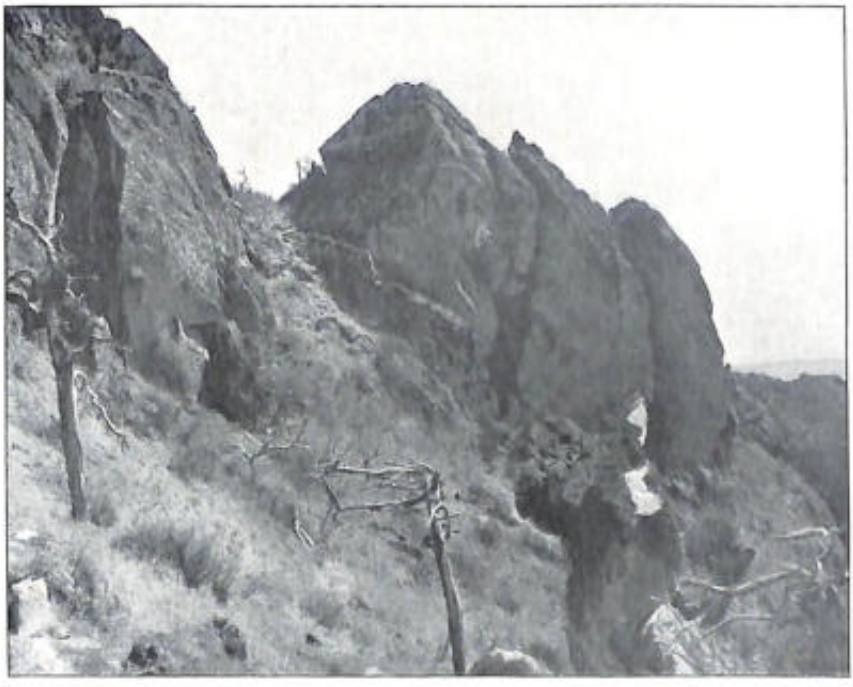
174. The Nepal Wood-Shrike. Tephrodornis pelvicus pelvicus (Hodgs).

Strictly *a plains species.* Obtained up to an elevation of *3,300′* in the Tista Valley, (G.E. Shaw). Mandelli obtained it breeding at 3,000′, Ging near Darjeeling.



H. S. Photo.

SANDAKPHU SUMMIT.
11,923', South Face.
Haunts of *Pyrrhocorax graculus, Loxia curvirostra himalayensis, Gypaëtus barbatus grandis*, &c. March, 1912.



H. S. Photo.

BOULDERS. South Face, Sandakphu.
Haunts of *Troglodytes nipalensis nipalensis, Liiscopus collaris nipalensis*, &c.
March, 1912.

175. The Indian Scarlet Minivet. Pericrocotus speciosus speciosus (Lath).

Generally distributed up to *an elevation of 5,000′* or thereabouts. It does not congregate in parties during "the cold weather" to the same extent as *P. brevirostris*; as I have, more frequently than not, observed it in pairs in December. In the hills, abnormally coloured females are occasionally to be seen; which is similarly the case with *P. brevirostris*, when the yellow-coloured portions of the plumage are replaced in a varying degree by a beautiful tint of rich orange.

One such bird observed at Gopaldhara on the 13-4-16*. A description is given of two specimens as there is a differentiation in these characters from the normal. Gopaldhara, 4,720′, 31-12-11, ♀ ? On dissection I failed to satisfy myself as to its correct sex. Forehead, paling posteriorly up to the crown, orange; sides of the head and the whole lower plumage from the chin to the under tail-coverts paling from orange into deep yellow; abdomen silvery white, as in typical specimens:—this character which is apparent in well-prepared skins, has been missed by Oates. Rump orange, tinged green, deepening into the orange of the upper tail-coverts, greater wing-coverts with a spot of orange on the outer web and in a lesser degree on the inner web yellow, forming a wing-bar; two of the later secondaries with the cross band and the oval spot near the tips of the outer webs orange; outer pair only of the tail feathers yellow, remainder of the tail as in the normal bird, only the yellow is replaced by orange; other parts similarly coloured as in typical specimens.

Gopaldhara 4,700′, ♀ 27-2-19. Orange colour confined to forehead, sides of the head, chin to the throat, patchy only on breast, upper tail-coverts mixed orange and greenish-yellow; two of the secondaries with the cross band and one with the oval spot near the tip of the outer web orange; tail similarly deeply coloured as in the previous specimen.

176. The Assam Short-billed Minivet. Pericrocotus brevirostris affinis McClell. Male "Raja lall," Female "Rani chara", Paharia.

Recorded for the Himalayas up to 10,000′. It came as a surprise to find this Minivet at such extreme elevations during a severe winter; when the more congenial climate of the plains would have been in keeping with what was an every-day occurrence in Assam at a similar period of the year. Sandakphu to Saburkum, 19-2-12*. Observed on the Nepal-Sikkim Frontier at *11,000′*, in parties flitting about the tops of the gaunt, dead pines on the ridge. At this time the bare branches were wreathed in snow and the trunks were laden with an accumulation of icicles projecting out at right angles for some two to three feet in length,—the result of an interminable, piercing, westerly wind, while the ground was obliterated in heavy snow-drifts. The whole effect making a scene of exquisite grandeur yet withal of intense loneliness. The brilliant splashes of colour in these Minivets came as a welcome relief and as a reminder that some bird-life not only did exist, but that these Minivets were able to withstand such intense cold with little, appreciable discomfort. Sandakphu summit, *11,900′*, early March 1912, a few birds in evidence, very restless; every appearance of hot weather in the plains: the valleys being obscured in a haze.

Abnormally coloured females observed amongst a small party of normal Minivets at Gopaldhara at 4,700′, on the 13-5-16*, and at 3,800′, on the 22-1-18*. One, obtained out of a party of eight to ten individuals at 4,720′, on the 27-2-19, has the entire parts, which are coloured yellow in the normal female, replaced by orange, and, whereas the crown is merely tinged with yellow in normal examples, in this specimen it is a deep orange similar to the breast; the wing patches, upper tail-coverts and tail are more intense in colour showing this beautiful tint to greater perfection; the back is also more ashy than green.

At Gopaldhara this Minivet is to be found in parties before the end of June, which points to it being an early breeding species.

177. The Yellow-throated Minivet. Pericrocotus solaris Blyth.

Confined to *low elevations* in the Tista Valley. Obtained on one occasion at an elevation of *5,800'*, ♂ 5,30-3-18, above Mangpu, (G. E. Shaw). Blanford is recorded as having observed this Minivet at 10,000' in Sikkim. It is almost incredible such an authority should be mistaken in his identification, in which case this altitude is remarkable for this frequenter of the hot, moist valleys.

Dikchu, Tista Valley, 2,300', 23-2-20, a large party of both sexes disporting in the trees at close quarters, and very confiding as they settled within a stone's throw on the light vegetation along the road-side. There can be little doubt that Blanford's record refers to an upward dispersal through the Lachung Valley; his specimen was obtained out of a flock above Lachung.

178. The Rosy Minivet. Pericrocotus roseus roseus. (Vieill.)

Recorded as occurring in the Himalayas up to 5,000'. Entirely absent so far as my observations go to prove in the Sikkim-Himalaya. Represented in the National Collection by a single pair ♂ ♀ collected in January 1874 from the Sikkim Terai, so probably has some status at extreme low limits.

179. The Dark Grey Cuckoo-Shrike. Campophaga melanoschista melanoschista. (Hodgs).

A summer migrant to the hills. Occurs in the Rungbong Valley up to 5,000' at all events and breeds around this elevation. Obtained up to 4,500' around Mangpu (G. E. Shaw), where I heard it calling for the first occasion in 1917 on the 29th of March. In the Rungbong Valley, my observations place its arrival at later intervals: one secured at 4,600', ♀ 30-3-11, several noted on the 7-4-16*, and a pair on the 6-5-15*. Obtained at Sookia Pokhari at 7,200' and Dentam at 4,500', (C. M. Inglis). Its call is a mournful, plaintive, whistling "phew", "phew", "phuit" as best described in syllables, and must not be confused with any of the Cuckoos. It occurs during the cold season at the foot of the hills. Bhotan Ghat, Raidak River, Eastern Dooars, where a ♀ was obtained on the 24-1-22 showing the ovaries active.

180. The Himalayan Large Cuckoo-Shrike. Graucalus macei nipalensis Hodgs.

Partial to open, forested tracts. An irregular migrant to the Rungbong Valley, occurring up to an elevation of 4,720' at Gopaldhara. Obtained in the Tista Valley up to 3,600', (G. E. Shaw), and found at the base of the hills during the cold-season. Sungma, 4,500', ♀ 5-9-17, (C. E. Brown). Gopaldhara, 4,500', ♂ ♀ 23-2-18, three birds altogether, the odd remaining bird, frequenting the vicinity of their old quarters for some brief period afterwards. 23-3-16*, a pair observed in "the garden". Three birds seen on the 17-7-14*.

181. The Ashy Swallow-Shrike. Artamus fuscus Vieill.

The Swallow-Shrike is a summer visitor to the hills, arriving in the Rungbong Valley during the latter days of March and first week in April; departing about the first week or later in October. Gammie speaks of it making its appearance in the Tista Valley (Mangpu) the last week in February, and leaving in the last week in October. A warmer atmosphere pervades throughout this deep valley, in evidence of which numerous plains-birds disperse in an upward direction, which are absent or poorly represented in the steeper minor valleys which have a closer affinity

in their fauna with higher limits. Reported from Dentam in the interior at 4,500′ by Mr. C. M. Inglis. In the Rungbong Valley, it appropriates the upper foliage of the lofty "rungbong" (Lepcha) palms, (*Carvota urens*), wherever, these are found as at Seeyok and Turzum, up to an elevation of 5,600′. Earliest arrivals: Gopaldhara, 23-3-16*, a pair noted; thurbo, 4,300′, 18-4-11*, about half-a-dozen birds frequenting the sago palms, first noticed to-day, but their arrival had probably escaped my notice. Latest departures: 7-10-16*, at 4,700′. Numbers seen on the 18-9-17*. A single bird seen about, on the 23-9-17*, which finally disappeared on the 8-10-17*. 20-10-15*. 3,450′, 23-10-21*, two noted to-day in the bare branches of some "siris" trees; a score or more the following day hereabouts. During August, they move further afield, when I have observed them at the bottom of the valley at 3,500,′ 17-7-14*; three noted; 24-7-16, a party at rest on the single telegraph wire, edging up to one another with lively twitterings and partially extended wings. 26-7-15*, three noted. It takes full advantage of the swarms of termites which on occasions emerge from the ground, to fill the air around. Specific instances of these occurrences noted on the 25-4-18*, 15-5-15*, 16-5-18*. Seen to catch Butterflies, *Huphina* sp. ? or *Appias* sp. ? 31-8-17*.

3,400′, 9-7-21*, Swallow-Shrikes in some numbers, Drongos, a Hair-crested Drongo *C. hottentotta*, Bulbuls--(*Molpastes bengalensis* and *Otocompsa leucogenys*), *Campophaga melanoschista*, *Oriolus traili*, *Cuculus canorus*, *C. micropterus*, and C. *intermedius* (a pair), *Dendrocitta himalayensis*, Swallows, and odd Swift and Jungle-Crow, all busy at work gorging on the termites; some were more adept at the game than others, but the Swallow-Shrikes appeared to make the most of their time and secure their quarry with the least exertion. Other such occasions mentioned previously when the white ants rise in myriads, yet I have never actually witnessed a diverse congregation of birds to partake of the feast as at this particular event.

182. The Burmese Black-naped Oriole. Oriolus indicus tenuirostris Blyth.

Recorded for the "Darjiling Terai, Bhutan and Buxa Doars. Rare, but apparently a permanent resident." I have no information in respect to this Oriole.

183. The Indian Oriole. Oriolus oriolus kundoo Sykes.

Recorded for the Himalayas up to 9,000,′ which evidently refers to its status in the N. W. Himalayas. There is only a remote chance of meeting with it, notwithstanding its distribution in the plains is stated to be as far east as Manbhoom.

184. The Indian Black-headed Oriole. Oriolus xanthornus xanthornus (L).=(O. luteolus (L.) Auct).

The correct nomenclature of this species is *Oriolus xanthornus xanthornus* (L). which takes precedence of "*luteolus*" and "*melanocephalus*" See Ibis. Vol. v., No. 1, January 1923, p. 74. (A review of the Genus *Oriolus*, Meinertzhagen.)

Recorded for the Himalayas, probably not above 4,000′. Entirely a plains Oriole. A reported occurrence of an Oriole seen below the Bannockburn Estate in the Great Rangit Valley by the late Mr. E. A. Werdicke most likely referred to this species. Neither Mr. G. E. Shaw nor myself have come across Golden Orioles in these hills. I found this bird common in the "open country" around Kumargram, some few miles out from the hills of the Eastern Dooars.

185. The Maroon Oriole. Oriolus trailii. (Vig.)

Resident, irrespective of season and generally distributed, occurring chiefly in scattered pairs at all elevations from the base of the hills up to 7,500′ or thereabouts.

Eleven specimens examined : Six females in this series, inclusive of a breeding female obtained 13-3-11 along with the adult male, bear out my observations which have previously been remarked upon by Mr. A. M. Primrose, Journal B. N. H. S., Vol. XXI, page 676, that the adult female differs from the adult male in coloration, in its " less defined " gloss of its sombre plumage ; dull black head, neck, chin and throat ; maroon-brown back ; dull maroon upper and under tail-coverts ; outer portion only of the outer webs and two middle tail feathers entirely maroon-brown, remaining portion of tail dull maroon ; brownish breast and pale underparts streaked with brown. Information is desirable as to the sex of birds having the forehead, chin to vent throughout streaked ; the period required before the male reaches full maturity, and if any females actually do breed in similar garb to the adult males.

186. The Indian Grackle. Eulabes intermedia intermedia (Hay).

Confined to *low elevations*, in all probability not to be found much above *2,500′*. Observed below Tindharia and around Nurbong at 2,200′ and obtained in the Tista Valley up to 1,600′, (G. E. Shaw). Nurbong, 2,050′, 27-2-14, a party of ten Hill Mynahs ; first heard calling on the 18-2-14 ; but located to-day in the trees surrounding the bungalow.

Sepoydoorah, 2,000′, 11-3-14, observed a party of ten birds hereabouts-Bhotan Dooars, Jainti to Newlands ; numerous parties observed in heavy forest during January 1922.

187. The Spotted-winged Stare. Psaroglossa spiloptera (Vig).

Recorded as found up to 6,000′ in the Himalayas ; which limit is *too great an extreme* for Sikkim. Obtained up to *3,800′ in the Tista Valley* at Mangpu, (G. E. Shaw). Sepoydoorah, 2,000′, 16-4-15*, a party observed at close quarters.

188. The Rose-coloured Starling. Pastor roseus (L).

Recorded as found in the lower ranges of the Himalayas as far east as Sikkim. It can only occur as a very rare straggler to this district ; and I have no information in support of its claim for inclusion. Stragglers of common plains-birds, nevertheless, do at times go far beyond their more or less defined limits and this fact must not be lost sight of. In this case I fail to see why this Pastor which is a cold-weather migrant to the plains should ascend the hills even to moderate elevations, and as there is no defined migration route through Sikkim ; it is fair to presume these birds have entered the plains at a more westerly point. I have searched through a large series in the B. M. Collection. It is represented by only one specimen from Nepal, (Hodgson), and none from Sikkim. Behar specimens in some numbers from whence mine have come. (C. M. Inglis).

189. Finsch's Starling. Sturnus vulgaris poltaratskyi Finsch.

Recorded as a winter visitor to the Himalayas as far east as Dibrugarh in Assam. I have no record of any true Starling occurring in these hills. Evidently they arrive by a south-easterly route in the North-West Himalayas and on their descent to the plains spread out in an easterly direction. I failed to obtain a specimen during my sojourn in the Dibrugarh district of Upper Assam. It is not represented from the Sikkim-Himalaya in the National Collection.

190. The Grey-headed Myna. Sturnia malabarica malabarica (Gm).

A plains Myna entering the hills in a similar manner to other low elevation species. Obtained in the Tista Valley at all elevations up to 3,860′, Mangpu, (G. E. Shaw). Entirely absent at anything approaching this elevation in the Rungbong Valley. Gammie speaks of it as occurring around Mangpu in the same places as *Artamus fuscus* frequents, where it breeds on the ridges at from 2,500′-4,000′.

191. The Common Myna. Acridotheres tristis tristis (L).

A common scavenger in the station of Darjeeling. To some extent locally migratory or merely a more or less general descent to lower limits is undertaken in the "cold weather" as I have noticed Mynas around Gopaldhara in December, 26-12-21, when all the breeding birds had long since left. There is a corresponding influx of their numbers into the hills during the breeding season, when it is a common occurrence to see them squabbling and hear the discord that takes place preparatory to nesting. The roof of the bungalow at Gopaldhara on many occasions being the scene of "a rough and tumble", when the rogues roll down, locked together by beak and claw, squawking all the time they are descending in rapid transit to the ground, to the accompaniment of the cautious element-instigators but non-active participants. Once harmony reigns, the worries of life are by no means ended, as the arrival of inquisitive rats bent on the pillage of their nests must cause them anxiety and loss. Through the experience gained at the expense of the crafty rat, their attentions have been confined to taking possession of the most secure, limited nesting-sites available. Notwithstanding their apparent unruly behaviour on arrival, which is only another instance of the keen struggle for survival which is not always so obvious, they are sure of a welcome, as any shortcomings are amply repaid by the useful work they perform in the compound, unfortunately they are by no means content to employ their energy at this useful if not so congenial pursuit, as on occasions marked and affectionate attention has been paid to the luscious caterpillars of some cherished Saturnid moth I was endeavouring to carefully nurse on the verandah, as if they had been put there for their special benefit.

192. The Bank Myna. Acridotheres ginginianus (Lath.)

Obtained in the *plains* of the Darjeeling district (G. E. Shaw).

193. The Indian Jungle Myna. Æthiopsar fuscus fuscus (Wagl)

Recorded as resident and ascending the Himalayas up to about 8,000′.

Neither Mr. G. E. Shaw nor myself have been able to locate this Myna and apparently it is *absent or extremely rare* in Sikkim.

194. The Pied Myna. Sturnopastor contra contra (L).

Occurs commonly at Jalpaiguri and possibly may extend in its range to the foot of the hills.

195. The Himalayan Sooty Flycatcher. Hemichelidon sibirica cacabata (Penard).

Recorded as a permanent resident in the Himalayas, occurring as high as 13,000′ in summer. This Flycatcher is undoubtedly *migratory*, as it is *absent from moderate elevations during "the cold weather"*. No evidence is available, as to where their quarters are at this period of the year. Oates remarks "it appears to be entirely absent from the plains of India". It is much more plentiful on the downward movement at Gopaldhara in the second week of October, than it

is on arrival in the first week of April. Specific observations around 4,720′ have been noted during October 1911. 16-10-19*, 11-10-20*, 7-10-21*, plentiful and observed at higher elevations. On the 12-10-21*, during a dirty spell of weather, some birds were at the bottom of the valley at 3,500′. Whilst stragglers may ascend to extreme limits as recorded, the majority breed at elevations of from 6,000′-7,000′. Gopaldhara, 5,250′, ♂ 12-4-17. Mai "Khola", East Nepal, 26-4—22-5-12; eggs taken with the parent bird ♀, on latter date at an elevation of about 7,000′. Obtained around Mangpu at elevations of from 2,000′-4,500′, (G. E. Shaw) and on Tonglo, (C. M. Inglis). Blanford met with it in the Lachung Valley at 9,000′, in September. It keeps to the outermost, naked branches, and not the leafy boughs, from which it sallies out, to return again times innumerable, to its identical point of vantage.

Seven specimens examined: ♂ Wing, 73-75, av., 74; ♀ wing, 72-74, av., 73.

196. The Ferruginous Flycatcher. Hemichelidon cinereiceps Hodgs.

Recorded as a permanent resident in the Himalayas from about 4,000′-8,000′. This Flycatcher has the same zonal distribution and is *similarly migratory as its near ally*, though it is much more sparingly distributed. Mai "Khola", East Nepal, ♀ 9-4-12, ♀ 27-4-12, ♀ 8-5-12, upper reaches of the valley around 7,000′. Sookia Pokhari, 6,500′, 26-5-12*, observed hereabouts in forest. Gopaldhara, 5,300′, 17-9-21, a single bird in the forest. Obtained above Mangpu at 7,300′, (G. E. Shaw), and at Jore Pokhari at 7,400′, and Rinchenpong at 6,000′, (C. M. Inglis).

197. The Orange-gorgeted Flycatcher. Siphia strophiata Hodgs.

Recorded for the "Himalayas up to 12,000′ in summer, descending to the lower valleys in winter"; which is certainly the case, as odd birds no doubt, remain at the base of the hills; while the great majority undoubtedly migrate farther south and evidently pass over the plains. Commonly occurs in the Rungbong Valley, December to March, from 3,500′-4,700′, and around Kalo Pokhari, on the Singile La Ridge at 10,000′, in March and April; males at this time predominating. Obtained at as low an elevation of 1,200′ in the Tista Valley, (G. E. Shaw). Kalo Pokhari, 10,160′, 24-5-12, nest, a slight composition of moss, lined with bents, containing a single feather of a female Tragopan and three white eggs, situated twenty feet above the ground, in a crevice of a large branch of a tree on the slopes of the forested mountain-ridge: the eggs vary much in size. Blanford mentions it from the Lachen and Lachung valleys at the recorded limit in September.

Eleven specimens examined. The colour of the throat patch in the female varies in depth of colour, and sometimes is quite as deep orange-rufous as in the male; when this occurs, the chin and throat are also black. ♂ Wing, 71-77, av., 74; ♀ wing, 69-73, av., 71.

198. The Eastern Red-breasted Flycatcher. Siphia parva albicilla (Pall.).

Undoubtedly nests at no great distance above Gopaldhara, 4,720′. Much more in evidence in October, than it is in March during the latter part of the month, when on its upward migration. Gopaldhara, 4,720′, 21-9-16*, ♀ or immature ♂. 24-9-19* ♀. or immature. ♂ 26-9-17*, a few in evidence. 24-9-18, females or immature males in evidence. 3,750′, ♀ 28-10-19, one or two about. 4,450′, ♀ 12-10-19, 4,720′ ♀ 12-10-19. 4,500′, ♀ 16-10-19, adult males extremely rare.

Absent during the cold-weather months, November to February, at Gopaldhara. Numerous along the level, forested ground at the base of the hills from Jaint

to Kumargram in January 1922. Thurbo, 4,500′, ♀ 22-3-11, ♀ 28-3-20. Gopaldhara, ♀ 7-4-16. One adult male only, seen on the upward migration over a period of nine years.

Obtained at elevations of 3,800′, ♀ 10-11-19. 3,000′, ♂ 20-4-21, (G. E. Shaw). Sukna, 500′, ♂ 22-11-19, (C. M. Inglis).

Five specimens examined : all females. Wing, 67-69, av., 68·2.

8 Four filariæ taken out of the eye cavity of this specimen.

199. The Rusty-breasted Blue Flycatcher. Cyornis erythacus hodgsonii (Verr.).

Recorded for Sikkim during March and April. Occurs at *moderate elevations on migration*, both at its ascent and descent to and from its breeding habitat, but only sparingly distributed. Sookia Pokhari, 6,500′, ♂ 18-1-12*, observed in the bed of a mountain stream, a few paces from the track through the forest. Gopaldhara, 4,720′, ♂ 21-3-16, wing, 74. Mangam, near Ringim Gompa, 4,300′, interior of Sikkim, ♂ 23-2-20, wing, 74, procured in light trees near road-side. Bhotan Ghat, (Base of the hills) Raidak River, Eastern Dooars, ♀ 27-1-22, wing, 68. Obtained at elevations of 3,200′, ♀ 16-2-19. 3,600′, ♂ 21-2-20, around Mangpu above the Tista Valley, (G. E. Shaw).

200. The Rufous-breasted Blue Flycatcher. Cyornis hyperythrus (Blyth).

A summer migrant to elevations, probably *not exceeding 7,000′ on the Outer Ranges*. Plentiful at Gopaldhara around an elevation of 5,000′, where it breeds in forest. Males obtained at the time of arrival in 1921 at elevations of from 5.250′-5,500′, ♂ ♂ 5-4-21, testes developed, evidently about to nest ; many others seen. 6,000 13-5-23,* several observed in forest Seeyok, 6,300, 22-5-23*, a pair, with their fully fledged young in the precincts of the forest. Specimens obtained in the Mai "Khola", East Nepal, 1st April to 22nd May 1912, at an elevation below 7,000′. Obtained at 2,000′, ♀ 18-3-20, in the Tiata Valley, and at 6,500′, ♂ 29-6-19, above Mangpu, (G. E. Shaw), Gopaldhara, 5,200′, 7-10-21*. I saw a male on the ground making a somewhat fruitless attempt to demolish a large earth-worm ; which it eventually flew away with, though this feat was by no means an easy undertaking.

Soft parts. : Iris hazel ; bill black ; tarsus pinkish-plumbeous.

201. The Slaty-blue Flycatcher. Cyornis tricolor tricolor (Hodgs.).

Occurs at *all elevations from 3,450′-10,000′* according to season *on the Outer Ranges*, and in all probability descends to the foot of the hills during "the cold weather." Obtained at elevations of from 3,600′-5,200′ around and above Mangpu, (G. E. Shaw). Kalo Pokhari, 10,000′, ♂ 7-5-12, observed also on other occasions in dense thickets of "maling" bamboo, rarely seen as it shuns observation in these haunts. Gopaldhara, 4,700′, ♂ ♀ 25-3-11, ♀ 31-3-11 ; 3,500′, ♂ 8-2-19 ; 4,250′, ♀ 4-2-19, Thurbo, 4,300′, ♀ 25-3-11.

202. The White-browed Blue Flycatcher. Cyornis superciliaris (Jerd).

Recorded for the "Himalayas, Kashmir to Sikkim, found up to 12,000′ in summer". I have failed to locate this Flycatcher. All specimens collected on the off-chance of being this species proving to be *C. astigma*. Represented in the B. M. Coll. ♂ March 1874. ♀ collected near Darjeeling by J. Gammie.

203. The Little Pied Flycatcher. Cyornis blythi (Roths.).

For this nomenclature see Novitates Zoologicæ, XXVIII, 1921, page 48.

This Flycatcher is absent around Gopaldhara at 4,720′ during the cold-weather months,-November to January, and though it nests hereabouts, it is not much in evidence during the summer. It is much more plentiful at the foot of the hills in the Eastern Dooars during the winter, than it was in North Lakhimpur, Upper Assam, where I only met with it on one occasion in December 1907 during a period of seven years. Gopaldhara, 4,700′, 28—30-3-11* plentiful at this time; several secured. Nurbong, 2,000′, ♂ ♀ 28-2-14*, Gopaldhara, 4,720′, ♂ ♀ 5-3-16*; ♂ 12-3-18. ♂ 14-3-18; ♂ 8-3-18, two pairs noted to-day, 4,500 31-5-23,* a pair and fully fledged young located in the "siris" (*Albizzia* sp.) trees. 4,720′, ♀ 25-7-20, in moult. ♂ 25-7-20, juvenile, in spotted upper plumage. ♀ 2-10-19, a bird of the year. Bhotan Ghat, Eastern Dooars, ♀ 20-1-22, others seen on several occasions, as far out from the hills as Kumargram village, Gopaldhara, 4,720′, ♂ ♀ 24-9-19; 5,000′, ♂ 16-10-14*. Obtained at the foot of the hills around Sukna at 500′, (G. E. Shaw). Recorded up to *an elevation of 7,000′* in the Himalayas which is about correct for its upper limits in distribution for the Sikkim Himalaya.

204. The Little Blue and White Flycatcher. Cyornis astigma (Hodgs).

Obtained at Gopaldhara at 4,720′, ♂ 21-3-16; ♀ 22-3-16; ♀ 29-3-16; ♂ 9-4-19, the ♀ probably in the vicinity. ♂ ♀ 19-4-18, the male being secured. ♂ 30-9-19, a juvenile in process of change from the female phase into that of the adult male. ♂ 2-10-19, juvenile, in similar plumage to the previous example. Obtained around Mangpu at an elevation of 4,600′, ♂ 14-4-21, and 4,700′, ♀ 24-9-20, (G. E. Shaw).

This species has a similar *zonal distribution at the breeding season as C. blythi*, yet occurring with less frequency, and the above records constitute the sum total of its appearances which have come under my observation.

205. The Sapphire-headed Flycatcher. Cyornis sapphira (Tick).

Recorded as a permanent resident in Sikkim, which may be correct in so far as a few birds evidently stay in the warmer portions of the valleys. Its rarity accounts for the lack of information respecting its movements. Observed at Thurbo, 4,500′, ♂ 3-4-11*, and obtained at Gopaldhara, 4,720′, ♂ 19-4-18, also in the Mai "Khola" in East Nepal, 7,000′ approximate, ♂ 4-4-12. ♂ 11-4-12, Tista Valley below Mangpu at 2,400′, ♀ 29-1-20, (G. E. Shaw).

206. The Pale Blue Flycatcher. Cyornis unicolor unicolor Blyth.

Recorded for Sikkim,—Namchi, "breeding" (Mandelli). I anticipate it being discovered in the foot-hills. This species is well represented in the British Museum by 17 ♂ ♂ and 16 ♀ ♀ collected in every month of the year, but unfortunately without any indication of the elevations. I am indebted to Mr. Thomas Wells for all the trouble he has taken in searching through the series of this bird and many others in the National Collection, with the view to throwing light on the distribution areas of many species which at present are only imperfectly known.

207. The Blue-throated Flycatcher. Cyornis rubeculoides (Vig).

Recorded for the "Himalayas up to 6,000′ or 7,000". *These limits appear to be too high for Sikkim*, otherwise I could hardly have failed to meet with it at intermediate elevations. My impression is that it does not reach far beyond the foot-hills, with a similar distribution and at low elevations as was the case when it arrived on the north frontier of Upper Assam. Obtained at all elevations

from Sukna at 500′, to below Mangpu *at 3,760′, in the Tista Valley*; which supports a plains-fauna, and this fact lends its due weight to my contention. Mr. Shaw's records are as follows—500′ ♂ juv. 12-12-19. 2,700′, ♀ 28-6-20. 3,300′, ♂ 19-5-18. 3,500′, ♂ 11-4-18. 3,760,′ ♂ ♀ 15-1-19. This last occurrence is of especial interest as it points to some birds remaining in suitable haunts at moderate elevations throughout the year.

208. The Large-billed Blue Flycatcher. Cyornis magnirostris Blyth.

Recorded as resident in Sikkim. Apparently as rare in Sikkim as it was in the Naga Hills on the north-eastern frontier of Upper Assam. I erroneously recorded this Flycatcher from the Miri Hills, Vol. XXIII, No. 2, Nov. 20, 1914, page 256, which record refers to *Ianthia hyperythra*. Represented in the B. M. Coll. by 10 ♂ ♂ and 5 ♀ ♀ collected in every month from April to October without locality and elevation data.

209. The Pigmy Blue Flycatcher. Nitidula hodgsoni (Moore).

Recorded as resident in Sikkim up to 7,000′ or higher. Decidedly rare. Obtained in the Mai "Khola" Valley, East Nepal, ♂ 21-3-12, and in the Tista Valley at 1,500′, ♀ 30-1-20, (G. E. Shaw). There is every likelihood of this delicate, diminutive Flycatcher moving south with the advent of "the cold weather," and ascending into the hills to breed in the summer. I have recorded it from the foot of the Dafla hills in the third week in March where, however, it was only once met with. Our meagre records substantiate Oates' statement in that some birds are resident in the warmer portions of the valleys in the foot-hills, and as my single specimen was procured at a similar elevation of around 7,000′; it is fairly certain to ascend to some appreciable extent. Well represented by numerous specimens in the B. M. collected by Mandelli; several of which were obtained in Sikkim during the cold-weather months, at which period of the year he also got it from the Bhotan Dooars.

210. The Verditer Flycatcher. Stoparola melanops melanops (Vig).

Generally distributed up to 10,000′, (Tonglo) *during the summer* and commonly observed at all elevations according to season. The earliest observation on the upward movement noted at Gopaldhara, 4,720′, as that of a ♂ 5-3-16.* Singhik, 4,600′ in the interior of Sikkim, on the 13-3-20*. They congregate in small parties towards the breeding season. It commonly nests at 4,000′-5,000′, and up to its highest summer limit. During the third week in May the young are fully fledged.

Obtrusive habits combined with an unusual greenish-blue type in coloration cause it to be conspicuous everywhere.

211. Hodgson's White-gorgeted Flycatcher. Anthipes monileger monileger (Hodgs).

Recorded for "Sikkim up to about 7,000′ or so". (Lebong at 5,800′, breeding, Mandelli). Obtained in the Mai ("Khola") Valley, East Nepal, ♀ 8-4-12. Gopaldhara, 6,000,′ a male presumably, 24-5-23, giving forth to the best of its vocal efforts, with a rapid quivering of the wings, from its stance amongst brush wood in the close forest. Apparently only locally distributed. Oates doubts Hodgson's specimens as having been obtained in *Nepal where it occurs*, though how far to the west is not known.

212. Brooks's Flycatcher. Anthipes poliogenys (Brooks).

Recorded by Hume from the *Sikkim Terai* as stated by Oates. I have no specimen from the foot-hills of Sikkim. One ♀ 27-1-22, from Bhotan Ghat,

Raidak River, Eastern Dooars, as the only specimen obtained, seems to point to it being none too plentiful. We found it a common bird in Upper Assam.

Oates makes no distinction between the sexes. My specimens are not sufficient satisfactorily to settle this point from an examination of skins. There is, more often than not, a general facies difference with a bird in the flesh as field-naturalists will bear out, even if there is not some slight colour difference apparent in many birds which are generally considered to have the sexes similarly coloured. On comparing the single skin from the Bhotan Dooars, this female has the forehead, crown, nape and ear-coverts more greyish-brown in comparison with skins from Assam, in which these characters are olive-brown; the rufous on the under parts is not as intense in colour; this difference I regard as sexual. Oates rightly draws attention in the discrimination of this female and "*Cyornis rubeculoides*" which closely resemble one another, to the large 1st primary of *A. poliogenys*, yet this is not so easy to follow as may be inferred from his remarks. *Cyornis rubeculoides* is a slighter bird, has the rufous tinge commencing from the chin, and of a brighter tint on the breast, even in comparison with males of *A. poliogenys*; the forehead, sides of the head and ear-coverts are more rufous than olive. I can detect no difference in the size and shape of the bill between the two species. Wherever possible it is advisable to collect the females, when the birds are in pairs towards the breeding season.

213. Layard's Flycatcher. Alseonax muttui (Layard).

Recorded "summers in Sikkim." I have so far failed to locate it. Amongst the British Museum material are three skins obtained by Mandelli in Native Sikkim, in August, September and November 1873-75.

ALSEONAX LATIROSTRIS (Raffl.) is recorded as having a wide range and occurring in the Himalayas as far west as Chamba. The B. M. Coll. contains no specimen from Sikkim, but it is interesting to know Mandelli obtained three specimens in the Bhotan Dooars in April, 1874-76, and there are other examples from Nepal, (Nepal Valley and Khatmandu) collected in April by Scully 1877. It has been recently recorded from the Dooars by Inglis from which locality O'Donel obtained specimens in July, Ibid, Vol. XXVI, 1920, page 993.

214. The Grey-headed Flycatcher. Culicicapa ceylonensis ceylonensis (Swains).

Recorded as resident in the Himalayas up to 8,000′. This is another common Flycatcher which occurs at *all elevations from plains-levels*, irrespective of season though the majority frequent the valleys in "the cold weather." Noted as particularly plentiful in the Rungbong Valley in February 1918, at elevations of from 3,400′-6,000′.

This species is strictly resident and moves little in comparison with even some of the other supposed sedentary Flycatchers.

215. The Large Niltava. Niltava grandis (Blyth).

In all probability occurs up to *an altitude of nearly 8,000′*. It breeds commonly above Gopaldhara at elevations of from 4,700′-6,000′. Confined to forest where it is resident throughout the whole year. Obtained as low as 2,500′ in the Tista Valley, (G. E. Shaw). During "the cold weather," they are partial to a purple berry,—name of tree unknown, which stains the stomach and vent. Often to be seen on the ground. The tail feathers when not worn, are pointed at the tips, in just as marked a degree as in *Ianthia*. This character also holds good in *Niltava sundara* and *Siphia strophiata*, and possibly has some significance as regards the correct relationship with the so called Bush-Robins, as the habits of these two species of *Niltava* are somewhat similar and a few of the Flycatchers spend a portion of their time on or about the ground, and in this habit differ from the true *Muscicapidæ*.

216. The Rufous-bellied Niltava. Niltava sundara Hodgs.

There is a possibility of this Niltava reaching the extreme limit of 8,000′ as recorded, though my records place its *zonal distribution at somewhat lower limits than N. grandis.* Obtained above Mangpu up to an elevation of 7,000′, (G. E. Shaw). Occurs commonly around Gopaldhara as a resident, breeding species. It is generally distributed, and notwithstanding its gaudy plumage, more often than not overlooked as it keeps to dense undergrowth in forest.

217. The Small Niltava. Niltava macgrigoriæ (Burton).

Oates records this Niltava as breeding in Nepal and Sikkim from April to June at elevations of from 3,000′-5,000′. Occurs commonly around Gopaldhara *during the breeding season up to 6,000′* or thereabouts. More plentiful at the bottom of the Rungbong Valley in "the cold weather" at 3,500′. Obtained up to 3,600′ around Mangpu, (G. E. Shaw). There is little doubt that it occurs at the foot of the hills.

218. The Indian Black-naped Flycatcher. Hypothymis azurea styani (Hartl).

Apparently *confined to the Lower Foot-hills.* Observed on one occasion on the Nagri Spur at an elevation of 4,300′, date and month overlooked, though it was probably, May. Obtained up to an elevation of 1,400′ in the Tista Valley. (G. E. Shaw).

219. The Yellow-bellied Flycatcher. Chelidorynx hypoxantha (Blyth).

Occurs up to *an elevation approaching 12,000′,* (Sandakphu) on the *Outer ranges in summer* and found at all intervening heights from the plains at the base of the hills, both on the downward and upward migration. I found this pretty, little Flycatcher equally as plentiful at the base of the hills in the Eastern Dooars in January 1922, where it extended into the plains as far out as Kumargram, as it was in Upper Assam during "the cold weather." A single bird observed at the end of March 1917, at 10,500′ above Karponang, the first arrival. Kalo Pokhari, 10,60′. First week in April, 1912. Every morning a party of a dozen or thereabout, males and females in equal numbers are to be seen flitting about the trees on the ridge above my camp, almost oblivious to my presence in the fearless manner they approach me at close quarters. 26-4-12, ♀ obtained. This party left on the 4-5-12, for still higher ground. Tista Valley, February 1920, single birds everywhere obstrusive in the interior, at elevations of 2,000′ and upwards. Congregating in small parties near Singhik at 4,600′ on the evening of the 12-3-20. Nurbong, 2,200′, 22-2-14, an odd bird or two uttering a feeble "tsip," "tsip", towards evening, seeking the topmost branches of the trees, searching for food until sunset. Namsoo, 2,100′, 13-3-14*, in evidence hereabouts. Gopaldhara, 4,700′, ♂ 23-12-11. 6,200′, 24-7-17*. Lepcha Jagot, 7,150′, 21-8-19*, a single bird observed. I consider these two latter observations remarkable for the extraordinary low limits at this time of the year which may denote a lower breeding habitat unless they referred to unpaired birds. Since observed above Gopaldhara at 6,150′, 22-5-23 Blanford met with it on the Cho La Range in August at 12,000′, but did not notice it in the interior above 8,000′.

220. Baker's White-throated Fantail Flycatcher. Rhipidura albicollis stanleyi Stuart Baker. "Naklay chara", Paharia.

The local name signifies very appropriately the obstrusive antics of this sprightly little fop, which is the exact translation of the word without having to

resort to slang in current use. Strictly resident. Commonly breeds at *all elevations up to 6,000'*. Its nest is a masterpiece in avian construction, and needs no detailed description as it is referred to in the "Fauna" and other articles.

The white-browed Fantail Fly-catcher. Rhipidura aureola aureola. Less.

is recorded as ascending the Himalayas up to 4,000' or 5,000'. I failed to locate this Fantail Flycatcher in Assam and the same thing has so far happened in Sikkim. I am more than curious to know its exact status. It is not represented in the National Collection from Sikkim.

The Indian Paradise Fly-catcher. Tersephone paradisi paradisi (L).

is recorded also for the Himalayas from Sikkim eastward. It probably only occurs at low elevations during "the rains". I have not met with this remarkable bird; the eastern form of which "*affinis*" was well known to me in Assam.

221 ? The Northern Indian Pied Bush-Chat. Saxicola caprata bicolor Sykes.

Recorded as "ascending the Himalayas up to 8,000,' probably in summer only". I have no record in support of this assertion for the Sikkim Himalaya, and I very much doubt if it has any status whatsoever in these hills which appear to be too far east of its accepted distribution, and though it is recorded for Assam; I entirely failed to meet with it during my sojourn in Upper Assam. Specimens in my collection are from Tirhoot (C. M. Inglis.) and South Sylhet (C. B. Antram). Both of these localities represent the limits of its winter distribution to the east in the plains fairly accurately. This is a well-marked species and not likely to be overlooked. I have since had the opportunity of examining the B. M. series of this Chat which is not represented from Sikkim: the nearest localities being Nepal and the plains (Behar).

222. The Indian Bush-Chat. Saxicola torquata indica (Blyth).

223. The Japanese Bush-Chat. Saxicola torquata stejneri (Parrot).

Recorded for the Himalayas under *Pratincola maura* and as "breeding at all heights up to 5,000'." These Chats are an extremely difficult group. Oates has lumped several races or even good species in his treatment of *P. maura*. All our Indian birds appear to be relegated to three forms which are generally regarded as cold-weather migrants only to the plains. Distribution according to Stuart Baker. Measurements given by Hartert.

S. t. indica. Breeding Kashmir and N. W. Himalayas. ♂ wing, 67-72.
S. t. stejneri. Breeding East Siberia and Japan. ♂ wing, 67-70·5.
S. t. przewalskii. Breeding Turkestan and Tibet. ♂ wing, 72·5-75·5.

After an examination of all my available material from Assam and Sikkim. Unfortunately, all the skins "might be called" cold-weather examples and poorly represented from Sikkim: twelve and four respectively; there is no appreciable difference in size of 5 Assam and 2 Sikkim males, wing 71·7-73, av. 72·3, exclusive to a single ♂ obtained at the foot of the hills, 26-3-10, "in fat condition" preparatory to migrating, noted on the label, wing 75. This bird agrees with *S. t. przewalskii* as regards the wing measurement and possibly, is this form. Another ♂ 5-11-19, obtained at 6,000' above Gopaldhara on the Semana-Mirik Ridge with wing, 66·5, is altogether a smaller bird with white under parts and can only be relegated to *S. t. indica*, yet in common with every other specimen there is no vestige of white at the base of the tail; "*indica*", is said to have the "tail-feathers with rather less than the basal quarter white."

Colour differences are very difficult to decide in this group, though these males have very rufous breasts and the females, creamy throats. Two of the above series were collected in the plains as late as the 11th and 16th of April in different years; when I have found *S. leucura* with testes and ovaries active, exactly two months earlier. Had these birds got to ascend to extreme heights I could well understand their late departure. I cannot conceive that the vast network of mountains and valleys in the Eastern Himalayas and far beyond, does not afford the necessary conditions for a breeding habitat, without having to undertake a lengthy journey to the breeding grounds of *S. t. stejnegeri* for instance. There is the alternative of an enormous breeding range, and our imperfect knowledge does not yet allow of any splitting of numerous races from well-defined breeding areas.

My impression is, a large proportion of these birds breed in the foot-hills at moderate elevations, while a few may remain in the plains to the north-east, apart from cold-weather migrants of other forms, and Oates rightly states "The Indian Bush-Chat breeds so abundantly at all moderate levels in the Himalayas that it is not improbable that the Himalayas form the northern limit of its range". This statement seems substantially correct. The difficulty exists none the less, when the true migrants are mixed up with the low-elevation breeding bird during "the cold-weather" as it is practically impossibleto separate them by size or colour. Blanford records *S. t. indica* as common in the Lachung and Lachen valleys in September and the beginning of October apparently migrating, but did not meet with it on the Cho La Range; he remarks on it as first seen at Lachung on the 9th of September. Large numbers were seen on migration and specimens obtained at 17,000′ in September by Mr. A. F.R. Wollaston during the Mt. Everest Expedition and Mr. N. B. Kinnear refers to a specimen obtained at 12,000′ in nestling plumage in August. I have recorded *S. t. stejneri* from the base of the Dafla Hills as early as the 20-8-07*, and numerous records during this month on later dates over several years. Seen as late as the 25-4-10* in the plains of Upper Assam.

I have now satisfied myself beyond all doubt that the Chat which comes up to breed around Gopaldhara at elevations from about 4,500' up to 5,500' and apparently is to be found at somewhat higher limits possibly up to 7,000' in East Nepal in *S. t. indica*. Every year a few birds are to be seen in the Rungbong Valley, when at 4,700' the earliest arrivals have been noted 7-4-16* 4,000' 10-4-11*; 4,500' 22-4-23*; a pair. The adult breeding bird and eggs have been obtained while the juvenile in spotted plumage has been observed on the 11-7-23. I doubt if there is ever more than half-a-dozen pairs at Gopaldhara which might be regarded as a small colony as it appears to be very capricious in the choice of a breeding habitat, which is boulder-studded, steep ground, and roughly cultivated. When the maize grows up in the adjacent ground under better cultivation; the birds utilize the stalks which reach a height of some 12-15′ and have almost the dense close growth of a reed-bed, at this time they keep much to the ground when feeding, and seldom appear to perch on the extreme tops of the stalks. It is remarkable that this chat should have been also recorded at such extreme heights.

224? The White-tailed Bush-Chat. Saxicola leucura (Blyth).

It is with some misgivings that this bird is introduced into the fauna of the Sikkim Himalaya as I now relegate all the birds which have been observed in the hills during the last ten years and which at the time were put down as this species, to be no other than *S. t. indica*. In the light of subsequent information, there can be little doubt *the majority* of the birds *remain in the plains* throughout the whole year and they breed at the plains-level much earlier than was suspected, before their breeding grounds are

submerged with the rise in the rivers and before the S. W. Monsoon has exerted its full force. A series from Dhunsiri Mukh on the Brahmapootra obtained on the 14-2-11 are undoubtedly breeding birds and my remarks anent the advanced condition of the sexual organs on the labels, bears out this deduction; while specimens obtained at Hessamara on the Subansiri, where I obtained Chat's eggs, are in April, in well-worn breeding plumage.

225. Hodgson's Bush-Chat. Saxicola insignis (Blyth).

Recorded for the "Lower Hills of Sikkim, (Mandelli). Summer quarters not known, probably central hills of Nepal and Sikkim." All efforts to locate this Chat have been without avail. Som allowance must be taken into consideration for the secretiveness of all Chats at the breeding season in common with many birds which are obtrusive at other times.

226. The Dark Grey Bush-Chat. Oreicola ferrea ferrea (Gray).

This Bush-Chat has a somewhat, higher breeding distribution than the breeding birds of the two Saxicolas. It commonly occurs at that time of the year at *elevations of from 6,000'-8,000'* chiefly nesting in April and May. *Cuculus canorus* has a predilection for the nest of this bird, with the result that possibly it is victimized more than any other bird in these hills. I have never seen this Chat during the breeding season at any great distance, from its haunts which is usually ground under rough cultivation or scrub-growth, but on the 18-6-23* at Gopaldhara, a single bird had been in the habit of frequenting the compound at dusk for the last two or three evenings, for which unusual incident there was no accounting, 24-8-23* three birds seen to perch at intervals on the lofty "Utis" tree adjacent to the bungalow this evening but only to remain for brief periods. Blanford records it from Northern Sikkim in Autumn at 7,000'-9,000' but less common than about Darjiling.

227. The Slaty-backed Forktail. Enicurus schistaceus Hodgs.

Apparently mainly confined to *moderately low elevations* in the foot-hills. Obtained in the Tista Valley at elevations of from 1,200'-1,500'. (G. E. Shaw). Gopaldhara, 3,750, 29-5-23,* four fully fledged youngsters in nest, located in one of the "kholas."

228. The Eastern Spotted Forktail. Enicurus maculatus guttatus Gould.

Occurs in hill streams at *all elevations from 3,500' and probably somewhat lower up to 7,500' or thereabouts in winter.* Breeds commonly at elevations of from 4,000'-5,000' in the Rungbong Valley. Obtained between Ghoom and Sookia Pokhari at 7,200', ♀ 19-1-12, and equally plentiful in the Mai Valley at similar and lower limits in East Nepal. When taken by surprise, they utter a shrill note and invariably take refuge in the vegetation along the bank of the "Khola", when a perceptible, whirling movement of the tail is apparent. On these occasions they settle on the branches of light growth and above the ground.

229. The Black-backed Forktail. Enicurus imaculatus Hodgs.

Only found at *low limits in the foot-hills.* Obtained in the Tista Valley at elevations of from 500'-1,500'. (G. E. Shaw).

230. The Assam Forktail. Enicurus leschenaulti indicus Hartert.

Only occurs at *low elevation*, where it has been obtained at the plains-levels of 500′. (G. E. Shaw).

231. The Little Forktail. Microcichla scouleri scouleri (Vig.)

Generally distributed at *all elevations up to 8,000′*, and possibly breeding at somewhat lower limits. I have failed to observe it up to an elevation of 11,000′ in summer, as recorded for the Himalayas. It commonly occurs in the Rungbong River in "the cold weather", and observed as numerous in the Tista River and streams between Dikchu and Singhik at a similar period of the year.

232. The White-capped Redstart. Chaimarrornis leuco cephala (Vig.)

This sprightly and charming Redstart commands attention with its striking plumage and lively actions when during "the cold weather" it is to be found at all elevations from the foot of the hills upwards. During the summer *the majority breed around and below 7,000′ and evidently at much higher limits, the remaining few.* Recorded at about 20,000′ in summer, exact elevation evidently 17,500′ (Stolickza) which extreme height refers to the N. W. Himalayas. Blanford records it from the Cho La Range at 12,000′ (August) and from Northern Sikkim at 10,000′ (September). "In the middle of October in the Lachen Valley, all had descended below 10,000′."

233. The Plumbeous Redstart. Rhyacornis fuliginosa (Vig.)

This more sombre coloured Redstart is not less attractive by reason of its smaller size, as it has all the varied actions of its more conspicuous companion, the White-capped Redstart, and has a similar distribution. Recorded up to 13,000′, which is probably an extreme limit. My April to June records place its *breeding range on the Outer Ranges from 7,000′ downwards.* There is every likelihood, however, of it attaining much higher limits in the interior in summer; yet, I have no records to substantiate this supposition. Blanford records it from the Cho La Range 11,000′-12,000′ (August) also at the same season below 3,000′. In September and October not above 7,000′ in Northern Sikkim.

234. The Blue-fronted Redstart. Phœnicurus frontalis Vig.

Recorded "seldom below 5,000′, in summer 14,000′ or even higher at that season." This Redstart has been obtained around Mangpu above the Tista Valley at elevations of from *3,500′-5,000′ in the cold weather.* (G. E. Shaw). In the Rungbong Valley my observations almost coincide with its lowest limit reached at this period of the year. Whilst it is generally distributed around Mirik, 5,200′ and along the ridge upwards; a few birds may be seen every year during the coldweather months,—November and December,—around the Gopaldhara Bw. at 4,720′.

I found it fairly numerous on Tonglo at *10,000′ in the winter* of 1911-12, only males, however, at this extreme limit, although every opportunity was taken to keep a sharp look-out for the female and secure specimens. At all times there seemed to be a disparity of the sexes. 4 ♂ ♂ collected 23—29-1-12. Gopaldhara, 4,720′, ♀ 9-10-15, earliest arrival noted. 4,500′, a single ♀ 30-3-20, latest departure. Other records: Nigali, near Mirik, 5,300′, ♂ 23-3-11. Ghoom to

Sookia Pokhari, 7,000′, ♂ 19-1-12; 7,200′, ♀ 9-2-17. Chungthang, 5,350′, 24-2—11-3-20*. Sandakphu, 11,900,′ ♀ 8-3-12. Kalo Pokhari, 10,160′, ♂ 1-4-12 ; ♀ 2-4-12. ♀ 10-4-12, in fat condition. Mr. Shaw's records are 3,500′, 9-2-19 ; 3,700′, 2-3-19 ; 4,000′, 19-12-12 ; 5,000′, 14-12-12, and refer to all males.

"In contrast to the last species (*R. rufiventris*) which abounds in the plains of India in winter, but crosses the snows to breed, this Redstart which rarely, if ever, visits the plains but which Jerdon found abundantly around Darjiling in winter, evidently breeds in the higher hills of Sikkim. I met with it on the Cho La Range and again abundantly in the Lachung and Lachen valleys at from 12,000′-14,000′ and at Yumthang on September 12th and 14th. I shot three birds in spotted plumage. I, several times at high elevations both on the Cho La Range and in Northern Sikkim saw another species of Ruticilla which was perhaps *R. caeruleocephala*." (Blanford).

235. The White-throated Redstart. Phœnicurus schisticeps (Gray).

This handsome Redstart occurs on the *Singile La Ridge of the Outer Ranges in winter, not below an elevation of 10,000′. In the Interior* it has been observed at Gangtok at as low *an elevation as 5,800′* ♂ 21-2-20*. Invariably found in pairs at this period. Tonglo, 10,074′, 3 ♂ ♂, 2 ♀ ♀ 23—26-1-12, Sandakphu, 11,929,′ 3 ♂ ♀, 28-2-12, ♀, 2-3-12, all procured on the bare mountain-tops. Lachung, 9,500′-10,000′, 4 ♂ ♂ 2 ♀ ♀ 1—4-3-20, numerous, males "in fat condition"; which certainly points to early nesting, the birds being congregated on the winter snow-line. Observed at Chungthang 5,350,′ 24—25-2-20*. None were visible on the 11-3-20, which was to be expected as they were already much above Lachung. Observations at Gangtok, 5,800,′ 21—22-2-20, when one or two were seen to be particularly tame, on the outskirts of "the station". Blanford strangely enough, makes no mention of meeting with it in the interior.

236. Hodgson's Redstart. Phœnicurus hodgsoni Moore.

Curiously, this Redstart rarely occurs at moderate elevations on migration. It is to be found sparingly in the Bhotan Dooras, where it is confined to the river-beds : a similar habitat it frequented in Upper Assam during the cold weather. Observed on one occasion at Gopaldhara at 3,440′ on the upward migration, exact date overlooked. Chungthang, 5,350′, ♂ 11-3-20, no female seen, but may have been in the neighbourhood. Bhotan Ghat, Raidak River, Eastern Dooars, ♂ 26-1-22, ♀ 19-1-22 one or two males scatter at wide intervals along the river-edge and an equal number of females ; both sexes keeping apart ; the females farther inside, away from the river and on the outskirts of the forest.

237. The Indian Redstart. Phœnicurus ochruros rufiventris. (Vieill).

Recorded as procured by Mandelli in June in Native Sikkim.

Found on the *Outer Ranges on migration*. My meagre records point to this Redstart as being of rare and accidental occurrence.

Gopaldhara, 4,500, 31-9-21*, a pair observed at fairly close quarters ; they had disappeared a few days afterwards, on their descent to the plains. 4,720′, ♀ 12-4-16, an interesting date on account of the late appearance, noted as "in fat condition"; undoubtedly a very late straggler on its upward journey to its breeding grounds. Seeyok, 5,200′, 30-10-20*, a glimpse obtained of a female which I identified as this Redstart.

"Not seen on the Cho La Range but abundant in the Lachen and Lachung valleys during the latter parts of our stay in them. The first specimen was sho

at Momay Samdong, 15,000′, on September 21st. In this case there could be no question that the birds migrated from beyond the passes, because none were seen before the date mentioned, even in the highest parts of the valleys at 15,000′-18,000′ whilst afterwards they were abundant everywhere and on one occasion in the middle of October we saw them at 4,000′ in the Tista Valley. It certainly, I should say, does not breed in Sikkim." (Blanford.) Large numbers observed on migration at 20,000′ during the Mount Everest Expedition. (A. F. R. Wollaston.)

238. Guldenstadt's Afghan Redstart. Phœnicurus erythrogastrus grandis (Gould).

Recorded "Himalayas, Kashmir to Sikkim, summer 10,000′-14,000′ or even higher in winter, descends to 5,000′." Whatever its winter extreme limit is in the N.-W. Himalayas; there is only a remote chance of meeting with it in Sikkim at this recorded low elevation and that would be in the far interior, where it might occur at Chungthang. Blanford met with it in the Lachen and Lachung valleys at 14,000′ in the autumn of 1870; his specimens are in the B. M. Coll., Donkia Pass, 16,500′, ♂ 20-9-70. Kangra Lama Pass, 14,000′, ♂ 5-10-70, and represented by four others of which a ♂ juv., July 1873 and ♂ ♀ October 1873, were collected by Mandelli. The Mount Everest Expedition obtained this Redstart at an elevation of 17,500′. I have not been fortunate to come across it anywhere in the interior in the winter and as far as its status is in Sikkim; it appears to be well above the snow-line even in winter.

(*To be continued.*)

THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By Colonel W. H. Evans, D.S.O., R.E., F.Z.S., F.E.S.

Part V.

With 4 Plates.

(*Continued from page* 907 *of Volume* XXIX.)

F. Nymphalidae.—The Nymphalids—(*contd.*)

F22. Neurosigma.—The Panther. (Plate 21).

α. ♂ DSF tawny with 9 large black spots on the basal half and 2 lunular black bands on the outer half of the F; uph basal two-thirds tawny with black markings, outer third black with 2 rows of white spots. WSF ♂ and both ♀ ♀ with bases only tawny and the rest white.

**doubledayi doubledayi, Wd.* (80-100). The Panther. Sikkim—Chittagong. R.

β. Smaller and paler, base F only tawny; H no tawny colour.

doubledayi nonius, DeN. (70-90). Karens. R.

F23. Abrota.—The Sergeant major (Plate 21).

♂ above tawny with dark bands; uph 4 bands of which the two central ones are well separated in the WSF and nearly united in the DSF. ♀ dark brown with dusky tawny bands; upf a streak in cell with a spot beyond; uph 2 tawny bands.

**ganga, M.* (70-90). The Sergeant-major. Sikkim, Bhutan. NR.

F24 Liminitis—The Admirals, etc. (Plates 21-22).

1a (8a). F upper end of cell about opposite origin v3. Antennæ not prominently yellow tipped. Uph discal band, if present, not strongly curved.

1b (7). F lower dcv ends about origin v3. No prominent large white spot at end cell.

1c (3a). H cell closed. Eyes smooth. Palpi smooth and white. Above ♂ no prominent pale discal band.

1 (2). Upf highly zigzagged postdiscal double line and uph inverted shaped spots. Above dark brown, paler brown discal band.

α. Above not purple glossed. Below grey.

**austenia austenia, M.* (85-90). The Grey Commodore. Assam. R.

β. Above purple glossed.

austenia purpurascens, Tyl. Abor Valley. VR.

2 (1). No such zigzag line. ♂ above dark brown basally and pale brown outwardly, with a dark brown straight band, tornal area H dark green. ♀ dark green with outer area white, greenish discal band F and dark band H.

danava, M. (80-85). The Commodore. Simla—N. Burma. R.

3a (1c). H cell open. Eyes hairy. Palpi white, hairy at sides. Above with a prominent pale discal band.

3 (4a). Upf the band yellow; uph white.

**zayla, Db.* (80-95). The Bicolour Commodore. Sikkim—Assam. NR.

4a (3). Upf discal band not yellow.

4 (5a). Upf discal band curved out at the upper end to the apical spots; the band green.

**daraxa, M.* (60-70). The Green Commodore. Sikkim—Karens. NR.

5a (4). Upf discal band curved in at the upper end, well away from the apical spots; the band white or nearly so.

5 (6). Upf discal band continuous to costa. Below mauve, apex F and tornus H chestnut; unh spots in cell and base 7 white.



F. **Nymphalidae.** 24. *Limenitis*: 25. *Pantoporia*: 26. *Neptis*.

F24. Liminitis—*contd.*

**dudu, Wd.* (75-85). The White Commodore. Sikkim—N. Burma. R.

6 (5). Upf discal band macular at upper end; beyond discal band there are 2 rows of black spots, separated by a fulvous line; discal band tinted blue. Below prominent dark basal markings.

zulema, Db. (80-85). The Scarce White Commodore. Sikkim—N. Burma. VR.

7 (1b). F. lower dcv ends far beyond origin v3. Eyes smooth. Palpi smooth and white. Above prominent white discal band. Uph 2 rows sub-marginal black spots on a tawny area. H cell open.

α. Upf no white spot at end cell.

procris calidasa, M. (60-75). The Commander. Ceylon. NR.

β. Upf large white spot end cell. Above discal band narrow, especially on H; upf sub-marginal reddish brown band narrow. Below darker.

procris undifragus, Fruh. S. India. NR.

γ. As last, but all bands above wider. Below paler and more irrorated violet.

**procris procris, Cr.* Dun—Burma. NR.

8. Upf spot end cell very small and sometimes absent. Larger and black markings above wider.

procris anarta, M. Andamans. NR.

8a (1a). F. upper end cell opposite well before origin v3; lower dcv ends about origin v3. Cells shut. Eyes smooth. Palpi hairy, white below, black lined at sides. Upf prominent white bar mid cell and a curved white discal band on both wings; 2 apical dots on F. ♂ (9) Upf single bar in cell.

α. Above discal white band narrow, macular, width less than one-sixth wing. More or less prominent black sub-marginal spots, bordered on either side by dusky fulvous spots.

trivena ligyes, Hew. (60-75). The Indian White Admiral. Chitral—Kashmir and Pangi. NR.

β. Above band still narrower and the fulvous spots on either side of the black submarginal spots much brighter.

trivena hydaspes, M. Hazara—Chilas. R.

γ. Above discal white band continuous, very wide, equal to one-third of the wing; a narrow white sub-marginal line; the fulvous spots hardly visible.

**trivena trivena, M.* Murree—Kumaon. C.

9 (8). Upf two bars in cell: discal band broken into well separated spots.

elwesi, Ob. (62). The Chinese Admiral. S. Shan States. VR.

F25. Pantoporia.—The Sergeants. (Plate 22.)

1a (11a). F cell shut.

1b (8a). Eyes smooth.

1 (2a). Unh 5 prominent black spots about the origin of v7. Sexes alike, markings normal, white. Upf cell streak and spot beyond end cell entire, incised once on upper side; discal spots well separated, that in 2 large, in 3 small, in 4 a long streak under the middle of spot in 5. F lower dcv ends well beyond origin of v3.

sulpitia adamsoni, M. (55-75). The Spotted Sergeant. N. Burma. VR.

2a (1). Unh no prominent black spots about origin v7, but with brown streaks more or less prominent. F lower dcv ends about origin v3.

2b. (6a). Sexes dissimilar. ♂ upf discal streak obscure or very broken; discal spots dorsum to 2 or 3 conjoined and directed to apex or costa, not mid termen as usual. F lower dcv ends at or just after origin v3.

2c (4a). F no prominent discal spot in 3 as wide as and in line with the spots in 1 and 2. ♀ with broad orange markings normally arranged.

2 (3). ♂ unf discal streak much broken. ♀ discal spots in 4, 5 and 6 form a continuous, even-edged, apical band.

F25. Pantoporia.—*(contd.)*

a. ♂ uph postdiscal band broad orange; apical orange markings upf and always a small discal spot in 3.

nefte inara, Db. (55-70). The Colour Sergeant. S. India, Orissa, Sikkim—N. Burma. NR.

β. Uph postdiscal band white or partly white; upf spot in 3 usually present; discal streak better defined; bands narrower.

nefte asita, M. Shan States—Tavoy. NR.

γ. ♂ markings above white, not orange and no discal spot in 3 upf.

nefte nirifera, But. Tavoy—S. Burma. NR.

δ. ♂ uph no postdiscal band, just a brown line. ♀ markings mostly white, orange tipped towards apex upf.

nefte rufula, DeN. Andamans. NR.

3 (2). ♂ unf discal streak continuous, but upper edge irregular. ♀ discal spot in 4 small and against outer edge spot in 3. ♂ upf discal streak obscure ferruginous; prominent orange apical markings; uph postdiscal band obscure.

**cama, M.* (60-75). The Orange Staff Sergeant. Mussoorie—Burma. NR.

4a (2c). F prominent discal spot in 3 upf and no apical orange markings in ♂. ♀ with white or sullied brownish bands above.

4 (5). Unf discal streak twice divided by a brown line across cell; triangular spot beyond well separated, obscure in ♂ prominent in ♀, lies at the base of 5 and not of 4 as usual.

a. ♂ above darker, bands narrower, discal spot in 4 parallel to rest and not inclined as usual; spot in 2 wider than rest; cell streak obsolete except for a single pale spot; below darker. ♀ white markings broad; below rather pale ochreous brown.

selenophora kanara, Evans. (60-70). The Staff Sergeant. S. India. NR.

β. ♂ markings broad, reddish mark in cell prominent. White markings in ♀ often sullied more or less. Seasonal forms well marked.

selenophora selenophora, Koll. (55—75). Mussoorie—Burma. NR.

5 (4). Unf streak in cell entire and hardly separated from the spot end cell in 4; apical white spots coalesced to a band. ♂ upf discal streak very obscure. discal band slightly curved in. ♀ markings sullied pale brown.

zeroca, M. (50-65). The Small Staff Sergeant. Kumaon—Burma. NR.

6a (2b). Sexes alike (except for colour in No. 6); (except ♀ of No. 6) discal spot in 2 well separated from the spot in 1, no discal spot in 3; lower part of discal band directed to mid termen; discal streak prominent. Markings white (except No. 6 ♀).

6 (7). Upf discal streak twice divided and well separated from the spot beyond. ♀ with pale brown confluent markings, very like ♀ of No. 2, but bands on H narrower than the dark brown space between. F lower dcv ends just after origin v3.

reta kresna, M. (60-70). The Malay Staff Sergeant. Assam—Mergui. VR.

7 (6). Upf discal streak entire and separated from spot beyond. Below olive brown. F lower dcv ends just after origin v 3.

kanwa phorkys, Fruh. (60-70). The Dot-dash Sergeant. Assam—Burma. R.

8a (1b). Eyes hairy. F lower dcv ends just after origin v3. Upf always a discal spot in 3.

8 (9a). Upf discal band normal, spots in 1a-3 directed to termen and in line with spot in 4; cell streak twice divided and well separated from the spot beyond. F upper apex cell acute, upper and lower dcvs in a continuous concave line.

a. Above white bands broad and always pure white.

opalina opalina, Koll. (60-70). The Hill Sergeant. Kashmir—Kumaon. C.

β. Above white bands narrow and often sullied.

opalina orientalis, El. (55-70). Sikkim—Burma.

F25. Pantoporia—(*contd.*)

9a (8). Upf discal band abnormal, discal spot in 3 at base 3, centre line of spots in 2-3 pointing to the costa; spot in 2 nearer base than usual and more widely separated from spot in 1. F upper end cell right angled and lower dcv takes off from some distance along v5, not in line with upper dcv.

9 (10). Uph basal band straight, narrow and continuous; postdiscal band white. Upf discal spot in 3 minute; apical 3 spots directed to mid termen, marginal spots small and white; cell streak consists of a narrow streak and a large spot beyond in the cell, no spot beyond end cell as usual; unf end cell marked by a white bar. Below dark brown. Sexes alike. Upf obscure bluish green spots in cell.

abiasa clerica, But. (60-70). The Abnormal Sergeant. S. Burma. VR.

10 (9). Uph basal band broad, curved; spot in 7 separated from rest; postdiscal band sullied also all marginal markings in ♂, whiter in ♀. Upf no cell streak, obscure bluish spots in cell and at base of 1; apical spots directed to tornus. Below pattern abnormal, white markings very broad and veins black.

α. ♂ above discal band only present; postdiscal band H absent. ♀ prominent wide postdiscal and marginal bands F and H.

ranga kresna, Fruh. (60-70). The Blackvein Sergeant. S. India. R.

β. ♂ above with sullied postdiscal and mariginal spots.

ranga ranga, M. Sikkim—Burma. R.

11a (1a). F cell open; apex cell obtuse.

11b (15). Eyes smooth.

11c (13a). Upf no discal spot in 3.

11 (12). Upf unbroken streak in cell and no spot beyond (similar to No. 15).

pravara acutipennis, Fruh. (55-60). The Unbroken Sergeant. Assam—Burma. R.

12 (11). Upf streak in cell divided so as to enclose a small spot in the middle; a triangular detached spot beyond the streak.

larymna siamensis, Fruh. (75-100). The Great Sergeant. Manipur—S. Burma. R.

13a (11c). Upf with a discal spot in 3.

13 (14). Upf cell streak narrow, entire, with a rounded, detached, spot beyond.

α. Uph a black spot in the centre of each white spot forming the postdistal band.

* *asura asura, M.* (65-75). The Studded Sergeant. Kulu—Tavoy. R.

β. Uph no black spots on the postdiscal band.

asura idita, M. (60-70). Mergui—S. Burma. R.

14 (13). Upf cell streak divided into 4 portions. Unh prominent row of black spots on the inner edge of the postdiscal band.

**perius, L.* (60-70). The Common Sergeant. S. India—Simla—Burma. C.

15 (11b). Eyes hairy. Upf cell streak entire and no spot beyond; a discal spot in 3.

**jina, M.* (60-75). The Bhutan Sergeant. Sikkim, Nepal, Bhutan. VR.

F.26. Neptis.—The Sailers and Lascars. (Plate 22).

1a (28a). F v10 ex cell.

1b (10a). Upf cell streak always divided into a basal streak and a spot beyond. Above markings white or sullied.

1c (4a). Upf discal spots in 2 and 3 in line with the discal spot in 5, which line is directed to the costa well before the apex. Uph inner discal band never to the costa.

1d (3). Unh basal white markings normal, consisting of a costal streak and a streak across base cell, which is often continued under v7.

F. 26. Neptis.—(*contd.*)

1 (2). Uph postdiscal row of white spots prominent and separate. Below termen broadly chequered black at the ends of veins and white in the interspaces. H v8 ends on termen and is aberrant.

α. Above markings tinged blue.

olumella nilgirica, M. (65-70). The Short-banded Sailer. S. India. NR.

β. Above markings white.

columella ophiana, M. Dun—Burma. NR.

γ. Larger. Below very dark and outer white markings much developed; lunules beyond sub-basal band in a series of deep crescents.

columella kankena, Evans. (75). Nicobars. VR.

2 (1). Uph postdiscal row white spots absent or represented by a narrow continuous line. Unf usually with prominent dark chestnut discal streaks beyond the cell and unh prominent large discal black spots and a black spot in cell near base.

α. All white markings narrow. Below darker; unh discal spot in 7.

jumbah nalanda, Fruh. (60-70). The Chestnut-streaked Sailer. Ceylon. NR.

β. Unh with a discal spot in 7.

jumbah jumbah, M. S. India—Bengal—Burma. NR

γ. Unh no discal spot in 7.

jumbah amorosca, Fruh. Andamans.

δ. Upf 5 not 6 discal spots; unh termen bluish white with a black line.

jumbah binghami, Fruh. Nicobars. (Fruh).

3 (1d). Unh basal white streak broad, single, not entering cell or extending below v8 (also so in Nos. 13a and 15). Below very uniform dark brown.

α. Upf pale markings very narrow and bluish; discal spot in 3 reduced to a dot. Uph postdiscal spots large and with diffuse edges. Unh white sub-marginal band discontinuous.

magadha khasiana, M. (55-60). The Spotted Sailer. Bhutan—N. Burma. R.

β. Upf markings broader; uph postdiscal spots small. All markings sharp. Unh white sub-marginal line continuous.

magadha magadha, Fd. S. Burma. R.

4a (1c). Upf discal spots in 2 and 3 not in line with spot in 5 and the line joining 2 and 3 points to termen below apex (in No. 5 and individuals of No. 6 it points to the apex).

4 (5a). Uph discal band not to costa. Abdomen white where discal band uph meets it, as in *Pantoporia*. Below uniform dark brown.

nata cresina, Fruh. (55). The Burmese Sailer. Karens—S. Burma. R.

5a (4). Uph white discal band to costa (or very nearly so in individuals of No 7). Abdomen never white banded.

5b (7a). H termen prominently chequered black and white and below markings more or less black edged, more especially inner discal band unh. Unf spot end cell well separated from basal streak.

5 (6). Upf apical part of discal band nearer termen, crosses base of v8 and is nearly at right angles to the costa, the costal streak as wide as the rest; discal spot end cell outwardly blunt; discal spots in 2 and 3 directed to apex; spots of upper and lower part of the discal band usually confluent. Below black edgings to markings obscure. Uph the white discal band widens towards the costa.

mahendra, M. (55-60). The Himalayan Sailer. Chitral—Kumaon. C.

6 (5). Upf upper part of discal band well behind base of v8 and is oblique, costal streak short and behind the spots below it; discal spot end cell outwardly sharp pointed. Uph inner discal band not widening towards costa.

F. 26. Neptis.—(*contd.*)

α. Above white markings broad and sharp. Below rather dark ochreous and unf veins beyond cell prominently black.

hylas varmona, M. (50-60). The Common Sailer. Ceylon. S. India—Kumaon and Sikkim. VC.

β. Above markings narrow and often sullied. Below ferruginous brown, no veins blackened.

**hylas astola, M.* Kashmir—Karens (Hills). VC.

γ. Below bright golden ochreous, no veins blackened. Above markings broad. Very variable.

hylas adara, M. Assam—Burma. (Plains). VC.

δ. As last. Uph postdiscal band narrow and unh inner discal band more prominently black edged than usual.

hylas andamana, M. Andamans. C.

η. Upf spots in 2 and 3 directed to apex. All markings very broad. Below rather dark ochreous and white markings along termen broader. Unh inner discal band constricted at ends.

hylas nicobarica, M. Nicobars. C.

7a (5b). H termen not prominently chequered and below markings not black edged. Unh cell streak and spot beyond often conjoined; discal spots in 2 and 3 always directed to termen.

7 (8a). Uph inner discal band very narrow, does not enter base 3, or if so, there is an equivalent dark space at base 2. All markings narrow and macular, usually sullied above. Below dark ochreous brown.

α. Large. Uph spots of postdiscal band widely separated, spaces between as wide as the spots.

soma kallaura, M. (60-70). The Sullied Sailer. S. India. R.

β. Small. Uph postdiscal spots conjoined.

soma soma, M. (50-60). Mussoorie—Burma. R.

γ. Larger and darker. Unh inner discal band broad. Very like *nandina clinia*, but below dark chocolate brown and unf discal spots in 2 and 3 are rounded and further from the margin.

soma mananda, M. (55-60). Andamans. R.

8a (7). Uph inner discal band always fills base 3 and extends up to base 2 or beyond. Below much brighter ochreous brown.

8 (9). Upf upper 3 spots of sub-marginal line not markedly shifted in. Unh the 2 pale sub-marginal lines, not equally prominent, the outer one obscure.

α. Above markings broad, not sullied; upf discal spots in 2 and 3 outwardly rounded.

nandina hampsoni, M. (55). The Clear Sailer. S. India—Central Provinces. R.

β. Upf discal streak usually sullied; discal spots in 2 and 3 outwardly square or concave.

nandina susruta, M. (45-60). Sikkim—Burma. C.

γ. Uph postdiscal band obscure or absent. Much darker above; inner discal band uph broad and prominent.

nandina clinia, M. Andamans. C.

9 (8). Upf upper 3 spots of sub-marginal series shifted in markedly and at right angles to costa. Uph white band broad and expanding to costa. Unh the 2 sub-marginal white lines equally prominent.

α. Large, markings wide, unsullied, but sometimes yellow tinged. Upf discal spot in 2 outwardly concave.

yerburyi yerburyi, But. (60-70). Yerbury's Sailer. Kashmir—Kumaon. NR.

β. Smaller and markings much narrower, usually slightly sullied. Upf discal spot in 2 outwardly rounded.

yerburyi sikkima, Evans. (58-60). Sikkim—Assam. NR.

F26. Neptis—(*contd.*)

γ. As last, but markings wider. Upf discal spot in 2 outwardly rounded.
yerburyi shania, Evans. (55-60). N. Burma. NR.

10a (1b). Upf cell streak and spot beyond conjoined (in No. 13 nearly as separated as in No. 8a).

10b (23a). Upf cell streak not extending into base 3 (but see No. 20a where spot in 3 lies at base 3 and touches cell streak).

10c (17a). Unf no pale spots on costa above end cell streak internal to the upper discal spots.

10d (15a). Above markings not orange yellow and upf sub-marginal pale line always traceable.

10e (13a). Unh basal costal streak narrow and not more prominent than the streak base cell; both prominent in No. 10 and obscure in Nos. 11 and 12.

10 (11a). Upf the usual pale line between the discal and the sub-marginal spots absent. Above all markings broad and clear.

α. Above markings very broad and white; upf discal spot in 4; uph discal band reaches costa.
**sankara sankara, Koll.* (65-75). The Broad-banded Sailer. Kashmir—Kumaon. NR.

β. As last, but markings narrower; spots forming discal band well separated.
sankara quilta, Swin. Sikkim—Burma. NR.

γ. Above very dark, pale markings F and postdiscal band H tinged yellow; inner discal band H narrowing to costa and not reaching it; upf no discal spot in 4 and uph sub-marginal pale line absent. Below very dark brown, tinged violaceous.
sankara nar, DeN. Andamans. VR.

11a (10). Upf with the usual thin pale line between the discal and sub-marginal markings, the line highly zigzag; all markings obscure, fuliginous brown and very narrow. Uph inner discal band not to costa.

11 (12). Upf discal spot in 2 more or less quadrate; cilia at apex prominently white. Uph inner discal band to v7 in ♂; postdiscal and sub-marginal pale lines well separated. Below dark brown, pale markings all prominent and white.
vikasi pseudovikasi, M. (60-70). The Dingy Sailer. Kumaon—Assam. NR.

12 (11). Upf discal spot in 2 crescentic; cilia not prominently white at apex. Uph in ♂ discal band only to v5; postdiscal and sub-marginal pale lines wide and close together, encircling the dark area between so as to form a row of dark spots. Below olive brown, all pale markings obscure pale brown.
harita, M. (55-60). The Dingiest Sailer. Bengal—Burma. NR.

13a (10a). Unh basal costal streak broad, extending to v8 only and no pale streak base cell (just as in Nos. 3 and 15).

13 (14). Above markings from white to more or less sullied, discal spots macular and well separated. Upf always prominent discal spot in 3; sub-marginal pale spots prominent and the highly zigzag line between them and the discal spots. Very like *nandina*, but easily separated by the basal costal markings unh.

α. Above markings broad.
cartica cartica, M. (55-70). The Plain Sailer. Sikkim—Assam. NR.

β. Above markings narrow.
cartica burmana, DeN. Assam—Burma. NR.

14 (13). Above markings highly sullied and diffused; upf no discal spot in 3 and the line between the discal and sub-marginal markings not zigzag.

α. Uph inner discal band whitish, other markings pale brown; unf sub-marginal pale line at apex not bent in parallel to apical discal spots. Below dark ochreous brown and all markings more or less white.
anjana nashona, Swin. (65-70). The Rich Sailer. Assam—N. Burma. VR.

F26. Neptis—*(contd.)*

β. ♀ very much as in α, but unf in ♂ and ♀ the sub-marginal pale line at the apex curved in parallel to the apical discal spots. ♂ above very dark with narrow brown bands; below very dark ferruginous ochreous, flushed violet, markings not white.

anjana anjana, M. Karens—S. Burma. R.

15a (10d). Above markings orange yellow and sub-marginal line upf obscure.

15 (16). Unh basal costal streak broad and no streak at base cell. Upf discal spots in 1 & 2 well separated; unf spot in 5 small, completely detached from spot in 6 and not extending below v5. F termen excavated in middle.

α. Below markings pale clear ochreous.

ananta ananta, M. (55-70). The Yellow Sailer. Chamba—Kumaon. R.

β. Below dark ferruginous ochreous.

ananta ochracea, Evans. Sikkim—Karens. R. (high).

γ. Above darker and all markings much darker. Below darker. H. termen more crenulate.

ananta namba, Tyt. Manipur. Nagas. R. (low elevations).

16 (15). Unh basal costal streak narrow and with a streak base cell. Upf discal spots in 1 and 2 conjoined or very close; apical spots coalesced and extending into 4 on both sides. F termen even, not concave in middle.

α. Below markings more or less whitish, especially the discal band H. Upf spots in 1 and 2 separated by the black vein.

miah miah, M. (45-60). The Small Yellow Sailer. Sikkim—Assam. NR.

β. Below markings ochreous; marginal markings more obscure. Upf discal spots in 1 and 2 completely conjoined.

miah nolana, Druce. Burma. R.

17a (10c). Unf with pale costal spots above end cell streak, internal to the upper discal spots.

17 (18a). Upf discal spots complete, with a spot in 4; inner edge sub-marginal line highly bent in the middle.

α. Above all markings narrow, brown. Below entirely brown with prominent yellow or whitish bands.

ebusa fuliginosa, M. (55). The Fuliginous Sailer. Karens—S. Burma. R.

β. Upf apical markings whitish and below all markings whitish.

ebusa ebusa, Fd. Nicobars. VR.

18a (17). Upf no discal spot in 4; inner sub-marginal pale line absent.

18 (19a). Upf discal spot in 3 narrow and not to v4, immediately above and coalesced to spot in 2, not produced towards cell streak.

α. Above markings white.

antilope melba, Evans. (55). The Variegated Sailer. Sikkim. VR.

β. Above markings yellow.

antilope antilope, Leech. (60). Naga Hills. VR.

19a (18). Upf discal spot in 3 reaches v4.

19 (20a). Upf discal spot in 3 not curved in so as to meet cell streak. Above markings yellow.

cydippe kirbariensis, Tyt. (80). The Chinese Yellow Sailer. Naga Hills, VR.

20a (19). Upf discal spot in 3 meets cell streak, forming a hockey stick.

20b (22). Upf discal spot in 3 fills base 3.

20 (21). Above markings yellow.

aspasia, Leech. (85). The Great Hockeystick Sailer. Nagas. VR.

21 (20). Above markings white. Below greenish yellow.

manasa, M. (65). The Pale Hockeystick Sailer. Sikkim; VR.

22 (20b). Upf discal spot in 3 not to base. 3. Below rich ochreous brown.

α. Above markings white.

F26. Neptis—(*contd.*)

nycteus nycteus, DeN. (60). The Hockeystick Sailer. Sikkim. VR.

β. Above markings yellow.

**nycteus phesimensis, Tyt.* Nagas. VR.

23a (10b). Upf cell streak extending into base 3.

23b (25a). Unf with pale costal spot or spots above end cell streak, internal to the apical discal spots.

23 (24). Unf these spots small and confined to costa.

α. Above markings white.

**narayana narayana, M.* (60-70). The Broadstick Sailer. Kulu—Kumaon. R.

β Above markings yellow.

narayana nana, DeN. Sikkim—Manipur. R.

24 (23). Unf these spots continued to the cell streak.

α. Large; markings orange yellow above.

radha radha, M. (70-80). The Great Yellow Sailer. Kumaon—Assam. R.

β. Small; markings pale yellow above.

radha asterastilis, Ober. (60-70). Momeit, N. Burma. VR.

25a (23b). Unf no costal spots internal to the apical discal spots.

25 (26a). Upf spot in 1 well separated from the spot in 2. Above markings broad, white to pale yellow. Below pale yellow green.

zaida, Db. (65-75). The Pale Green Sailer. Murree—Shan States. R.

26a (25). Upf lower discal spots coalesced, not even separated by veins. Above markings yellow.

26 (27). Below bands pale greyish ochreous, with a violet tint; uph dark area between the pale bands nearly as wide or wider than the bands.

α. Above bands wide. Below paler and all markings with their edges suffused.

viraja kanara, Evans. (55-75). The Yellowjack Sailer. S. India—Orissa. NR.

β. Above bands narrower and below darker and all markings with sharply defined edges.

viraja viraja, M. Kumaon—Burma. NR.

27 (26). Below all bands ochreous. Upf cell streak never bearing a black mark on its upper edge, but instead a slender black edged, yellow bar. H. discal black band narrower below than above. Uph dark margin bears a narrow ochreous line; black discal band further from margin. Upf outer sub-marginal yellow line always traceable, inner line comparatively broad and the inner dark line irregular.

α. Larger, paler, yellow above. Upf irregular dark line bordering the yellow discal area much more irregular in middle than elsewhere. Below markings pale; termen not fuscous edged.

heliodore sattanya, M. (45-50). The Burmese Lascar. Assam—N. Burma. NR.

β. Smaller, darker, orange above. Upf dark line bordering yellow discal area zigzagged throughout. Below markings dark, well defined, termens narrowly fuscous.

heliodore dorelia, But. (40-45). S. Burma. NR.

28a (1a). F v10 ex 7. Above markings yellow; all small.

28b (32). Below not striated with fuscous brown lines.

28c (31). Upf lower discal spots conjoined.

28d (30). Upf 2 narrow sub-marginal pale lines; uph narrow ochreous line on the dark margin.

28 (29). Upf the 2 narrow sub-marginal lines yellow, curved in middle. Below markings ill-defined, pale; unh at base several short brown dashes, termen ochreous, bearing 2 narrow dark lines.

F. 26. Neptis—*contd.*

**paraka, But.* (45-50). The Perak Lascar. Assam—Burma. NR.

29 (28). Upf the 2 narrow sub-marginal pale lines greyish, not conspicuously curved in the middle. Below markings dark, sharply defined, no basal brown dashes. Unh dark discal band and dark margin bear prominent, well defined greyish ochreous lines.

γ. Upf the sub-marginal lines united.

dindinga assamica, M. (40-45). The Greylined Lascar. Assam—N. Burma. VR.

β Upf submarginal lines separate.

dindinga dindinga But. (45-50). S. Burma. VR.

30 (28d.) Upf a single ochreous sub-marginal line. This line broad, not bent in middle; uph an ochreous line on the dark margin. Below washed pinkish; unf veins black at apex, margin broad ochreous. Unh some dark dots at base cell; dark discal band more heavily black edged on inner side than on outer.

aurelia, Stg. (25-40). The Baby Lascar. Assam—Burma. R.

31 (28c). Upf discal spots in 1 and 2 well separated. Uph postdiscal yellow band narrow and no ochreous line on the dark margin.

paona, Tyt. (45-50). Tytler's Lascar. Naga Hills, VR.

32 (28b). Below more or less brown striated. Very pronounced seasonal variation.

α. Upf marginal lines highly zigzagged throughout.

hordonia sinuata, M. (45-50). The Common Lascar. Ceylon. C.

β. Upf marginal lines much less zigzagged, but often in WSF prominently so in the middle.

**hordonia hordonia, Stoll.* S. India. Dun—Burma. C.

γ. Uph sub-basal pale band white.

hordonia cnacalis, Hew. Andamans. C.

F. 27. Cyrestis.—The Map Butterflies. **(Plate 23).**

1 (2a). F apex broadly truncate and produced below v6. Above white with narrow pale ochreous lines and a broad brown border.

α. Upf dark border rather pale brown and costa pale brown.

**periander periander, F.* (40-50). The Little Map. Shan States. R.

β. Upf dark border much darker brown, costa whitish. Above ochreous lines broad and darker, especially at tornus H.

periander binghami, Martin. Dawnas—S. Burma. NR.

2a (1). F apex not truncate.

2 (3a). H apex rounded and termen F even.

α. Smaller. Typical form white, with fine lines, bases and margin not darkened.

cocles cocles, F. (50-60). The Marbled Map. Orissa. Sikkim—Burma. R.

v. earli, Dist. Bases and margin darkened, but interspersed with white patches. R.

v. natta, Swin. Bases and margin darkened and very slightly interspersed with white patches.

β Large. Typical form white, bases and margin not darkened.

cocles formosa, Fd. (60-70). Andamans. R.

**v. andamanica, WM.* Bases and margins darkened and interspersed with white. R.

3a (2). Apex H and tornus F truncate.

3b (5). Above ground colour white or pale yellow.

3 (4). Upf outer thin discal line meets black border at v5 and just below v2; inner discal line has no dark patch at its upper end. Uph 3 thin basal lines parallel. Prominent ochreous area at tornus F and H and this area on F bears 2 small prominent black dots. Above ground colour white.

F. 27. Cyrestis—(*contd.*)

nivea nivalis, Fd. (50-60). The Straight Line Map. S. Burma. NR.

4 (3). Upf outer thin discal line runs from dorsum to v7 and inner discal line has a small dark patch at its upper end. Uph the fine basal lines irregular. Upf no prominent tornal ochreous area. Uph postdiscal dark band straight.

α. Upf apical and terminal dark area distinctly blueish grey. Ground color never yellow.

thyodamas indica, Evans. (50-60). The Common Map. S. India. NR.

β. Upf apical and terminal dark areas narrower and dark brown. Above usually white in ♂ and pale yellow in ♀.

thyodamas ganescha, Koll. Kashmir—Kumaon. NR.

γ. Upf apical and terminal dark areas much broader and brown. Nearly always white above.

**thyodamas thyodamas, Bdv.* Sikkim—Burma. C.

δ. Above all markings much heavier; upf 2 discal lines joined by the dark area in 4. Uph tornal orange areas much more extensive and darker.

thyodamas andamanica, WM. Andamans. NR.

5 (3b). Above deep rich fulvous; below yellow. Above markings much as in No 4, but with a complete row of postdiscal lunular brown spots.

tabula, DeN. (55-60). Nicobars.

F. 28. Chersonesia.—The Maplets. (Plate 23).

1a (3). H tornus produced and termen with a short tail at v4. Above fulvous with dark brown narrow lines.

1 (2). F 6th line from base, as all the others, quite straight throughout and parallel to the rest.

**risa, Db.* (40-45). The Common Maplet. Kumaon—Burma. NR.

2 (1). F 6th line from base sinuous, much curved at upper end.

rahria rahrioides, M. (35-45). The Wavy Maplet. Manipur—Burma. R.

3 (1a). H tornus not produced and termen not tailed. In ♀ termen very convex. Upf 6 lines nearest base paired and filled in darker between pairs; 7th line waved as 6th in No 2.

peraka, Dist. (30-35). The Rounded Maplet. S. Burma. R.

F. 29. Pseudergolis.—The Tabby. (Plate 23).

Above golden brown; upf 4 dark lines in cell, 3 dark lines beyond and between the last two a row of black spots. Below dull brown, more or less glazed violet, especially at apex unf. Apex F truncate.

**wedah, Koll.* (55-65). The Tabby. Kulu—Burma. NR.

F. 30. Hypolimnas.—The Eggflies. (Plate 23).

1 (2a). Unh prominent black costal spot mid 7. ♂ above dark indigo blue prominent large discal white patch on each wing ona shot blue area. Normal ♀ tawny with white banded black apex upf.

**misippus, L.* (70-85). The Danaid Eggfly. Ceylon, India, Burma. C.

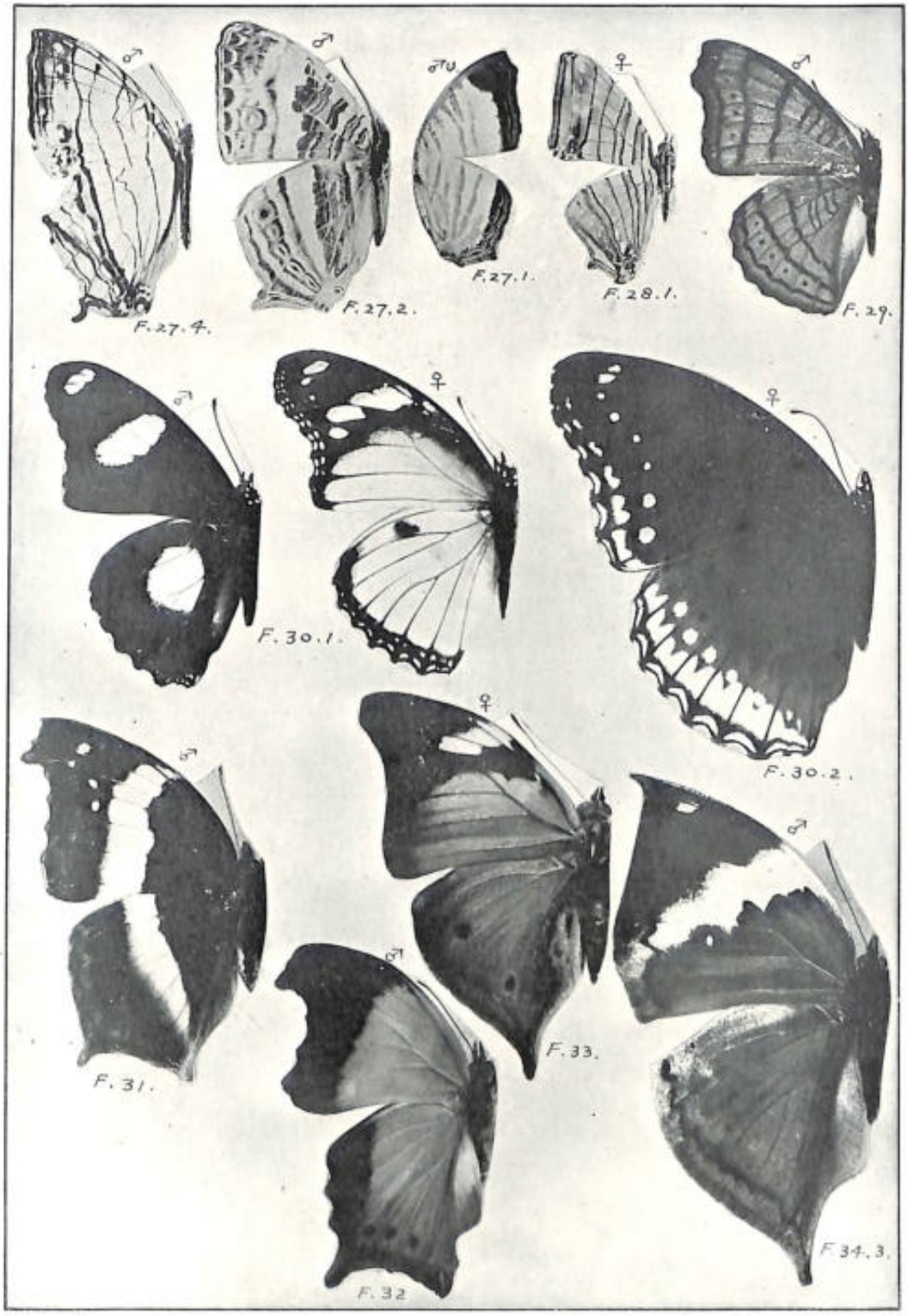
♀ *v. alcippoides, But.* Uph white on disc. VR.

♀ *v. inaria, Cr.* Upf white banded black apex absent. VR.

2a (1). Unh no prominent black costal spot mid 7.

2 (3). Unh broad white or whitish marginal band. ♂ above as No 1, but white patches suffused blue in DSF. ♀ normally with a prominent row of sub-marginal white spots and a broad white margin uph; upf in WSF 2 blueish white spots end cell; DSF with a blue shot discal band. ♂ ♀ below in DSF with a prominent white discal band on either wing.

**bolina, L.* (70-110). The Great Eggfly. Ceylon, India, Burma, Andamans. C.



F. **Nymphalidae.** 27. *Cyrestis*: 28. *Chersonesia*: 29. *Pseudergolis*: 30. *Hypolimnas*: 31. *Yoma*: 32. *Rhinopalpa*: 33. *Doleschallia*: 34. *Kallima*.

F. 30. Hypolimnas—*(contd.)*

♀ *v. melita, Cr.* Upf a series of suffused, rather small, whitish spots beyond cell and a dark obscure fulvous patch near tornus; uph discal area suffused, golden tawny. S Burma. VR.

♀ *v. iphigenia, Cr.* Above postdiscal spots absent and marginal markings obsolete. Upf a row of large white discal spots beyond cell, outwardly obscurely blue edged; prominent tawny tornal area. Uph large white discal area, inwardly obscurely blue edged and outwardly very obscurely tawny edged. S. Burma. VR.

3 (2). Unh no broad pale marginal band. ♂ above dark olive brown, glossed blue on costa and termen F; postdiscal white spots F and H; upf ill-defined whitish streaks in 4, 5 and 6 beyond cell. ♀ as ♂ but all upf except basal third shot rich satiny blue.

antilope anomala, Wall. (85-95). The Malayan Eggfly. Nicobars. NR.

F. 31. Yoma.—The Lurcher. (Plate 23).

Above dark brown with a broad yellow discal band across both wings. Below DSF leaf-like; WSF with a very pale yellow discal band as above.

**sabina vasuki, Doh.* (75-85). The Lurcher. Burma. NR.

F. 32. Rhinopalpa.—The Wizard. (Plate 23).

♂ above rich tawny fulvous with a broad black border F and the upper part H; lower part H with black sub-marginal spots. Below rich dark brown with very narrow silver lines and fulvous markings and a complete row of sub-marginal spots F and H. ♀ paler, bases darker ochreous brown and a broa yellow discal band.

**polynice birmana, Fruh.* (70-80). The Wizard. Assam—Burma. R.

F. 33. Doleschallia.—The Autumn Leaf. (Plate 23).

Above rich tawny fulvous with a very broad black apex bearing a tawny band from the costa beyond the cell. Below leaf-like.

α. F termen between vs 7-9 convex or straight. Upf yellow spot in 4 parallel to termen, narrow, diffuse, just extending into 3 and 5 and sometimes very narrowly jointed to the costal band along v5.

bisaltide ceylonica, Fruh. (75-85). The Autumn Leaf. Ceylon. R.

β. F termen as in α. Upf yellow spot in 4 smaller, confined to 4 and not joined to costal band. Paler.

bisaltide malabarica, Fruh. S. India. R.

γ. F. termen concave between vs 7-9. Upf discal spot in 4 variable, but better formed and more quadrate.

bisaltide continentalis, Fruh. Sikkim—Burma. NR.

δ. F termen between vs 7-9 straight. Upf 3 white apical spots instead of 2. In ♀ costal band broadly joined to spot in 4, which extends into 5.

**bisaltide merguiana, Evans.* Mergui. NR.

η. F termen between vs 7-9 convex. Above as γ but black apex extends broadly along 3 to base 3. F tornus much produced and termen more concave in middle.

bisaltide andamanica, M. Andamans., Nicobars. NR.

F. 34. Kallima.—The Oakleafs. (Plate 23).

1a (4). Upf dark basal area extends beyond end cell. Base F and all H some shade of blue or green.

1 (2-3). Upf discal band blue or blueish white, a dark bar defining end cell, another just beyond in 4 and a bar from v3-v1.

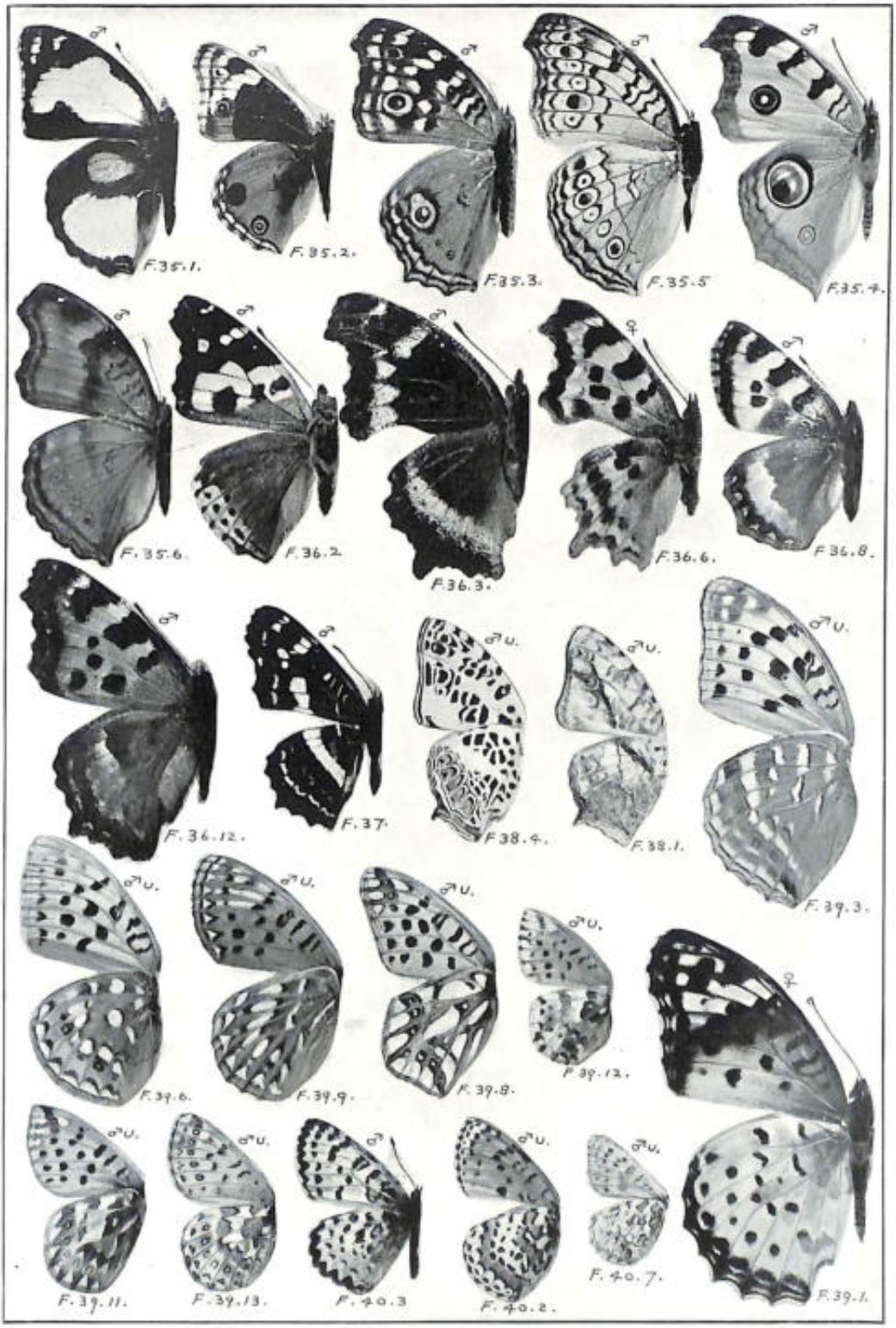
α. Darker. In WSF ♂ lower part of the band darker than the apical part.

F. 34. Kallima—(*contd.*)

philarchus philarchus, Wd. (85-110). The Blue Oakleaf. Ceylon. NR.
β. Paler. Band more uniformly coloured. ♀ much greener.
philarchus horsfieldii, Koll. (85-110). S. India. R.
2 (1-3). Above band orange.
a. DSF very pale and the sub-marginal dark lines very prominent on H.
inachus huegeli, Koll. (85-110). The Orange Oakleaf. Kashmir—Kumaon. NR.
β. DSF not much paler than the WSF, which is darker.
inachus inachus, Bdv. Sikkim—Assam. NR.
γ. Blue areas with a rich steely blue sheen and the orange band much more richly coloured.
inachus limborgi, M. Burma. NR.
3 (1-2). Above discal band white.
**albofasciata, M.* (85-110). The White Oakleaf. Andamans. NR.
4 (1a). Upf dark basal area not extending beyond end cell, which is defined by a black bar, but no black markings beyond. Band bluish white. Upf black apex broader than the dark basal area. Uph dark ochreous brown.
alompra, M. (95-110). The Scarce Blue Oakleaf. Sikkim—Dawnas. R.

F.35. Precis.—The Pansies. (Plate 24).

1a (6). Upf a black spot or variegated ocellus in 2.
1 (2a). Uph a black spot in 2. Above bright yellow; ♂ prominent blue patch uph about base 6.
a. Smaller.
hierta hierta, F. (45-55). The Yellow Pansy. Ceylon. India. Andamans. VC.
β. Larger and brighter.
**hierta oenone, Cr.* (50-60). Sikkim—Burma. C.
2a (1). Uph a variegated ocellus in 2.
2 (3a-5). Upf and uph a variegated ocellus in 2 and 4. Above bright shining blue, which in uph extends nearly to base along costa.
a. Smaller. Below paler.
**orithyia swinhoei, But.* (40-55). The Blue Pansy. Ceylon. India. VC.
β. Larger, below darker.
orithyia ocyale, Hub. (45-60). Sikkim—Burma. VC.
3a (2. 5). Uph single large variegated ocellus. Upf 2 variegated ocelli.
3 (4). Above dark brown with a number of lemon yellow spots F.
a. Small and dark.
lemonias vaisya, Fruh. (45-55). The Lemon Pansy. Ceylon—S. and Central India. C.
β. WSF as last. DSF very variable, often rosy below.
lemonias persicaria, Fruh. Kashmir—Kumaon. C.
γ. Larger.
**lemonias lemonias, L.* (50-60). Sikkim—Burma. C.
4(3). Above rich fulvous. Uph ocellus very large, from v4 to above v7. DSF leaf-like below and wings much produced. WSF ocellated below and wings rounded.
**almana almana, L.* (60-65). The Peacock Pansy. Ceylon, India, Burma. C.
β. Much smaller.
almana nicobariensis, Fd. (50). Nicobars. R.
5 (2-3a). Upf and uph complete row of ocelli, of which those in 2 and 4 are variegated. Above grey, with dark brown lines.
**atlites, Joh.* (55-65). The Grey Pansy. Ceylon, India, Burma. Andamans. NR.



F. **Nymphalidae.** 35. *Precis*: 36. *Vanessa*: 37. *Araschnia*: 38. *Symbrenthia*: 39. *Argynnis*: 40. *Melitaea*.

F. 35. Precis—*(contd.)*

6 (1a). Above no prominent ocelli, pale to dark brown, with darker brown bands.

α. Small and dark.

iphita pluvialis, Fruh. (55-65). The Chocolate Soldier. Ceylon,—S. and Central India, Maldives. C.

β. Small and pale.

iphita siccata, Stich. (55-65). Kashmir—Kumaon. C.

γ. Usually larger and darker. DSF may be very variegated.

iphita iphita, Cr. (55-80). Sikkim—Burma. VC.

F. 36. Vanessa.—The Tortoiseshells, etc. (Plate 24).

1a (3a). H termen not produced and angled at v4. Upf black apex, bearing 3 conjoined apical and 4 sub-marginal white spots.

1 (2). Above pinkish red, base golden brown. Upf 3 central black spots on the red area.

cardui, L. (55-70). The Painted Lady. Ceylon, India, Burma, Andamans. Nicobars. VC.

2 (1). Above dark brown, uph red band and black spotted margin. Upf basal dark area up to the 3 central black spots.

α. Dark. Uph termen black. Upf 2 lower central black spots confluent; red discal band deep crimson and only a very thin red line behind the black spot in cell.

indica nubicola, Fruh. (55-65). The Indian Red Admiral. Ceylon. NR.

β. Transition between last and next.

indica pholx, Fruh. (55-65). S. India. NR.

γ. Dark brown areas above with a golden gloss. Upf discal band much wider and paler; lower of the 2 central spots detached. Uph termen red. Unf bluish spots end cell large and prominent.

**indica indica, Herbst.* Kashmir—N. Burma. C.

3a (1a). H termen produced at v4.

3b (7a). F dorsum markedly concave before tornus, which is produced, rendering termen highly concave. H tailed at v4 and tornus produced; apex prominently truncate.

3 (4a). Above very dark indigo blue, with a broad postdiscal blue band F and H.

α. Upf discal band joined to the blue spot at end cell and not or only obscurely continued to the white apical dots. Uph the black spots on the outer edge of the discal band large and merged to the black marginal area.

canace haronica, M. (60-70). The Blue Admiral. Ceylon. NR.

β. Upf discal band not joined to the blue spot at end cell, but continued to the white apical dots. Black spots on the outer edge of the discal band clear and separated from the black margin. Small and discal band greenish blue.

canace viridis, Evans. (60-70). S. India. NR.

γ. As last, but the band is blue and the spots on the border H are minute.

**canace himalaya, Evans.* (60-70). Chitral—Kumaon. NR.

δ. As last, but larger and the blue band wider.

canace canace, L. (65-75). Sikkim—N. Burma.

4a (3). Above tawny fulvous with black spots.

4b (6). Uph broad fuscous border, bearing small yellow, well separated, spots.

4 (5). Uph no black spot base 3. Unh dark line defining the outer pale area above the silver dash end cell nearly straight and continued across to the dark line below the silver dash. Above dull fulvous red, black spots small and often obsolete, margins broadly dull fuscous, inwardly bearing obscure yellow spots F. Below slatey brown.

F. 36. Vanessa.—*(contd.)*

egea undina, Groum. (45-55). The Dull Comma. Baluchistan Chitral. NR.

5 (4). Uph black spot base 3. Unh the upper dark line irregular and curving into the upper end of the silver dash at end cell. Above bright fulvous red, paler in DSF. Below slate.

interposita, Stg. (50-60). The Kashmir Comma. Chitral, Kashmir, Ladak. NR.

6 (4b). Uph margin narrow brown, inwardly bordered by a continuous band of the ground colour, internal to which there is a narrow fuscous band.

α. Above bright fulvous red in the WSF, yellow in DSF; below slatey brown in WSF, ochreous in DSF.

**c-album cognata, M.* (50-60). The Himalayan Comma. Kashmir—Kumaon. NR.

β. Above darker fulvous red, more uniform and with smaller markings, fuscous margin narrow and uniform, not outwardly ashy; H post discal fuscous band ill-defined. Below slatey.

c-album agnicula, M. The Thibetan Comma. Nepal—Bhutan. R.

7a (3b). F dorsum straight. H termen never produced to the same extent, tooth at v2 projects as far as the tornus; apex not or only slightly truncate.

7b (11a). Costa F, dorsum H and palpi not bearing long erect coarse black hairs. Above tawny with black spots.

7 (8a). Upf white apical spots completely enclosed by the black apex; always black spot base 2. Uph large quadrate black spot mid costa, broadly white edged on either side.

l-album, Esp. (65-75). The Comma Tortoiseshell. Chitral—Kashmir. R.

8a (7). Upf the tawny ground colour always extending up to the white apical spots; no black spot base 2 (except in No 8). Uph basal two-thirds black and except for an area below the costa shaded golden scales; no white patches below costa.

8b (10). Uph the sub-marginal row of blue centred black spots not inwardly fuscous bordered. Wings broad and square.

8 (9). Termen F rounded at apex and only slightly produced at v6. Above very prominent yellow patches; uph black spot mid 1 extending to base 2; uph tawny postdiscal area narrow.

**ladakensis, M.* (45-55). The Ladak Tortoiseshell. Ladak—Sikkim. NR.

9 (8). Termen F concave below the apex. Upf black spot mid 1 extending to base 2.

urticæ rizana, M. (50-60). The Mountain Tortoiseshell. Safed Koh. Chitral—Sikkim, R.

10 (8b). Uph the sub-marginal row of blue centred black spots inwardly fuscous bordered. Wings narrow and more produced; termen F concave below apex and tornus more produced F and H.

α. Upf fuscous inner border to the sub-marginal spots no wider than the tawny area between it and the discal spots in 2 and 3.

cashmirensis cashmirensis, Koll. (55-65). The Indian Tortoiseshell. Safed Koh. Chitral—Kulu. C.

β. The fuscous border wider and the yellow areas more developed.

cashmirensis æsis, Fruh. Simla—Sikkim. C.

11a (7b). Costa F, dorsum H and palpi with long black coarse hairs, which are erect.

11b (13). Above tawny with black spots, similar in general appearance to Nos. 6-9; uph with a large black spot mid costa, as in No 7, but tawny edged both sides or yellow outwardly.

11 (12). Mid and hind legs brown. Above darker; uph black sub-marginal band irregular, wider in middle, bearing outwardly a prominent narrow blue line.

F. 36. Vanessa—(*contd.*)

ranthomelas fervescens, Stich. (60-70). The Large Tortoiseshell. Chitral—Kumaon. NR.

12 (11). Mid and hind legs black. Above paler, with yellow patches more developed. Uph sub-marginal black band narrower and of equal width throughout, the blue line absent or only represented by a few blue scales here and there; the black border with broad diffused yellow markings on either side. Below more uniform and outer half not conspicuously paler.

* *polychloros fervida, Stdfss.* (60-70). The Blackleg Large Tortoiseshell. Chitral—Murree. R.

13 (11b). Above rich dark maroon with broad pale yellow margins, internal to which there is a row of small blue spots. Upf 2 pale yellow costal spots.

antiopa yedanula, Fruh. (70-80). The Camberwell Beauty. Chumbi Valley, Sikkim. VR.

F. 37. Araschnia.—The Mongol. (Plate 24).

Above dark brown with a pale yellow discal band and sub-marginal line both completely broken in middle. Upf with 3 sub-apical yellow spots and narrow yellow lines in cell.

* *prorsoides dohertyi, M.* (50-55). The Mongol. Manipur—Nagas. R.

F. 38. Symbrenthia.—The Jesters. (Plate 24).

Dark brown with yellow bands arranged rather as in *Neptis*.

1a (3a). Unf lower half of cell with brown markings, in particular a long bar right across cell from costa; below markings ferruginous brown rather than black.

1 (2). Below a straight brown line from nearer base v1 H across cell to just before mid costa, joining a similar straight bar on F from dorsum to apex; this bar darker than the other markings.

* *hippoclus khasiana, M.* (45-55). The Common Jester. E. Ghats—Kumaon—Burma. C.

2 (1). Below all markings equally dark and darker than in No. 1; the dark bar across F and H not continuous; network of markings very intricate. Upf sub-marginal dark markings from tornus narrow and continued to the central dark markings, not confined to a dark spot in 1.

hypatia chersonesia, Fruh. (45-55.) The Intricate Jester. Mergui. VR.

3a (1a). Unf lower half of cell and a band of the ground colour H free from dark markings. Below all markings consist of black spots of an irregular shape, except for a series of blue or green sub-marginal ocelli and tornal markings H.

3b (5). Unf always a black spot base 1 under the spot in the cell near the base.

3 (4) Unf no black streak running above the costal vein from spot at extreme base cell to above the 2nd spot in the cell; also counting from the yellow centred cell spot there are 6 spots on the costa.

a. Above fulvous markings very broad; apical, cellular and lower discal areas often joined; H black discal band curved, often incomplete and tawny margin often reaches nearly to the apex. Below ochreous brown, dark markings reduced. Unf inside fine marginal line, there are several narrow parallel lines at apex and middle; unh postdiscal band without prominent metallic green centres and sub-marginal dark line from tornus to v4 enlarged and blue centred in 3.

hypselis brabira, M. (40-55). The Himalayan Jester. Kashmir—Kumaon: NR.

β. Above fulvous markings very variable, cellular yellow area may be joined in the ♀ to the apical, but lower discal area always separate. Below

F. 38. Symbrenthia—(*contd.*)

variegated ochreous and whitish, markings prominent and fully developed. Unf inside fine marginal line there is an ill-formed ocellus at the apex and in the middle. Unh metallic green centres to the postdiscal band large and prominent: sub-marginal discal band from the tornus—v4 of equal width, continuous and centred metallic green.

* *hypselis cotanda, M.* (45-55). The Spotted Jester. Kumaon—Burma. NR.

4 (3). Unf a black streak from the black spot at the extreme base cell running above cell to above the 2nd spot; also counting from above the pale centred spot in the cell there are 7 costal spots. Unh sub-marginal metallic green band from v4 to tornus sharply broken at v2, followed by a tornal metallic blue spot, broadly black edged. Above markings narrow, well separated. Upf always an ochreous line at apex. Uph no yellow sub-marginal line at tornus.

α. Below ochreous, uniform.

niphanda hysudra, M. (50-60). The Bluetail Jester. Kashmir—Kumaon. R.

β. Below pinkish. Unf central postdiscal markings centred metallic green.

niphanda niphanda, M. Sikkim—Assam. R.

5 (3b). Unf no spot base 1. Above as No. 4, but markings broader, paler in middle and darker edged. Unf no black streak at base costa as in No. 4, but a costal spot between the two basal spots making in all 9 costal spots. Below pinkish, markings broad and ochreous edged. Unf central postdiscal markings rounded as in No. 3, not elongated as in No. 4 and never metallic green. Unh green or blue postdiscal ocelli much smaller and with yellow rings; sub-marginal blue or green line from tornus to v4 continuous, but portion in 2 and 3 conical.

silana, DeN. (50-60). The Scarce Jester. Sikkim—Manipur. VR.

F. 39. Argynnis.—The Fritillaries. (Plate 24).

Above tawny with black spots; below usually with silver markings.

1a (8a). H precostal well curved forward. F upper apex cell opposite well beyond origin v3; v10 ex cell.

1b (6a). Unh silver stripes, not rounded spots.

1 (2a). Unh ochreous and olive brown.

α. Darker. ♂ F v2 unswollen and apex F hardly produced. ♀ with white banded dark blue apex upf.

hyperbius taprobana, M. (65-75). The Indian Fritillary. Ceylon. NR.

β. ♂ F v2 swollen; apex F not produced. ♀ as ♂, duller and bases darker, no blue and white apex.

hyperbius castetsi, Ober. (65-80). Travancore, Palni Hills. NR.

γ. ♂ as last. ♀ normal, with white banded dark blue apex upf, but much darker and duller than usual, the white band narrow and the apex only slightly produced.

hyperbius hybrida, Evans. Nilgiris. NR.

δ. ♂ F v2 unswollen. ♀ with white banded, dark blue apex. Apex F much produced in ♂ and ♀, termen concave in middle.

**hyperbius hyperbius, Joh.* (70-85). Central Provinces. Chitral—N. Burma. NR.

2a (1). Unh dark green.

2b (5). Unh all markings silvery. In ♂ vs 2 and 3 inflated and distorted (v1 to a lesser extent also) and their origins pushed right back.

2 (3a). Unh basal silver stripes continued to costa; the discal silver band straight.

α. Smaller. Uph blue marginal suffusion, reduced especially in ♂.

F. 39. Argynnis.—(*contd.*)

childreni sakontala, M. (75-90). The Large Silverstripe. Chitral—Kumaon NR.

β. Larger and more richly coloured, Uph the marginal blue suffusion broad and prominent.

childreni childreni, Gray. (85-100). Kumaon—N. Burma. NR.

3a (2). Unh no silver marking in 8; discal bands very sinuate.

3 (4). Unh 4 silver bands as in No. 2, excluding the marginal band.

**kamala, M.* (65-75). The Common Silverstripe. Safed Koh. Chitral—Kumaon. C.

4 (3). Unh only 2 silver bands, one discal and one through end cell.

maia pasargades, Fruh. (65-75). The Western Silverstripe. Chitral—Gilgit. NR.

5 (2b). Unh only the broken discal band is silver; band through mid cell is ferruginous brown. ♂ F vs 1 and 2 only swollen.

laodice rudra, M. (65-75). The Eastern Silverstripe. Assam—N. Burma. NR.

6 (1b). Unh with silver spots, not stripes; dark green.

6 (7). Unh upper 3 discal spots at right angles to the costa and not in line with the 4th spot; 2 small silver spots just inside the upper two; usually 3 basal spots in line; a discal incomplete row of silver centred ferruginous spots. Unf. silver spots in 5 and 6 well away from the termen. ♂ F v2 slightly swollen.

α. Darker and more richly coloured.

**adippe jainadeva, M.* (55-70). The Highbrown Silverspot. Safed Koh. Chitral—Kumaon. NR.

β. Much paler.

adippe pallida, Evans. Ladak. R.

7 (6). Unh upper 3 discal spots inclined to the costa, parallel to termen and in line with 4th spot; no spots just inside the upper two; usually only 2 basal spots, but a third minute one may be present at base cell. Unf no silver spots in 5 and 6 away from the margin, but the uppermost spots of the sub-marginal series are silver from 4 or 5 to costa. ♂ no veins swollen.

α. Large and richly coloured. Normal ♀ tawny.

aglaia ashretha, Evans. (60-65). The Dark-green Silverspot. S. Chitral, up to 8,000 feet. NR.

♀ *v. purpura, Evans.* Completely suffused very dark purple above. R.

β. Smaller, paler.

aglaia vitatha, M. (55-60). N. Chitral—Kashmir, over 8,000 feet. R.

8a (1a). H precostal straight and rather obscure.

8b (10a). F upper apex cell produced and well beyond opposite origin v3.

8 (9). Unh ochreous, bearing very large silver spots, in particular a very large spot end cell and one above it as well as one below; postdiscal series small, brown ringed, silver spots, much bowed out in middle. H termen angled at v4. F v10 ex cell.

**lathonia issæa, Db.* (50-60). The Queen of Spain. Safed Koh. Chitral—N. Burma. C.

9 (8). Unh dark green with silver streaks; discal series of long silver streaks complete and no postdiscal row. F venation is variable, v10 may be ex 7 or ex cell.

α. Large and richly coloured. ♀ dark greenish with ochreous spots on H.

**clara clara, Blanch.* (50-65). The Silverstreak. Garhwal—Kumaon. R.

β. Smaller, paler ochreous, but dark markings broader. ♀ as ♂

clara manis, Fruh. (45-50). Chumbi Valley. C.

10a (8b). F upper apex cell not produced, opposite origin v3. All of small size and fly at high elevations.

10b (13a). Unh a white or silver spot mid cell. F v10 ex cell or 7.

F. 39. Argynnis—(*contd.*)

10c (12). H apex rounded. Unh markings brilliant silvery, spot end cell very long, nearly or quite reaching the postdiscal row of small spots. Apex F pointed.

10 (11). Unh marginal silver markings long, narrow, of equal width throughout and nearly reaching postdiscal spots. All markings narrow and elongated.

altissima, El. (33-36). The Mountain Silverspot. Sikkim—Bhutan. R.

11 (10). Unh marginal silver markings short, not of even width, not nearly up to the postdiscal spots.

α. Small. Unh marginal silver markings inwardly rounded.

gemmata mackinnoni, DeN. (35-40). The Brilliant Silverspot. Nila and Basra Valleys. R.

β. Large. Unh marginal silver markings conical, inwardly pointed.

**gemmata gemmata, But.* (45-50). Chumbi Valley. NR.

12 (10c). H apex pointed and costa straight. Unh markings not prominently silver and spot end cell not elongated. Apex F rather pointed.

α. Small and with small markings.

**pales sipora, M.* (35-40). The Straightwing Silverspot. Chitral—Kumaon. NR.

β. Large and pale; markings upf much reduced.

pales korla, Fruh. (40-45). Kashmir—Lahoul. R.

γ. Small and dark with much darker and heavier markings.

pales eupales, Fruh. (35-40). Chumbi Valley, Sikkim. NR.

13a (10b). Unh black spot mid cell. Apex F and H rounded. F v10 always ex 7.

13 (14). Unh spot end cell and marginal spots silver. Below variegated with chestnut brown. Unh marginal spots separated by equally wide ferruginous spots at end veins.

α. Smaller. Above markings smaller and better defined.

**jerdoni chitralensis, M.* (35-40). Jerdon's Silverspot. Chitral. R.

β. Larger. Above markings wider.

jerdoni jerdoni, Lang. (40-45). Kashmir. R.

14 (13). Unh all spots white and ground colour uniform yellow; marginal white spots continuous, only separated by veins; row of postdiscal spots bordered by a narrow pale yellow band. Above pale bright tawny with very small markings.

hegemone, Stg. (38-42). The Whitespot Fritillary. Chitral—Ladak. VR.

F. 40. Melitaea.—The Small Fritillaries. (Plate 24).

1 (2a). Unh no yellow or red bands, dull pale ochreous brown, bands concolourous with ground, markings obscure. Above yellow; upf discal band prominent; uph no discal band.

shandura, Evans. (45-50). The Shandur Fritillary. Chitral. VR.

2a (1). Unh with yellow or red bands.

2b (4). Unh no red or yellow band at base, a series of black spots instead. Above veins not markedly black.

2 (3). Uph submarginal band joined to the marginal along the veins. ♂ above bright dark red with prominent markings; ♀ much darker, with an additional discal band on F and all markings very broad and diffuse, leaving only a few yellow or reddish spots; uph tornal half black and costal half red in ♀. Unf red, with few markings, postdiscal band either not continued below v4 or, if so, by very large spots, much shifted in. Unh pale yellow, red bands dark, broad and very prominent; the black spots on the yellow discal band between the 2 red bands have the upper 4 spots in a straight line and the next 2 at right angles inwards.

**didyma chitralensis, M.* (42-48). The Redband Fritillary. Chitral. NR.

F. 40. Melitaea—(*contd.*)

3 (2). Extremely variable. Paler and smaller; ♀ as ♂. Uph sub-marginal black spots very rarely joined to the marginal. Unf postdiscal spots nearly always continued to 1, spot in 2 being the largest of the series. Unh red bands pale and variable, all markings very irregular and the black spots in the central pale area never regular as in No. 2.

α. Larger, wings more elongated. Upf with pale yellow patches between each spot of the discal band. Uph nearly devoid of markings and the basal dark area only extending to just half way or less along the dorsum.

trivia dodgsoni, GrS. (40-50). The Desert Fritillary. Baluchistan—Punjab. NR.

β. Smaller and wings rounder. Upf pale yellow discal patches rarely present. Uph more or less spotted and basal dark area extending beyond half way along the dorsum.

**trivia mixta, Evans.* (35-45). Chitral. C.

4 (2b). Unh with a red band at base. Upf veins more or less black.

α. Unh the pale central band not divided by a black line into an inner yellow and an outer whitish band; marginal band white, not reddish. Unh inner white cell spot constricted, smaller than or equal to the central white cell spot; bands dark red and broad, central whitish band narrow; the broad whitish margin just inside the black terminal line bears a series of flattish conical spots. Above bright red, heavily marked; ♀ basal ¾ wing blackened, leaving a narrow red postdiscal band, narrow yellow patches beyond the black discal line and a yellow spot mid cell.

arcesia balba, Evans. (35-40). The Dark Fritillary. Chitral. R.

β. Unh the central pale band broad and divided by a black line into an inner pale yellow and an outer white area; central cell spot always smaller than the inner one. Unh margin as in last, no red marginal band; bands wide, outer one consists of more or less black circled spots on a yellow band. Large. Above ♂ red with rather feebly developed markings. ♀ dark red and much as in last.

arcesia balbita, M. (40-45). The Kashmir Fritillary. Chitral—Kashmir. R.

γ. Above red, sparsely marked. Unh prominent reddish marginal band of the same tint as the remaining reddish bands; yellow central band inside the whitish one very broad. Small; ♀ as ♂.

arcesia sindura, M. (35-40). The Blackvein Fritillary. Chitral, Ladak—Kumaon. R.

δ. Above ochreous, heavily marked. Unh much as last.

**arcesia sikkimensis, M.* (25-35). Chumbi Valley, Sikkim. NR.

F. 41. Cupha.—The Rustic. (Plate 25).

α. Upf discal area reddish ochreous, not yellow; black apex devoid of yellow spots or they are vestigial; black spot in 1 not prominently larger than the spots in 2 and 3. Below markings in cells, small, black, separate and clearly defined.

erymanthis placida, M. (50-60). The Rustic. Ceylon. C.

β. As last, but upf discal area yellow. Unf markings as in last, but unh they are obscure and pale ferruginous.

erymanthis maja, Fruh. S. India. NR.

γ. Upf always yellow spots on the black apex; black spot in 1 much larger than the spots in 2 and 3. Below markings in cells pale and conjoined.

**erymanthis lotis, Sulz.* (50-65). Mussoorie—Burma. C.

δ. As last, but above base F and all H much darker. Larger. Upf outer edge dark basal area defined by an inclined, not a vertical straight line in 2.

erymanthis andamanica, M. (55-65). Andamans.

γ. Uph space between submarginal lines paler.

erymanthis nicobarica, Fd. Nicobars. R.

F. 42. Atella.—The Leopards. (Plate 25).

Above spotted very much as in *Argynnis*, but unf a very prominent tornal spot in 1.

1 (2). F, excluding bar end cell, with 4 dark lines within cell; markings rounded.

**phalanta, Drury.* (50-60). The Common Leopard. Ceylon, India, Burma. C.

2 (1). F, excluding bar end cell, with 5 or 6 dark lines in cell; markings more linear and above more or less shot violet.

α. Upf apex very broadly black, width=¼ wing.

alcippe ceylonica, Manders. (40-50). The Small Leopard. Ceylon. R.

β. Above veins black. Generally darker and below all markings well developed.

alcippe mercea, Evans. (40-50). S. India. R.

γ. Above veins not black. Upf fully spotted, postdiscal line between vs. 2-4 slender and in an even curve.

alcippe alcippoides, M. (35-45). Sikkim—N. Burma. NR.

δ. Upf terminal dark border not thickened at all at apex and postdiscal line zigzagged throughout; darker, but markings more reduced and linear.

alcippe burmana, Evans. (45-50). Karens—S. Burma. NR.

η. Upf as γ, but all markings heavier, especially in ♀. Below markings as prominent as in β. Apex F less produced.

alcippe andamana, Fruh. (40-50). Andamans. NR.

ξ. Paler with reduced markings. Below with a well marked whitish transverse band.

alcippe fraterna, M. Nicobars. VR.

F. 43. Issoria.—The Vagrant. (Plate 25).

α. Much paler with paler, narrower, markings.

sinha pallida, Evans, (55-65). The Vagrant .Dun—Kumaon. NR.

β. Darker and more heavily marked.

* *sinha sinha, Koll.* (55-65). Bengal, Orissa, Sikkim—Burma. NR.

F. 44. Cynthia.—The Cruiser. (Plate 25).

α. ♂ dark fulvous. ♀ white band only shows in 5 and 6 uph; above rather pale bluish green.

erota asela, M. (90-100). The Cruiser. Ceylon. NR.

β. ♂ bases dark, centre paler, yellowish. ♀ white band as in last; above rather dark olive brown.

* *erota aaloma, Swin.* (95-110). S. India. NR.

γ. Seasonal forms very sharply marked. ♀ discal band from costa to v2 uph; bases green, marginal area H broad ochreous brown.

erota erota, F. (90-110). Sikkim—Burma. NR.

δ. As last but ♂ much paler. ♀ as DSF of last.

erota pallida, Stg. (90-100). Andamans. NR.

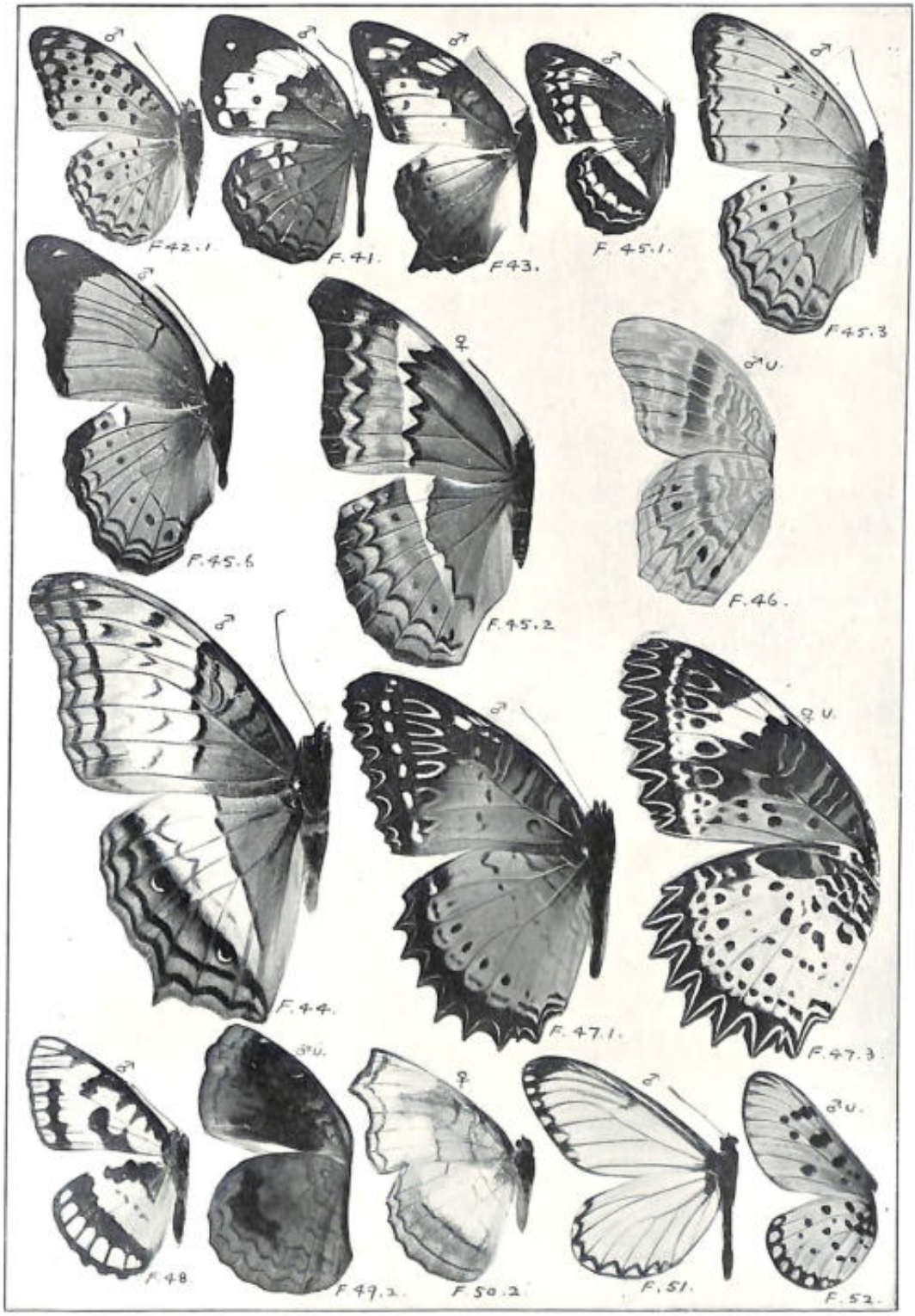
F. 45. Cirrochroa.—The Yeomen. (Plate 25).

1 (2a). Above dark brown with a pale yellow discal band F and H and 2 outer rows of conjoined yellow spots; the discal band upf ends at v4 and there are 2 yellow spots beyond in 5 and 6. ♂ upf with a dull ochreous brand on either side of the basal half of vs 5 & 6.

**fasciata, Fd.* (45-55). The Branded Yeoman. Karens—S. Burma. Andamans. NR.

2a (1). Above tawny fulvous.

2b (4a). Unf dark bar end cell double. Below white discal band broad and a distinct yellow or brown broad irregular band inside it, as well as a distinct sub-marginal zigzag yellow or brownish band.



F. **Nymphalidae.** 41. *Cupha*: 42. *Atella*: 43. *Issoria*: 44. *Cynthia*: 45. *Cirrochroa*: 46. *Terinos*: 47. *Cethosia*: 48. *Byblia*: 49. *Ergolis*: 50. *Laringa*: 51. *Pareba*: 52. *Telchinia*.

F. 45. Cirrochroa—*(contd.)*

2 (3). Uph the 3 upper black discal spots in an absolutely straight line. Unh the white discal band expands widely to costa above v6. Apex F more or less truncate and produced. ♂ uph a yellow brand along vs 5, 6 and 7, also just visible on vs 6 and 7 upf.

a. Upf black apex narrow; in ♂ sub-marginal dark line separate below v6; in ♀ the black margin absorbs the sub-marginal dark line, but is quite separate from the postdiscal zigzag line. Considerable seasonal variation.

**aoris aoris, Db.* (80-90). The Large Yeoman. Sikkim—Assam. NR.

β. Upf black apex broad; in ♂ the dark sub-marginal line is only separate below v4 and in ♀ the dark apex and margin absorb the whole of the postdiscal line.

aoris olivacea, DeN. N. Burma—Dawnas. R.

3 (2). Uph the 2nd of the 3 upper discal spots out of line. Unf white band broad and of very nearly equal width, expanding very slightly to costa above v7; band may be absent. Apex F only slightly produced and not truncate. ♂ uph a brand along vs 6 and 7; no brand upf.

a. Paler.

**tyche mithila, M.* (65-75). The Common Yeoman. Sikkim—Burma. C.

β. Darker, especially at bases above and generally below.

tyche anjira, M. (70-85). Andamans. NR.

4a (2b). Unf dark marking end cell single.

4b (6a). Upf post discal zigzag line always more or less separate from the black marginal area. Unf discal band narrow and expands to costa. Uph 2nd of upper 3 discal spots out of line.

4 (5). Uph costa dusky from white spot mid costa to apex. Above dark fulvous. Upf apex and margin broad black. Below pale discal band variable, may be regular and narrow, expanding to costa or may be broken into irregular spots. Upf ♂ a brand along vs 5, 6; none uph.

a. Darker and markings, especially at margin, heavier.

thais lanka, M. (60-70). The Tamil Yeoman. Ceylon. NR.

β. Paler and less heavily marked.

thais thais, F. S. India. NR.

5 (4). Uph costa not dusky. Smaller and much paler above, ochreous rather than fulvous; all markings small, but uph the narrow black discal line present and continuous. Below very pale; discal band narrow, but never broken into spots. ♂ upf no brand; uph brand along vs 5 and 6.

surya, M. (50-60). The Little Yeoman. Dawnas—S. Burma. C.

6a (4b). Upf no trace of any sub-marginal or discal line except in space 1; apex and margin broad black. Unh discal band narrow.

6b (8). Above veins on disc black; uph 2nd of upper 3 discal spots out of line. Upf no prominent pale band. Unf discal band very narrow at dorsum and expanding widely above v2.

6 (7). Apex F produced. Upf a prominent ochreous spot on the black apex. Uph discal black spots small; margin black and the 2 sub-marginal lines narrow. No brand in ♂.

**emalea, God.* (70-80). The Malay Yeoman. Mergui—S. Burma. R.

7 (6). Apex F not produced; no ochreous spot on the black apex. Uph discal black spots very large and sub-marginal dark lines broad. ♂ Uph obscure brand along vs 5 and 6.

nicobarica, WM. (53-65). The Nicobar Yeoman. Nicobars. VR.

8 (4b). Above vs not black. Upf broad yellow discal band from mid costa to tornus, which unf is white. ♂ upf and uph brand along vs 5 and 6.

orissa, Fd. (60-65). The Banded Yeoman. Tavoy—S. Burma. R.

F.46. Terinos.—The Assyrian. (Plate 25).

Above suffused rich purple; uph terminal third rich yellow. ♂ outer half upf and apex uph with dark velvet brown modified scales.

**clarissa lioneli, Frus.* (70-80). The Assyrian. S. Burma. VR.

F.47. Cethosia.—The Lacewings. (Plate 25).

1 (2a). Unf all markings in cell right across it and beyond cell an irregular pale straight band continuous on F and H.

α. Upf discal row white horseshoes complete from 2 or 3 to 6. ♀ varies from red as in ♂ to moss green.

**biblis tisamena, Frub.* (65-90). The Red Lacewing. Sikkim—Burma. C.

β. Upf white quadrate patch in 3 instead of a horseshoe. ♀ upf nearly black; uph greenish white.

biblis andamanica, Stich. (85-100). Andamans. NR.

γ. As last, but smaller and upf white markings less prominent. Below bands more heavily black edged.

biblis nicobarica, Fd. Nicobars. Fd. NR.

2a (1). Unf one of the black bars in the cell only reaches half way across it from the costa. Below no straight pale narrow band across both wings.

2b (4). Unh with a row of black spots beyond end cell on a more or less regular curve.

2 (3). Below broad ochreous sub-marginal band, as broad as the black border. Uph discal row of large black oval spots.

α. Upf no white band 3-6. ♂ above black, dusky ochreous about base below cell; lower part uph blueish white; ♀ greenish blue.

nietneri nietneri, Fd. (80-95). The Tamil Lacewing. Ceylon. NR.

β. Upf white band 3-6. ♂ ♀ above tawny; ♀ paler, black markings large and diffuse; unf red area replaced by dusky ochreous.

nietneri mahratta. (80-95). S. India. NR.

3 (2). Below sub-marginal ochreous band narrow, much narrower than the black border. Upf prominent white band beyond cell. Uph discal black spots small. ♂ tawny. ♀ upf black, base below cell dusky tawny turning to blueish white; uph blueish.

**cyane, Drury.* (85-95). The Leopard Lacewing. Orissa, Mussoorie—Burma. NR.

4 (2b). Unh row of black spots beyond cell sharply angled out in the middle. Above tawny with broad black borders and apex upf, which are practically unmarked; a cream band upf. Unh prominent white discal band, base red, ochreous between the white band and the margin.

hypsea hypsina, Fd. (85-95). The Malay Lacewing. S. Burma. R.

F.48. Byblia.—The Joker. (Plate 25).

Above bright tawny, black markings in ♂, fuscous in ♀, ends veins black. Unh white basal and central band, discal and marginal black band with small white spots and a row of large white spots between.

**ilithyia, Drury.* (45-55). The Joker. Ceylon. S. India—Central Provinces. NR.

F.49. Ergolis.—The Castors. (Plate 25).

1 (2). F termen deeply concave between vs 3-5. Above discal line just beyond cell single and regular, angled on F at v5.

F. 49. Ergolis—(*contd.*)

α. Above uniform. Small. ♂ uph vs 5 and 6 shining white and discal black lines do not run through them to costa.
ariadne minorata, M. (45-50). The Angled Castor. Ceylon. C.
β. As last, but larger.
ariadne indica, M. (50-55). S. India—Bengal. C.
γ. Larger and more variegated above in DSF. Above veins blacker. Uph vs 5 and 6 not conspicuously white and the discal lines run to the costa.
ariadne pallidior, Fruh. (55-60). Mussoorie—Burma. C.*
2 (1). F termen only faintly concave between vs 3-5. Above discal line just beyond cell double and highly irregular. Unf ♂ brand enters cell.
α. Above uniform. ♂ below upper part of disc F and H dark velvet brown, obliterating the bands. Larger, darker; richly coloured in WSF.
merione taprobana, Wd. (55-60). The Common Castor. Ceylon. C.
β. As last, smaller and duller.
merione merione, Cr. (50-55). S. India—Bombay. C.
γ. ♂ DSF with variegated yellow bands: below upper part of disc on H not darkened and bands clear. Small.
merione tapestrina, M. (45-55). Central Provinces—Orissa. Kashmir—Kumaon. C.
δ. As last, but larger and DSF never much variegated.
**merione assama, Evans.* (55-60). Sikkim—N. Burma. C.
η. Smaller. DSF variegated. Unh pale and bands faint, especially towards dorsum.
merione pharis, Fruh. (50-55). Karens—S. Burma. C.

F.50. Laringa.—The Dandies. (Plate 25).

1 (2). ♂ above deep ultramarine blue, no pale band. ♀ smoky brown with paler discal band, interrupted mid F.
castelnaui, Fd. (50-55). The Blue Dandy. Dawnas—S. Burma. R.
2 (1). ♂ with band above. ♀ ochreous.
α. ♂ above shining dark plumbeous, paler discal band, interrupted mid F. ♀ ochreous brown, with paler discal band, all covered with small brown strigæ.
**horsfieldii glaucescens, DeN.* (50-60). The Banded Dandy. Karens—Dawnas. R.
β. ♂ above indigo blue, discal band pale blue; base and cell F and broad sub-marginal band H black. ♀ ochreous brown, with clear yellow discal band.
horsfieldii andamanensis, DeN. Andamans. R.

F.51. Pareba.—The Yellow Coster. (Plate 25).

Yellow with a black border F and H bearing yellow spots; veins black. ♂ with bar end cell F. ♀ very variable, black spots in cell and on disc, which may be conjoined to a continuous band; the whole wing may be covered with black scales.
α. Small.
vesta anomala, Koll. (45-65). The Yellow Coster. Kulu—Kumaon. NR.
β. Larger.
**vesta vesta, F.* (50-70). Sikkim—Assam. NR.
γ. Black border broader. Below white areas absent. ♀ with upf a sub-marginal series of short red brown arrows.
vesta sordice, Fruh. (50-70). Burma. R.

F.52. Telchinia.—The Tawny Coster. (Plate 25).

Tawny with black spots. H with a black border bearing white spots.

**violæ, Hub.* (50-65). The Tawny Coster. Ceylon. India. C.

Notes.—The arrangement of the *Nymphalidæ* follows generally that adopted by English authors; Fruhstorfer reverses it. A natural key appears impossible without recourse to the larvæ, which are better known in this family than in any of the others. Some authors split up the *Euthalias* into several genera, while others unite *Adolias* with *Euthalia*. Those *Neptis*, where on the forewing v10 arises from v7 instead of from the cell, are usually separated as *Rahinda*, but *heliodore* is obviously much more closely allied to *paraka*, etc., than to say *mahendra*. The same remarks apply to the separation of the last section of *Argynnis* under the name *Brenthis*.

The following are new to India: *Eribœa hebe chersonesus* (F. 2. 6) obtained by Mr. Mackwood and identified by Mr Riley; *Euthalia godarti asoka* and *pelea* (F 18. 2 & 4) obtained by Mr. Cooper; *Hypolimnas bolina* ♀ vs *melita* and *iphigeneia* (F. 30. 2) obtained by Mr. Fowle; *Symbrenthia hypatia chersonesia* (F 38. 2) caught by myself. *Liminitis elwesi* (F. 24-9) caught by Capt. J. G. Crummond.

The following are new names: *Eribœa narcœa aborica* (F. 2. 8); *Penlema binghami merguia* (F. 15-8); *Euthalia jahnu jahnita* (F. 18. 7); *Pantoporia selenophora kanara* (F. 25. 4); *Neptis yerburyi sikkima and shania* (F. 26. 9); *ananta ochracea* (F. 26. 15); *viraja kanara* (F. 26. 25).; *Cyrestis thyodamas indica* (F. 27. 4); *Doleschallia bisaltide mergueana* (F. 33); *Vanessa canace viridis* and *himalaya* (F. 36. 3); *Argynnis aglaia ashretha* ♀ v *purpura* (F.39.7); *Atella alcippe mercea* and *burmana* (F. 42. 2); *Ergolis merione assama* (F. 49. 2) *Melitœa shandura. Evans.* (F. 4[illegible]).

On account of alterations since going to press; the followings corrections are needed to the plates:

Plates 19 and 20. F. 18 reduce all numbers from (15 to 31) by 1; thus (F. 18·22). should read (F. 18· 21).

Plate 22 For (F. 26·29) and (F. 26·34) read (F. 26·28) and (F. 26·32).

Plate 24. For (F 38·4) and (F. 40·7) read (F. 38·3) and (F. 40·4).

(To be continued)

BIRDS' NESTING WITH A CAMERA IN INDIA.

BY

CAPTAIN R. S. P. BATES.

(Continued from page 957 of Vol. XXIX.)

PART II.

(With 4 Plates.)

RAMPUR AND THE LOLAB, KASHMIR.

The mention of the Wular, Kashmir's largest lake, recalls to my mind many pleasant days spent in the shelter of the little bay at Kunus under the protection of its Ziarat surmounted promontory. From here a straggling track ascends the narrow defile to the diminutive but charming Rampur Valley and the Lolab Pass beyond; the Lolab, that hidden vale far famed for its walnuts and its village beauties, and at one time for its bears. It was here, so the story goes, that the overkeen sahib, intent on a bear at any price, stalked with ultimate success what he took to be a fine specimen amongst the branches of a mulberry tree, only to find to his horror that he had dislodged an old woman, who was just as keen as bruin on the watery but succulent fruit. A hundred rupees to the village headman, and he went on his way, rejoicing at getting out of a horrible situation so lightly. But alas! his relief was short-lived, and his sport entirely spoiled. Wherever he went, his fame spread before him, and every mulberry tree, to which he was almost forcibly led, contained at least one of the more aged and garrulous members of a family. However I digress.

The lower slopes of the promontory on the side overlooking the bay are clothed in thorny bushes, and amongst these Hume's Lesser White-throat (*Sylvia althea*) holds its sway. As a matter of fact I collected no specimens of this warbler, and I now find that there seems to be considerable doubt regarding the identity of the Kashmir breeding race. Towards the end of May many of their nests are to be found containing from 3 to 5 eggs, greenish white with a number of both large and small yellowish and reddish brown spots, usually most numerous around the large end. These average about ·66″ by ·5″. The nest is rather flimsily constructed of bents and grass, and is lined with a scant amount of hair. It is generally fairly well concealed in the heart of the bush and not above two or three feet from the ground.

Higher up and the entire outer side of the promontory consists chiefly of rough grassy slopes with scattered fuzzy bushes and patches of boulders, and this is where large numbers of the White-capped Bunting (*Emberiza stewarti*), and the annoying little Indian Bushchat (*Saxicola torquata indica*) are the chief denizens. I say annoying, because it is by no means easy to find the latter's nest. It is often exceptionally well concealed under the overhanging lip of a banktop, under a stone or in the roots of a bush, and the bird takes good care not to give its position away by visiting it when one is in the vicinity. It is small and well made of moss, roots and grass, lined with hair, and 3 to 5 small eggs (averaging ·7″ by ·55″) are deposited in it. These are very pretty and are typical Bushchat eggs, having a delicate blue-green shell with a zone of pale reddish markings. The male is a small black bird with white wing patches, and upper tail-coverts suffused with rufous, a large white patch on the sides of the neck, and an orange-red breast, and a habit of continually flicking the tail. I have always been in the habit of calling it a Stonechat*, as it somewhat closely resembles the

* It is a race of the Stonechat and should properly be called *Saxicola torquata indica*. The name *maura* was used in error in the Fauna (1st Edition) and refers to another race.

bird one sees in the British Isles. The females of these Bushchats are dull plumaged, and very similar to one another.

The White-capped Bunting chooses much the same kind of situation for its home as does the Indian Bushchat, but the nest is not as a rule so well concealed, and the bird is much bolder. The nest is more or less the same too, but the eggs are bigger and of course very differently coloured, being of a whitish ground colour thickly spotted and blotched with purple and purplish greys. The Buntings are squat sparrow-like birds, in fact they belong to the Fringillidæ as do the latter, and they spend most of their time on the ground.

It was on this side of the promontory that a great discovery was made, a shikari pointing out to a friend and myself a Chukor's (*Alectoris graeca chukar*) nest containing the amazing number of 21 eggs. The photograph (already published in a previous number of the Journal) shows 20, as one unfortunately got broken, when he was first examining them. As the largest number of eggs ever previously recorded is, I believe, 16, it is easy to imagine our surprise. Unfortunately the situation of the nest in a tangle of grass between the broken faces of a boulder, which had been split and forced apart in the course of time, rendered it difficult to obtain photographs, otherwise a much more artistic effort might have been produced.

The resources of my promontory are not yet exhausted. An outcrop of tilted and weather beaten strata, on which more than one unlucky houseboat has met with disaster when caught in a sudden squall on the treacherous waters of the lake, forms its extremity, and is invariably the home of a pair of Eastern Blue Rock-thrushes (*Petrophila solitaria pandoo*). The male in summer has head and shoulders of bright blue, and the remainder of his attire deep blue black. His consort, whose lower plumage is barred after the autumn moult, has now, the end of May, an almost uniform brown plumage, owing to the edges of the feathers having worn down. The eggs are 4 in number, 1·1" by ·75," and are light blue sparingly spotted with red. These markings are often minute and few, and at times entirely absent. The nest is placed on a ledge or in a cleft of the rock. The male has quite a pleasing song. They are never to be found away from the vicinity of their beloved rocks. In the winter they have a very large range, spreading over the whole of India, but in the early spring most migrate to the Himalayas and even beyond to breed.

Before leaving the spur for good and all, I must mention that in the sandy banks on the sides of the col joining it with the main hill-mass, the tunnels of those graceful fliers and delightfully coloured birds, the European Bee-eaters (*Merops apiaster*) will be noticed. I also took here in the bank of a tiny watercourse the nest of a Central Asian Kingfisher (*Alcedo atthis pallasii*) containing 7 eggs.

This brings to an end those birds, whose nests one can be certain of finding year in and year out on the promontory itself. Certainly one may find others. I have seen the Brown Rock Pipit (*Anthus leucophrys jerdoni*) on its slopes, and took nests containing young ones on just such another promontory at Watlab but three miles distant. Hawks and marauding Jungle Crows I have seen quartering the ground, and sneaking around the rocks, but at present the few trees around the Ziarat hold no nest. A stately Eagle, the rather majestic Bearded Vulture, and an occasional vulgar Kite too may often be seen prowling round, but these of course have their homes elsewhere, the latter in the tall chenars at the neighbouring village.

However, this article was primarily intended to be about Rampur and the Lolab, and so far I have hardly touched on either. We must, therefore, leave the shores of the Wular, and traversing the village commence to ascend. The village of Kunus contains some fine fruit trees as well as great spreading chenars and slender poplars, so I was not surprised, but rather I expected it, when I was led to nests of the Rufous-backed Shrike (*Lanius schach erythronotus*) Tickell's









(*a*) THE WHITE-CAPPED BUNTING.
(*Emberiza stewarti*).

(*b*) THE LARGE CROWNED WILLOW-WARBLER.
(*Acanthopneuste occipitalis occipitalis*).
(*Showing egg of Himalayan Cuckoo*).

(*c*) THE GREY-HEADED OUZEL.
(*Planesticus castaneus castaneus*).

(*d*) THE CRESTED BLACK TIT.
(*Lophophanes melanolophus*).



THE SMALL BILLED MOUNTAIN THRUSH.
(Oreocincla dauma dauma).



THE INDIAN BUSHCHAT.
(Saxicola torquata indica).

Ouzel (*Planesticus unicolor*) the photographs of which turned out failures, and the Indian Oriole (*Oriolus oriolus kundoo*). The last was amongst the upper branches of a tall pear tree. However with the aid of much caution, patience and lots of string (even my shoe-laces had to be pressed into service), with which to tie the camera in position, I succeeded in getting quite a passable negative. A few annas to the discoverers of these nests produced many pleased smiles and also some delicious cherries, so I was able to go on my way feeling my labours had not been in vain.

Within three hundred yards of the village and close to the straggling Rampur track a nest of the Indian Bushchat was revealed, snuggling in a small cavity under a stone. The half plate was produced, and an excellent photograph soon obtained.

On this hurried trip (May 30th to June 8th), with which I am chiefly concerned here, my object was firstly to camp on a minute little marg perched on the hill-top about a mile and a half north of the summit of the pass into the Lolab. A more charming spot I have never found. On the one side the ground slopes abruptly for about 1,500 ft. to the tiny land-locked Rampur valley, a vale of enormous chenars walnut and fruit trees, over whose further boundary a wonderful panorama of the whole happy valley still further below one, and of its surrounding mountain ranges, is obtained. The slopes on this side are not very thickly wooded. In fact there are few deodars, and but straggling patches of rhododendrons and other bushes. Though a wonderful prospect to the Pir Panjal themselves is obtained, it is nothing when compared with the surpassing beauty of the view into the Lolab and of the mountains which enclose it, with Nanga Parbat some fifty miles distant yet dominating every intervening range. My little marg christened on my first visit the "Saddleback," cannot be much more than thirty yards across, and on this, the Lolab side, it dips most abruptly in one great sweep of unbroken forest to the hamlet studded vale beneath, so far beneath, that the whole has the appearance of a wonderful landscape painting of tiny green fields, the vivid green of the early rice, and orchards, woods and villages with silvery streams winding amongst them, occasionally spreading into little glass-like lakes. The ranges on the northern side of the valley raise their snow-capped heads twenty thousand feet and more into the heavens, but those on the south are only about eight thousand, and through facing north are of course thickly forested.

On this occasion I was forced to spend the night in the little forest hut at Rajpur, as, shortly before arriving there, a heavy downpour set in. In the previous year quite close to this very hut I took the nest of a Yellow-billed Blue Magpie (*Urocissa flavirostris cucullata*) containing four eggs. As will be seen from the illustration it is not domed and not very large. As far as I can remember it was rather loosely built of twigs, and lined with roots. In fact from the ground, it was not more than 10 feet up, one could just make out the eggs through the bottom. This was the first occasion, on which I had met with this rather striking bird. I have never seen it in Kashmir below the 6,000 ft. level in the breeding season, nor, do I think, does it ascend much above 8,000 feet. Its name describes it excellently but for the tail, the feathers of which are much graduated, the centre ones being as many as eighteen inches in length, and as each feather has a white tip and a sub-terminal band of black, when spread in flight, it has rather a chess board appearance. The eggs are pale cream, profusely marked with red-brown and grey. It breeds from May to August and is decidedly partial to forest. On the same day I saw another pair building, one of them carrying what looked to me like a large piece of rag to the nest, which was being constructed about 30 feet from the ground.

Leaving the hut early next morning, I passed through some undulating and thickly wooded country near the edge of the valley to the foot of the Lolab Pass. In this I saw many Kashmir Cinnamon Tree-sparrows(*Passer rutilans debilis*) and

evidence of numerous Western Himalayan Pied Woodpeckers (*Dryobates himalayensis*). Soon after commencing the ascent of the Pass, I heard the Himalayan Cuckoos (*Cuculus optatus*) uttering their hoopoe-like notes, and began to meet with Crested Black Tits (*Lophophanes melanolophus*). I also passed about half a dozen nests of the Himalayan Jungle Crow (*Corvus coronoides intermedius*), only one of which, at the top of a deodar more easily climbable than the rest, I investigated. It contained but two eggs (this was on June 3rd). Numbers appeared to be still building.

Having reached the top, I turned off along the hillside to the right, and commenced searching more thoroughly as I went along. I was soon rewarded by my attention being drawn to a Small-billed Mountain Thrush (*Oreocincla dauma dauma*) sitting tightly on its nest under a rotten stump surrounded by wild strawberries. It was in a beautiful situation a few yards down the hill on the Lolab side, and so amongst the thick deodar forest I have alluded to. As usual she sat very close and allowed me to have a really good look at her at a range of only a few feet. It was unfortunately too dark for a photo with the reflex, so I reluctantly shooed her off. Three eggs were displayed. The markings, distributed evenly and entirely all over the surface, were very pale red, paler than the usual markings of the eggs of this species. The ground colour was greenish white. They were quite fresh, and the bird could only just have started sitting. Though being so brave on the nest, once disturbed, she made off straight down the hillside without a sound, and never put in another appearance, although I waited for a hour or so in the vicinity. The nest was made entirely of pine needles, and the eggs averaged about 1·2″ by ·9″. The only other nest of this species, which I have found, was lined with pine needles, but had an outer shell of bents and roots.

Both Asiatic and Himalayan Cuckoos (*C. canorus telephonus and C. optatus*), in appearance resembling one another very closely, abounded here, as evidenced by the loud "Cuckoo" of the former, and the latter's four hoopoe-like "Uks," which are preceded by a very soft and higher pitched "Cuck," only to be heard when one is quite close to the utterer. As a matter of fact when I first heard the Himalayan Cuckoo, I was surprised to hear, as I then thought, a Hoopoe at an elevation where I was under the impression they did not exist,until it struck me that the notes were somewhat too loud for the subdued tones of the Hoopoe, and that four were uttered in succession instead of three. It was sometime before I was near enough to a bird, which, as it happened, alighted on a branch but a few feet above my head, to hear the initial syllable.

Fly-catchers were now very much in evidence, and during the remaining mile or so to camp I saw a pair of Nutcrackers (probably *Nucifraga multipunctata*), fairly large white-spotted brown birds, a pair of Black and Yellow Grosbeaks (*Perrisospiza icteroides icteroides*) and also a pair of Hobbies (*Falco severus indicus*) dashing about overhead, besides numerous Turtle Doves (*Streptopelia orientalis meena*), White-cheeked Nuthatches (*Sitta leucopsis leucopsis*) and Crested Black Tits (*Lophophanes melanolophus*). Occasionally a Griffon Vulture (*Gyps himalayensis*) or a Lammergeyer (*Gypaetus barbatus grandis*) sailed slowly overhead.

While camp was being pitched, I sat on the edge of my glade to admire the view over the Lolab. I soon noticed that a Crested Black Tit kept descending to the ground just behind a deodar a few yards to my right. On examining the ground, I found a small hole amongst the roots. It went down about a foot, and at the bottom was the Tit's nest, containing hefty youngsters. I left them in peace, and turned my attention to a Himalayan Sooty Flycatcher (*Hemichelidon sibirica cacabata*), which was evidently building in the very next tree. Its half finished nest was well out on a horizontal branch about 30 ft. or so from the ground, and was practically invisible from below.

The sun was now setting, and the air consequently rapidly chilling, so the remainder of the evening was spent close to a roaring log fire. As usual I dined in the open, still closer to the fire and muffled up in a heavy coat. At 8,000 ft. in May the nights are far from warm. A hot toddy finished the proceedings, and I went to bed, after ejecting the mangled corpse of a black scorpion, which had taken possession of my tent, well contented and well pleased with quite a successful day spent amongst unrivalled surroundings.

In the year previous close to this camp I took the nests of a Himalayan Tree-creeper (*Certhia himalayana himalayana*), a Crested Black Tit, and a Grey-headed Ouzel (*Planesticus castaneus castaneus*), all with eggs. I also noticed a number of nesting holes of Western Himalayan Pied Woodpeckers, but all appeared to have young ones, and I also took a nest with young ones of the White-throated Tit, (*Ægithaliscus niveogularis*). The White-throated Tit's nest was a most interesting find from all points of view. To begin with it is a rare bird, and secondly its nest is a beautiful structure, nearly resembling that of the Long-tailed Tit. It is more or less pear-shaped, covered with moss and lichen, and about five inches deep, with the entrance hole placed in the side and near the top. This nest was about 7 ft. from the ground, and suspended near the end of a slightly drooping branch of a fir tree, growing almost on the very crest of the hill, and consequently catching every breath of wind. Such a knife-edge of a hill top naturally caught every scrap of wind there was, and, being so exposed, more often than not half a gale was blowing. The result was that my efforts to procure photographs were not over fruitful, and the only record I now possess is a somewhat underexposed negative, which gives one a mere silhouette of the nest.

The Himalayan Tree-creeper's nest was as usual behind a loose flap of bark against the side of a very large deodar. It was about 4 ft. from the ground and contained five eggs. I believe some writers say that this bird usually builds at a considerable height up, 40 ft. or more. Nevertheless I have noticed many old nests, exposed to view by the loose and rotting bark falling away, at from but 2 to 5 or 6 feet from the ground. The Himalayan Tree-creeper is a cheery little soul, and at the end of the breeding season (about July) bands of them are to be seen dashing from trunk to trunk, piping shrilly the while. They alight close to the ground and work their way upwards in short little runs hunting the crevices for insects. Their tails are used as a rest and with their slender curved bills they probe every little nook and cranny, and let not a single luscious morsel escape. Their dark brown and fulvous upper plumage blends extraordinarily well with the bark. The underparts are smoky-brown. About 6 eggs are laid in April or May. These are white with a number of red spots mostly at the larger end and measure ·6″ by ·45″.

The Crested Black Tit's nest was in very much the same sort of situation. To show the nest and eggs a piece of bark had to be removed. Wool and hair had been almost entirely used, and there were 6 eggs. These too are white with red spots, and average about ·6″ by ·47″. They inhabit forest and well-wooded country, and the situations chosen for nesting purposes are most varied. Holes in trees, in the ground, or in banks are all utilized, nor is a disused Woodpecker's abode despised. The breeding season is from April to June, and the elevation at which the bird lives during this time, is from about 6,000 to 9 or 10,000 feet. They are about the size of Blue Tits, and are black about the head and breast and have a perky black crest. The cheeks are white, and practically the whole of the remainder of the plumage is iron-grey.

A decayed stump, 4 feet or so in height, was the Grey-headed Ouzel's home. One side had fallen away, disclosing a small shelf floored with rotten shavings, and on this was the nest, a well built affair of moss bents and grass with four eggs in it. Both nest and eggs might have been those of a Ring-Ouzel (*Merula*

torquata) at home. The markings of the eggs of this species however are darker and larger than those of the average Ring-Ouzel's eggs and of a distinct purple hue. They measure about 1·2″ by ·85″, and 3 or 4 are laid in May or June. They are typical Ouzels in size shape and habits. The male is largely chestnut with grey head and shoulders and black wings; the female is not so bright-coloured, being much browner. They are exceedingly fussy, especially when disturbed with youngsters, and are apt to keep up an incessant cackle when danger threatens. A stump appears to be a very favourite nesting site, and I think to find a nest on the ground is more or less exceptional, though the "Fauna" has it that this is the usual situation.

I stayed but one complete day on the saddleback, and that not a very successful one from the ornithological point of view. I took photos showing the situations of the nests of a White-cheeked Nuthatch (*Sitta leucopsis leucopsis*) and a Kashmir Cinnamon Tree-sparrow (*Passer rutilans debilis*). Both contained young ones.

Nuthatches, having chosen a convenient hole in a tree, proceed to close it with a sort of mud-plaster, till it is only large enough to just admit the owners. Sometimes the nest is very difficult to detect, whilst at others the mud entrance forms a sort of cone, which stands out from the bark, and is plainly visible from below. They are fairly early breeders, and one should commence looking for their nests at the end of April or beginning of May. The eggs of all species are white, marked with red, and the nest generally consists of a collection of shavings and wool.

The Cinnamon Tree-Sparrow takes possession of any hole or crevice in a tree, and constructs its nest in May, June or July of grass wool and feathers, etc. It is usually an untidy affair containing 3 to 5 eggs, in colour white thickly marked with brown, ·76″ by ·57″.

I next moved my camp to another of my favourite hunting grounds, also known by a nickname. The correct appellation of the place, that is of the little village down below, is Imaslwara, but owing to the abnormal number of Cuckoos, both Asiatic and Himalayan, to me it will always be "Cuckoo Glade." It is a small horse-shoe depression with very steep sides, the upper slopes of which are pretty bare and inhabited largely by Eastern Meadow Buntings (*Emberiza cia stracheyi*), on which the Asiatic Cuckoos (*Cuculus canorus telephonus*) prey. Lower down a pretty thick scrub-jungle obtains, in which are to be found Crested Black Tits, Himalayan Pied Woodpeckers, Red-breasted Flycatchers, Large Crowned Willow-warblers, and Laughing Thrushes, etc. The two latter are the chief victims of the Himalayan Cuckoos. In the bottom of the valley is a considerable amount of ploughed land, interspersed with bushes and clumps of pines. Here I have noticed Minivets, Dark Grey Bushchats, Kingcrows, etc., and down by the little stream, which takes its source on the upper slopes, Western Spotted Forktails and Plumbeous Water-Robins may be met with.

To reach the glade one had to retrace one's steps to the Lolab Pass and then at right angles to it along the outer slopes of the heights, following them for three or four miles round the south of the valley. From the pass, which by the way is used by large numbers of Slaty-headed Paroquets (*Psittacula schisticeps schisticeps*) in transit from the Rampur Valley to the Lolab, my road ran first through lovely glades of pines, and then skirted a wood consisting chiefly of small trees resembling Hazels. It was within the edge of this wood, that I made the acquaintance of the Rufous-tailed Flycatcher (*Alseonax ruficaudus*). The result of our meeting was one of the prettiest photographs I possess. The sunlight was struggling through the leafy pall above, dappling the nest and its surroundings with little golden patches. The nest itself was a beautiful piece of workmanship, snuggling in a fork ten or so feet from the ground, and fabricated from soft mosses and lichens lined with hairs, many of them white. It was as neat as and in fact very like that of a Chaffinch. It contained four pure white eggs. The Rufous-



THE INDIAN PARADISE FLYCATCHER
(*Terpsephone paradisi paradisi*).



THE RUFOUS-TAILED FLYCATCHER
(*Alseonax ruficaudus*).



THE WESTERN SPOTTED FORKTAIL
(*Enicurus maculatus maculatus*).



THE WESTERN YELLOW-BILLED BLUE MAGPIE
(*Urocissa flavirostris cucullata*).

tailed Flycatcher is about the size of a Robin. The tail and upper tail coverts are bright chestnut, the remainder of the upper plumage more or less olive-brown, and the lower plumage earthy brown. The next time I saw one of these little birds was many hundreds of miles distant in its winter quarters at Ootacamund in the Nilgiri Hills, where I spent my Christmas leave.

To obtain photos of an Eastern Meadow Bunting's nest containing an egg of the Cuckoo (*Cuculus canorus telephonus*) was the chief object of my visit to the glade. In this I was unsuccessful. It was certainly getting rather late on in the season but the chief reason was that my coolies mistook my instructions (purposely methinks), and planted my camp in the valley bottom near the village. I was suffering somewhat from malaria at the time, and so didn't feel up to the stiff ascents to the slopes where the buntings' nests were mostly to be found. On the way down I did come across two nests, but neither held the coveted cuckoo's egg.

However, next morning I received ample compensation for my disappointment. I had only just set out, and as usual, wherever I noticed a likely looking cavity, I tapped the trunk or branch with my khud stick. One of the first taps bore fruit. From a tiny hole about 1½" in diameter in a hazel stump out flew a little green bird with yellow eye stripes and a yellow line running over the crown, a Large Crowned Willow-warbler (*Acanthopneuste occipitalis occipitalis*). I could just make out the edge of a nest some seven or eight inches down. As it could not be reached any other way, I proceeded to open it up. For this very purpose I had had made to my own design a tiny hatchet, a folding saw, and a folding chisel, all of which I carry attached to a clip on my belt. The deed was soon done, and to my delighted gaze 5 eggs were displayed. Four small and white (size·65" by ·5"; and one also white but very much larger and rather long in proportion to its width. The latter was that of a Himalayan Cuckoo (*Cuculus optatus*). Never for an instant had I expected to find one in a nest so situated. The entrance hole was so small that the cuckoo could not possibly have entered the cavity. It must have pushed in its head and shoulders, holding the egg in its beak, and then have dropped it into the nest. This is borne out by the fact that one of the Willow-warbler's eggs was not only cracked but also bad. This egg is plainly visible in the photograph. The other eggs and the cuckoo's were in a fairly advanced stage of incubation. The nest was made chiefly of moss and had been lined with one or two leaves and goats' hair. The Large Crowned Willow-warbler has the sense to tuck away its eggs out of sight, and I have found nests in crevices in tree-trunks in holes in branches, amongst tree-roots and even in holes descending practically vertically into the ground. They are fairly early breeders, as by the end of June only nests containing young ones are to be found. The normal clutch is 4 or 5, and the eggs are unspotted white ·65" by ·5". Moss and leaves are the chief building materials. They are to be met with in summer at from about 6,000 ft. or even less up to the forest limit.

The same morning I discovered a nest of the Western Spotted Forktail (*Enicurus maculatus maculatus*). This bird is not unlike a wagtail especially in habits. It is much larger of course, laying an egg not much smaller than that of a Black-bird, but like the wagtails it is always to be found near water or wet ground. It is also possessed of an abnormally long tail, the outer feathers of which curl outwards leaving a distinct fork, from which the name is derived. Its feeding habits are the same as those of a wagtail, but its chief resemblance lies in its habit of continually vibrating the tail. The plumage is barred black and white throughout. Hence altogether it is a very striking bird. The nest is a pretty bulky affair of moss lined with grass and hairs, and is invariably very well concealed. The one in question was under the overhanging lip of the perpendicular bank of the stream. It was concealed from above by the long grass, which hung down over the edge. It contained three nearly fresh eggs, white

thickly speckled and mottled with brown and yellowish brown. The normal clutch varies from 3 to 5, and the eggs average a little above ·95″ by ·7″. The season is from the end of April to about half way through June. The Fork-tails are to be met with on most of the torrents and mountain streams of the North-west Himalayas from quite low up to considerable elevations.

I have now finished with Cuckoo Glade, except for mentioning the fact that I noticed a trio of Western Himalayan Pied Woodpeckers' nesting holes quite close to one another. Two were being used by their rightful owners, and the third by a Crested Black Tit. All contained young ones.

On arrival in the glade the previous year, I was brought a clutch of eggs of the Simla Streaked Laughing Thrush (*Trochalopterum lineatum griseicentior*) by some gujars, who had noticed the nest the day before. These eggs are a most beautiful unspotted greenish blue.

A ten mile walk brought me back to the houseboat, which I had sent round to Watlab to await my arrival. The road led gradually downwards, following the stream till it debouched into the valley on its way into the Wular. To begin with I was wending my way along what might have been an English country lane; high hedges on either side and picturesque villages to be traversed every couples of miles: thence along a mere track through thick woods, until the final descent to the vale of Kashmir was reached. Here one descended a deep and narrow gorge, down which the stream, now of quite decent volume, fell in a series of waterfalls. It was in this gorge that I noticed a nest of the Himalayan Whistling Thrush (*Myiophoneus horsfieldi temminckii*) which must have been perched a good 200 feet above the gorge bottom. Just before reaching the descent, I had also found another Western Spotted Forktails' nest containing newly hatched young ones.

At the bottom the gorge suddenly turns, and opening out, discloses a good sized village, surrounded by shady orchards chenars and mulberry trees. I was seated at the foot of one of the latter, when my eye was attracted by the antics of a female Indian Paradise Flycatcher (*Terpsiphone paradisi paradisi*) in a neighbouring fruit tree. She was fussing round a nest, on which the male was seated, his filmy snow-white tail drooping down in a most slender curve beneath the nest. Both sexes take part in incubating the eggs, and this is unfortunate from the point of view of concealment, as the glistening white plumage of the male makes him such a very conspicuous object.

The nest was so placed, about 20 feet from the ground and amongst the slenderest branches, as to make it simply impossible to anchor the camera anywhere near it. The only solution was to bring the nest to the camera. This was accordingly done by cutting off the branch and lashing it lower down in a more convenient position. Having obtained the photographs, I relashed it as close to its original site as I could, and, strange as it may seem, I had hardly reached solid earth with my apparatus, before the female Flycatcher was calmly seated on its restored possessions. The three eggs were in an advanced stage of incubation, so I was highly gratified to see that she thought so little of the extraordinary liberties I had taken with her entire house and home.

The eggs of the Paradise Flycatcher are pink with small red spots, and measure about ·8″ by ·6″. 3 to 5 is the clutch, and the breeding season is from May to July. As can be seen the nest is compact and neat, and placed rather on top of a branch or fork and is composed of grass mosses and lichen lined with hair. They especially effect orchards and groves, and in Kashmir are to be found chiefly round about the villages in or near to the main valley.

The remainder of my way to the boat was on level ground and was soon covered. No more photographs were taken, although I certainly ought to have exposed a couple of plates on a nest of the Brown Rock Pipit (*Anthus leucophrys jerdoni*), which I discovered amongst some rough ground a few yards up the hillside. It was pretty well concealed by a small bush and some tufts of rank grass, and

contained young ones. I noticed one of the parent birds fly to the place with something in its bill, otherwise I should certainly never have spotted it.

A King crow's nest (*Dicrurus macrocercus albirictus*) high up in a chenar tree was the last discovery, before the boat was reached and my week's journey ended. This nest too held young ones. I would have liked to have photographed it, but it was in a most difficult situation, besides which I was feeling far too tired to bother; tired, but eminently satisfied with my week's outing.

(To be continued.)

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

PART XIX.

(With 1 Plate and 2 Text-figures.)

(*Continued from page* 1006 *of Vol. XXIX.*)

(Subfamily—*Gomphinæ*, genus *Onychogomphus—continued.*)

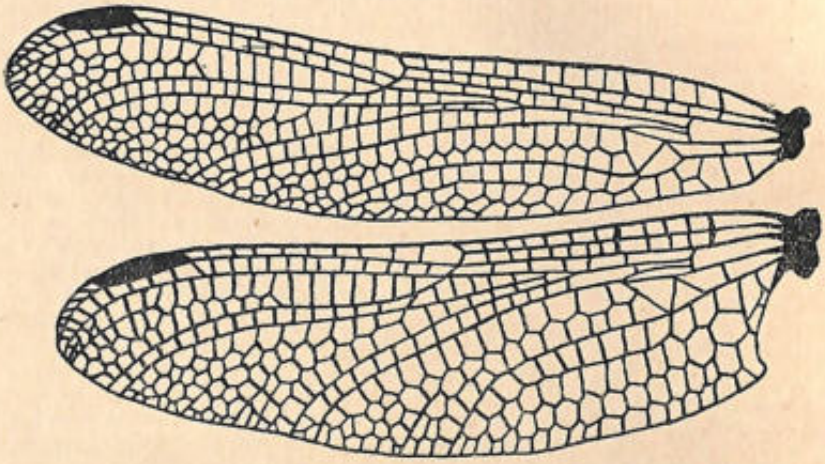


Fig. I.

Wings of *Onychogomphus saundersi* Selys ♂.

Onychogomphus saundersi Selys Bull. Acad. Belg., xxi (2), p. 31 (1854) Mon. Gomph. p. 22 (1857); Kirby, (*Lindenia saundersi*), Cat. Odon. p. 58 (1890); Will., Proc. U. S. Nat. Hist. Mus., Vol. XXXIII, pp. 31, 312 (1908); Laid. Rec. Ind. Mus., Vol. XXIV, pp. 371, 405 (1922).

Male: Abdomen 40 mm. Hindwing 31 mm.

Head: Labium yellowish brown; labrum citron yellow bordered with black and traversed with a vertical line of the same colour at its middle, this splitting the yellow into two large spots; anteclypeus nearly entirely yellow, postclypeus black with a lateral spot of yellow on each side; lower part of frons black, its crest and upper surface yellow, a vestige of black in the sulcus partially dividing the yellow. Rest of head and occiput black.

Prothorax black marked with yellow, its hinder border and a small lateral spot.

Thorax black marked with yellow as follows:—Oblique antehumeral stripes confluent below with an interrupted mesothoracic collar, the black of the middorsal carina slightly dividing it, vestigial humeral stripes consisting of a yellow point above and a fine separated line below; laterally yellow with two broad black bands on the lateral sutures. Tergum spotted with yellow.

(It is to be stated here that Selys described the thorax as "yellow marked with black," thereby causing some confusion, as is evident from Mr. Williamson's description (l. c.) and Laidlaw's remarks thereanent. I have reversed this

description, interpreting the Selysian description by a comparison with *duaricus*, to which species *saundersi* is very closely allied.)

Legs black, rather short, the inner sides of anterior pair of femora yellow, a spot of the same colour on inner sides of middle pair and on the base of the hinder pair.

Wings hyaline, slightly tinted with yellow at the base; costa finely yellow, pterostigma black, about 3 mm long; anal angle very acute; nodal index 8-14. 13-9.

Abdomen tumid at base, cylindrical and narrow as far as segment 6, segments 7 and 8 dilated laterally. Black marked with yellow as follows:—segment 1 with an apical dorsal spot and the sides broadly, 2 with a lanceolate dorsal stripe not extending as far as apex, the whole of the sides except the base which is finely black, 3 to 6 with basal rings occupying the basal fourth of each segment and finely divided by the black of dorsal carina, each segment has also a small median oval dorsal spot, segment 7 has the basal half yellow, 8 and 9 with lateral basal spots, 10 with its basal articulation ochreous.

Anal appendages. Superior nearly as long as segments 9 and 10 taken together, yellow with black apices, nearly cylindrical, base tumid, notched above at junction of abdomen, at first separated, then converging and curving downward, the apex grooved and moderately acute. Inferior nearly as long as superiors, black, broad and hollowed out in the basal half, then cleft into two fine, contiguous branches, turning rather abruptly up and ending in a fine point.

Female: Length of hindwing and abdomen unknown.

Very similar to the male, differs as follows:—The yellow markings on face broader, this colour, on crest of frons, descending the anterior surface for some way, the labrum yellow bordered with black and without the dividing medial line. There is a rounded reddish spot on the vertex between the eyes and occiput, and the latter is yellow behind, at its middle.

The posterior lobe bordered with yellow, the rest of prothorax black. Thorax similar to that of male.

The yellow markings of abdomen broader, the basal half of segment 2 being wholly yellow, the mid-dorsal spots on segments 3-6 are larger, the base of segment 7 is more broadly marked and there is a lateral yellow point on segment 10.

Anal appendages rather longer than segment 10, pointed yellow, separated by a conical protuberance of the same colour.

Vulvar scale short, reddish, deeply notched. The sides of segments 8 and 9 not distinctly dilated.

Wings similar but the base of hind rounded, pterostigma brownish black between thick black nervures.

Hab. The type is a female in the B. M., doubtfully from Bengal. India and Burma are given as its distribution but the species is probably limited to N. E. India and Upper Burma. A pair in the Selysian collection are from Bhamo, July and August, Sumatra has been given as one of its localities but this probably incorrect.

I have not seen a specimen of this insect but have been struck by the very close resemblance it bears to *O. duaricus* which must be very closely related to it. I note the following differences:—

The median dorsal spot on segment 6 is absent in *duaricus* and that on segment 5 is almost or entirely absent. The basal rings are not divided by the black of dorsal carina and the base of segment 10 is black, not ochreous as in *saundersi*.

The anal appendages are similar in shape and colour save for one important item, the basal spine of the inferior appendage. This is so strikingly a feature in *duaricus*, that it is impossible that it could have been overlooked in the descriptions of *saundersi* by Selys and Williamson.

The nodal index is higher in *duaricus* and as regards the female, there is no yellow spot on the vertex, no spot on segment 6 and no lateral spot on segment 10.

Onychogomphus modestus Selys. *Causeries Odontologiques* No. 7, Ann. Soc. Ent. Belg. p. 168 (1894); Will., l. c. pp. 310 and 311 (1908); Laid., l. c. pp. 371, 408 and 409 (1922); Kirby (*Lindenia*), Cat. Odon. p. 60 (1890).

Male: Abdomen 27-28 mm. Hindwing 25 mm.

Head black, the bases of mandibles, a small spot on either side of labrum and the crest of frons yellow, the latter nearly divided by the black ground colour.

Thorax black in front, yellow at the sides. A slightly interrupted mesothoracic collar and an oblique antehumeral stripe well separated from the mesothoracic collar. Laterally the sutures mapped out in black, these two black stripes united at their centres by a bridge of black.

Legs black, femora yellow on their inner sides, short and robust.

Wings hyaline, slightly saliated, costa yellow; pterostigma brownish black, 2·5 mm in length; anal border slightly excavated; nodal index of front wings :— 10-12, 14-10; outer side of trigone of forewing angulated.

Abdomen slender, tumid at base, segments 8 and 9 dilated, black marked with yellow as follows :—the sides of segments 1 and 2, including the oreillets, 2 has also a dorsal lanceolate stripe which does not extend quite to the apical border, segments 3 to 6 have small dorsal basal lunules, 7 has its basal half yellow, this divided partially into two lobes, segments 9 and 10 wholly black.

Anal appendages equal, as long as segments 9 and 10 together, the superior yellow changing to brownish black towards their apices, separated, simple tapering to apex, curved slightly inwards and down; inferior dark brown, narrow curling slightly up, hollowed out above, deeply cleft into two contiguous branches.

Genitalia. Lobe black, very prominent and vesiculated.

Female: (Teneral). Abdomen 27 mm. Hindwing 24 mm.

Head: Labrum with a broad band of yellow running transversely across it; epistome, cheeks and clypeus yellow, the band on frons much broader than in the male.

Thoracic markings broader but poorly defined, the dark lateral stripes on sutures almost obsolete.

Wings hyaline but dirty yellow at the base; pterostigma dusky brown between dark blackish nervures, 3 mm. in length. Outer side of trigone straight.

Abdomen cylindrical, slightly compressed, the basal dorsal lunules on segments 3 and 4 are longer and pointed behind and are followed by a mid-dorsal spot on the carina, segments 5 to 7 are marked with two lateral pale spots low down on the sides and the basal lunules are connected over the dorsum to form complete basal rings. (Segments 9 and 10 missing.)

Hab. The type male is from Bengal, collected by Mr. Atkinson and is now in the Selysian collection. The teneral female described above is in the MacLachlan collection and is given as doubtfully from India.

Concerning it, Selys remarks that its relationship with the male is very doubtful, a belief in which I concur. They agree in size and the thoracic markings only, the markings of head and abdomen are totally different and there can be but little doubt but that the two insects are not conspecific. Laidlaw is of opinion that the general dark colouring of the male refers it to group *bifurceps* (*Lamellogomphus*), but Selys considered it related to *O. saundersi*. There is no doubt but that the latter was correct in his surmise, as I possess a species, the description of which follows, very closely allied to *modestus*, and which is clearly related to *saundersi*.

In the same *Causeries Odonatologiques*, Selys describes a second female. The hindwing in this specimen is 29 mm. in length compared to 24 mm. of the specimen described above. The pterostigma is only 2 mm. in length, the head is

darker than in the teneral specimen, the sides of the labrum are dark yellow, as also is an unbroken stripe on the crest of frons and the bases of mandibles. The occiput is low, black and fringed with hairs. Lastly the mesothoracic collar is uninterrupted. Possibly these two females will be found to be species of *Microgomphus*.

Onychogomphus walli sp. nov.

Male: Abdomen 27 mm. Hindwing 23 mm.

This new species, which reached me after the completion of the MS. of this article, appears to be a link species between *O. modestus* and *O. diminutivus*, sharing the features of each in about equal proportions.

The head and thorax are marked similarly to *O. diminutivus*, but the postclypeus is very distinctly yellow. A narrow isthmus of yellow is found uniting the oblique antehumeral stripe as in *diminutivus*.

The legs are coloured as in *diminutivus*, but the markings of the abdomen differ from both species in having linear medial spots on the middorsum of segments 3 to 6, almost obsolete on the latter segment.

The anal appendages are identical in colour and shape to those of *modestus* and differ from *diminutivus* by the total absence of the subapical spine on the branches of the inferior appendage. These latter are perhaps distinctly paler than in *modestus*.

O. modestus, *diminutivus* and *walli* form a very distinct group within the genus being perhaps most nearly related to group *saundersi*, and distinguished from all others by their very small size.

The female described above as belonging to *modestus*, may possibly be referred to *walli*. The small size of these three insects has led me to again examine a number of female specimens which I had previously referred to *Microgomphus* and I find that one collected by Mr. H. V. O'Donel at Hasimara, Duars, Bengal, may well be classed as an *Onychogomphus* by reason of the specialisation of the cross nervures between *Mi-iii* and *Mir*, which number only 2 in the forewing, and 1 in the hind. Moreover the markings in this specimen are almost identical to those of *modestus*, the slight differences being that the mesothoracic collar is barely interrupted and that the middorsal stripe on segment 2 is continued for a short way onto the dorsum of segment 3 and the lateral yellow of the former segment is continued on to the latter as far as the jugal suture. Finally the basal ring on segment 7 is the same width as on other segments. The nodal index is identical. The anal appendages are very small and yellow. The vulvar scale is small, deeply cleft into two small triangular leaves, nearly hidden by the overhanging sides of segments 8 and 9. I am inclined to regard this as the true female of *O. modestus*. Abdomen 23 mm. Hindwing 27 mm.

Onychogomphus walli is named after Col. F. Wall, I.M.S., by whom it was scovered at Maymyo, Upper Burma, June 1924.

Onychogomphus diminutivus sp. nov.

Male: Abdomen with appendages 28·5 mm. Hindwing 23 mm.

This new species is very closely related to the foregoing *O. modestus*, and resembles it in several important particulars. Thus the trigone of the forewings is remarkably angulated as to its outer side, the length of abdomen and hindwing are similar, the markings of the abdomen are identical as also is the general shape and colouring of the anal appendages. The genitalia shows the same vesiculation of the lobe.

The specimen however differs in the following important particulars which I consider sufficient to give the insect a specific value of its own:—There is a yellow spot on either side of the postclypeus against the eyes, the postclypeus

is obscurely yellow at its middle, the antehumeral stripes are connected to the mesothoracic collar by a narrow isthmus, the latter being finely interrupted by the black middorsal carina. Lastly the branches of the inferior anal appendage bear a robust spine on their upper surface not far removed from the apex.

The peculiar nature of the junction of the antehumeral stripes with the mesothoracic collar suggests some possible variations of this marking but I do not think it at all possible that the spines on the inferior appendage could have escaped the notice of Selys if they had been present in *modestus*.

The very close resemblance of the species to *modestus* is useful in establishing the correct place of the latter. The neuration of *diminutivus* is that of *Onychogomphus* and the markings and general facies show a near relation to *O. saundersi*. I add the following notes in amplification of its description :—

Head. Labium ashy white ; labrum black with two large basal oval yellow spots ; mandibles yellow ; anteclypeus black, postclypeus paler but very obscurely so, a yellow spot on either side against the eyes ; frons black, bright yellow above with its base very narrowly, and a point prolonged forward in the sulcus, black.

Legs black, inner side of anterior femora and distal ends of inner side of mid femora yellow ; hind femora with a row of moderately closely-set robust, very gradually lengthening spines, mid femora with fewer, more widely spaced less robust spines.

Wings hyaline, very palely yellow near the base ; pterostigma black, weakly braced, over 3 to 3½ cells ; only a single row of postanal cells in the forewing, 4 rows in the hind, the first divided and not extending as far basad as the inner end of the subtrigone ; a single row of cells between *Mi* and *Mia* ; nodal index $\frac{8\text{-}14 \mid 13\text{-}9}{8\text{-}10 \mid 9\text{-}8}$.

Anal appendages of about equal length, the branches of inferior with superior apical spines similar to those seen in *Megalogomphus*, otherwise exactly similar to those of *modestus*.

Hab. A single male from Darjeeling District, coll. H. Stevens, in the Fraser collection.

Onychogomphus annularis Selys. *Causeries Odonatologiques*, No. 7, Ann. Soc., Ent. Belgl. p. 166 (1894) ; Will., l.c. pp. 308, 312, 313 (1908) ; Laid., l.c. p. 411 (1922).

Male : Abdomen 37 mm. Hindwing 32 mm.

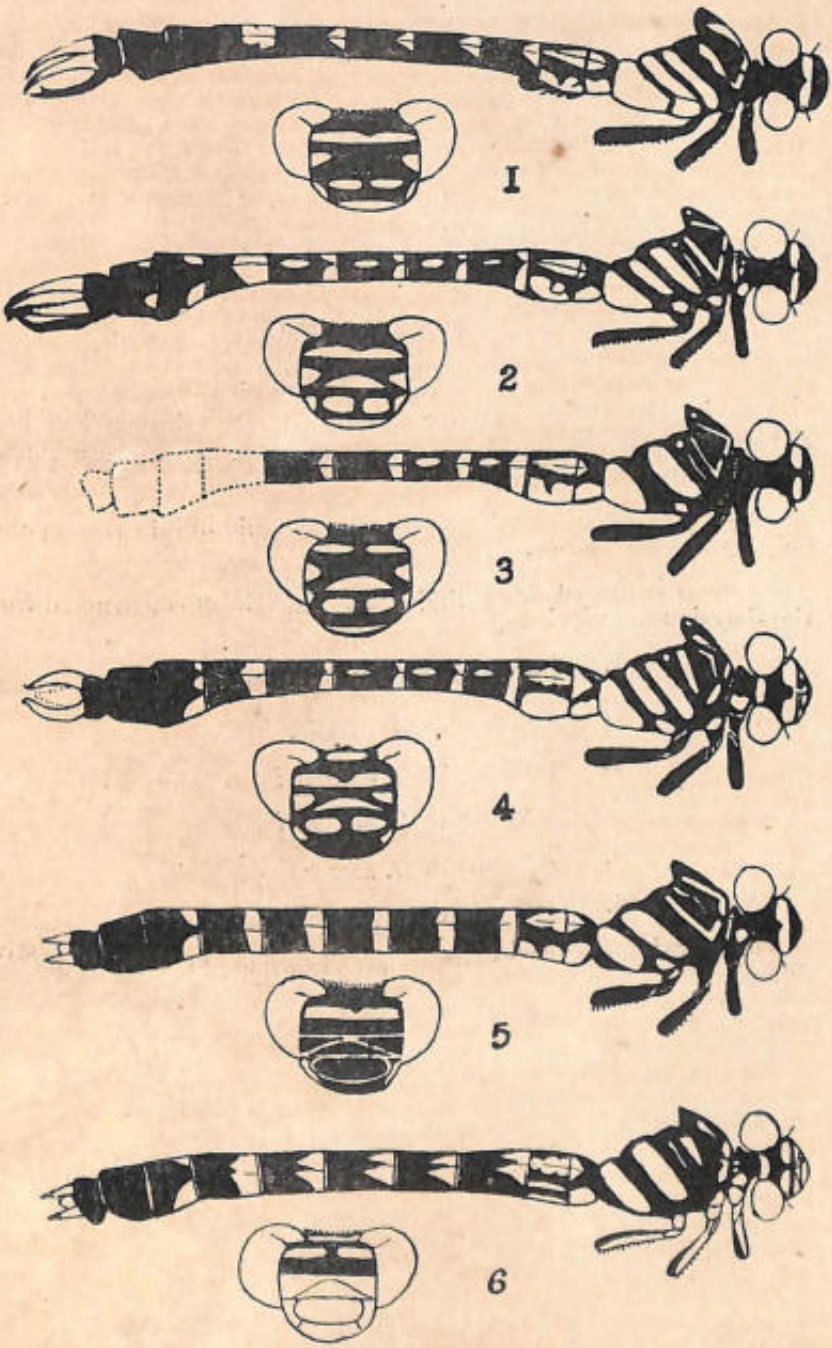
Head glossy black marked with citron yellow as follows:—labium dirty yellow, labrum with two oval spots, the bases of mandibles, a small spot on either side against the eyes at level of postclypeus, and a transverse band on upper surface and crest of frons, interrupted in the middle. Rest of head black, occiput simple, hinder border nearly straight.

Prothorax black.

Thorax glossy black marked with greenish yellow as follows:—a mesothoracic collar interrupted at its middle, oblique antehumeral stripes not extending upwards as far as alar sinus, but confluent below with the mesothoracic collar, humeral stripes represented by an upper spot followed by a vestigal fine line below, at about middle height of thorax. Laterally two rather broad bands.

Wings hyaline, slightly tinted with yellow, especially at bases ; costa slightly yellow outwardly ; pterostigma black, 3·5 mm. in length, braced ; nodal index :— $\frac{10\text{-}14 \mid 15\text{-}9}{10\text{-}9 \mid 10\text{-}10}$.

Abdomen tumid at base, then slender and cylindrical as far as segment 7 (the end segments missing). Black marked with yellow as follows:—segments 1 and 2 with a longitudinal pyriform spot on dorsum tapering nearly



DRAGONFLY COLLECTING IN INDIA.

(For explanation, see reverse.)

INDIAN DRAGONFLIES.

Explanation of Plate I.

The size shown is purely hypothetical, each insect has been shown the same size for the sake of contrast—correct measurements are given in the text.

Structures shown in dotted outline are missing in the types or only specimens known.

Figure I is drawn from life, 2—6 have been constructed from the Selysian descriptions.

1. Markings of *O. diminutivus*, ♂
2. The same of *O. saundersi*, ♂
3. The same of *O. annularis*, ♂
4. The same of *O. circularis*, ♂
5. The same of *O. maclachlani*, ♀
6. The same of *O. frontalis*, ♀

The markings of head and face are shown under their respective figures.

to apical border of segment 2, the sides of these segments broadly, including the oreillets, segments 3 to 6 with broad basal rings occupying from one-fourth to one-third the length of segments. In addition segments 3 and 4 have an oblong oval middorsal median spot on the carina.

Legs black, short, hind femora 5 mm. long, furnished with a row of short spines.

Hab. Upper Burma. Described from two males sent to Selys by MacLachlan and probably in the MacLachlan collection. Selys was of opinion that this species might be conspecific with *O. maclachlani* (described below), but in *annularis*, the markings on the face are much more extensive, there is also a vestigial humeral stripe and middorsal spots on segments 3 and 4 which are absent in *maclachlani*. These differences seem so broad that I do not think that there is any possibility of the two being one and the same species.

There are some strong points of similarity between this species and *saundersi* which do not appear to have been noticed by Selys or subsequent authors. These points seem so important as to lead to a belief that *annularis* may be but a variety of *saundersi* or at least very closely related to it.

In *annularis* the yellow stripe on frons is broken, in *saundersi* it is nearly so. The latter is described as having the sides of the thorax yellow with two broad black bands on the sutures, whilst *annularis* is described as having the sides black with two broad yellow bands. These two descriptions may be but two different ways of describing the same markings. The legs in *annularis* are entirely black but marked with yellow in *saundersi*. Segments 5 and 6 in the latter have median dorsal spots in addition to those on 3 and 4 seen in *annularis*. With the exception of these small differences the two species are alike.

What has been said of *saundersi* applies almost equally to *duaricus*; all three insects are very closely allied.

Onychogomphus aureus Laid. Rec. Ind. Mus. Vol. XXIV, p. 405 (1922).

Male: (Female, unknown) Abdomen 38 mm. Hindwing 30-31 mm.

Head: Labrum black with a pair of large yellow spots; anteclypeus black, postclypeus black marked with a large yellow spot on each side; frons black in front, traversed by a broad yellow stripe above, rest of head black.

Prothorax black, posterior lobe, a large lateral spot on each side and a small paired median anterior spot yellow.

Thorax black marked with yellow as follows:—an interrupted mesothoracic collar, oblique antehumeral stripes confluent below with the mesothoracic collar, humeral stripes vestigial, represented by an upper spot and a short line below it. Laterally broadly yellow, the second lateral suture mapped out in black.

Legs black, hinder femora largely brown deepening to black apically.

Wings. (Description of these structures not given by Laidlaw.)

Abdomen: Segments 1 and 2 yellow with a subdorsal black band on either side enclosing a yellow triangle on segment 1, and a trilobed stripe on segment 2 which tapers towards the apical border. Oreillets yellow finely margined with black. Segments 3 to 6 golden brown with black apical rings growing progressively broader from 3 to 6, on segment 3 occupying the apical fourth, on 6 the apical third. In addition, all these segments have a longitudinal obscure dark mark on middle of segment, segment 7 with basal two-thirds yellow, apical third black, 8 and 9 wholly black, 10 golden brown margined apically with black and with a black subdorsal marking on either side of middle line.

Anal appendages yellow, very similar to those of *geometricus* Selys, to which this species appears to be closely allied. Superiors as long as segments 9 and 10 taken together, curving downward, cylindrical and tapering to a point. Inferior cleft into two closely contiguous branches, rather abruptly curved up at the

beginning of their apical third, then truncate, bearing a dorsal tubercle at junction of basal and middle thirds, slightly shorter than superiors.

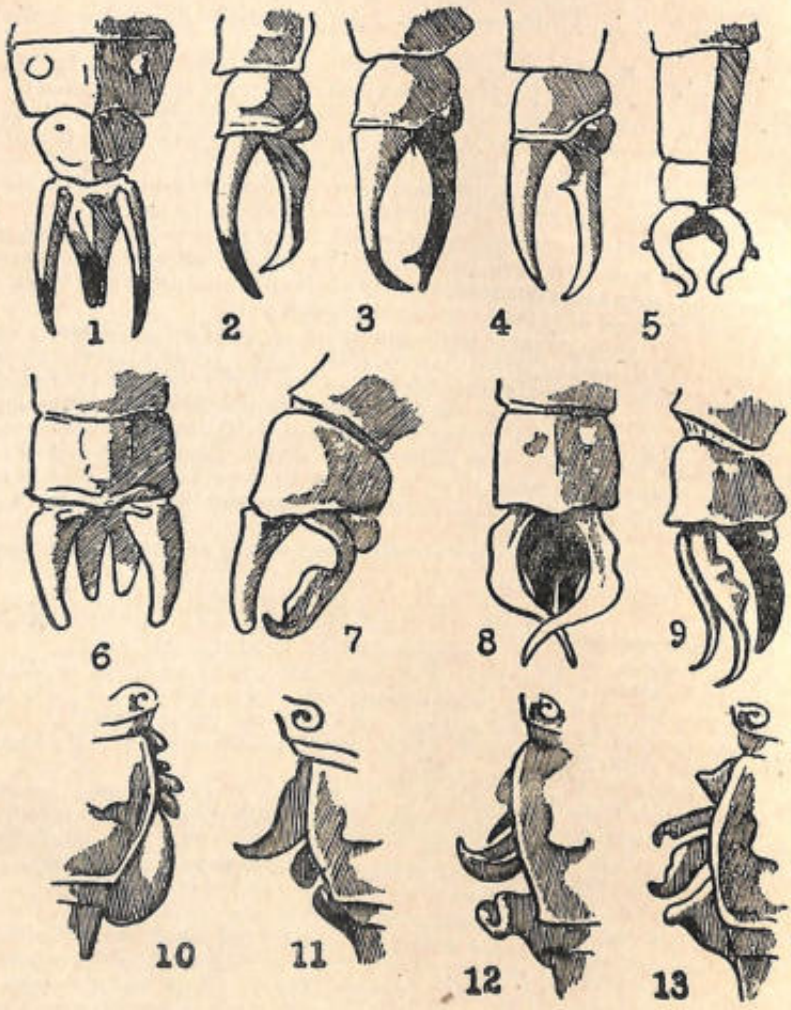


Fig. 2.

1. Anal appendages of *Onychogomphus saundersi*, dorsal view. 2. The same seen from the side. 3. The same of *Onychogomphus diminutivus*, lateral view. 4. The same of *Onychogomphus aureus*, lateral view. 5. The same of *Indogomphus longistigma*, dorsal view. 6. The same of *Ophiogomphus reductus*, dorsal view. 7. The same seen from the side. 8. The same of *Stylogomphus inglisi*, dorsal view, and 9, lateral view. 10. Genitalia seen from the side of *Onychogomphus diminutivus*. 11. The same of *Stylogomphus inglisi*. 12. The same of *Indogomphus longistigma*. 13. The same of *Indogomphus duarensis*.

Hab. Three males from the Garo Hills, Tura, Assam, collected by S. Kemp and now in the Indian Museum. The species belongs to the *geometricus* group, to which also belongs *saundersi*, *annularis* and *duaricus*, *modestus* and *diminutivus*.

The following seven species belong doubtfully to genus *Onychogomphus*, being known only from imperfect males or from females.

Little or nothing is known of the venation of most of these species, if we except *Onychogomphus sp.* Will. (here named *O. earnshawi*) and *O. echinoccipitalis* Fras., or it would be possible to definitely place them in the genus.

Onychogomphus earnshawi Will. Proc. U. S. Nat. Hist. Mus., Vol. XXXIII, pp. 313-315.,(1907).

Male. (Female unknown). Abdomen 38 mm. Hindwing 33 mm.

Head. Labium pale yellow; labrum yellow bordered in front and behind and traversed with black; anteclypeus yellow bordered below on either side with black, postclypeus black with a narrow margin below at its middle and a large spot on either side yellow; frons yellow, its lower part in front black, above, a triangular medial basal black spot not dividing the yellow; occiput simple, nearly straight, yellow at its centre, black on either side against the eyes; back of head black.

Prothorax black margined with yellow.

Thorax black in front marked with yellow as follows:—the lower part of middorsal carina, an uninterrupted mesothoracic collar, oblique antehumeral stripes joined to the mesothoracic collar below and forming inverted "7's," a vestigial humeral stripe on either side represented by an upper spot and a smaller lower one; laterally yellow, the sutures mapped out in black, that on the anterior suture interrupted in two places.

Wings hyaline; costa yellow; pterostigma black; nodal index $\frac{10\text{-}13 \mid 13\text{-}10}{9\text{-}10 \mid 10\text{-}9}$; 4 cells in anal triangle; 4 rows of postanal cells in hindwing, the first cell divided, a single row, or occasional double-cells in anal area of forewing. *Cui* and *Cuii* widely divaricate at the wing margin, 5 cells between them at their distal ends, only a single row of cells between *Mi* and *Mia* nearly to extreme apex of wings.

Abdomen: Segment 1 with a dorsal interrupted crescent of brown, the ends of the crescent running back and downwards, 2 yellow with subdorsal bands of brown which are confluent at the apical border of segment and cut out a tapered stripe of yellow on the middorsal carina, 3 and 4 yellow marked with black, a narrow basal ring, an interrupted median ring and a lateral apical triangular spot which is confluent with its fellow dorsally, 5 to 7 similar but the apical spots larger, confluent and covering the apical half of segments, 7 has the median annule almost obsolete, 8 to 10 black, the former with a large lateral basal yellow spot and a trace of a dorsal basal spot, 9 with a mere trace of a similar latero-basal spot.

Anal appendages. Superior twice as long as segment 10, slender, tapering, curved towards each other and downward, the extreme apex with a shining black tooth, the lower external edge on the curve before the apex minutely denticulate; brown at base shading at once into pale yellow. Inferior slightly more than half the length of superiors, broadly bifid for more than half its length, branches simple, rounded, tapering and continuously divaricate, only slightly recurved dorsally and ending at apex in a minute tooth, colour similar to superiors.

Hab. A single male, in fragments, collected by Mr. R. A. Earnshaw, at Toungoo, Burma. Mr. Williamson in describing this specimen, which is I believe still in his collection, has not named it, on account of its poor and damaged condition. This he says makes the figures of the anal appendages of questionable accuracy. Mr. Martin is of opinion after an examination of the specimen, that it is certainly new. As the number of species from India described under the

heading "*Onychogomphus species*" already numbers three, and thus creates considerable confusion, and as Mr. Williamson has given an admirable and detailed description of the species, backed up by an excellent wing photograph, I have taken the liberty of naming the species after its discoverer.

It is to be noted that the form of the inferior appendage is quite foreign to the genus. This organ is in fact identical in shape to that of a new *Gomphus* from Coorg, which is certainly not an *Onychogomphus*. The description of the upper pair applies rather closely to those of *O. circularis* Selys, but unfortunately the lower appendagein this species is missing and so the comparison cannot be carried further. The markings of the two species are also closely similar so that they may be closely related or even conspecific.

It is to be hoped that more material of this interesting insect will soon come to hand, together with some short notes on its habits which may help to throw light on its correct position. From the venation, the species is an undoubted *Onychogomphus*.

Onychogomophus maclachlani Selys *Causeries Odonatologiques*, No. 7, Ann. Soc. Ent. Belg., pp. 167 (1894); Will., l.c. pp. 312-313 (1908); Laid., l. c. p. 411 (1922).

Male unknown.

Female: Abdomen 43 mm. Hindwing 38 mm.

Head glossy black marked with bright citron yellow, the bases of mandibles and a transverse band across the frons above. Occiput simple, fringed with hairs.

Prothorax black.

Thorax black marked with citron yellow as follows:—a mesothoracic collar interrupted in the middle, antehumeral oblique bands not extending as far upwards as the alar sinus, but confluent with the mesothoracic collar below. Laterally two broad equally broad yellow stripes.

Legs short, brownish black, hind femora 6 mm. in length, furnished with a row of short closely set spines.

Wings hyaline, costa yellow outwardly; pterostigma pale yellow between black nervures, 4 mm. in length, covering 5 cells; no basal antenodal of second series present. Nodal index $\frac{10\text{-}13 \mid 15\text{-}10}{12\text{-}10 \mid 10\text{-}12}$.

Abdomen slightly tumid at base, laterally compressed, segments 8 and 9 slightly dilated laterally. Black marked with yellow as follows:— segment 1 brownish; 2 with a tapered dorsal stripe not quite extending to the apical border, its sides, including the oreillets broadly, segments 3 to 7 with basal lunules occupying about the basal fifth of segments and confluent over the dorsum, segment 8 with only a small basal spot on each side, 9 and 10 wholly black, the latter very short.

Anal appendages small, conical, brown.

Vulvar scale rudimentary, not discernible.

Hab. Upper Burma. Described from a single female in the Maclachlan collection, the type.

As mentioned above, Selys remarks that this species may be the female of *annularis*, but the broad differences already pointed out, when discussing the latter species, preclude this possibility.

Onychogomphus frontalis Selys. Syn. Gomph., 4th Add. Bull. Acad. Belg. (2) XLVI., p. 428 (1878); Will., l. c. pp. 309, 311 (1908); Laid., l. c. p., 409 (1922); Kirby (*Lindenia*), Cat. Odon., p. 60 (1890.)

Male unknown.

Female: Abdomen 29 mm. Hindwing 25 mm.

Head: Labium, labrum and epistome pale yellow; frons black in front, yellow above, the base black, a prolongation of this colour running forward to join the

black of front and cutting the yellow into two halves; vertex black; occiput yellow, its crest dark, sinuous, fringed with long hairs.

Thorax black marked with yellow as follows:—a mesothoracic collar interrupted in the middle line by the black dorsal carina, an antehumeral stripe squared above where it fails to reach the alar sinus, pointed below and well separated from the mesothoracic collar, a vestigial humeral stripe, laterally two broad yellow bands, one at the level of forewing, the other covering the middle fourths of the metepimeron.

Legs very robust, short yellow, outer sides of femora striped with black, hind femora with short spines.

Wings hyaline, reticulation black, pterostigma brown or blackish brown, 4 mm. in length, covering 5 cells; trigone of forewing followed by a row of three cells, then rows of two; nodal index $\frac{7\text{-}14 \mid 13\text{-}8}{? \mid ? \mid ? \mid ?}$

Abdomen of nearly uniform thickness, oreillets rudimentary, segments 8 and 9 not dilated, black marked with yellow as follows:—segment 1 with a dorsal and, a lateral spot, 2 with a middorsal trilobed stripe and two parallel superposed stripes on each side, segments 3 to 7 with broad basal rings occupying rather less than the basal half of each segment (probably considerably less than half except on segment 7), all these rings nearly cut in half by an invasion of the black of dorsal carina, segment 8 with a lateral basal spot, 9 and 10 wholly black, very short.

Anal appendages slender, yellow tipped with black, separated by a conical yellow tubercle.

Vulvar scale about half the length of segment 9, lanceolate, cleft at apex.

Hab. Moolai, Burmah. Kirby in his Catalogue gives the Nicobars as a locality but this is an obvious error, as the specimen described by Selys, is the only one known. The above description differs somewhat from the Selysian which was made from a teneral specimen. I have attempted to describe the adult insect, as the description of the teneral would be very misleading to a collector who happened to come across an adult. Selys remarks that the species appears to be related to *O. reinwardti* from Java, the markings being very similar. It differs by its smaller size, the eyes yellow behind, the sides of thorax black traversed by two yellow bands (yellow marked with 3 dark lines in *reinwardti*). From the female of *modestus*, which it resembles somewhat, it is distinguished by its smaller size and longer pterostigma, etc. Type in the Selysian collection.

Onychogomphus circularis (Selys) *Causeries Odonatologiques*, No. 7, Ann Soc. Ent. Belg., p. 165 (1894); Will l. c. p. 312 (1908); Laid. l. c. pp. 371, 412 (1922).

Male. Abdomen 41 mm. Hindwing 32 mm.

Head. Labrum yellow, bordered and traversed with black, anteclypeus yellow encircled with black, postclypeus yellow with a medial black spot, frons yellow bordered with black below at its junction with the clypeus, its base above finely black; rest of head black save for a small yellow spot on occiput, the latter slightly raised at its middle and fringed with brown hairs.

Prothorax yellow, black at its middle.

Thorax black in front marked with yellow as follows:—the dorsal carina finely, a mesothoracic collar narrowly broken at its middle, an oblique isolated antehumeral stripe (which may be joined to the collar but is not confluent in the type), a small upper spot, the vestigial remnants of a humeral stripe. Laterally and beneath yellow with two medial black bands.

Legs short, femora yellow, armed with short spines, the anterior pair brown on the outer side, the hind pair black on outer side; tibiae and tarsi black.

Wings hyaline, palely saffronated, reticulation brown, costa finely yellow, pterostigma blackish brown, 3.5 mm. in length, covers 5 cells, irregularly braced; incomplete basal antenodal nervure absent; nodal index $\frac{9\text{-}16 \quad 16\text{-}10}{10\text{-}12 \quad 12\text{-}10}$; anal triangle with 4 cells; tornus prominent.

Abdomen. (In poor condition), moderately slender, black marked with yellow, probably very similar to that of the female described below, segments 8 and 9 slightly dilated, 10 very short.

Anal appendages. Superior about equal in length to segments 9 and 10, yellow simple, curved in a semicircle towards each other. In profile, slightly thickened distad to their middle, inclined slightly down, the apices slightly emarginate. Inferior appendage absent.

Female. Abdomen 41 mm. Hindwing 38 mm.

Head and thorax similar to that of male, the humeral spot is better defined and the antehumeral oblique stripes are confluent with the mesothoracic collar, the first lateral black line nearly obsolete in its upper part.

Abdomen compressed, a little tumid at its base, parallel sided thereafter, but borders of 8 and 9 perceptibly dilated. Black marked with yellow as follows :— the whole of segment 1, segment 2 with a trilobed middorsal stripe not extending as far as the apical border, its sides broadly, segments 3 to 7 with complete basal rings, broadest on 3 and 7 and followed on 3 to 5 by a lanceolate middorsal spot. Segment 8 has small dorsal and lateral spots, 9 and 10 are wholly black.

Vulvar scale of medium size, made up of two contiguous tubercles.

Anal appendages, yellow tipped with black, slender, tapering, separated by a conical yellow prominence which terminates the abdomen.

Legs and wings as for male, nodal index slightly higher than in male.

Hab. A single pair in the Maclachlan collection from Upper Burma. The semi-circular anal appendages suggest those of *Heliogomphus* more than *Onychogomphus* and I think the species will ultimately be found to belong to the former genus.

Onychogomphus (ex Garo), sp. Laid., Rec. Ind. Mus., Vol. XXIV p. 409 (1922).

Female. (Male unknown). Abdomen 37.5 mm. Hindwing 35 mm.

Head. Labrum black unmarked; bases of mandibles yellow; anteclypeus yellow, postclypeus black; frons black, its crest narrowly yellow; rest of head including occiput black. The hinder margin of latter slightly elevated medially.

Prothorax black on dorsum, yellow on the sides.

Thorax black on dorsum marked with yellow as follows :—an uninterrupted mesothoracic collar, narrow isolated antehumeral stripes, *no trace of humeral stripes.* Laterally yellow with a broad black band over first lateral suture and a more narrow band of grayish brown along the second suture.

Legs black, the first pair of femora yellow on inner side, the hind pair yellow on outer side.

Wings. (No description of these has been given by the author.) Venationally the species is stated to be a true *Onychogomphus.*

Abdomen black marked with yellow. Dorsum and sides of segment 1 yellow, segment 2 with a middorsal trilobed stripe separated from the sides, which are broadly yellow, by a black subdorsal stripe, segments 3 to 6 with yellow basal rings interrupted by the black dorsal carina and occupying about the first sixth of each segment. Each of these segments has also a median longitudinal spot on the middorsal carina. Segment 7 has its basal half yellow, 8 has a small baso-lateral spot on each side, 9 and 10 wholly black. Apical half of segment 7 dilated, the following segments progressively narrowing.

Anal appendages short, dirty white.

Vulvar scale small, bifid apically, overhung by a projection of the 8th sternite.

Hab. A single female from the Garo Hills, Assam, 1200-1500 ft., June to July 1917. Coll. S. Kemp and now presumably in the Indian Museum. (No. 7979 Hi). Laidlaw considers this species to be allied to *L. biforceps* (Selys). It is distinguished from *L.inglisi* by its much smaller size, by the labrum unmarked, and by the dorsal spots on segments 3 to 5. From *L. biforceps* by the entire absence of a humeral stripe. As I have not had an opportunity of comparing it with other species of *Lamellogomphus*, I retain it for the present in genus *Onychogomphus*.

Onychogomphus echinoccipitalis Fras. Memoirs of Pusa, pp. 74, 75 (1922).

Female. (Male unknown.) Abdomen 34 mm. Hindwing 35 mm.

Head. Labium dark yellow; labrum similar but its base narrowly black; bases of mandibles yellow, anteclypeus and postclypeus olivaceous green; frons black, its crest bright yellow, its base black, from which springs a medial prolongation cutting the yellow in halves. Rest of head black including occiput which is slightly indented at its middle and bordered with a row of about twelve small spines.

Prothorax black spotted with yellow on the dorsum.

Thorax black marked with yellow as follows:—an interrupted mesothoracic collar, antehumeral oblique stripes separated from the mesothoracic collar, *humeral stripe entirely wanting*, tergum spotted with yellow. Laterally traversed by two rather diffuse black stripes, ground colour yellow, one stripe medial, the other lining the posterior border of metepimeron.

Legs black, very short and robust, femora yellow on outer side.

Wings hyaline; stigma black, rather long; venation in left hindwing aberrant (thus the hypertrigone is traversed twice and there are vestigial nervures in the trigone and subtrigone of same wing); 5 to 6 rows of postanal cells in hind wing, 2 in the fore; nodal index :— $\frac{9\text{-}21 \mid 18\text{-}10}{10\text{-}11 \mid 12\text{-}10.}$

Abdomen very stout, compressed, evenly wide throughout but segments 7 and 8 slightly dilated. Black marked with yellow as follows:—segment 1 with a triangular apical spot on its dorsum and the sides broadly, 2 yellow on the sides, traversed obliquely by a black stripe, dorsally marked with a trilobed lanceolate stripe, segments 3 to 6 with large basal subtriangular dorsal spots covering about half of 3 and rather less of segments 4 to 6, segment 7 with its basal half occupied by a large quadrate spot, 8 and 9 with basal joints finely yellow, and small subdorsal basal lunules on either side, 10 wholly black.

Anal appendages very small, conical black.

Hab.—A single female from the Shillong-Gauhati road, Assam, *ca.* 1,000 ft., 2 VIII. 1919, coll. T. Bainbrigge Fletcher. The insect was ovipositing at the time accompanied by a male of *Heliogomphus spirillus*, the latter not however molesting it. This species cannot be placed for certain in genus *Onychogomphus* until the male is known, although venationally it appears to belong to the genus.

Type in Pusa collection.

(To be continued.)

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES.

Being Natural History Notes

BY

Col. A. E. Ward.

Part II.

(*Continued from page* 887 *of Vol. XXIX.*)

(*With two plates and* 9 *Text Figures*).

Sub-family ii.—*CAPRINAE.*—(Continued.)

The Bharal or Blue Sheep—*Pseudois nahoor.*



The Bharal or Blue Sheep—(*Pseudois nahoor*).

Local names—*Bharal—Sna* or *Narpu* of Ladak, *Whar* or *Mendha* of the Sutlej Valley.

The Bharal is entered in the Fauna of India series as *Ovis nahura*. Blanford although admitting that this animal is neither a true goat nor a true sheep was averse to establishing a new genus, intermediate between the goats and the sheep.

Pseudois nahoor has no sub-orbital glands, in this it resembles the goats, also the interdigital gland is, in the hind feet, feebly developed. The inginual glands exist and here it differs from the goats.

The horns are smooth and marked with cross lines. The males have not the goaty smell. Thus in some respects the Bharal resembles the goat, in others the sheep.

The distribution is wide—common on the tributaries of the Sutlej, it extends throughout Ladak, parts of Baltistan and into the great ranges of the Kuenleun mountains. In appearance and also in its habits it resembles the sheep for it prefers the open slopes; it is capable of climbing precipices, more so than the Sharpu (*O. v. cycloceros*), but is never found in forest, in this it differs from the goats.

Description.—The ram or buck is bluish-grey, intermingled with greyish-brown in the back, the lower and hinder parts are white. The front of the face and legs are black, so is the chest. A dark line runs along the body and divides the upper colouring from the white belly. The height at the shoulder of the male is about 34 inches, length 52 inches to 54 inches—tail about 7 inches—weight, according to the time of the year, from 120 to 140 lbs. The Nanny or Ewe is much smaller than the male, the horns are short and more erect. The black markings on the chest, legs and sides are absent.

General Notes.—Eminently gregarious the Bharal is found in large flocks. I have counted over 120 on one hill side, at first they were split up into three lots but eventually they got together and lay down amongst the stones. Now and again a small collection of males only can be found, generally the sexes are together. The Snow Leopard or Ounce, and the Lynx take toll of the Bharal, and so do the Wolves. On the Kharakoram they seemed to be always on the track. The Bharal seldom comes down below 12,000 ft. and in summer ascends to 16,000 ft. and over. Provided the wind is in the right direction and the stalker is concealed, Bharal will, after the first shot is fired, run for a short distance and then stand, apparently undecided what line to take, sometimes they will scatter and afford a chance for further shooting. Unlike the Sharpu, *Pseudois* will not cross with the tame sheep, nor does it get as domesticated or accustomed to living near the haunts of men; it does fairly well if kept in a paddock, but must be enclosed with a high fence as it is a wonderful jumper. It delights in the dry cold, but retires to the sheds in damp snow, at which time the Kashmir Deer delights to come out and, after running about, to sit down in the snow.

THE GOATS—Genus *CAPRA.*

The Goats are devoid of the sub-orbital and inginual glands both of which exist in the sheep, and the interdigital gland is only found on the fore feet.

The males are odorous—Horns on both sexes, those of the males are placed close together in the skull and are long, those of the females are short and are further apart. The Goats brouse more than they graze and are chiefly found amongst cliffs and low bush growth, some frequent the forests especially during the rainy season.

The Genus *Capra*, as far as these articles are concerned, is represented by the Persian or Sind Wild Goat, the Ibex, and the Markhor.

THE PERSIAN WILD GOAT, *Capra hircus aegagrus.*

This species of Wild Goat (*Capra hircus*) of our limits has been divided into two races, why it is rather difficult to follow.

Capra hircus blythi, The Wild Goat of Sind.
Capra hircus aegagrus, of Persia, Caucasus, &c.

Local names are *Tet* and *Sarah* in Sind. *Chank* by the Brahuis. *Parsang* male and *Boz* female in parts of Persia.

It will be noticed that this wild goat has a very wide distribution through Sind, where it is found both at high and low altitudes, thence to Baluchistan, Persia, Asia Minor and the Caucasus. Considering this vast area the variations in size and colouring are slight.

Description.—The name given by sportsmen is the "Sind Ibex," it is a much smaller animal than the Himalayan Ibex, the horns also differ; as Blanford remarks they are "compressed in front", this implies they are devoid of the flat frontal surfaces which are seen on the true Ibex.

The illustration shows the compressed front or ridge very clearly, this pair of horns was exhibited at the Allahabad Exhibition in 1910.

Plate II. is the photo of a buck, standing at the shoulder 33½", the horns are 42½" and the photo is by Major Stockley who shot it in the Khirtar Range in Sind in 1919—it is in its winter coat. Blanford and others give the height of

this goat as 37", if from Sind this is very large. I have no measurements over 34" from any portion of this goat's habitat. The record horns of the Sind race are 52 ⅜" by 7" girth, from Persia a little over 55", the horns of this latter race are thicker and average longer than those from Sind.

The female, which is a good deal smaller than the buck, has short horns inclined backwards in a gentle curve.

The summer colouring is rufous and dirty white, there is a brown line along the back from the neck to the tail ; the tail, round the throat, the face, chest, the legs to the knees and flanks, are dark brown, there is much white on the lower part of the leg. The colouring varies but the deepest shade of brown is generally near the shoulder.



THE SIND WILD GOAT (*Capra hircus blythi*).
Length 46 ¼" Girth 7 ⅜" In the Quetta Museum.

Underneath, the colour is from brown to almost grey according to the season, but old bucks are much lighter in colouring than the younger. The sides of the neck are whitish and the body drab or dirty white behind the colour on the shoulders.

The domestic goat is believed to be the descendant of the Persian animal. The pursuit of the Sind Goat is a trying affair, the rocks are very friable, the sun often scorching, and the prickly cactus is detestable. Many

years ago there was not much difficulty in getting specimens in Baluchistan and the low hills, except that it was possible you might yourself be "stalked" by tribesmen; naturally in summer it was the "hottest of the hot" forms of sport.

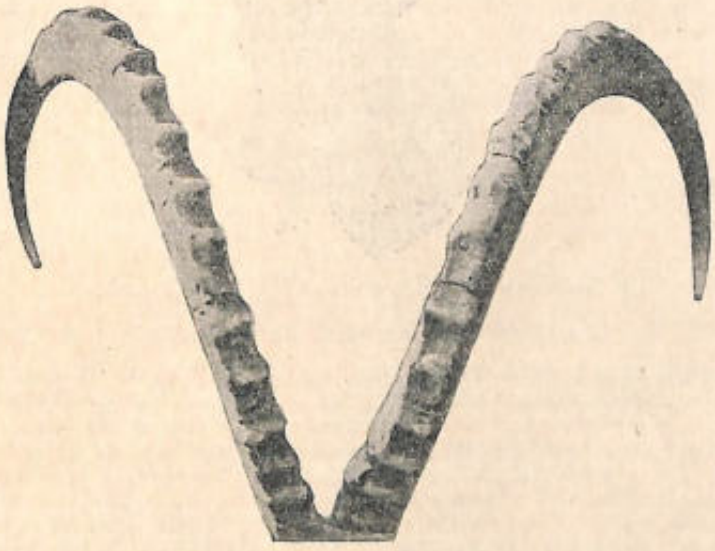
General Notes.—More than one writer has mentioned that this wild goat probably crosses with the Markhor in Baluchistan. I have seen the head of one of these supposed hybrids which came from Takatu, and Mr. G. P. Tate gives the following interesting details:—

"I can recall only two or three examples of heads which were said by local shikaries to have belonged to this hybrid animal. The horns were distinctly curved backwards with a flange which had a much wider twist than those of the Trans-Indus Markhor. I seem to recollect a head in which one horn was curved backwards and the other one was straight and resembled the Markhor horns. The length was, as far as I can remember, about 20 inches, but they were not perfect specimens as the points were broken.

This hybrid used to be met with in the Takatu and Chahiltan groups of mountains near Quetta, those that I saw I believe to have been obtained in Chahiltan."

As regards the head referred to by Mr. Tate in which one horn curved backwards and the other one was "straight" this was probably a freak. I have twice seen these heads with one horn curved backwards whilst the other was almost straight and inclined to one side.

THE ASIATIC IBEX.—*Capra sibirica.*



Ibex from the Wardwan, 48½" × 11¼".

The Sayansk type is considered to be the typical Ibex. It inhabits the neighbourhood of Lake Baikal in Siberia and is styled *C. sibirica sibirica*. The Thian Shan Ibex is *C. sibirica almasyi*. The Irtish Ibex from the Altai Mountains is *C. s. altiaca*, the Irtish flows from the Great

Altai range northwards through Omsk, and in the Tarbagatai Mountains this race is located—again in these ranges near the Irtish there is another name given to a local race "*C. s. lydekkeri.*" There are also the Gilgit, Baltistan, Kashmir and Lahul races.

The native names are.—*Kheyl* in Kashmir, *Skyn* in Ladak and Baltistan, also *Dubmo* for the female in the former country.

This Ibex is found in the hills bordering Kashmir to the north but not in the Pir range, it is common in Baltistan and Gilgit and in Ladak, but is not found in the Changchemno—On the Slyok river there are fine Ibex, mostly at the head waters.

The Central Asian Mountains in Siberia and Mongolia nearly all hold this goat which also is said to be found near Lhasa in Tibet, but this is very doubtful.

It probably will not interest the readers of the Magazine to wade through asserted distinctions of all these races, hence only a few will be described.



Thian Shan Ibex (*C. s. almasyi*) shot by Mr. P. F. Hadow.

Right Horn 53": Left Horn 52¾" Girth : 10½"

The huge horns from the Thian Shan range, from Gilgit, Baltistan and, formerly, from Northern Kashmir have for years past attracted attention. Mr. P. F. Hadow measured his horns from the Thian Shan as 59½" × 13½" and this is a record ; this Ibex was shot in 1907 together with other grand specimens. The record head is followed closely by 58" and others over 55": a fine head shot by Mr. P. F. Hadow is figured.

If the Balti Ibex (*C. s. wardi*) is taken for purpose of comparison in colouring, for this is probably the race mostly seen by sportsman, it will be noticed that the Thian Shan goat (*C. s. almaysi*) is much lighter in the shades of brown, and the lower parts and back of the legs are a drab white or sometimes nearly white. The light coloured saddle is less pronounced. All Ibex are sturdy thick-set animals with strongly made legs and differ little in this respect. The Gilgit Ibex which has been called *C. sibirica pedri* after Prince Pedro (why, it is not easy to imagine) is much like its neighbour the Balti Ibex in colour, but generally is not quite so darkly marked.

Lydekker's statement that the horns are very slender is scarcely justifiable when the long list of horns of a girth of 10½″ up to 11½″ is studied. Compared with the thick Central Asian heads, they are certainly of less girth, but the Ibex horns which are slender come from the Nubian and Sinaitic races. The record horns from Gilgit are 55″ by 11½″, 53½″ by 10½″ (Col. Biddulph's)and 53″ by 10¼″, the first and last were obtained by Major B. E. M. Gurdon. As regards the Baltistan Ibex (*C. sibirica vardi*) I think Rowland Ward was the first to call attention to the dark colouring of this race and the large whitish saddle with the narrow brown line between this and the white on the neck. The Balti animal varies however greatly in colour; season and age govern the changes. The Ibex from the head of the Wardwan and in Dachin (opposite to Kishtwar) are also often very dark brown. The Kashmir Ibex has been called *C. sibirica sakeen*. On the hills bordering the Vale of Kashmir, Ibex are on the decrease and a large head is seldom seen. The Ibex from the Sutlej has been named *C. sibirica filippii*. Formerly they were many in number but the horns are shorter than those of the other races mentioned. I have no measurement over 40″, and amongst many heads seen there, none seemed to exceed this measurement.

Colouring.—If several Ibex skins from various provinces are placed on the ground and compared, it is scarcely possible to separate them according to the localities from whence they came and the horns tell but little. The colouring of a buck, when most sportsmen see him in the spring, is very light and shows up clearly against the dark rocks, for in the winter the hair is generally shaded with light or tawny brown. In summer the general hue is dark brown with irregular markings of a lighter shade, there is a good deal of dirty white or yellowish white on the back, so in summer if an Ibex is standing against a rock it does not show up plainly, but if on a snow field it appears to be very dark brown or chocolate. A male in good condition weighs slightly over 200 lbs. A female 104 lbs. The male stands from 39″ to 41″.

A Nanny which dashed down hill after a shot had been fired was apparently blind and continued her downward course until scrub jungle was reached, in this she got entangled and was easily captured, her horns measured 10″ in length,—much out of condition she only scaled 86 lbs.

The female Ibex is practically all one colour, yellowish brown, and insignificant to look at but she generally governs the stalker. An old ewe standing sentry on a rock, vigilant and not even occasionally grazing, is not easy to outwit; she is ready, on suspicion arising, to utter a shrill whistle of alarm which will send the flock dashing downwards for a short distance followed by a climb upwards amongst the precipices and it will be long before the retreat ceases. In places where Ibex are much disturbed it is not uncommon to find two or three females on the look-out.

The young are born in June, at that time the big bucks leave the flock and wander up to the high cliffs, they are then easier to approach for they seldom post a sentry.

The trade in blankets manufactured from the under-fleece or *pushm* of this goat seems to have died out, grand warm blankets they were.

Although there are fewer Ibex than there were a few years ago, still the finest sport in the Himalayas can be obtained.

Of other Ibex.—There are *Capra ibex* found in the Alps but now rare, the horns are small. I have seen none much over 30″ in length.

Capra walie (The Abysinian Ibex) is a large heavy animal.

Capra nubiana with long, not very massive horns, has the frontal knots on the horns not so much rounded or as large as in the Himalayan Ibex.

Capra sinatica has long thin horns. A pair shot many years ago are 41″×7½″ and are much curved at the end, where they are very slender. These are undoubtedly long horns but are not nearly the record.

THE MARKHOR.—*Capra falconeri.*

Local names.—*Markhor* in Astor. In Baluchistan *Sara*—also *Math* (male), *Het* (female).

The Markhor is found in the Pir Panjal—Kajnag and Shamshibri ranges and in Poonch to the South-westward of the Pir Mountains; in Hazara and Chilas, in Baltistan, Gilgit and Chitral, also on the Suleiman westward of the Punjab—, in Baluchistan and Afghanistan.

Four races are recognised by naturalists, these are distinguished by the horns and to a certain extent by size.

1. The Astor race has widely divergent horns forming a very open spiral never exceeding one and a half turns. Plate 1 shows a fine head with less than two twists.



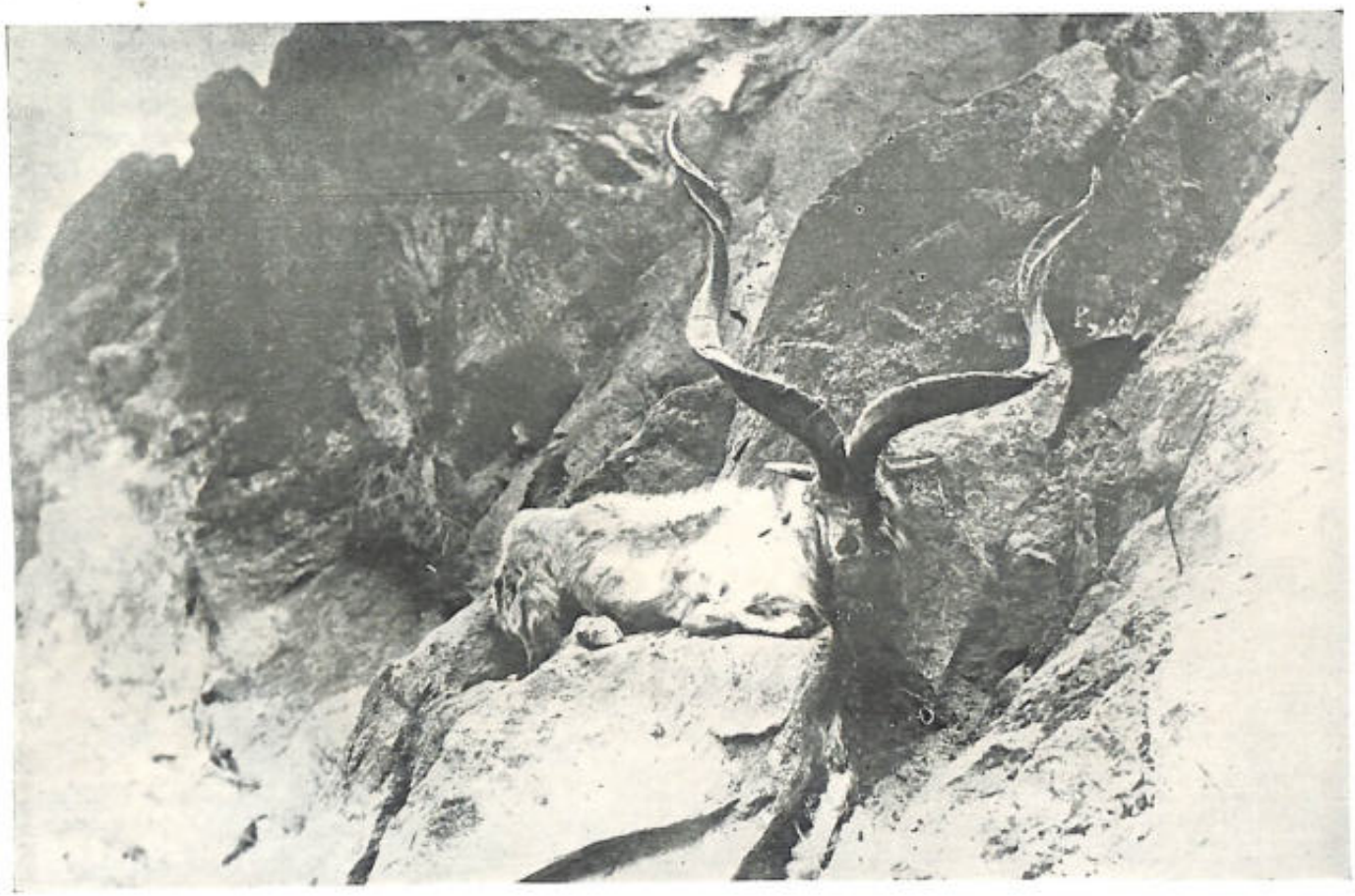
Pirpinjal Markhor (*Capra falconeri cashmiriensis*).

The best head shot of late years in the Pir Range. L. 43".

2. The Pir Panjal race has two or rather more spirals, these two are shown on the illustration figured above in the right horn. This is the best head shot of late years in the Pir Range and the horns tape 43". The shape is not constant.

3. The Afghanistan Markhor has a contracted spiral of more than two twists and is intermediate, as Rowland Ward remarks, between the Pir Panjal and the fourth race the Suleiman, the form is not however very constant.

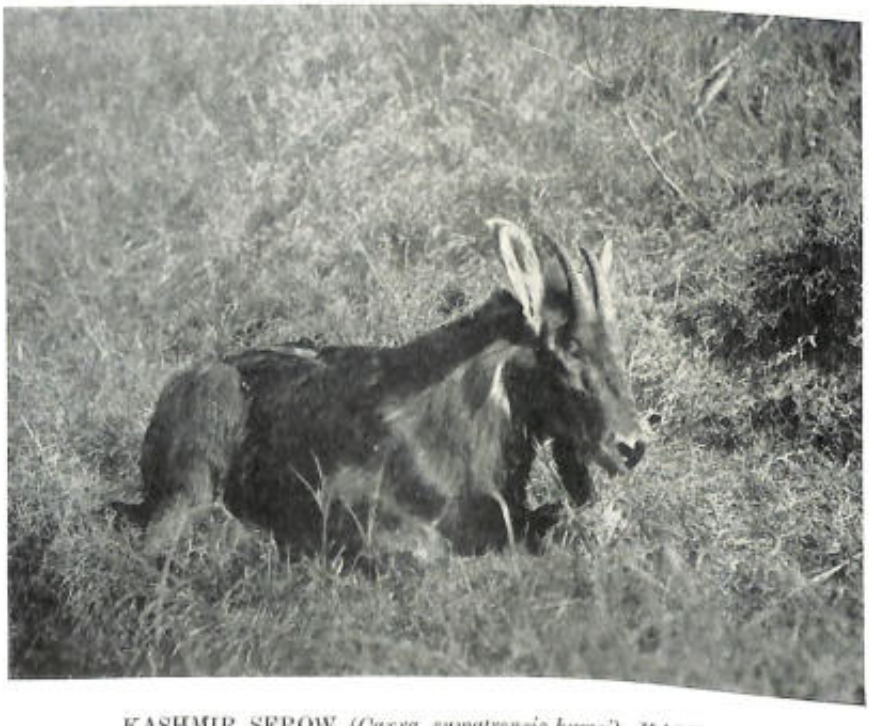
4. On the Suleiman Markhor the spirals form a screw with a front and back keel and are numerous, as many as five turns are found in the horn. The marginal figure portrays a specimen from the B.N.H.S. Collection. These horns are measured straight, not round the spirals. It is very difficult to tell where these four varieties of Markhor begin or end, for instance the Kajnag horns vary greatly and a 53" head I shot in Malanjan approached in shape the Afghan or Cabul Markhor. Sometimes from Gilgit and Baltistan the horns are not true



ASTOR MARKHOR (*Capra falconeri falconeri*).
Shot by the late Col. G. Sulivan. Length 52½″ × Girth 11″.



SIND WILD GOAT (*Capra aegagrus blythi*), KHIRTAR RANGE, SIND.



KASHMIR SEROW (*Capra sumatrensis humei*), KASHMIR, 9".
(*Photos by Major C. H. Stockley.*)



Suleiman Markhor (*C. f. megaceros*).

to the type adopted by naturalists as the Astor variety. Sir Henry Mac Mahon showed at a meeting of the Baluchistan Natural History Society in 1907 a pair of horns obtained in Takatu (Quetta) which were more like the Pir than the Suleiman race.

The extremes in the horns of *Capra falconeri* are those of the Astor, and the Suleiman. Between these two there are the considerable variations in the horns of Pir and Cabul races. It is not easy to obtain the lengths of all horns approaching the record.

Of the Astor race there are a pair (measured after drying) 60¾″ in length and 11¼″ in girth, also a single old horn 61″ by 10½″ picked up in Damool near Gilgit. Of the Pir race, we include the Kajnag and Shamshibri,—there is a single horn of 63″ picked up many years ago by the late Colonel Cuppage, and grand heads of 59″ by 10¾″, and again 59″—this was shot by the late Col. S. D. Turnbull. From Afghanistan and its frontier, horns measured in a straight line approaching 40″ by a girth of 11″ or more have been recorded. Of the Suleiman race the longest horns I have seen were 36″. Rowland Ward & Co., in their Eighth Edition, record a gigantically long odd horn measured in a straight line as 48½″ but only 7¾″ girth. This may be set down as a freak.

As to size, I give some measurements made by Major Stockley and myself.

Height.	Length.	Girth.	Weight.	Sex.	Locality.
39½″	..	..	240 lbs.	Male.	Astor.
39½″	73½″	54″	....	,,	Astor.
39½″	..	..	220 lbs.	,,	Gilgit.
39″	..	..	....	,,	Gilgit.
40″	..	..	220 lbs.	,,	Kajnag.
38½″	..	..	200 lbs.	,,	Pir Panjal.
39″	..	..	....	,,	Suleiman.
28½″	59″	42″	....	Freak	Astor.

The Markhor from Sheik Budin seem to be small in the body and so were the few I have seen of the Afghan or Cabul race.

Colour.—The winter coat is grey or yellowish-grey but as the summer comes on the general colouring is reddish to yellowish-brown. The old bucks have grizzled beards darker in front than underneath.

The under part of the body is greyish as a rule and the front portions of the legs below the knees are dark.

General Notes—The reason why the area inhabited by the Markhor is more restricted than that of the Ibex is that the former cannot exist in the high hills when covered with deep snow, it is therefore confined to those rocky mountains which are in the vicinity of low ground of 7,000′ elevation or less. In the Kajnag and Pir ranges the Markhor come down in winter to abuot 6,000′ whilst on the Indus in Baltistan they have been shot from a lukh (a raft of skins) on the river at quite low altitude.

Markhor are gregarious, in the day time they rest high up, but in the evening they rush down the steepest hills at a great pace, utterly regardless of broken ground or sliding shale. It is a fascinating sight to see the flock coming straight down a mountain side where with difficulty you have managed by the aid of hands and alpenstock to crawl. The rutting season is in November and December, when the bucks come down from the high cliffs where they have spent the summer.

Since sending this article to Press a very fine Markhor has been shot by Colonel A. B. Souter, the photograph of this head is attached. The Markhor was shot in the Mozi Nullah, Kajnag Mountains, in May 1924. The measurements taken by Major H. Wigram, Secretary, Game Department, Kashmir, are as follows :—



Record Markhor shot in the Mozi Nullah, Kajnag Mountains, by Col. A. B. Souter.

L. Horn.	R. Horn.	Girth.	Tip to Tip.
65¼"	59¾"	13¾"	36½"

Some very fine heads have from time to time come from the Kajnag and Sham Shibu Hill ranges, but these horns excel any of them, and are superior to the 63″ single horn picked up by Col. Cuppage many years ago which up to date was considered the record.

THE TAHR—*Hemitragus jemlahicus.*



Tahr (*H. jemlahicus*) shot by Col. C. B. Wood.

Local names.—*Khras* or *Jirgla* in Kashmir. *Kurt* in Chamba and elsewhere—*Jula* (male) in the United Provinces hills—also *Ther* or *Therni* (female)

This goat is an inhabitant of the Pir Panjal, the lower Wardwan in Kashmir, Kishtwar—Badarwar and Chamba and extends eastward through the Punjab and United Provinces Himalayas, on the southern side of the big ranges of the mountains.

A dark coloured old buck standing on a cliff is a grand sight, the shaggy blackish mane hangs low down, the general colouring is a slightly reddish deep brown and there is a dark dorsal streak, not always very distinctly marked. The younger animals are not nearly so black in appearance as the older, the dark colouring being a sign of age. The horns have a sharp keel in front and flat sides, which are much striated, the back is nearly smooth but shows striations.

When writing on sport in Kashmir, &c., I gave a list of horns from Kishtwar and the lower Wardwan and did not touch on heads from other places.

Prominent amongst big heads stands Shikari Wilson's (Mountaineer) specimen 16½" by 10½" in girth. I remember years ago everyone was sceptical, but it was measured by Mr. A. O. Hume—Wilson told me about this head, and if I remember correctly he got it at Harseel in Tehri territory. I notice Rowland Ward & Co. allude to it, and give three other measurements over 15"—Garhwal gives the finest heads. A very fine buck scaled close on 200 lbs. and in measurement was practically the same as an Ibex.

Height at Shoulder.	Length of body.	Tail.
38½"	54"	8"

The female is smaller but the horns do not vary much in length from the males, they are easily distinguished from the really fine *Julas* by their colouring and from the hair being less shaggy. There are four mammae, whilst the Nilgiri Tahr has but two. The plate was kindly contributed by Col. C. B. Wood.

General Notes.—Tahr are gregarious, the sexes are generally together, but, following the general rule, the big males leave the flock at midsummer, the kids are born in June and July. Like the Markhor the Tahr is found on precipices interspersed with forest trees and undergrowth, a big male is very shy and hard to locate. I have never come on large flocks of this goat nor seen them descend to feed in the evening, as is the habit of Ibex and Markhor, nor have I seen them on the very high hills above the forest line.

Tahr do fairly well if kept in an enclosure which is shaded by trees and has rocks on which they can climb, they are not however very interesting pets, nor do they appear to breed freely in captivity.

The second species of *Hemitragus* found in India is the Nilgiri wild goat or so called Nilgiri Ibex, this is confined to localities outside the areas to which these notes refer.

The measurements are slightly larger than those of the Himalayan Tahr.

Probably the record head is 17½" by 9⅞" but very few horns exceed 16".

The longest horns I have personal knowledge of taped 16" and were then considered a record.

The species is hard to stalk, as the females are greatly on the alert.

SEROW—*Capricornis sumatrensis.*

Ramu in Kashmir also *Yahmu*—Kust.

The Serow is found in the extreme outer hills of the Himalayas and for a considerable distance towards the big passes at various elevations from a little over 2,000 ft. to certainly 10,000 ft. It extends through Kashmir to Kishtwar—Chamba and into Kulu the United Provinces and Nepal.

Colouring.—Blackish-red or reddish-grey are the prominent tinge. The description given by Lydekker is "flanks, buttocks, upper portion of limbs, chest and throat are reddish rusty red", the stomach and inside the thighs greyish inside the ears, and the chin whitish. Some seen are much redder than others.

Measurements.

No.	Height.	Length.	Girth.	Sex.	Weight.	Locality.
1	38½"	56½"	40"	Male.	..	Kashmir.
2	39½"	..	..	,,	..	U. P.
3	38"	..	..	,,	190 lbs.	,,
4	37"	..	..	,,	190 lbs.	,,
5	33"	..	..	Female	120 lbs.	,,

A very large female shot by Major C. H. Stockley in Kashmir was 39½" in height.

No. 5 was the smallest mature serow I have ever seen. She was shot in Budraj in Dehra Dun and had 10" horns.

Both sexes have horns, the record in the Dehra Dun is 14" shot by Chowdry Shib Ram on his preserves below Mussoorie. The Chowdry told me about this head. I did not see it, but it was measured by several sportsmen. A twelve inch horn is a good trophy for the male and ten very fine for a female. It is almost impossible to tell the sexes apart on the hill side, hence as many females as males are shot, but as serow pair this is not of much importance. Serow are seldom quite solitary, in the immediate vicinity the second animal will be present—very rarely more than two are together.

Serow wander very little, year after year they stay on the same hill, and often frequent the same patch of ringal or other suitable undergrowth. Even a serow, which is a very shy animal, will become accustomed to the vicinity of man:—a pair used to frequent a small patch of ringal on a bridle path leading from one homestead to another on a hill farm; the first time I pulled up my pony to look at them they dashed wildly down hill but after a few days they did not even get up from their lairs, probably they thought they were hid from view.

The young are born about May and stay for a long time with the mother. The pairing season is in the autumn.

Let us now turn to the Journal, Vol. XXII, No. 2, page 296 (*et. seq.*) we get the following races :—

Capricornis sumatrensis.

1.	sumatraensis	Sumatra.
2.	robinsoni	Perak, Malay.
3.	rubidus	Arakan.
4.	milne-edwardsi	Eastern Tibet, Ynnan.
5.	jamrachi	Darjeeling.
6.	thar	Nepal, Sikkim Chumbi.
7.	rodoni	Chamba.
8.	humei	Kashmir.

With Nos. 4, 6, 7 & 8 we are more or less concerned.

No. 4 (*C. s. milne-edwardsi*) is described as "brownish black or blackish with reddish hairs intermixed on outside of the thighs, legs below the knees and hocks rusty-red", &c. ; this is unlike the Kashmir serow.

Passing on to 6 (*C. s. tahr*) we get a serow with legs which are white or greyish white below the knees and hocks, &c. (see page 309).

No. 7 (*C. s. rodoni*) is the Chamba serow and there remains No. 8 (*C. s. humei*) the Kashmir serow. I confess to being utterly puzzled because I cannot follow the differences in colouring when studying skins. Adjoining Chamba comes Kishtwar and Bodarwar and in these districts I have shot a fair number of serow and I would take the description of "*rodoni*" as applicable to 7 & 8 with very slight differences. It may be doubtful whether a sufficient number of skins were shot at the same season of the year and if adult animals were available but. as Pocock remarked, every naturalist may wish to change the names of animals and is it admissible? He hints at this in the Journal referred to.

General Note.—The serow is one of the best climbers of the mountain Game animals ; whilst dashing down the rocky sides of the hill it never falters, of course being nearly always in the same patch of ground it knows the locality well but a heavy thick set creature being able to hurl itself about on a mass of rocks and bushes is wonderful.

Under certain circumstances a serow will show fight and will go for dogs when brought to bay or if wounded—many wild animals will do so, especially hinds when their fawns are chased by dogs, but they strike with their feet whilst a a serow will make a headlong charge.

It is seldom that this animal can be watched, however not far from Srinagar there are several scattered over a rocky range which is fringed below with scrub jungle of no great width, this cover borders on some rock strewn fields, the villagers, working, disturb the serow and they climb on to the cliffs where they can be plainly seen and their habits studied. When the disturbance ceases they steal back into cover; when on the rocks they are generally standing still and seldom wander any great distance, evidently the instinct is to get back and hide.

GREY GORAL (*Nemorhædus goral.*)



Goral (*N. goral*).

Length of Horn 9¼", World's record.

Local name *Goral* .. .. *Pijur* (Kashmir).

The habitat as far as these articles are concerned is the Jhelum Valley—Kishtwar, The Wardwan, Badaswar and Chamba. In Kashmir proper, that is inside the Valley, there are no goral, but in the Jhelum Valley from downwards they exist; on the outside of the Pir range they are common. To get on to goral ground the sportsman must visit these localities or else he must

cross the passes which lead to Kishtwar and the lower Wardwan (Dachin). If we look at the wide distribution of Goral, which is from the lower ranges of the Himalayas, through Jammu—Chamba, the Punjab and the United Provinces into Nepal and again into Sikkim, Tibet, Burma and China, we must be prepared to find several races differing in colouring and size. For our purpose we have :—

The Western Race, The Grey Goral (*Nemorhaedus goral*) is of a yellowish colour, at times what I should call a greyish brown. Chin, upper lip and throat patch white, a dorsal stripe on the older animals. Tail, black at the lower portion. Legs, lower part grey. Stomach and inside the thighs white, and—

The Eastern Race, The Brown Goral (*Nemorhaedus hodgsoni*)—(Where the boundary comes in it is hard to say, roughly we could put it at the Sardah river between the U. P. Provinces and Nepal). In this Eastern race the white on the legs is practically absent, and in some entirely so. The general colour is brown with often a reddish tinge, the throat patch is not pure white. There is a dorsal stripe of blackish brown. The stomach and inside the thighs grey. This is as near as I can get with a description taken from a few skins from the Nepalese side of which the colouring varies.

An average sized male of a Western Goral is 28″ at the shoulder and weighs 50 to 65 lbs.

As to the size of horns. The plate shows what is generally acknowledged as the record 9¼″ ; this specimen was measured by many keen sportsmen.

When quoting the size of horns Lydekker mentions an 8½″ horn from Busahir, he also alludes to the horns of a female of the same length. I have horns of a male 8″ from Busahir and had that of a female just under 7″ from the same place, but there is no doubt heads run large in that State. B. B. Osmaston shot a female with 7″ horns.

On the hill side there is practically nothing to tell the sportsman which is a male or a female, except that the latter's horns are very thin. When a female is shot, there is always the saving clause that this animal is numerous.

Goral may be called semi-gregarious in their habit. Often apparently a solitary one is found but during the stalk an unseen goral gives a succession of stamps with its forefeet and makes a hissing noise,and then two or more scamper away, for they live scattered amongst the rocky hill sides. They love precipices and can climb wherever any other goat is able and that is saying a good deal.

The Goral is a sturdy little beast which luckily gives sport close to hill stations. There are many in the Siwaliks close to the main road.

It may be stated that I have purposely omitted mention of the Grey Mongolian Long-tailed Goral (*N. caudatus*) and the Gorals which come from the East of Tibet. The latter I understand are grouped under one species *N. griseus*. Some day I may be able to refer to these Goral.

(To be continued.)

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

By

T. R. Bell, C.I.E., I.F.S. (Retd.)

(*Continued from page* 946 *of Volume XXIX.*)

Part XXXII.

Family—HESPERIIDÆ—*continued.*

Subfamily (3).—Ismeneinæ.

Imago.—Large, powerful butterflies often taking long, sustained flights in great leaps or bounds so to speak, mostly straight ahead and nearly always in the morning or evening, being somewhat crepuscular in habits although, in dull weather, especially on the hills in the monsoon months when there is mist about in jungle-covered country, they may be seen quite early in the afternoon. They invariably rest on the undersides of leaves with their wings closed over the back and mostly with the fore wings well drawn down between the hinder ones; they will fly out from bushes when one passes, take some rapid flights backwards and forwards with, occasionally, a circle round and return to the same leaf where they disappear as rapidly as they appeared. They are of course very difficult to see on the wing, that is it is extremely hard to recognize the species, but the general colour will give a cue to which group they belong: *Ismene*, *Hasora* and so on. The colour is enough for this: chestnut, brown or metallic-green. They are all more or less characterised by striking colours; metallic-green with a broad orange band to the hind wing or dark-chestnut brown with bright orange-red border to hind wing, or brown with a broad, white or orange, transverse band to the underside of hind wing; or, and these are not very striking, dark-brown with two rather large whitish-yellow spots on the underside of the hind wing (*Hasora badra*) or just hair-brown practically immaculate there (*Badamia exclamationis*). But this last butterfly is remarkable for having the longest, narrowest wings possessed by any Skipper though that is not easily seen when flying. There is another type still exemplified by *Ismene gomata* and *Ismene amara* in which the underside of the hind wing is whitish, each vein bordered on each side by a brown streak from base to outer margin or from origin of the vein to that margin. They are all large butterflies too varying from 2″ to 3″ in span. And they are characterised by palpi that distinguish them from all other members of the *Hesperiidae*.

Antennæ.—Club of varying robustness, always tapering to a fine point, occasionally hooked, in which case the terminal portion is always more than half the length of the remainder of the club.

Palpi.—Second joint upturned, pressed closely against the face; third joint long, slender, naked, porrect, projecting horizontally in front of face.

Hind tibiæ.—With two pairs of spurs but otherwise variable.

Fore wing.—With vein 5 equidistant from 4 and 6 or slightly nearer to 6. Otherwise the neuration and shape variable.

Hind wing.—More or less lobed at anal angle, vein 5 usually well developed. Neuration and shape otherwise variable.

The males never have a costal fold to the forewing but have various other secondarly sexual characters both on wings and legs.

Egg.—Small for the insects. Dome-shaped more or less with the surface ribbed meridionally, the number of the ribs varying greatly in the group and even in one genus, indeed, within very narraw limits, in the same species occasionally. Colour pink, green, yellow or whitish.

Larva.—This is characteristic, being brilliantly coloured, the pattern arranged in transverse bands, sections or spots differing from the stereotyped, longitudinal, ordinary pattern. The colours are black and rose-brick red with some blue and yellow or green with violet, or yellow and black mostly. The larva is more or less spindle-shaped with a large , rounded head that is also more or less parti-coloured.

Pupa.—Stout, quite rarely plain in colour, pink, green, always covered with a white powder ; and, in some species, marked with black lines and spots ; always has a rounded boss between the eyes, the cremaster well formed ; but without spiracular expansion to the spiracle of segment 2 and the proboscis is not produced free beyond the wings.

Habits.—The eggs are laid on buds, shoots, leaves, on the upper or underside ; always one at a time except in the case of *Ismene gomata* which lays them in batches on the undersides of leaves. The larva makes a cell by turning over a piece from the edge on to the top ; sometimes at the point of the leaf where it turns over a triangular half of the leaf with the midrib as hinge; sometimes an oblong piece from edge. The pupation takes place in the cell or, after wandering, in an untidy cell made of any leaf ; the edges of cell closed with silks, the inside well lined with the same material. The pupa is always attached inside by tail-fixing and body-band. The young larvais very active, running out of its cell easily and falling ; the mature larva is not. The egg or larva or pupa have not been ever observed to "hibernate."

Genus 11.—Ismene.

Characterised by Watson :—

"*Antennæ.*—Club very robust, about twice as long as shaft, terminal portion tapering to a fine point and curved into a crescent, never bent into a hook.

Palpi.—Second joint upturned, pressed closely against face ; the third long, slender, naked, porrect, projecting horizontally to face.

Hind tibiæ.—Slightly fringed and with two pairs of spurs ; in the males of all species the hind tibiæ are very much swol'en and have a long tuft of hairs affixed near the proximal end on the upperside beneath which, on their outer edge, they are clothed with large, rounded scales, this character being fully developed in some species, less in others.

Fore wing.—Vein 12 reaching costa almost opposite the end of the cell ; 5 equidistant from 4 and 6 ; upper discocellular minute, middle and lower subequal, almost erect ; 3 three times as far from base of wing as from end of cell ; 2 three times as far from end of cell as from base of wing ; inner and outer margins subequal ; cell slightly more than half the length of costa.

Hind wing.—Vein 7 twice as far from 8 as from 6 ; discocellulars very faint, slightly outwardly-oblique; 5 well developed; 3 from just before end of cell, cell

very short, only reaching about one-third across wing; outer margin sinuate but not distinctly lobed." (*A Proposed Classification of the Indian Hesperiidæ.*)

Egg.—Dome-shaped, rather less than twice as high as broad; the surface shining, sculptured with 19 or 20 meridional, fine, obscurely-beaded ribs that do not quite reach the top, some of them anastomosing before doing so. Colour yellow or white.

Larva.—Stout, spindle-shaped, with a round, large, well-distinguished head that is slightly broader than high and obscurely bilobed. Body smooth, covered with minute, short hairs fairly closely. Colour of body black with white and yellow and blue longitudinal lines and yellow transverse lines and some vermillion on segment 13; the head black and vermillion radiating from centre; or-colour french-grey suffused dorsally with yellowish and with large black patches and black spots; head yellow marked with black. The black larvæ characterise Swinhoe's genus *Gecana*; the light ones his genus *Burara*.

Pupa.—Stout, thickest in the middle, quadrate in front, frons with a boss or short protuberance-convexity; a well formed cremaster; colour pink and black (*Gecana*) or yellow-green and black (*Burara*).

Habits.—The eggs are laid on the upperside of a leaf (*Ismene fergussoni*) singly; or in batches of from 5 to 30 side by side on the underside of a young leaf (*Ismene gomata*) in shady jungles. The egg-larvæ sometimes eat the shell, at others do not do so and, shortly after emerging, repair to the side or point of the leaf and turn over a small triangular portion on to the top, fastening it down and coating the inside with silk; in the latter case, when they go to the point of the leaf, they cut into the midrib and turn over the piece no one side, using the midrib as a hinge. In the latter stages this last method is the usual one adopted; when the leaf is small, the whole of it is doubled along the midrib. The pupation takes place very often within the last cell which, also, may be cut entirely loose from its moorings, midrib, or stalk, and falls to the ground. The larva is very active in its first stages, becoming, however, sluggish as it increases in size. The butterflies are extraordinarily powerful fliers and frequent the jungles, keeping to the damper, denser, bigger forests. They are rarely seen feeding, being crepuscular in their habits but may be found round the foodplant on rare occasions. They are frequenters of nallas, ravines and shady spots and *Ismene gomata* is probably partly a night-flier.

"Typical *œdipodea* has a male-mark consisting of a rounded pouch of appressed scales on the disc of the upperside of fore-wing owing to which the lower margin of cell is curved up, vein 3 rises near base of wing close to vein 2; on the hind wing 8 is very short and runs up to costa near base and, just beyond it, the costal margin is folded over on the upperside; vein 7 is much as in the female but 6 is strongly curved down. The folding over of the costal margin on the upperside gives the wing, as seen from below, the appearance of being strongly arched at base and cut away obliquely to just beyond vein 7." (*Watson.*)

Watson says that other members of the genus have male-marks of variable size and shape, always on the upperside of fore wing while

some have none at all. He makes a key on the males alone in which he uses the characters of the folded costa of the hind wing, the position of vein 3 of the fore wing between the base and end of cell and the presence or absence of the male-mark as well as its shape, enumerating a total of fourteen species from the Oriental Region, China and Japan. Swinhoe, later, in his *Lepidoptera Indica*, creates special genera for what are more or less Watson's groups as far as they enter into the Indian fauna, calling them *Pola*, *Gecana*, *Tothrix*, *Burara*. These he characterises as follows :—

Fore wing.—Cell slightly exceeding half costa, its lower margin curved strongly upwards in ♂ because of rounded patch of *andraconia* ; vein 12 ends opposite end of cell; discocellulars erect, upper minute, middle, equal, lower ; vein 5 a little below middle, 6 from close to upper end of cell ; vein 3 in ♂ from near base of wing and close to 2, in ♀ it originates a little before lower end of cell; costa arched basally; apex acute; outer margin convex, very oblique, nearly as long as hinder margin which is straight.

Hind wing.—Cell very short, about one-third across wing ; vein 6 from beyond middle of cell ; discocellulars faint, slightly outwardly oblique; vein 5 distinct from a little above middle ; 6 from close to end, 3 from just before end of cell; outer margin somewhat sinuate.

Hind tibiæ.—Two pairs of spurs ; swollen in male, a long tuft of hairs from near proximal end on upperside, beneath which they are clothed with large, rounded scales along their outer edge. *Pola.*

Fore wing.—Vein 3 in ♂ emitted from middle of cell, 2 from one-fourth from base ; lower margin of cell straight; a small and inconspicuous patch of *andraconia* near the middle of wing between veins 2 and 8, very slightly overlapping those veins. *Gecana.*

Fore wing.—Vein 3 in ♂ from close to distal end of cell, vein 2 from close to base ; lower margin of cell straight ; sex-marks of four or five short streaks of *andraconia* along middle of veins 2, 3 and in interspace 1, sometimes more or less joined together.

Hind tibiæ—Much swollen. *Tothrix.*

Fore wing.—Vein 3 of ♂ from close to lower end of cell ; no *andraconia*. *Burara.*

213. Ismene fergussoni *deN.* (*Gecana fergussoni, Swinhoe*).—Male. *Upperside* : bright chocolate-brown, with a distinct orange-ochreous tint in fresh specimens ; the orange subcostal streak is composed of short, decumbent hairs; the base of the fore wing is clothed with longer, brown hairs and there is a fringe of long, brown hairs along inner margin ; the hind wing has a complete clothing of brown hairs except the subapical marginal area. Fore wing : with the disc slightly paler, a bright orange-red or orange-vermillion, sub-costal streak somewhat narrow and fining to a point beyond the middle of the wing ; a double rounded clump of deep-black scales a little above the middle of the first median interspace (interspace 2) crossing vein 2 and slightly overlapping vein 3. Hind wing without markings. *Cilia* of fore wing grey, of hind wing bright ochreous-vermillion, narrow at the apex, gradually widening to the anal angle and extending narrowly up the abdominal margin. *Underside* : much paler than above. Fore wing with the hinder, marginal space pale ochreous ; obscure, pale, ochreous spaces in the three interspaces above the abdominal margin decreasing in size upwards; the base of the wing with a black spot on a small, ochreous-vermillion spot. Hind wing : a small patch of ochreous vermillion at the base with a black spot on it ; all the veins ochreous-vermillion ; a few short streaks of that colour in the interspaces of the disc, with longer streaks towards the abdominal margin. *Cilia* of both wings as above. Antennæ

black, sometimes ochreous beneath; club ochreous vermillion; palpi ochreous with vermillion sides, the last joint and a line down sides black; head and body above concolourous with the wings; thorax with long, iridescent, greenish hairs; abdomen with vermillion tip; on the underside the body and legs are ocherous-vermillion, abdomen has blackish, segmental bands at the sides. Female. Like the male above and below, the subcostal streak often very narrow, of course no male-mark: clothing of hairs as in the male except that the whole disc and outwards of the hind wing is destitute of them. Expanse 52-60 mm.

Egg.—Hemispherical in *shape*; the top slightly depressed with a central, large oval or circular, impressed micropyle. *Surface* shining, with 19-21 rather fine but distinct, minutely beaded meridional ridges or ribs starting at the base and running towards the apex; only half the number of these ridges, generally each alternate one, reach the circumference of the mycropyle; the other half lose themselves in the surface at about two-thirds the height of egg; the space between the ribs is minutely, transversely, closely and paralleledly striate. *Colour* pinkish when first laid, becoming livid dirty-white, the raised ribs remaining always white. B: 1· 25mm. H: 0. 9mm.

Larva.—The body is cylindrical in *shape*, ending squarely at the extremity of the wedge-shaped, anal segment; the neck is little narrower than the stout large-seeming head and there is a somewhat tumid collar just behind it. The *head* is moderately shining as to surface, covered with small shining, glassy tubercles, each bearing a short, fine, grey hair which is directed downwards and appressed to surface: these hairs fairly numerous; clypeus rather small, triangular and black; the false clypeus not easily discernible; the labrum and ligula small, glassy-translucent; the basal, antennal joint opaque-white; the second, antennal joint glassy; eyes black; the mandibles rose-red; colour of the head brick-red with 6 black bands radiating from centre of face, expanding outwards, there being one dorsal above the middle of face, one dorsal below—thus 2, and four other radii. *Surface* of the body velvety dull, covered all over with a short sparse fur or dense covering of very short, black, erect hairs not in any way hiding the pattern of colour; the main hair tubercles are curious: quite circular, absolutely flush, glassy discs, the hair arising from each similar to those of the rest of the body. The *spiracles* are of ordinary size, flush, oval, light brown in colour with a darker brown stripe on each side of the central slit and with a thin, shining black edge or border to the oval; those of segments 2 and 12 larger by far than the others, especially those of segment 2. *Colour* of the body is velvety-black above a spiracular, white line which runs from the front margin of segment 2 to the hinder margin of segment 13 (that segment well developed dorsally, thinning to a point spiracularly); a subdorsal, white line with a blue tinge, the two close together; a canary-yellow, dorso-lateral, thicker line which is somewhat interrupted sending short off-shoots downwards on each segment, one in middle of segment and one before the hinder margin which off-shoots reach about to the lateral region and are slightly thicker than the mother-line; the intersegmental membranes bluish white; these membranes showing only as thin lines near the posterior off-shoots and having one, or two, similar, parallel, white, short lines in front of them on each segment; a subspiracular, white line absolutely parallel to the supraspiracular one, both well free of the spiracles; the spiracular space between these two spiracular lines light smokey-greenish like the ventrum; prolegs the same; the true legs very light glassy-yellow; segment 13 has a vermillion mark surrounding the dorso-lateral hair-tubercle on three sides, leaving the posterior side free, the mark thickened and produced slightly triangularly along subdorsal line; segment 14 smokey light-greenish, the actual flap separated by an impressed line from the basal portion; this flap broadly rounded at end, its dorsal line sloping nearly at an angle of 90° to the longtitudinal axis with a white spot

dorsally at its extreme margin. The black colour under a lens is really very dark greenish black ; segment 2 is shining black with a subdorsal line running diagonally forward and the two spiracular lines—all whitish. The soles are nearly completely circular—not quite a circumference but narrowly interrupted. L : 60mm ; B : 7 mm. in the middle.

Pupa.—Similar in *shape* to that of *Bibasis*. The *head* and segment 2 quadrate, broader than long, eyes prominent, rounded as also a short, blunt knob on the frons which is produced straight out in front—the eyes somewhat flattened dorsally ; segment 2 short, sloping in dorsal line at an angle of about 45° to the longitudinal axis of the pupa ; the thoracic, dorsal line is in the same plane as that of segment 2 and its highest point, the apex is somewhat behind the line joining the junction of its hinder margin with the wing-line after which the slope falls to the margin of segment 4; thorax stout, evenly convex or humped though not highly, a little broader than head after the shoulders which are slightly prominent and evenly rounded ; hinder margin meeting the wings in a rounded angle of about 80°; the abdomen behind the thorax is circular in the transverse section, thinning gradually to end from segment 6, there being a slight dorsal constriction and an extremely slight, very gradual lateral constriction; segment 14 is a short conical piece or cap to abdominal cone, the cremaster an oblong production thereof as long as the cone, bent down somewhat, the extremity set with the short, bunched, hooked shaftlets ; the front margin of segment is emarginate deeply in a small semicircle on dorsal line and, besides, impressed-toothed all along ; segment 13=12, somewhat shorter than 14+ cremaster, also impressed-toothed along front margin ; bevils of 8 to 10 quite well developed, front ones bordered behind by a ridge. *Surface* with all segments well marked, shining, shallowly large-pitted on the abdominal segments, the pits not very numerous with a very minute hair from each only visible against the light with a powerful lens ; covered all over with a white, cereous excretion that is quite easily rubbed off ; cremaster rugose on edges ; toothed margin of segments 14 (front) and 13 slightly raised, tumid. *Spiracles* of segment 2 not particularly indicated ; others oval, flush with the surface, about three or four lengths to a segment-length and deep-black in colour, about twice as long as broad. *Colour* pinkish, light, powdered all over with white, cereous powder ; a large black spot over each spiracle, about two spiracle-lengths above each and about two spiracle-lengths in diameter ; also the following deep black markings: 5 of a narrow, triangular shape along front margin of segment 3 (thorax), one central, the others subdorsal and lateral ; one, powdered over white, in centre of segment 2 : an indistinct mark just above each spiracle-patch ; a dorsal spot on segment 12, 13, one on each : a spot on top of each eye : cremaster with a lateral, ventral spot ; lateral margins and tip bloak. L: 25mm. ; B : nearly 10mm.

Habits.—The eggs are always deposited in some shady spot on the tops of the leaves and singly. The little larva emerges through the top and often does not eat the shell. It makes a cell at the point of the leaf by bringing the edges together or turning over one half for a very short distance from the tip onto the other half with the midrib as hinge ; fixing the piece turned over down from tip backwards along edge, leaving egress at midrib, lining the inside thickly with silk ; continuing this style up to maturity and uses old leaves all the way through ; the eggs are deposited on old leaves, the food consists of old leaves as distinguished from the young, pinkish ones and the cells are made of old leaves or even, finally, of a withered leaf if it happens to be soft enough to be suitable which it rarely is as the withered leaves are generally brittle and hard.

The final cell is occasionally cut altogether loose from the plant and falls to the ground or, if not actually cut loose, it falls to the ground eventually. The larva is not fond of sunlight and feeds generally in the early morning or towards evening, probably mainly at night and is very liable to be eaten by birds though it is rarely parasitised by flies or ichneumons ; there are often two or three eggs laid on one plant but it is of course impossible to say whether all by the same butterfly or by different individuals although commonly two larvæ of equal age are found together. The butterfly flies fast and rapidly but very straight as a rule and hovers at leaves rather like a humming-bird moth or settles somewhat heavily upon the surface ; it rarely visits flowers, if it ever does so, and it has never been seen at water by the writer. It is difficult to catch on the wing when seen as it flashes past in a moment and keeps close to the foliage of the trees or plants amongst which it is generally found. The foodplant of the larva is *Combretum extensum* (*Combretaceæ*), an extensive climber in the forests of the Western Ghats from Thana southwards and in Ceylon and Malaya ; it nearly always grows in the vicinity of water and is plentiful in Kanara in nalla-beds. The larvæ are also not at all scarce when looked for in the proper places in the Kanara District. The skipper is never found outside the areas of heavy rainfall (60 inches and over) and it has not been met with in the plains. Swinhoe (*Lepidoptera Indica*) gives the habitat of the butterfly as South India : Travancore, the Nilgiri Hills and Kanara District.

214. Ismene gomata (*Mocre*) (*Burara gomata, Swinhoe*).—Male. *Upperside* with the ground colour grey, the *cilia* whitish. Fore wing : the nervures broadly brown, a thin line of that colour inside the cell ; the interspaces, especially the lower, irrorated with brownish-grey ; costa, apex and outer margin darkening to brown. Hind wing : the costal space narrowly yellow ; the veins with broad, brown streaks broadening outwards, leaving very narrow streaks of grey in interspaces ; outer margin broadly brown ; yellow, decumbent hairs on fore wing along upperside of subcostal vein to end of cell with longer grey hairs at base and a fringe along inner margin ; on the hind wing the whole hinder area is thus haired, reaching to end of cell and outwards along veins 6 and 7. *Underside* : Fore wing with ground colour bluish-white ; the veins greyish-blue or greyish-green, metallic, streaked on each side with black, the streaks broadening outwards, the three lowest veins streaked only at their outer ends, leaving the whole space below the median vein unmarked. Hind wing : the ground colour purer white ; all veins greyish-blue, the black bands more uniform in width, covering the whole surface with black and white lines except the cell and a continuation outwards which is immaculate. Antennae black ; palpi greyish-ochreous with a black line on outside, the last joint black ; head with a black spot at base of each antenna ; body brown ; thorax with dull, greyish-green and ochreous hairs ; beneath the body is ochreous as well as legs, the abdomen with lateral bands of ochreous and black continued upwards more obscurely.—Female. *Upperside* black tinged with purple except on the outer margin which is darker than the rest of wing ; purple-green streaks in the interspaces giving the whole a purple-metallic sheen ; two obscure, pale spots in the middle of the disc of fore wing in an oblique line, the upper near base of interspace 3,

the other in the middle of interspace 2. *Cilia* and *underside*: as in male but the black line darker, thicker and purple-black, the ground-colour with a bluer tint, the pale, hinder marginal space more limited on the fore wing by fuscous from the base outwards. A line of subcostal hairs as in the male, but these hairs blue; the other hairs as in male, but not in cell outwards or along veins 6, 7. Expanse 52-57mm.

Egg.—In *shape* a dome. *Surface* shining, minutely and somewhat distantly tuberculate, with 19 meridional rays from the base upwards, half of which do not reach further than three-quarters up to the top, 7 or 8 of the others reaching further up but none of these getting to the very apex which is occupied by the micropyle-surface, a slightly flattened, more or less circular, slightly roughened portion, 0.35mm. in diameter; all these meridions are about 0.025mm. in height and about 0.05mm. in width, obscurely beaded throughout their lengths and lose themselves in the surface at their extremity; sometimes it is every alternate one that is short, sometimes two succeeding ones; the surface is, besides, rayed finely, paralleledly, transversely between the meridions, each such cross-ray being distant 0·025mm. from the one next it. The meridions are 1mm. apart at the widest part of the egg which is from the base upwards for a small distance—the base being absolutely perpendicular all round to the resting-surface and not constricted. *Colour* very pale honey-white. These eggs are laid in batches in parallel rows, from three to fifteen in number and each two of a row are joined at their bases which are practically contiguous, by a line of translucent gum-substance between each opposite meridion along the leaf-surface. H: 1.6mm; B: 0.9mm.

Larva.—Pl. II, fig. 29.—Subcylindrical in *Shape*, fattest in middle, gently decreasing in diameter to anal end and segment 2; segment 2 slightly tumid, of much smaller diameter than the head; anal segment flattened somewhat and rounded at end, gently sloping more or less evenly with the dorsal line from middle, overlapping the anal claspers, rounded broadly at end; segment 2 has seven black longitudinal lines, one dorsal, the others symmetrically below, as well as a black spot at the base of the leg; the anal segment has a triangular, subdorsal, shining patch on each side at the extremity, the apex pointing backwards, as well as a row of 6 black spots along the front margin; the *head* is roundly square, very slightly bilobed, the lobes being separated from each other by a thin, depressed line; the clypeus is an equilateral triangle, one-third height of face; the false clypeus outside it alightly curvilinear, half of the height of face, also triangular, both with the apex pointed; the labrum is transvense, oblong, orange; the ligula transversely oval, as long as base of clypeus, with a deep triangular emargination occupying the whole of the front margin; the basal antennal joint is light; the second, antennal joint is red-brown; the mandibles are orange tipped dark-brown, cutting edge with short blunt teeth towards the top, otherwise quite simple; the eyes are five nearly in a straight line, the first or top one displaced slightly behind the line, 1, 2, 3, 4 equidistant from each other, 5 much further down, 6 behind the line and forming a right-angled triangle with 4, 5 on a level with 4; the surface is shining, covered not very densely with fine, dark, short, semi-decumbent hairs all over which are about 0.2 mm. long, the colour light-brown yellow with a horizontal line or row of six spots across the clypeus, two on it, one on each side and the eye-spot on each cheek and a semicircle of four larger ones above them—two to each lobe—as well as a dark-brown mark at each extremity of the impressed line separating clypeus from labrum (the base of mandible): the prolegs and true legs are moderately strong, but rather short. *Surface* dull, the segments well marked, the whole clothed with short, fine, erect, light hairs, longer round the anal margin. *Spiracles* are small, oval, flush, dull black; those of segments 2 and 12 much longer. The *colour* of the larva is light bluish french-grey suffused dorsally on segments 5-12

with bright greenish-yellow; the following black markings : segment 3 with spiracular, roundish spots, a lateral, triangular patch with a short line behind it and a subdorsal and dorsal longitudinal line ; segment 4 similar, the lateral, triangular patch reaching the dorsoventral line with 2 spots, postspiracular ; segment 5 with an interrupted dorsal and subdorsal, longitudinal band and a small, lateral triangular patch with a spot behind it ; segment 6 a broad band covering the whole anterior half with a row of three spots immediately behind it ; the central one dorsal, the smaller ones, one in each lower posterior corner-post-spiracular ; segments 8-10 exactly similar to 6 except that 8 has a second row of three spots behind the others and above them ; segments 5, 7, 9, 11 have three dorsal spots : two or three lateral and two or three subdorsal, the front ones large, the hinder ones small, besides as well a largish, triangular patch antespiracular, above the dorsoventral line with a few small dots behind it ; segment 12 has three on front margin close together, the middle one dorsal, as well as three on hinder margin, the segment being laterally all black besides ; segment 13 has two subdorsal spots on front margin and a shining one behind on the hinder margin as well as a dorsolateral, triangular spot ; legs, prolegs, ventrum yellowish-green. L : 40 mm. B : 17 mm.

Pupa.—Pl. II, fig. 29*a*.—The general *shape* is that of the pupæ of *Ismene fergussoni* or *Bibasis sena* ; it is not covered, like they are , however, by cereous powder nearly so much but has similar markings. The *head* has the frons in a plane perpendicular to the longitudinal axis of the pupa and is square in front with a small, conical, rounded knob or boss between the eyes just above the base of the proboscis as well as another, longer and sharper, immediately above it, the former directed straight forwards, the second forwards and upwards ; the latter being, properly speaking, on the vertex of the head, the hinder part of vertex as well as segment 2 are in a plane at 40° to the longitudinal axis of pupa ; segment 2 is convex longitudinally as well as transversely and has both margins straight, being one-third the length of thorax ; the thorax is very lowly humped and has the hinder margin a quarter circle curve meeting the wings in a widely open, broadly rounded angle of about 90° ; segments 4, 5 are cocqual in length, equal to segment 2 ; segment 13 dorsally expanded into a plate ; the cremaster is moderately long with strong extensor ridges and it is triangular, the extremity blunt ; the dorsal plate of segment 13 is a transverse semi-ellipse, the hinder margin straight, the front one curved, this curve with a small, semi-circular emargination in the dorsal line, the whole plate slightly raised with the front edge bluntly serrated ; the front edge of segment 14 similarly toothed and emarginate also raised above hinder margin of 13 ; thorax slightly humped, fattest in middle, shoulders rounded and even, eyes prominent, dorsal constriction slight ; probosis reaching ends of wings. *Surface* more or less dull, segments well marked, the whole body being covered with very short, erect, light bristle-like hairs, a bunch or ring of slightly longer, dark ones below the longer head-process on each side. *Spiracles* of segment 2 linear, the expansion on the anterior margin of segment 3 behind them conical, rather prominent, black, its front face flattened and wrinkled ; the rest rather small and narrow-oval, the colour of the body. *Colour* of body light pinkish white-green and marked black ; the whole of the front of head yellow-orange, the lower knob black, the eyes also black and there are three black spots in a row across, the central one touching the root of the proboscis, as also two spots on each eye of which the upper is the larger and, further, two more above these eye-spots of which the lower is nearer to the centre of face or dorsal line than any of the others, also another dorsal on vertex of head ; segment 2 immaculate : segment 3 or thorax has a row of black marks along its anterior margin, the dorsal or central one being continued as a streak onto the apex of the segment and very nearly to the posterior margin ; along the wing margins are two black spots on either side of pupa ; each segment 4-12 has a

lateral large black spot or blotch, those on segments 6-8 being larger than the others; on the posterior margin of segment 14 is a black line or border with a small rounded sinus or curve on the dorsum, the concavity directed forwards; the strong extensor ridges of the cremaster black as well as the cremaster itself; thorax and wings are hyaline light-green, the abdomen pale brownish-pink dorsally and nearly white beneath. L: 26mm.; B: 17mm.

Habits.—The eggs are laid on the undersides of very young leaves while these are quite small and pinkish and they are laid in batches of from 5 to 30, side by side in rows. The egg-larvæ, emerging, eat the leaf-substance, omitting the veins, packed together in one company. Before the first moult each one turns over a triangular portion from the edge, fastens the edges of the piece down, coats the inside with silk and lives inside; at the third moult each one goes off to a separate leaf, eats a line from the edge to midrib, and at right angles to it, about a third of the way towards the base from the point on one half, turns the triangular piece over on to the top, eating away the cuticle along the midrib for the hinge; next it eats a band of cuticle in a curve from the edge on the same side a bit further up to the mouth of its cell on the midrib—the beginning of this line is as far as 2-3rds of the way up the leaf: and the area thus demarcated marks the limit of its food during that stage of its growth; after the 4th moult it wanders off from its cells to feed on other leaves, always returning to rest—it generally finishes a whole leaf before going off to feed on another. After the last moult it makes a cell of a half leaf or whole leaf according to the size of the leaf chosen, never feeding on any part of the leaf thus chosen. Changes to a pupa after wandering, often on another plant of another species and this last cell is made by just laxly joining the edges of the leaf together. The pupa is attached by the tail and a body-string.

The larva grows slowly, taking about a month to reach the pupal state and the emergence of the butterfly takes place in about a fortnight. The perfect insect is rarely seen and keeps to dense shade in the big jungles; it practically never goes to flowers but occasionally may be found sitting on a dropping of animals in shady places. It flies straight and fast, but is heavy when settling. It is most probably a dusk-flier if not absolutely nocturnal in its habits; a supposition that is strengthened by the abnormal fact that the female is metallic while the male is dull in colouring, a rare occurrence amongst butterflies. In Kanara the eggs and larvæ are not difficult to find and may be said to be comparatively plentiful locally—in such places as offer fitting conditions for the growth of the foodplant, *Heptapluron venulosum* Seem, a large, stout climber of the evergreen jungles over 1,000' above sea-level in the Western Ghats of Bombay from Belgaum District southwards with large, alternate, generally 5-digitate, fleshy leaves of 9" to one foot in diameter and (in the flowering season) large compound umbels of small whitish flowers with purplish stalks. The climber grows much in nallas and damp places, is common on the Kanara ghats in the evergreen jungles and is spread throughout

India, Malaya and Tropical Australia. The known distribution of the butterfly is Sikkim, Assam and South India. Colonel Swinhoe notes that he has it from Sikkim, the Khasia Hills and Kanara ; the type came from N. E. Bengal.

In the black and white plate II there is a representation of the larva and pupa (figures 29 and 29a respectively) which might help to recognise them if found.

Genus 12.—Hasora.

This is characterised by Watson as follows :—

"*Antennæ.*—Club thickening rather abruptly and gradually tapering to a fine point, bent beyond the thickest portion usually at a right angle but sometimes into a hook ; terminal portion not quite as long as the remainder of the club.

Palpi.—As for the subfamily.

Hind tibiae.—Very densely fringed and with two pairs of spurs.

Fore wing.—Vein 12 ending opposite the end of cell; 5 nearer 6 than to 4 ; upper discocellular minute, middle and lower inwardly oblique and in the same straight line ; 3 almost from the middle of cell, 2 nearer to base of wing than to 3; vein 1 distorted at the base; cell less than two-thirds the length of costa; inner and outer margins subequal.

Hind wing.—Vein 7 slightly nearer to 6 than to 8; vein 3 from just before end of cell, 2 from middle of cell ; with an anal lobe."

The female differs in vein 3 of the fore wing being three times as far from the base of the wing as from the end of cell.

Egg.—Dome-shaped with 16 to 18 meridional ribs and white or green in colour as a rule.

Larva.—Spindle-shaped with the head comparatively small for the subfamily although quite large enough to attract attention, the body slightly shining as to surface, covered with longish soft light hairs, very long for hesperid insects ; the colour of the body chiefly some shade of green or neutral tint with lateral patches of mauve or black on segments 6, 8, 10, 12 and with longitudinal yellowish lines, two subdorsal on each side and one subspiracular.

Pupa.—Stout, generally green, with or without black markings; always powdered with a cereous powder ; the cremaster well-formed and a boss between the eyes on frons ; the proboscis not produced beyond wings.

Habits.—Egg always single, laid on the leaf-buds and in the axils of young leaves. Larva emerges through a hole it eats at the top ; makes a cell at first by doubling a very young leaf along the midrib, the edges fixed down by silken threads and the inside carpeted more or less completely ; later on—the leaves having grown in the meantime—it is made of a portion of a leaf turned over with the midrib as hinge on to the top from the point backwards for which purpose a line is eaten in from the edge to, and at right angle to, the midrib ; finally a whole leaf is used. It of course depends upon the size of the leaf and the larva ; sometimes several leaves, when too small, are made use of to make the house in which case it is somewhat untidy-looking. Pupation takes place in a similar cell and generally after a short spell of wandering, on any plant ; and the pupa is attached strongly by the tail and a body band. The larvæ are fast growers and very active when young, running in and out of their cells with great alacrity. The foodplants

of the larvæ are leguminous but are, apparently, not interchangeable, each species being more or less confined to the one; it is not quite certain that *Hasora alexis* does not feed upon several: two at least, *Derris*, *Millettia*, both climbers of large size and *Pongamia*, the Indian Beech, a tree, are the plants chosen. The butterflies are all stout insects; the flight strong and extremely rapid, a series of jerks or jumps or skips up and down. Although, apparently, the insects all frequent open country as well as jungles and hills, the habits are somewhat crepuscular, they all rest with the wings perpendicularly held over the back and sit on the undersides of leaves invariably; go freely to flowers and moisture and bird-droppings on leaves. The genus is distributed throughout India, Malayasia, the Philippine Islands, Fiji, New Guinea and Australia. Some 68 species are known of which only 9 are recorded as belonging to the Indian fauna. Of these four come into these papers and are all that have been bred from the egg or larva—or any other way.

The two tyes of the genus are *Hasora badra*, (Moore), and *Parata alexis*, (Fabricius); the name *Hasora* being now reserved by some authors for those insects that are without a discal streak on the fore wings in the male, *Parata* for those that possess such a brand. Watson says:—"The type species of *Parata* differs from the type species of *Hasora* in being provided in the male with an oblique, discal stigma on the fore wing and also in some slight differences in the outline of the wings. These two characters exist together only in the type species of *Parata* and we find other species with the discal streak of *Parata* and the outline of *Hasora* and *vice-versa*, while the streak itself appears in every degree of intensity, being sometimes very prominent and at other times barely traceable or altogether absent, the females in all species being structurally inseparable."

Quite lately, Colonel Swinhoe—Watson's remark dates from twenty-years back—has adopted the genus *Parata*, however, for such butterflies as possess the sex-brand in the male and his judgment is based on a much larger number of individuals, probably also species, than were available in Watson's time. It may be taken, therefore, that the two divisions *Parata* and *Hasora* are separable in both sexes and possibly, in consequence, that male-marks constitute a really specific difference or a character of specific importance; but it is, probably, a matter of more individual appreciation and will always remain such in the future as it has in the past. It may be noted, in the meantime, that the earlier stages of *Parata* and *Hasora* are indicative of the fact that *Hasora chabrona* is much more nearly allied to *Parata alexis* and *Parata butleri* than it is to *Hasora badra* and this is confirmed by the very much stronger resemblance that the first three bear to each other as imagines than any one of them bears to *badra*.

All the butterflies are dark brown in colour above, often with some semihyaline spots on fore wing, the hind wing always immaculate,

except in *chuza* from Borneo and Burma that does not concern us; all have, on the hind wing below, including even *chuza*, a broad, transverse white or yellow (in *chuza*) band; or the hind wing underside is more or less immaculate with one or two, never more, yellowish, medium sized spots (*anura*, *badra* and *simplicissima* have the spots, all others being banded—only *badra* concerns us here).

215. Hasora badra. (*Moore*).—Male. *Upperside*: ochreous-brown, very dark when fresh; base of both wings darker brown. Cilia of both the wings grey. Fore wing with three minute, conjugated spots near the costa one-fourth from apex, sometimes absent; clothed with decumbent brown hairs, long at base of wing; no fringe of hairs to inner margin. Hind wing without markings. *Underside*: paler ochreous-brown with a slight purplish tinge. Fore wing with a dark patch before the middle, a dark fascia from the costa; outer margin narrowly brown leaving a pale, submarginal shade; the hinder, marginal space pale ocherous-grey, this colour running up a short distance in the middle, a patch of blue-grey scales below costa at end of cell. Hind wing somewhat darker than fore wing with a broad, discal fascia somewhat paler than the ground colour with an ochreous-white, short streak at its lower end; a suffused blackish patch covering the anal lobe; an ochreous-white, round spot at the end of cell.—Female. *Upperside*: darker than the male. Fore wing with the basal third covered with ochreous-brown hairs and shorter, brown ones beyond; two or often three subapical, semihyaline-ochreous spots and three large, discal, quadrate, ochreous-white spots of which one in the cell towards its end, another obliquely outwards underneath it and the third, in interspace 3 above and outside that again, smaller and more elongate: all three forming a triangle. Hind wing with the basal, abdominal third covered with ochreous-brown hairs and shorter ones beyond but otherwise immaculate. *Underside*: similar to that of the male but much darker. Fore wing with the dark fasciæ as in the male, the spots as on upperside, the lowest of the three quadrate spots touching the greyish-white hinder marginal space. Hind wing as in the male. Antennæ in both sexes dark-brown, the inside of crook reddish; palpi ochreous beneath and the second joint black in the middle in front with a brown line down side; head, thorax, abdomen above concolorous with wings; beneath the pectus is ochreous and the abdomen brown, banded ochreous; legs brown above and ochreous beneath, tarsi ochreous; thorax above clothed with long, brown hairs. Expanse 50 to 53mm.

Egg.—Dome-shaped, nearly twice as broad as high, the base slightly constricted about 0.1mm. below the broadest part. The surface is shining and sculptured by 16 strong, meridional ribs that lose themselves somewhat suddenly in the surface round a 0.5mm. broad, circular space on the top in the very centre of which is the perfectly-circular, quite smooth, 0.1mm.-broad micropyle; the ribless apical surface surrounding this micropyle is excessively-finely shagreeneed the shagreen-pits or risings about 80 to 0.05mm. square and crossrayed besides between what would be the continuations of the ribs were they there; these cross rays are nearly exactly 0.033mm. apart, about 0.005 or 0.006mm. in thickness; the ribs are just 0.05mm. high and 0.075mm. wide with a triangular section somewhat rounded with the cross rays running up the sides but not reaching their tops so that the tops are perfectly shining smooth. The colour is white, very slightly green-tinted possibly. B: 1mm. with the base 0.9mm. widening at a height of 0.1mm. to its greatest breadth; H: 0.55mm.

Larva.—This very like that of *Hasora chabrona* in general *shape*; nearly twice as fat at middle as at segment 2, the head nearly as broad as the middle of the body; the ventrum is flattened as usual, the dorsum convex—the cross-section would be circular but for the flattened ventrum as the larva sits close-applied to

surface; segment 14 is as long as 12 and double 13, semicircularly-rounded: indeed a quarter-sphere, the extremity very close to the resting surface slightly over-reaching anal claspers which show broad and quite short beneath it; these anal claspers with short, cylindrical, whitish shanks, a broad ancle (in sense of the longitudinal axis of larva) which is very narrow and an equally narrow foot which is divided into two lobes, one internal towards ventrum, the other external; the prolegs similar to this; the true legs nearly white (with a slight greenish tinge) rather short, with equal segments, shining and somewhat translucent; segments 13, 14 are nearly completely white with a clothing of long white hairs not quite as long as segment 14, segment 13 being longer dorsally than in the spiracular region where, as a matter of fact it is extremely short, nearly linear, so that the hinder margin is convex backwards; segment 2 is little longer than 13 in dorsal line, highly polished black with the neck bluish-white running into the occipital triangular sinus on the hinder margin of the head, only visible (this neck) when the larva moves the head in eating &c.; *head* 4·5 mm. in diameter by about the same height, very broadly bilobed, but very shallowly so; the surface of the head rough with numerous little tubercles closely placed from each of which arises a whitish hair at least as long as half the breadth of the true clypeus but many of them round the outer head are quite as long as half the breadth of head; the colour is sealing-wax red with the middle of true clypeus black in a fat-drop-shaped mark leaving the angles and sides narrowly red, also a large, black mark on each lobe of face reaching up beyond the apex of false clypeus and down along the side of that clypeus as far as the middle of its sides, being as broad as it is long; also the whole eye-curve is black—in a black circle that is; the true clypeus is an equilateral triangular not reaching half the height of the head with the apex acute, the false clypeus a gothic arch outside it, the strip very narrow at base outside the true one, widening upwards and reaching well over half the height of the face, the apex acute as a gothic arch should have it; the labrum is transverse, as broad as the true clypeus, the hinder margin very slightly curved, as long as half the length of true clypeus, narrowing somewhat forwards red like the head with the very front of it white; the ligula rather more than half its breadth, not quite its length, kidney-shaped-circular, the sinus not half its depth and narrow, the angle of sinus about 45°, the colour deep reddish honey-coloured with the edges of sinus blackish; antennal, basal joint red, the other two the same colour as ligula; mandibles also similarly honey coloured, evenly not very broadly black-ended, the cutting edges to all intents entire; the eyes 1 to 6 in a straight line practically, 1 a bit behind perhaps, 1 to 4 equispaced, equal in size, 6 nearly 2× as far below and 5 behind making an equilateral triangle with 4, 6; all black. *Surface* dull; the segments well-defined; covered with similar hairs to those on the head and rather densely, those on the black patches black, the rest white, not all of exactly the same size or length, some being shorter, those round the anal end longest. *Spiracles* seven or eight to a segment-length, oval, flush, about twice as long as broad, soiled-whitish; those of segment 2 twice as large, those of 12 smaller than those of 2 but larger than rest. *Colour*: a sort of pale indigo hue with the ventrum, segments 13, 14 and the spiracular region whitish with a very slight greenish tinge; a subdorsal and dorsolateral longitudinal yellow line from and including segment 3 to hinder margin of segment 12 and faintly on to the white of segment 13 with five transverse, yellow or white lines to each segment reaching down to an imaginary supraspiracular line (except on segments 13 and 14 which are practically immaculate and segment 2 which is shining-black); a large black patch laterally on segment 3, 4, 6, 8, 10 and 12 reaching from the dorsolateral, longitudinal line to the supraspiracular and nearly as long as broad, starting very close to the front margin—there are always three of the thin, yellow, transverse lines behind these patches; on segments 5, 7, 9, 11 these patches are represented merely by a black transverse streak between the first and second transverse, yellow lines

situated about the middle of the segment ; prolegs all coloured like the ventrum and the true legs, also the anal claspers. L.: 38 mm.; B.: 6·25mm.

The body-colour—pale indigo with a greenish tint—is darkest on 3 to 8, lighter behind that. The feet of prolegs and claspers are circular, the circle being supplied with tiny hooklets all along its circumference except at the back ; this circle doubles in the direction of the length of larva along its diameter and becomes long oval when clasping.

Pupa.—This is like that of *Hasora alexis* in *shape* ; it has, however, a longer snout ; the eyes are prominent, the front of the head square except that the frons is produced into a short triangular prominence or cone continued into a porrect, rather long, cylindrical, blunt-topped snout directed slightly upwards which is about as long as segment 2 ; segment 2 rather long and convex with its dorsal line in a plane inclined at an angle of 45° to the longitudinal axis of the pupa the frons is in a plane perpendicular to that axis ; the thorax is humped the front slope more inclined to the axis than segment 2 with the posterior slope from the apex nearly parallel to that axis and with the hinder margin a quarter-circle curve meeting the wings in an open, broadly-rounded angle of about 60° ; there is a rather slight lateral constriction behind the prominent eyes and a more gradual one at segment 4 ; the body is fattest in the middle although only slightly broader than at shoulders which are not prominent in any way and are evenly rounded ; the transverse section of the body is circular more or less, decreasing from middle to the anal end in diameter ; at the anal end where the stout, oblong cremaster has the lateral faces pear-shaped ; segment 13 is longer in the dorsal line than segment 12, disappearing on the dorsoventral line, has a minutely-toothed front margin and a dorsal, convex shield with a semicircular sinus on dorsal line on front margin ; the cremaster on the whole, is triangular consisting of two dorsal pieces starting broad and rounded from the lateral parts of hinder margin of 13, narrowing backwards into the stout, rather short, four-sided, terminal portion, the two pieces bent out at right angles just where they narrow backwards and not meeting in the dorsal line but divided there by a depressed line ; ventrally on segment 14-cremaster there are two other pieces symmetrical with the dorsal ones which, with their lower edges enclose a widely semicircular space in which the broad clasper scars appear as two symmetrically-juxtaposed, semicircular plates ; the blunt extremity of the cremaster is slightly dilated and covered with short, largely-hooked suspensory shafts ; *head* might be described as a short, transverse oblong or trapezoid (for of course it is deeper behind than in front) with the prominent eyes forming its lateral ends, produced conically between these eyes into a perfectly cylindrical snout or frontal process ; the cylindrical part being twice as long as the posterior, basal trapezoid, the vertex being therefore dorsal, and about as long as segment 2, while the frons is ventral and about the same length or a trifle shorter, the process or snout dividing the two from each other ; the frons, as a matter of fact is not entirely ventral but slopes towards it ; the clypeus is also sloping ventral and is trapeze-shaped, the hinder margin curved forward and equal to the lateral margins, the distal margin only about one-quarter its length and triangularly emarginate where it receives the base of the ligula between the inner eye-covers, this ligula diamond shaped here at base, then contracted into a short longitudinally-oblong, narrow piece connecting it with the distal half which is longitudinally oval between the bases of the proboscis-halves ; the fore legs reach to about one-third the length of the wings, the mid legs and antennæ to two-thirds and the proboscis reaches just a wee bit beyond the end flanked on each side by a slight production of the costal ends of the apices under which they are somewhat tumid because of the ends of the hind legs beneath; eyes prominent laterally, the crescent narrow-shining dividing the eye-surface into a large inside two-thirds and an outside third. *Surface* of pupa shining, covered thickly with a white,

cereous powder that has to be rubbed off to see the details ; segment 14 (mostly cremaster) equals more or less 13 (mostly consisting of dorsal plate) which again equals 12=11 in length ; the bevilled margins of the segments 8 to 11 are well-developed, the hinder ones smooth, the anterior ones very sparsely pitted superficially and they are much longer laterally than dorsally and ventrally ; segments 10, 9, 8 increase slightly in length forwards until 8 is nearly double 12 ; segments 7=6 are again shorter than 8 equalling 9 about ; segment 5=half 8 and 4 equals half 5 ; the thorax=5+6+7 together in length and has the hinder margin a quarter circle curve meeting the wings in a deep, somewhat broadly-rounded angle of somewhere about 70°, its front margin is perfectly straight ; the shoulders are very slightly prominent but on the whole even ; segment 2 in length between 5 and 6 with the front margin quite straight ; the surface of the wings has the veins rather deeply impressed, the head with its process, segment 2 and thorax are very superficially cross-wrinkled and covered sparsely, including the snout, with fine, light, somewhat soft-woolly looking hair that is about as long as a spiracle-length ; the abdomen is nearly absolutely smooth except for a similar hair-covering and the front margins of segments 6, 7, 8 are beaded in the dorsal region ; the cremaster-sculpture and the sinus in front margin of 13 have been mentioned above. *Spiracles* of segment 2 are indicated by a very little transverse black, conical prominent just behind them on the surface of segment 3 (thorax), this prominence rugose, slightly longer transversely than longitudinally, rather broader than the antenna adjacent ; the other spiracles are about four to a segment-length long, about twice as long as broad or more, somewhat narrowly oval, raised discs, black. *Colour* of pupa very light g een with the following absolutely black markings ; the whole of the cylindrical part of snout of head, a small spot on anterior, upper margin of eye ; a spot on dorsal line on front margin of 2 ; a similar, larger spot in dorsal line of hinder and front margin of thorax ; all spiracles and sometimes a slight suffusion round them ; the front margin of segment 13 ; and the markings on cremaster ; the beading on front margins of segments 6 to 8 rusty as well as the hooklets of cremaster. L : 28 mm. ; B : 7 mm. at middle ; snout 2·25 mm. long, included in the length ; breadth of head across front of eyes : 5 mm. ; H : 7 mm. at middle.

Habits.—Since writing the above a small larva came out of an egg and the following is a description of it :—

The little egg-larva of *Hasora badra* is somewhere about 2·5 mm. in length and 0·45 mm. in diameter, one of the middle segments measuring about 0·2 mm. in length ; on each segment there are two subdorsal hairs and two dorso-lateral ones (one on each side) a supra-spiracular and two subspiracular hairs more or less in a line ; these hairs are at the most 0·1 mm. long, the dorsal trapeze is 0·090 mm. long or about one-third of a segment length, more or less, the subdorsals being 0·15 mm. apart while the dorso-laterals are 0·25 mm. ; the supra spiracular hair is about two spiracle-lengths above and slightly in front of the spiracle, the subspiracular one below, also in front of and about two spiracle lengths off and the other hair is more directly under the spiracle at an equal distance from it, perhaps a bit behind it ; there are no other visible hairs except two towards the end of the leg-base next the foot ; the subdorsal hairs on free margin of segment 14 are 0·15 mm. long, the longest on body. Segment 2 is 0·1 mm. long and black dorsally, chitinized, red-brown or brown-red laterally and ventrally ; the spiracle of segment 2 is 0·025 mm. long by less

in breadth, a broad oval ; the rest about 0·0163 mm., long by less in breadth ; that of segment 12 between these in size and rather rounder. The *head* is 0·55 mm. high of which the prominence of the mouth parts takes up 0·1 mm.; it is only 0·3 mm. thick ; the colour is shining-black, rather wrinkled-rugose and minutely shagreened besides under the microscope and there are the usual main hairs but no others ; all erect or nearly so, about 0·1 mm. long and white, translucent ; as a matter of fact they vary from 0·05 mm. to 0·15 mm. in length, only two of 0·15 mm. those at the end of little white antennæ ; the labrum and ligula are the same shape and comparative lengths compared to the clypeus as in the adult larva ; the mandibles are strongly toothed and the eyes similar. The colour of the little larva when it first comes out of the egg is yellowish, soon becoming green after it has eaten.

The egg-larva wanders about a bit before settling down which it eventually does inside one of the still-folded (along the midrib), young leaves upon which the egg is laid, always singly ; sometimes it is deposited upon the tender end of the creeper, just upon the bare bark. The caterpiller spins a few webs inside the folded leaf and eats the edges during the first stage. As it grows it changes its abode, or as it consumes the leaf in which it lives ; and, in the end, growing with the foliage, as this latter increases in size and hardens in consistency, it eats food that is more and more mature and naturally also makes its house of similar leaves although it never wanders far to feed and never eats anything but fairly young leaves. This accounts for the fact that its appearance is strictly limited to the times when the climber has young foliage which is in the hot weather just prior to the break of the monsoon and the monsoon time itself. The most prolific time for broods is towards the months of September and October in the Kanara District. The foodplant of the caterpiller is *Derris uliginosa*, Benth., a leguminous climber characterising the sea-coast and muddy salt-water creeks from the Western Coast of India to Ceylon, China, N. Australia, Polynesia, Madagascar and Zambesi-land in Africa. That is Botany. The distribution of the butterfly is given by Swinhoe as India and Ceylon ; to Burma, Sumatra, Java as far east as Borneo. He says :—" Horsfield and Moore record it from Java. Moore's description in *P.Z.S.*, 1865 is from a Bengal example. We have both sexes from Java ; Borneo ; the Runjit Valley, Burma ; Sikkim and the Khasia Hills ; we cannot distinguish any specific difference between the Java, Bornean and Indian examples. Fergusson records it also from Travancore ; Watson from the Chin Hills ; Wood-Mason and de Niceville from Cachar ; and Davidson, Bell and Aitken from Kanara. Our figures of the larva and pupa are copies of Horsfield and Moore's figures." And extraordinarily bad figures at that although the actual *markings* of the larva are more or less correct. The pupa is painted brown and it is really green, white from the powder

that always covers it. Swinhoe's representations are in his *Lepidoptera Indica*, Volume IX, Plate 751. It is extremely probable that, eventually, the habitat of the butterfly will be found to be same as that of *D. uliginosa*, Benth, the caterpiller's foodplant. At any rate eastwards to Polynesia. Africa is not so likely—but, all the same, not impossible. The pupation takes place in a doubled leaf or amongst several leaves on the plant; sometimes between two fixed down one on top of another; and the pupa is fixed by the usual tail-pad and body-string. It is active and squirms a lot when touched but makes no perceptible noise. The growth of the larva is rapid; the times for the stages normal; the time spent in the pupa also. The butterfly comes out in the early mornings and always sits with its wings held perpendicularly over its back on the undersides of leaves. It is a very powerful flier and mounts high into the air at times and does not seem to be averse to sunlight and hot places. It comes greedily to flowers in the mornings until about 11 o'clock and again in the afternoon. In Kanara the larvæ are found along the banks of salt-water creeks and estuaries as well as along the sandy shores where the small rivulets and springs dribble through from the hills; it is there the foodplant grows. The butterfly is often seen further inland in the thick, big jungle and certainly ascends the immediately adjacent ranges to 1,000' or more. When on the wing it is nearly impossible to capture with a net for it flies in dives and often not straight; but, when at flowers, it can be caught. It just arrives and that is all one knows about it. You see it settle rather heavily on a spray and then is the only chance. If you delay, it is just gone! And it would puzzle the sharpest eyes to say how and in which direction. Otherwise, that is except at flowers, the insect is hardly ever seen in Kanara notwithstanding that it cannot be rare, judging by the numbers of eggs laid and found, and the larvæ it would be possible to gather in, were anybody to put their mind to it. There is one place at the upper end of an estuary in Kanara about 18 miles away from the sea where there is a plantation of the exotic *Caesalpinia coriaria*, Will., the Dividivi or American Sumach, introduced years ago, which flowers profusely in the month of October and scents the whole atmosphere for hundreds of yards around with a pleasant fragrance that attracts insects by the thousand both day and night. And this was—and probably is—the one place where *badra* was a certain find as long as the flowers lasted. It was also a sure find for *Halpe honorei*, a rare Skipper and *Sataspes infernalis*, a rarer sphingid moth that fed in the evenings and mornings. A further charm was added to the general perfection of the place by thousands—literally—of the smallest of Sun-Birds (*Arachnecthra minima*) making the whole place musical with their soft, low twitterings.

The way these *Ismeninae* prepare the tail-fixing for the pupa is perhaps somewhat peculiar; two ropes of silk attached, at the ends

to the leaf-surface, meet in a knot; or a short loop is made with a knot in the middle, which is increased into a small pad, into which the hooklets of the cremaster are screwed in the usual manner.

The egg that produced the little larva of which a description is given in the foregoing, was brought in fresh on the 19th of September. The caterpillar came out of it on the 22nd, three days afterwards. It was full-grown on the 5th, and had settled down to pupate on the 7th of October. The butterfly emerged on the morning of the 20th and was a female. In the case of a male the larva changed into the pupa on the 4th of October, actually cast its skin on that day; and the butterfly appeared on the 14th. In the case of the female the casting of the skin probably took place actually on the 10th. So that ten days is probably the duration of the pupal stage and 18 days would represent the period of larval growth and existence; the whole time from butterfly to butterfly would come to four weeks at the outside under normal conditions, that is when there is plenty of food in the form of young leaves. Very few larvæ are to be found at the beginning of the monsoon or in the hot weather when the climbers begin to put forth young leaves in any number but, later on, in August and September, they are quite plentiful in Karwar. After November-December few young leaves are produced and what happens then is, probably, that most of the eggs laid are parasitized and come to nought or that, larvæ being born, succumb, through insufficiency of nourishment, or from other causes due to exposure, enforced by having to wander in the open in search of the tender food, to the attacks of enemies such as birds, lizards, hymenopterous insects and spiders. So that extraordinarily few eggs laid would result in butterflies which, then, when provender again began to appear in May and June, would only exist in small numbers to continue the cycle. The egg being always laid upon tender shoots and leaves preclude the probability of their lying over and no case has ever come to notice of a larvæ æstivating as those of the genus *Tagiades* are known to do.

(To be continued.)

THE SNAKES OF BOMBAY ISLAND AND SALSETTE.

BY

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(With four plates and a text figure.)

Read before the Bombay Natural History Society at a meeting held on the 19th September 1923.

The layman's chief concern in regard to a snake is as to whether it is poisonous or not. As a rule he is indiscriminating and either increases the distance between himself and the reptile or deals it an exterminating blow after which, if interested, he sends us the mangled remains for identification and report. The victims frequently arrive at the Society's rooms and are examined and reported upon favourably or otherwise. A reference to the Society's records will show that a number of snakes so received are obtained within the limits of the Town and Island of Bombay, and the neighbouring Island of Salsette. I do not mean to imply that these delectable islands are particularly 'snakey' although many people might be misled into believing it when we consider that one of the City's most populous wards is named Nagpada—the hamlet of the Serpent, and that Nagdevi Street is so called after an old serpent shrine. To be exact however, out of over 300 different species of snakes found within the Indian Empire, thirty-six species have been recorded from the Islands of Bombay and Salsette and the surrounding seas. Of these sixteen, including ten sea snakes, are poisonous, the remainder may be classed as more or less harmless to man.

The Terrestial Snakes of these Islands are all species inhabiting the Main Peninsular area of India; by which is indicated that area below the Gangetic plane and exclusive of the Southern and Western Region. Our snakes are the common snakes of the Indian plains. We can lay no claim to any hill species except to a single Pit Viper which has been recorded from Kheneri caves, where the chain of hills that bisects Salsette reaches an altitude of 1,500 feet—the highest point on these islands. The belt of low-lying land under tidal influence which encircles the coast, and also our rivers and creeks afford harbourage to certain acquatic species, found under like condition on the main land. Such snakes as are found within our dwellings will be found in a similar association with the human element in towns and villages of the Main Peninsula.

Snakes are divided into nine families, four of which are represented in the Islands of Bombay and Salsette. We will take them in their natural orders commencing with the lowest forms, the burrowing snakes, and passing to the most highly developed species the Vipers.

BURROWING SNAKES.

The burrowing snakes are poorly represented locally. There are four families of typical burrowing earth snakes but only one of them, the *Typhlophidæ*, is found on these Islands*. Its representative is a little snake which will be commonly found when digging earth in Bombay gardens. At first sight you would probably mistake it for a worm. It has the colour and appearance of an earth worm but if you took it up in your hands you would see its little forked tongue shooting out very rapidly, and if you examined it very carefully you would find that its body was covered with tiny scales. Lay it on the open palm of your hand and it will wriggle away in that typical snake like manner. You are now sure that it is a snake. This is the little blind snake *Typhlops braminus*. The eyes are very small, and protected by semi-transparent shields so as to be scarcely visible. The eyes of a snake are lidless. They vary in size from minute as in burrowing species, to enormous as

* On the road to Powai Lake in August this year I found the remains of a Burrowing Earth Snake (*Silybura sp.* Family *Uropeltidæ*). Identification of the species was impossible. Phipson's Burrowing Snake (*S. phipsoni*) occurs at Thana and very probably in the hilly portions of Salsette.

in some of the tree snakes. They are covered by a transparent cap which is likened to a watch glass. This transparent cap is apparently the lower eyelid which has become joined to the upper lid thus losing all mobility. The same feature is to be seen in certain types of Lizards in which the whole of the lower eyelid is composed of a transparent disc which in certain species fuses with the rudimentary upper lid. Burrowing snakes are said to be degraded members of the tribe which took to this mode of life at the early stage of evolution. In addition to the rudimentary eye of the Blind Snake, examination will reveal that in these snakes the large ventral scales have completely or partially disappeared. These would manifestly be an inconvenience in burrowing, and have therefore been either lost or modified. The food of the blind snake consists of earth worms and also of the larvæ of ants. It is an inoffensive creature and will do no harm.

Boas.

Our next family are the *Boidæ*, *i.e.*, Boas or constricting snakes. The *Boidæ* are divided into two groups or sub-families, one include the Boas and the other the Pythons. The Boas are typically South American, the greatest of the tribe is the giant Anaconda, but certain genera of this subfamily are Asiatic, among these the *Eryx*. Two species of *Eryx* occur locally. The Red Earth Boa, *Eryx conicus*, and the Black Earth Boa, *Eryx jaculus*. Both these snakes occasionally form part of the local snake charmers outfit, particularly the Black Earth Boa. Like the bearded lady this snake is an object of wonder, for we are told that it has two heads—for six months one of these is in active operation, the other being apparently dormant, and at the end of the period the roles are reversed—a great convenience—it were a pity to spoil it but the phenomenon is explainable. The Black Earth Boa is a burrower. Your burrowing snake has apparently no neck, the body looks like a cylinder—the head really resembles the very short tail—the mouth is small and is placed under the projecting snout and is similar in shape and position to the vent, the eyes are hardly in evidence; thus the uncritical observer will have some difficulty in distinguishing the head from the tail. In habit the Black Earth Boa is extremely sluggish. The *Sampwalla* removes it from his little round basket and it lies inert upon the floor but when picked up it will coil itself tightly round your hand. Like all Boas it is a constrictor and kills its prey by crushing it. Rats and mice are its chief victims. Its temper is uncertain, the snake may lie inert and take no notice or it may make a sudden vicious and unexpected snap at you. The young of the Black Earth Snake is very differently coloured to his parent. One killed in Messrs. Phipson & Co.'s godown, Apollo Street, was a pale straw colour with three broad black bands in the vicinity of the tail. The uniform black colouring seems to be assumed with age. The Red Earth Boa (*Eryx conicus*) is sometimes seen with the snake charmer but not commonly, he is a rather handsome snake, brick red in colour rather blotched with white. The unpracticed eye might be misled into mistaking him for a Russel's Viper. He has the same heavy build and a rough imitation of the viper's colour and markings, but if turned on his belly the ventral scales will be found to be typically those of a burrowing snake. They are quite narrow and do not extend completely across the body as do a viper's. Like the black earth boa this species feeds chiefly on rats and mice. So much for the Boas.

Pythons.

The next to be dealt with are the Pythons. Unlike the Boas, the Pythons are typically old world species. The Common Rock Snake or Indian Python (*P. molurus*) is found in Salsette, and I have seen one killed beyond Parel. A specimen 12 ft. long was recently killed at Andheri, the reptile was roused from a hedge by a terrier, and in a very short time the snake had the dog firmly wrapped within its coils; the struggle took place on the edge of a tank, snake and

dog, in a struggling heap, rolled into the water, the cold douche seems to have damped the ardour of the Python who immediately loosed the terrier and in endeavouring to escape was killed. Under suitable conditions the common Python attains the enormous length of 20 feet, but our local specimens never averagebeyond 10 or 15 feet. Locally their chief food appears to be poultry and small animals. Pythons are voracious feeders and are capable of making an enormous meal. They are also capable of long fasts; one kept alive in the Society's rooms refused food for 10 months; his record was however easily eclipsed by an individual in the Paris Zoo who is said to have gone on hunger strike for a period of two years and six months. The power most snakes possess of swallowing prey greatly exceeding their own calibre is remarkably exemplified in the Python. A writer in the *Asian* records having disposed of one that had swallowed a young wild boar, and the Society's journal records an instance of one that had swallowed a 6 feet panther! The distinguishing feature of all snakes is to be found in the structure of the jaws. If one has the opportunity of watching a snake swallowing its prey one discovers that its jaws possess the power of working independently, the right upper and lower jaw may be firmly closed on the victim while the left halves push forward in an attempt to obtain a fresh bite, the jaws of either side push forward alternately till the head of the victim enters the gullet, the muscles and ribs now come into play, the jaws then work in unison till the prey



L

Lower extremity of a Python showing claw-like structures on either side of the vent. They are the terminations of the rudimentary hind-limbs.

is swallowed. The phenomenon is explained by the fact that the two halves of a snake's lower jaw are not rigidly attached to one another in front as is the case with other animals. The long lower jaw bones are connected in front by an extremely elastic ligament which gives them the power of independent action. An examination of a snake's skull also reveals the fact that the lower jaw bones are attached to the skull by ball and socket joints and held in position by means of elastic muscular bands so that in the act of swallowing the mouth can be widely opened. In most snakes, the bones of the upper jaws, and the palate are also mobile. This is not all, to aid the passage of the victim down the body of the snake there is a further peculiarity in the structure of the skeleton. In most animals the ribs rising from the spinal column are normally attached below the body to the sternum or breast bone, now snakes have no breast bone, the mobile ribs are therefore quite free below and are capable of being widely expanded. These pecularities in the structure of a snake account for enormous differences observed in the relative proportion of the captor and its quarry. Snakes do not chew or masticate their food after covering it with saliva, they swallow it entire and the loosely attached and widely distendable jaws, and the expandible ribs are adaptations in its structure which enable it to accomplish the feat easily.

By many the Boas and Pythons are believed to paralise their prey by a supposed power of fascination. It is a belief which must however be discredited. Observation has shown that the majority of animals possess no special fear of snakes; a duck placed in the python's cage will waddle unconcernedly practically into the jaws of the crouching reptile. I have seen a rat in a Russell's Viper cage squat himself amongst the coils of the snake.

Mr. H. M. Phipson has commented on this fact in his notes on the Python in the second volume of the Society's Journal. He writes "The rats on being placed in the cage appeared to take little or no notice of the snake. They would frequently run over the coils in their efforts to find their way out of the cage; and on occasion, when the snake remained quiet for a time they would frequently approach it, smell it, or even bite at it. The hens appeared to have even less instinctive fears of a snake and would if left to themselves for a short time commence scratching and picking up grains in the cage. The crows, on the other hand, showed considerable apprehension of the danger" (Phipson, Journ., B. N. H. S., Vol. II, p. 166).

The only animals that show a decided terror to snakes are monkeys and it has been concluded that human beings have inherited the fear of snakes from their anthropoid ancestors!

The family *Boidæ*, and more especially the Pythons are believed to be the ancestral group from which all other snakes have been derived. Pythons, like some of the burrowing snakes, display unmistakable evidence of their derivation from the more ordinary type of limbed reptile, by their retention, both internally and externally, of the vestiges of the hind limb. In the python a small pair of spur-like structures will sometimes be found in the neighbourhood of the vent, these are the rudimentary hind limbs. They are used by the Python as claspers when pairing (See Fig.)

COLUBRINE SNAKES (*Colubridae*).

Passing over three families of earth snakes, the *Ilysidae*, the *Uropeltidæ* and the *Xenopeltidæ*, of which no representatives have been found in our islands,* we come to that large family of typical snakes, the *Colubridæ*, which numbers the majority of living snakes within its fold. This enormous family is divided into three great groups, the differences being based on the structure of the teeth. Three types of teeth are to be distinguished in snakes: solid teeth, grooved teeth and tubular or "perforated" teeth; in the grooved teeth an open channel or groove runs along the outer surface of the tooth, its object being to convey the

* *Vide* footnote on page 153.

secretion of the poison glands into the wound. The tubular tooth is merely a further development of the grooved variety, the groove being so deep that its sides meet and form a hollow tube: Grooved teeth with the open canal may be situated either in front of the jaws or at the back of the jaws. Tubular teeth are always in front. Colubrine snakes are therefore classed into groups in accordance with the type and position of the teeth. The first group is the Aglypha or solid toothed Colubrines. These snakes, like the pythons, boas and burrowing snakes, have solid teeth and may be regarded as non-poisonous.

But it must be remembered that the distinction correctly speaking is merely one of degree; experiments have proved that snakes of the family *Silyburidæ* (Burrowing Earth Snakes) secrete a certain amount of venom in the parotid glands which, when mixed with the saliva, is sufficiently potent to enable these snakes to paralize their prey, and the same may also be said of snakes of the genus *Zamenis* and *Tropidonotus*; in this respect all Indian snakes may be said to be poisonous, though comparatively few are harmful to man.

The second section of Colubrine Snakes is known as the Opisthoglypha or back-fanged Colubrines, snakes in which one or more of the hindermost teeth are grooved and channelled and connected with a small poison gland. This is quite a small group to which some of our tree and semi-acquatic snakes belong. They are only mildly poisonous, the venom being just sufficient to kill small mammals and birds on which these snakes feed. The last group of Colubrine snakes are the Proteroglypha or the front-fanged Colubrines which are far more venomous and include the deadly cobras, kraits and sea snakes. Representatives of all three colubrine groups are to be found on these islands. The solid-toothed Aglyphous Colubrines include the following genera: *Polyodontophis, Lycodon, Rhabdophis, Macropisthodon, Ptyas, Zamenis, Oligodon, Dendrelaphis* and *Chersydrus*. The Back-fanged Colubrines or Opisthoglypha include the tree snakes *Dryophis* and *Dipsadomorphus* and the two acquatic genera *Hurria* and *Gerardia*. The Proterglyphous or front-fanged colubrines include the three Elapine Genera—*Callophis, Bungarus* and *Naia* (Coral snakes, Kraits and Cobras), and the *Hydrophinæ* (Sea snakes).

Solid-toothed Colubrines (*Aglypha.*)

Let us commence with the solid-toothed snakes or Aglyphids. This series is divided into two sub-families—the *Colubrinæ* or typical snakes and an aberrant division, the *Achrochordinæ*, whose members lead an exclusively acquatic existence.

The first of the *Colubrinæ* to attract our attention is the Common Wolf Snake *Lycodon aulicus*. This is perhaps the commonest snake in Bombay. It is to be found in the busiest centres of the City and is equally common in its suburbs. It is a slender snake, smooth and glossy in appearance, its colour varies from pale to deep glossy-brown, almost bluish-black in certain lights. Its back is ornamneted with slender white rings arranged in pairs. Its lips and under surface are a glossy-creamy-white. This is the snake which is most easily mistaken for the Common Krait, so closely does it resemble the latter in colour and markings. The wolf snake generally takes up its quarters among loose brick work or in the rafters of ceilings, it is a wonderful climber, and very active in its movements, when freshly caught it will struggle vigorously and attempt to bite, but it is easily tamed and after a few days of captivity will submit readily to handling. It feeds chiefly on lizards. Some years ago we received a letter from a member stating that he had killed a snake with legs—the monstrosity arrived and on examination proved to be common wolf snake that had succeeded in swallowing a lizard several sizes too large for it. The victim in its vigorous struggles to free itself had forced its legs through the body of the snake.

Our next species is by no means a common snake in Bombay, we have only a single record of its occurrence. This is Jordon's Polyodont, *Polyodontophis*

subpunctatus, a slender snake, pale brown in colour with a line of black dots along the middle of the back.

Our next genera of Aglyphous snakes are *Rhabdophis and Nerodia*. One of each is found in Bombay, *viz.*, the Buff-striped Keelback *Rhabdophis stolatus* and the Checkered Water Snake *Nerodia piscator*. The Buff-striped Keelback appears to arrive with the frogs on the advent of the monsoon and seems to disappear with them at the close of the rains. During the monsoon it is extremely common in the rice fields and tall grass, in fact it will be found anywhere where its food is plentiful. This consists almost exclusively of small frogs, and it is surprising the number of little frogs that one of these reptiles is able to account for. In disposition it is perhaps the gentlest snake that it is possible to find, even a freshly caught specimen will never attempt to bite, although it will struggle vigorously for freedom. In colour it is a deep purplish-brown, a buff coloured stripe runs along the entire length of each side of its body, the underside is creamy-white, certain individuals have the underside of the throat and lips a bright yellow ; it is a slender graceful long-tailed snake, easily tamed and easily kept in captivity.

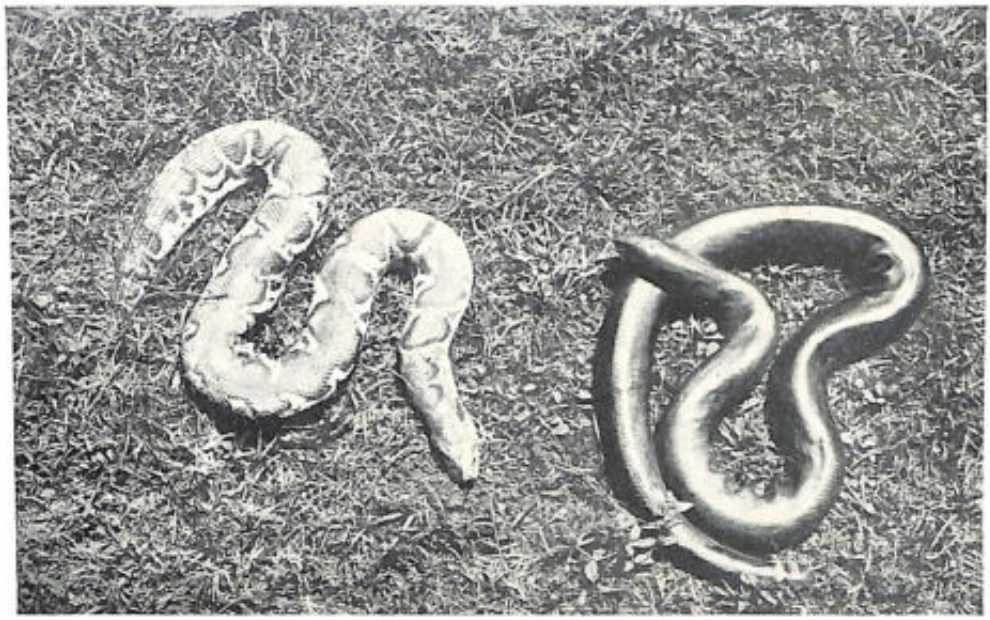
The Checkered Water Snake (*N. piscator*) is the common fresh water snake of all India. It is to be found in almost every pond, tank, or well. Its colouring is difficult to describe as the snake shows a great variation in colour and markings. The ground colour is usually a shade of green irregularly blotched with black, a dark check-stripe is always present running from the eye backwards to the angle of the jaws. The Checkered Water Snake is an active vigorous snake and when caught it will bite readily but, as with most snakes, a few days of captivity suffice to tame its spirit. It is one of the snakes commonly included in the collection of the local Snake-charmer.

Next follows a short, stoutly built, snake known as Green Keelback *Macropisthodon plumbicolor*. The snakes known as keelbacks are so named because in such species the scales covering the back are provided with a longitudinal ridge or keel, sometimes with several keels; in species like the Phoorsa the lateral scales are furnished with serrated keels which being rubbed against one another produce a rustling sound. The Green Keelback is not a common snake in Bombay. We have only records of two specimens. Its colour is uniform grass green, but the young have a special livery of their own, this is rather exceptional as in snakes the young are usually similar in colour to the parent. The young green keelback affects a broad black chevron on the nape of its neck, the hinder portion of this marking is often outlined in bright yellow giving the young snake a handsome and striking appearance. The green Keelback is a ground snake found chiefly in grass land and open spaces. When alarmed it possesses the power of flattening its body to a remarkable extent and lying close pressed to the ground is thus able to escape detection. This power of flattening the anterior portion of the body is possessed by many Snakes and reaches its highest development in the cobra.

Two species of Dhaman or rat snakes are found in these islands, the Common Indian Rat Snake *Ptyas mucosus* and the Fasciolated Rat Snake *Zamenis fasciolatus*.

Local belief credits both these species with being the female cobra. As the cobra is at no loss to obtain a mate of his own species from the plentiful supply available, this slur on the marital relations of the cobras is unwarranted.

The Common Rat Snake is a vigorous fellow that grows to over 10 feet in length. It is quite a common snake in the City and the suburbs. In one of the by-walks of the Victoria Gardens I once interrupted the nuptials of a pair of Dhamans. The colour of this snake varies. Dark brown specimens are met with, sometimes tawny yellow to a light wheat colour, we have had a black Dhaman from Cumballa Hill, the under surface is yellowish white. A distinctive feature in the colouring of the dhaman is the marking of the labials—the



RED EARTH BOA.
(*Eryx conicus*).

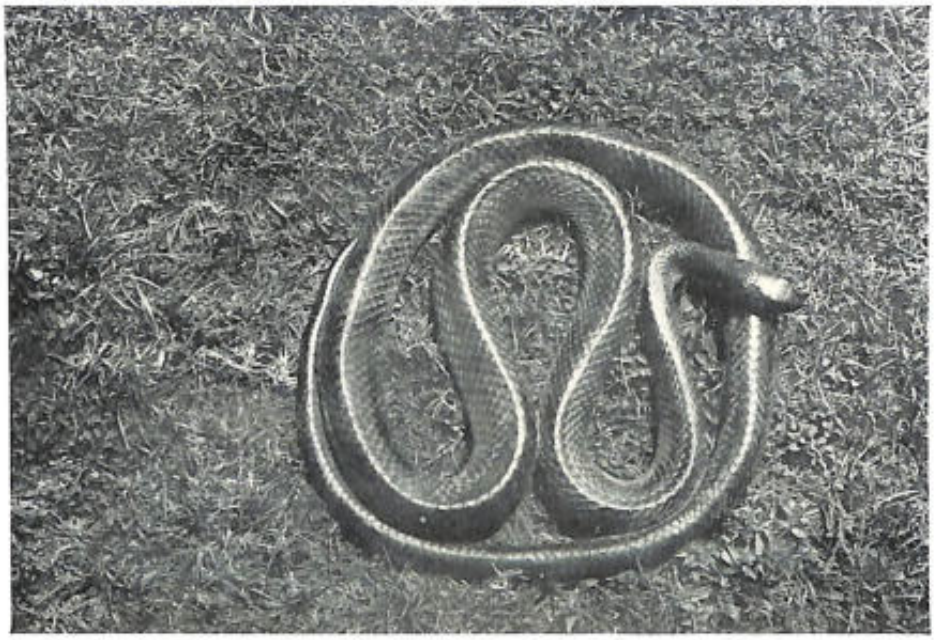
BLACK EARTH BOA.
(*Eryx jaculus*).



THE CHECKERED WATER SNAKE (*Nerodia piscator*).

Photographs of plaster casts in the Prince of Wales' Museum.

(*Photos by C. McCann.*)



THE DHAMAN OR RAT SNAKE (*Ptyas mucosus.*)



THE COMMON KRAIT (*Bungarus candidus*).

Photographs of plaster casts in the Prince of Wales' Museum.

(*Photos by C. McCann.*)

scales covering the lips,—the sides of the throat and belly. Each of these scales is outlined in black, and gives the snake a distinctive appearance, the eyes are large and bright and the neck narrow and distinct. The upper surface of the tail is sometimes covered with a net work of black markings. This is very distinct in some specimens and hardly noticeable in others. The Dhaman is capable of moving over the ground at a terrific speed. Snakes have been described as 'rib walkers.' The under surface of a snake's body is covered with transverse scales called ventrals. Except in burrowing species and sea snakes these scales usually extend right across the body, and under the tail they sometimes divide into a double series. Now each of these large scales corresponds to a pair of ribs, and in gliding, the scales in the fore-part of the body are erected and obtain a purchase on the ground with the aid of the ribs, in such a manner that the rest of the body is drawn up behind. This method of progression explains the climbing power of snakes, and is no doubt true for slow movement but it does not account for the great speed at which certain species are able to cover the ground and it is thus claimed that the action of the muscles alone are quite sufficient to account for the movement of a snake without the ribs having to play any essential part. The Dhaman is a dangerous snake when brought to bay. It will literally fling itself at its attacker and, although non-poisonous, is capable of inflicting a severe wound. The principal food of the Dhaman consists of rats which accounts for its presence among dwellings.

The fasciolated Rat Snake (*Zamenis fasciolatus*) attains a length of about 3 feet and is quite a small snake when compared to the species just described, the colour is brown above, white below, the fore-part of the body is ornamented with cross bars consisting of brown or black spots encircled with white. Often these cross bars are not readily apparent and the snake presents a uniformly brown surface. On account of its general colour resemblance to the cobra, and perhaps also because of its power of flattening the anterior portion of its body when excited, natives speak of this snake as the female cobra.

The next species to be dealt with is that extremely handsome snake *Coluber helena*, the Trinket snake, the young of this species is particularly beautiful, the cross bar ornamentation of the fore-part of its body has been likened to a series of bracelets, each cross bar is composed of a chain of oval white spots outlined in black, these markings disappear towards the tail and in adult specimens are hardly in evidence at all. The ground colour of this snake is in varying shades of brown, there is usually a black stripe radiating from the eye to the lips sometimes two or three of these lip stripes are present. It is not a common snake in Bombay and we have had only one or two records of its presence on these islands. Though occasionally found among dwellings it is really a snake of the jungle. Specimens kept in captivity in our Museum have never survived very long; in disposition they were extremely active and easily roused to anger. Like other species of the genus these snakes kill their prey by crushing it in their coils before swallowing it.

We will now pass to the next genus of snakes the *Oligodon*, two representatives of which are found within our limits—these are the Banded Kukri Snake, *Oligodon arnensis*, and the Variegated Kukri Snake, *O. taeniolatus*; till quite recently the former snake was included under a separate genus *Simotes*, the Gods have now decided that the difference which divided these two genera do not really exist, so both are now combined under the one genus—*Oligodon*, where let us hope they will now remain content and happy. The Banded Kukri Snake (*O. arnesis*) is not very common in Bombay; it is a short smooth snake, the general colour being brown with distinct black cross bars, each of the bars being outlined in colour of lighter tone, the bars are more distinct on the back and break up in the sides of the body; the belly is white but each of the ventral scales have the lateral edges marked with black.

The Variegated Kukri Snake (*O. taeniolatus*) is also uncommon; it is similar in form to its banded cousin ; its marking are however by no means so precise and regular. The prevailing colour is light brown with irregular shaped transverse dark markings, the costals or scales covering the dorsal surface are arranged in 17 rows while in the Banded Kukri Snake these scales are in 15 rows. The method of counting the rows of costal scales in a snake is by no means as difficult a task as one would expect—except of course when these are minute—an examination of these scales will reveal that their arrangement is very regular, being set in a series of transverse rows ; with the point of a pin one is able to easily follow the alignment of a single row and count the number of scales of which it is composed.

The shape, arrangement and character of a snake's scales afford important characters for its classification. The scales covering the dorsal surface of a snake's body are known as costals. Those covering the belly are spoken of as ventrals, while those beneath the tail are described as subcaudals. These subcaudals may form complete plates, when they are described as being 'entire', or may be broken up into a double row of plates, when they are described as " divided. " In the same manner the ventral scales may stretch across the whole width of the belly or they may be much narrower. In the latter instance, as far as our Indian Terrestral species are concerned, the owner may at once be classed as non-poisonous. The shield covering the vent of a snake is known as the anal, it may be 'entire' or divided in two. The scales covering the head of a snake may be similar to those covering the body, as is the case in most vipers, but usually they are in the form of large, flat, juxtaposed shields, the shape, number and proportions of which furnish very important characters for distinguishing the various genera and species.

The local Aglyphous colubrine snakes hitherto described were chiefly ground species. The next snake to be dealt with is a typical tree snake, *i. e.*, the Bronze-backed Tree snake (*Dendrelaphis tristis*). If in peering among the branches of a tree you discover a long brown snake with a rather elongate head, very large golden brown eyes and a creamy yellow belly and a long tapering tail it will probably be an individual of this species. A closer inspection will reveal a yellow stripe running along each flank of the body to the commencement of the tail, and that the neck and fore-part are marked with a series of black streaks. On the back of the snake's head, between the two broad shields known as the parietals, there is a light yellow spot. and at the apex of each scale covering the body there is a minute depression or pit, these depressions are known as the 'apical pits', these pits are said to coincide with the termination of nerve fibres extending along the outer folds of the skin and are of frequent occurrence in snakes, and, in the absence of a satisfactory explanation of their character, have been termed 'Organs of a sixth sense'. Certain snakes are spoken of as 'flying snakes', from their ability to shoot down from a height and reach the ground at an angle, the body being kept rigid during the movement. From the character of its scales the Bronze-backed tree snake is said to include this habit among its accomplishment. Each scale covering the ventral surface of the snake bears a pair of ridges. These ridges have been likened to hinges ; now the space between these ridges can be drawn in, making the belly deeply concave—this concavity of the under surface gives the snake the necessary support in its progress through the air ; in the same manner a split bamboo would be supported if dropped vertically from a height. The Bronze-backed Tree Snake appears to me to be a very gentle snake, a conclusion I have arrived at from observation of specimens kept in captivity. Its principal food consists of lizards.

We have received specimens from Andheri and it will be found in the more wooded portions of Salsette.

The last of the Aglyphous Colubrines to be mentioned is the Rasp-skinned Water Snake, *Chersydrus granulatus*, a member of the subfamily *Achrochordinæ*. As previously stated these snakes are purely aquatic being found in harbours and estuaries in purely salt or brackish water. The Granulated or Rasp-skinned Sea Snake is so called because its entire head and body are covered with close fitting granular scales, by which it may be recognised from other sea snakes whose heads are covered with flat shields. This is one of the commonest sea snakes found in Bombay harbour and is the one most frequently taken in the nets of the fishermen; it is our only non-poisonous sea snake. In common with other sea snakes this species shows the flattened tail and the almost complete absence of ventral scales, both characters being adapted to facilitate swimming.

Back-fanged Colubrines (*Opisthoglypha*).

We will now pass to the Opisthoglyphous or back-fanged Colubrines. Snakes of this class are to be regarded as mildly poisonous and are furnished with grooved fangs situated at the back of the upper jaw. They are divided into two groups—one, *Dipsadinæ*, typical tree snakes, the other, *Homalopsinæ*, contain species found in brackish water or estuaries. Two species of tree snakes are found locally. The Brown Tree Snake, *Dipsadomorphus trigonatus* and the Green Whip Snake, *Dryophis mycterizans*. The Brown Tree Snake is fairly common in Salsette. Its general colour tone is grey, the body being irregularly blotched with brown and white. The chief peculiarity in its colouration is its striking resemblance to the saw-scaled viper (*E. carinata*); we have an example of each of these two widely different species in which the markings of one are an exact replica of the other, a point which bears out the danger of identifying snakes from the point of colouration alone. An examination of the scales will immediately reveal striking points of difference: the viper's head is covered with tiny scales, similar in conformation to those covering the body, the head of the tree snake is covered with flat shields, typical of colubrine species, this point alone will suffice to distinguish these two species.

The Brown tree snake feeds chiefly on lizards and it is a fairly common snake in Bombay and Salsette. The second typical tree snake is the Green whip snake (*D. mycterizans*), a very common species found in gardens within the city and all over Salsette, its colouring is entirely protective, being almost a uniform light green, the snake is most difficult to detect among foliage and its slender whiplike body coiled among the branches aids further in the deception; a further detail in the colouring is a yellow line pencilled along each flank; the head is long and narrow and ends in a pointed snout. Its disposition is fierce, on being disturbed the snake will rear up the fore-part of the body in a series of rigid curves, and widely expanding its jaws will present a most formidable appearance.

Its principal food consists of lizards, though specimens in captivity will feed readily on mice. As an Opisthoglyphous or back-fanged Colubrine, the Green Whip snake is mildly poisonous, the venom secreted in its salivary glands being sufficient to paralyse its victims. These are usually seized by the head, the snake hanging head downwards and darting unerringly at its prey.

The fourth subfamily of Colubrine snakes are the *Homalopsinæ*, they are thoroughly aquatic back-fanged colubrines characterised by the nostrils being situated on the upper surface of the snout.

Two representatives of this group are to be found in our mud flats, estuaries and creeks; the commoner is the Dog-faced Water snake, *Hurria rhynchops*. This snake lives in the mud banks of creeks, rivers and estuaries; it has the power of accommodating itself to fresh or salt water. It feeds on fish. The colour is grey or olive-blackish above with more or less distinct cross bars, the under

surface is whitish with large black blotches and cross bars. The body is stout, the head very small and the snout covered with small shields, the scales being strongly keeled. The second species found locally is *Geradia prevostiana*, Gerard's Water Snake. In colour it is dark olive above and white below with dark edges to the ventral scales.

Front-fanged Colubrines (*Proteroglypha*).

We now came to the most important branch of Colubrine species, *i.e.*, the front-fanged colubrines which includes our deadly poisonous species. In these snakes the anterior teeth in the upper jaw are grooved or "perforated." The 'Proteroglyphous' snakes are divided into two groups, the Elapine snakes, including the terrestrial poisonous species, and the Hydrophine snakes including the sea snakes. To take the land snakes first.

I am afraid our poisonous snakes must at once be put on the blackest of black lists. In all India there are only five land snakes about the deadly virulence of whose poison there can be no question. We are guilty of harbouring 4 of the big five namely the Cobra, the Common Krait, the Russell's Viper and the Phoorsa or Saw Scaled Viper. To the list of our local poisonous land snakes must be added the Green Pit Viper (*T. gramineus*) and a small coral snake (*Callophis trimaculatus*) which has been taken in Bandra and Colaba.

To take the poisonous species individually, no one should need an introduction to the Cobra, he is invariably the star turn in every snake charmer's outfit. Our local species is the typical cobra with the spectacled hood. Calcutta favours the monoccellate variety with a single white circle in the centre of the hood, and in Cutch, Kathiawar and Rajputana the Cobra one meets is usually uniformly black with no pretensions to any markings. Within the City limits the cobra, being a bureaucrat, resides amongst the high Government officials on Malabar hill, if you seek him further afield you will find him in the more plebian vicinity of Parel, and among the suburban villas of Salsette. Although it is possible to find him anywhere the cobra possesses a fondness for taking up his quarters in the neighbourhood of dwellings. Loose brick work, old walls and masonry afford him comfortable quarters and hence he is to be met with in gardens and out-houses. His principal food consists of rats and frogs, but not being averse to a diet of eggs, the proximity of poultry would appear an added attraction.

An extraordinary belief is current not only in India but also in Europe that snakes are in the habit of entering cattle sheds with the object of sucking milk from the cows—the belief provides your *gowlee* or milk man with an excellent explanation for the sudden shortage in the milk supply of a favourite cow or buffalo. The humble gowlee aside, I have had an honest gentleman go red in the face and stoutly maintain that he had actually caught and killed a cobra in the act! May he be forgiven—the feat is materially impossible!

I believe the cobra to be by nature a timid snake. One might meet with an aggressive individual, but, like most snakes, his first impulse on encountering man is escape. If this is denied to him he will probably rear up, expand his hood, and be quite prepared to do you in, but if left alone he will probably retire with good grace. You will recollect the canny individual who distrubed 'Alph Cheem's' morning ablutions and retreated tail first down the bath room drain! Instances are on record of our cobras being able to eject or spit out their venom. There is an African species which makes a habit of this, but the Indian cobra unless exceedingly aggravated does not usually indulge in this much-to-be-condemned practice. It should also be noted that young cobras are from birth quite capable of inflicting a mortal wound, being in tender youth—lively and irresponsible, they are more to be dreaded than their rather staid and sober minded forbears.

The Common Krait (*B. candidus*) possibly needs some description. As I said previously he is so apt to be confused with what is perhaps the commonest nonpoisonous snake in Bombay, *i.e.*, the Common Wolf Snake (*L. aulicus*). Both snakes in life are deep brown in colour. Both are finely marked with linear white rings or arches and the unpracticed eye would have some difficulty in telling t'other from which. A stricter comparison of the two species—a dead Krait is more suitable for this—will reveal certain quite obvious points of distinction. First as regards colour the white linear rings of the Krait will be found to be more in evidence at the tail end of the body, while towards the head they are wider apart and less pronounced. Exactly the opposite holds good in the Wolf Snake. Now look at the scales. In the majority of snakes the scales covering the dorsal surface, known as costals, are mostly uniform in shape and size, but in the Krait and a few other species the central row of scales running along the spine are enlarged and hexagonal in shape and stand out in contrast to their neighbours. This is one of the more obvious points which will serve to distinguish the Krait from Common Wolf Snake, the costal scales are uniformly shaped in the latter species.

Owing to the difficulty of collecting the venom in sufficient quantities the manufacture of antivenine to counteract the effects of Krait poison has not yet been undertaken, in fact the manufacture of an antidote to the venom of any poisonous snake depends entirely on the possibility of obtaining the particular venom in sufficient quantity. The Krait must be regarded as one of our deadliest snakes, yet in disposition, the common Krait may be set down as extremely timid. Col. F. Wall, the greatest authority on the subject in India, believes it to be one of the most inoffensive snakes, and states that it would take a great deal of provocation to make a Krait bite. The writer can corroborate this from first hand experience. Years ago two small boys succeeded in tying a vigorously protesting snake with a small piece of twine to the end of a stick, the operation was performed with much labour and trouble, and the snake brought home in triumph. The triumph was short-lived; authority, declaring the victim to be a Krait, administered deterrent castigation to the victors, but you will admit that the provocation was extreme and the snake without malice. Yet it is certain that a number of deaths from snake-bite in India are caused by the Common Krait. Periodically we have instances of this in Bombay, and quite recently a case, was reported from Parel in the local papers. Locally the Krait would appear to be a common snake, particularly around Parel, Bandra, Santa Cruz and in the outlying portions of Salsette. We also have records of Kraits killed at Malabar hill. The Krait shares with the Cobra a fondness for intrusion into dwellings in which instance it will usually take up its quarters in the roof or the ceiling. From Bandra a few weeks ago we received a battered Krait together with a communication from a gentleman stating that he had caught it in his bed and enquiring as to the suitability of the snake as a bed companion. In replying we endeavoured to make it clear that sleeping with Kraits was unhealthy and, as a practice, greatly to be discouraged. The Common Krait like other members of the genus lives chiefly on snakes. Specimens kept alive in the Society's museum subsisted exclusively on this diet.

The last of our Colubrine poisonous land snakes is a little Coral Snake *Callophis trimaculatus*, a specimen in our collection was taken at Bandra and another from Colaba. Practically nothing is known as regards the poison or the habits of this species. It is a slender snake attaining a length of about 13 inches, the colouring is a light bay, each scale with a brown dot, the head and nape are black with a yellow spot on each side, the belly is a uniform coral red and the tail has two black rings, a distinctive livery which ought not to be difficult to recognise.

As regards the sea snakes probably few of us ever meet with one. On the advent of the monsoon they are occasionally washed up on the beach at Back Bay, and bathers at Juhu might find them cast up in the sands. This does not imply that it is dangerous to bathe at Juhu. There may be dangers but this is not one of them. Sea snakes are not vicious and it is a mercy because they are all poisonous, the commonest sea snake in Bombay, *Enhydrina valakadien*, is said to be 6 times more virulent than the cobra. On an evil day during the monsoon I was inveigled into joining two others who were going out with the fishermen to the fishing stakes at the mouth of the harbour. Two weary hours our boat lay in a heaving sea moored to one of these stakes. The experience is never to be repeated. After an eternity the nets were drawn and the catch placed in the boat. The harvest included a number of sea snakes. These the fishermen seized and cast into the sea. They displayed not the slightest trepidation in handling the wriggling and writhing brutes which made no attempt to bite during their vigorous struggles for freedom.

In the systematic list appended below it will be seen that 10 different species have been recorded. The commonest is *Enhydrina valakadien*, the Jew-nosed Sea Snake, a robust fellow of an olive grey tint with black transverse bands. Another of the commoner species is the Yellow-bellied Sea Snake, *Hydrus platurus*, a very handsome snake this, with a bright orange belly and dark chocolate upper surface. A third species known as the Chittul (*Lioselasma cyanocincta*) heavily built, the head large and the fore part of the body cylindrical, the colouring is greenish olive banded with black. A distinctive trait in the build of many Sea Snakes is the extreme slenderness of the anterior part of the body as compared with the girth further back, the tail is always strongly compressed and paddle-like, all the scales are small and there are often no enlarged ventrals. The eyes are small with round pupils. The colouring of a Sea Snake is protective, as a general rule the dorsal surface is bluish-black, the colour descending to the flanks in bars which are separated by light toned inter spaces, the under-surface is similarly light in tone, the general pattern is said to harmonise with the rippled surface of the ocean, the dark upper surface renders the snake invisible from above; while the light under parts when projected against the light of the sky render it equally inconspicuous to enemies from below.

Vipers (*Viperidæ*).

As regards the Viperine species we are guilty of harbouring three, the Russell's Viper (*V. russelli*), the Saw scaled Viper (*E. carinata*) commonly known as the Phoorsa, and the Green Pit Viper (*T. gramineus*). How marvellously efficient is the poison apparatus of a Russell's Viper! In Viperine snakes it reaches the highest development. It is the specialist's hypodermic syringe '*in excelsis*.' First we have the reservoir in the shape of a large gland situated below and behind the eye for secreting the poison, the needle is represented by the hollow tubular fang, the connection between the needle and the reservoir is supplied by a duct which connects the poison gland to the base of the fang. Spare needles are provided in the shape of fangs situated either below or at the side of the fang proper ready for use should any damage occur to the fang in action. The fang may be erected or lowered at will, and when not in use is folded back and kept safe out of harm. When a snake opens its mouth to strike, the fangs are automatically erected, at the same time the poison gland is compressed by the powerful cheek muscles and the contents driven forward into the duct and down the hollowed fang and out at the opening near the point. You will note the contrivance is perfect and the venom is driven deep into the heart of the wound. In spite of its indescribably sinister appearance the Russell's Viper is really a handsome snake. Its colour is usually some shade of brown, ornamented along the length of the body by three rows or chains of oval spots of a deeper tone. Quite often these markings are finely outlined in white



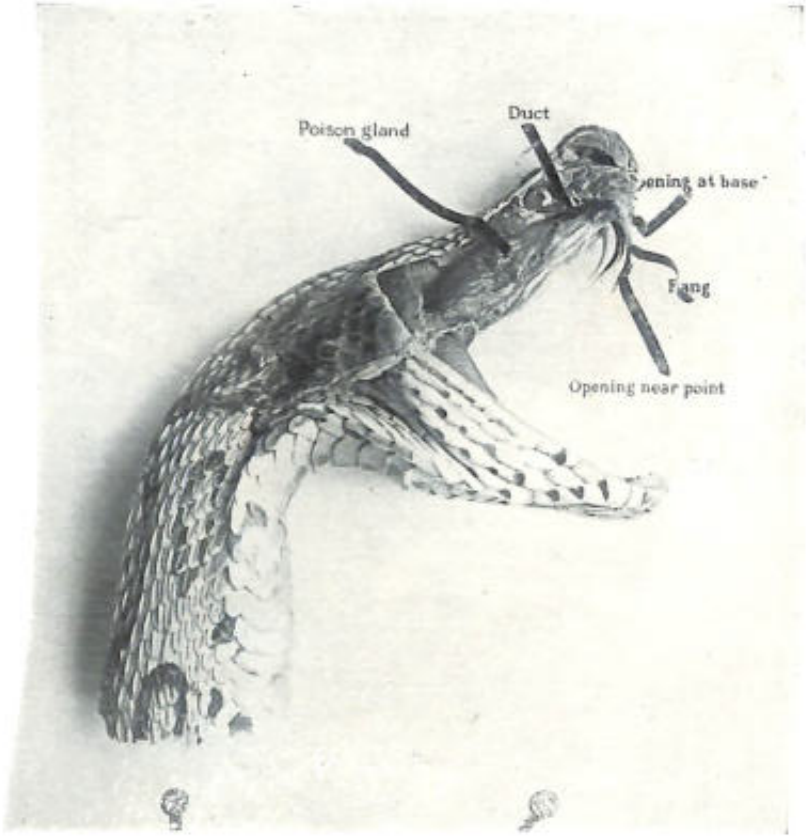
RUSSELL'S VIPER (*Vipera russelli*).



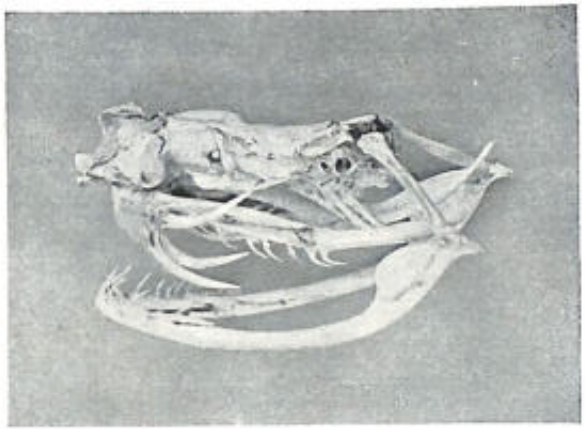
PHOORSA OR SAW-SCALED VIPER (*Echis carinata*).

Photographs of plaster casts in the Prince of Wales' Museum.

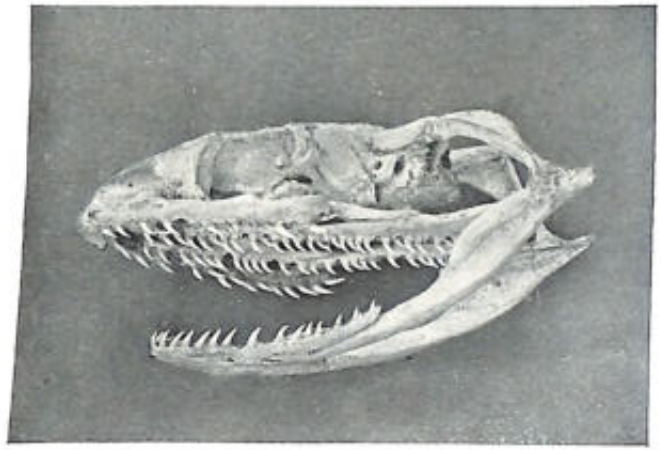
(*Photos by C. McCann.*)



Poison apparatus of Russell's Viper (Lateral view).



Skull of Russell's viper showing fangs that carry the poison.



Skull of checkered Water Snake (*N. piscator*) showing the relatively equal teeth none of which are grooved to carry poison.

Photos of exhibits in the Prince of Wales' Museum.

but our local specimens do not usually show this additional ornamentation. In habit the snake is sluggish and morose showing a disinclination to move from a position it has occupied. It has a fondness for basking in warm sunlight, a habit it shares in common with most vipers. The Russell's Viper may be found anywhere, in fields, paths and open jungle, and often in the neighbourhood of dwellings attracted possibly by the presence of rats. Our records show specimens killed at Parel, Bandra, Andheri and Santa Cruz. It is an extremely prolific species. A gravid female kept alive in the Society's rooms presented the Museum with 60 young, all alive and kicking and all only a few shades less venomous than the parent. The Russell's Viper is one of our deadliest snakes, though cases are on record in which the bite has not proved fatal. Fortunately a serum is now manufactured which combines properties which will effectually counteract both the poison of the Russell's Viper and the Cobra. The serum is available at most Government hospitals and dispensaries and also at the Bacteriological Laboratory, Parel.

The "Phoorsa" or Saw-scaled Viper (*E. carinata*) does not attain a large size locally, rarely over a foot, but there is a great deal of iniquity within that small compass. One cannot say that it is a common snake locally. We have examples from Bandra, Andheri and Santa Cruz. The name Saw-scaled is derived from the fact that each of the tiny scales covering his flanks is provided with a central serrated, saw-like, ridge. When disturbed the snake adopts a pose which is characteristic. A reference to the accompanying photo will illustrate the snake's position in attack; when in this position the coils are continuously in motion rubbing against one another bringing the rough keeled scales into contact and producing a rasping sound which is quite audible. The demonstration is accompanied by continuous hissing, rapid vibration of the tongue, and a vicious darting forward of the head, the pose expressing the very embodiment of the motto '*Nemo me impune lacessit*' (Apologies to all Scotchmen). It is extraordinary how many people still believe that a snake's tongue is its 'sting.' The narrow forked tongue which the snake often protrudes is the seat of the sense of touch. It is often exerted with a rapid motion, sometimes with the object of feeling some object, as when a snake is examining its victim preliminary to swallowing it, and sometimes under the influence of anger or excitement. The colouring of the Phoorsa varies considerably and is generally in harmony with its surroundings. Our local specimens vary from reddish-brown—the colour approximating red earth—to a pale-buff. The back is irregularly blotched with markings of a deeper tone. Its disposition is vicious in the extreme, and it will bite on the smallest provocation. Specimens we have kept in captivity would hiss and strike at people merely standing by the cage. Their food in captivity consisted chiefly of mice and as an occasional relish, a centipede or a scorpion. The *Echis* is essentially a snake of open sandy places. Locally it will be found in fields, often in paths. Going to the Railway station from the Volunteer camp at Santa Cruz we discovered one of these snakes on a road adjoining the camp—death lurking in a path trod bare by many feet. Another that I met in Andheri was in the process of enjoying an afternoon nap on a bit of corrugated zinc forming the roof of a hen coop. The zinc was hot to the touch and the snake basking in the hot sun evidently enjoyed the added warmth from below—but he could not have approved of the terrific bang I caught him as he slept. As stated previously the saw-scaled viper has a very good mimic in the Brown Tree Snake (*D. trigonata*).

The Green Pit Viper (*T. gramineus*) in our area is probably restricted to the hilly portions of Salsette. A specimen was killed at the Kheneri Salsette Caves during the monsoons in 1920. The snake is easily recognised by its bright almost uniform green colouring, and its typical blunt viperine head covered with small scales and the 'pit' or hole between the eye and the nostril. In

habits it is almost entirely a tree, or more correctly bush, haunting species where its green colouring harmonises with the foliage, making it very difficult to detect. Green Pit Vipers we have kept in captivity in the Society's Rooms fed very readily on mice. The snake lies coiled on a branch with the head poised downwards and darts with lightning rapidity at its victim as it passes below. The mouse is held firmly in the snake's jaws until it's struggles have ceased, after which the swallowing process commences. The method adopted is in marked contrast to the tactics of the Russell's Viper. That snake lies coiled in the corner of its cage and as soon as its prey comes within range the viper strikes and immediately releases its hold and takes no further interest in the proceedings, the snake appears to realize that its victim once injected with the fatal venom cannot be lying far off. It is only after the lapse of some time that the snake commences the search for its prey.

Books on Snakes.

Appended is a systematic list of the snakes of Bombay and Salsette, in each instance I have given references to the literature in which descriptions of the appearance, habits, etc. of the species mentioned will be found. I have restricted these references to two works which are accessible to local Residents *viz.*, the Fauna of British India "Reptilia" by G. A. Boulenger, and Col. Wall's Serial on the Common Indian Snakes which appeared in the Society's Journal. The latter is profusely illustrated with coloured plates and diagrams. A simple chart for distinguishing poisonous from non-poisonous snakes has also been issued by the Society which will be found very useful as it helps those not fully conversant with the subject to recognise a poisonous from a non-poisonous species. There have been so many instances of people dying from sheer fright after having been bitten by a non-poisonous snake that a small chart readily understandable by the laymen will be found invaluable in instances of this nature. Col. Wall's "Poisonous Terrestrial Snakes" of India, which gives in greater detail the descriptions of Indian Poisonous Land Snakes, is profusely illustrated with diagrams, and further deals with symptoms of snake poisoning and its treatment, is a work which should be in the hands of every doctor or layman in this country. Copies of the chart may be had on application to the Society.

Treatment of Snake Bite.

To the series of nostrums, charms, and mantras reputed to be sure and certain cures for snake bite there is no end. That a bite from any of our deadly poisonous species does not always prove fatal is certain, in such instances circumstances have generally prevented the victim from being injected with a fully lethal dose. Similarly people bitten by quite harmless snakes have submitted themselves to treatment whereby another marvellous 'recovery' is reported in the local press.

In the serum treatment for snake-bite science has provided a remedy against the venom of certain snakes. Unfortunately the specificity of different snake poisons is such that the serum prepared from the poison of a given species is only potent against the venom of that particular species. Therefore in India we should require at least 6 different antivenines, *viz.*, serums for the Cobra, King Cobra, the Krait, the Banded Krait, the Russell's Viper and the Phoorsa. The impossibility of collecting poisons of all these species in sufficient quantities for the purpose of immunisation of large animals prevents the manufacture of antiserums for these snakes with the exception of two, the Russell Viper and the Cobra. At the Pasteur Institute, Kasauli, a polyvalent serum is now prepared with a mixture of equal parts of Cobra and Russell Viper venoms. This serum is highly efficacious for both the poisons from which it is prepared but would be of little or no value for the bites of other Indian Poisonous Snakes. It is the only antivenine issued from this institute. Little is known in Bombay of the

facilities available locally for immediate treatment in cases of snake bite. I am indebted to Dr. D. A. Turkhud for the following note :—

"It is not generally known that the treatment with antivenine for cases of Snake-bite is available at the Bombay Bacteriological Laboratory, Old Government House, Parel, and that such patients are received there for treatment at any hour of the day or night. A number of cases of snake-bite are successfully treated in the Laboratory every year.

FIRST AID.

But before a case of snake-bite is sent, it is very necessary to see that a preliminary precaution is taken to prevent the injected venom from being rapidly absorbed into the body of the patient. This should be effected by applying a ligature at once to the limb above the seat of bite. A piece of bandage or a handkerchief should be used for this purpose, but it is well to remember that the ligature should be placed above the part of the limb which contains double bones. Thus, in the upper extremity the handkerchief should be tied above the elbow, while in a person bitten on the leg, the ligature should be placed above the knee-joint.

After this first aid has been rendered, the patient should be sent to the Laboratory with the utmost despatch, and if possible, a telephone message should also be communicated to the Laboratory (*Telephone No.* 40979) advising that a case of snake-bite is being sent for treatment. The snake if secured, alive or dead, should also accompany the patient.

The treatment consists of injections of antivenine given either subcutaneously or intravenously according to severity of the symptoms. The antivenine is efficacious against the venom of Cobras and Russell's vipers only ; it is of no use against the bites of Kraits and Phoorsas.

Antivenine is kept in the Parel Laboratory for the treatment of cases only, and is not available for sale. Should any one wish to purchase it, he should indent for it direct from the Central Research Institute at Kasauli, near Simla, where it is manufactured. In every case, after recovery, slight sloughing invariably occurs at the site of bite ; this should be treated with ordinary antiseptics.

The treatment of snake-bite with permanganate of potassium is not to be recommended ; the experiments conducted by the late General Bannerman, I.M.S., have conclusively proved its inefficacy.

Sub-Order.—OPHIDIA.

Family.—*TYPHLOPIDÆ.*

Typhlops braminus (Daud.) *Common Blind Snake.*

Typhlops braminus (Daud.) Boulenger, Fauna of British India, Reptilia, p. 236 ; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXV, p. 378. Description and coloured plate.

Bombay (A.M. De Cruz) ; Bandra, Bombay (B. N. H. S. coll.); Girgaum, Bombay (P. F. Gomes) ; Colaba, Bombay (S. H. Prater) ; Bandra, Bombay (H. M. Phipson, Journ., Bom. Nat. Hist. Soc., Vol. I, p. 84 ;f *ibid*, Vol. III, p. 49).

Form.—Worm-like ; body covered with minute cycloid scales. Scales 20 round the body. Length 6-7 inches.

Colour.—Brown above, pale beneath.

* *Distn.*—*S. America.* Mexico. *Africa.* South of the Equator. *S. Asia.* Arabia to S. China and Coastal Islands. *Islands of the Indian Ocean.* Madagascar. Comoro. Mauritius. Cocos. Ceylon. Andamans. *Malay Archipelago.* Java. Borneo. Celebes. *Pacific Islands.* Ceram. Philippines. Guam. Formosa. Loo Choos. (Wall.)

* The *Distribution* notes are quoted from Col. Wall's "Hand list of Snakes" which contains the most recent information available in this respect.

Family—BOIDÆ.

Sub-Family—*PYTHONINÆ.*

Python molurus (Linn.) *The Indian Python or Rock Snake.* "Harr"

P. molurus (Linn.) Boulenger, Fauna British India, Reptilia. p. 245, Wall, Common Snakes of India. Journ., Bom. Nat. Hist. Soc., Vol. XXI, p. 447, Description and coloured plate.

Andheri Salsette (S. H. Prater), Bombay (H. M. Phipson, Journ. Bom. Nat. Hist. Soc., Vol. III, p. 49).

Form.—Massively built, head flat, snout long, skin smooth and glossy, tail short and rapidly tapering. Length up to 20 feet, average 10-12 feet. Scales 60-75 rows, ventrals 242-265, subcaudals 60-72.

Colour.—Yellowish, above, with a series of reddish-brown black-edged spots or blotches.

Distn.—Ceylon. Peninsular India. To the extreme limit of Sind. (Habb River). *Bengal Himalayas.* Dehra Dun to Sikkim. *Assam. Burma. Siam S. China and Coastal Islands. Malay Peninsula? Malay Archipelago?* Java. (Wall.)

Sub-Family—*BOINÆ.*

Eryx conicus (Schneider). *The Red Earth Boa.*

Gongylophis conicus (Schneid.) Boulenger, Fauna Brit. India Reptilia,, p. 247, Fig.

Eryx conicus (Schneid.) Wall, Comm. Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXI, p. 2 descript. and coloured plate. Bombay (B. N. H. S. coll.); 2 Colaba, Bombay (Major Winter, R.A.M.C.); Parel, Bombay (Col. Bannerman); Colaba, Bombay (Lt. Jenkins, R.G.A.,); Santa Cruz, Salsette (R. W. Dunlop); 2 Bombay (H. M. Phipson, Journ., Bom. Nat. Hist. Soc., Vol. III, p. 49); Bombay (Major Ward); Bombay (M. Chadwick); Bombay (Mr. Montgomery); Santa Cruz (Major H. R. James).

Form.—Stout, body short and heavy, tail short and blunt, skin rough owing to keeled nature of scales particularly above the tail. Length 2 feet 9 inches. Scales in 40-55 rows, ventrals 162-196, subcaudals 16-24.

Colour.—Reddish-brown with a broad zig-zag pattern or series of dark-brown, black-edged spots on the back. Lower surface creamy.

Distn.—Peninsular India. South of the Himalayas. *Baluchistan.* Fort Munro. (Bombay colln.) *Sind.* Larkana. (Bombay colln.) *Ganges Valley.* Allahabad. Palair. Boxar, Naini Tal Dist. (Ind. Mus.) Behar. (D'Abreu.) *Lower Bengal.* Singbhum. Manbhum. Chaibassa. (Ind. Mus.) *Ceylon?* Trincomalee? (Bombay colln.) (Wall)

Eryx jaculus (Linn.) *Black Earth Boa.* "Dō moo samp".

Eryx johnii (Russ.) Boulenger, Fauna Brit. India Reptilia, p. 248. Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXI, p. 12. Coloured Plate.

2. Apollo Street, Bombay (B. N. H. S. coll.); Victoria Gardens, Bombay (J. M. Doctor); Bombay (H. M. Phipson, Journ., Bom. Nat. Hist. Soc., Vol. III, p. 49.)

Form.—Stout, head small, not distinct from neck, snout projecting; tail short and blunt. Scales midbody 47-65, ventrals 189-213, subcaudals 18-37. Length 3 feet 7½ inches.

Colour.—Adult, uniform black, young straw-coloured with indistinct transverse dark bands, 3 transverse bands usually distinct on the tail.

Distn.—Peninsular India. South of the Himalayas. *Baluchistan.* Hanna. Duki. (Quetta Mus.) *Sind.* Karachi. (Ind. Mus.,) Larkana (Bombay colln.). *Punjab.* Rajanpur. Pind Dadun Khan. (Ind. Mus.) Multan. Jullunder. Delhi. (Bombay colln.) Jhelum. (F. W.) *U. P.* Agra. (Ind. Mus.) Lucknow. (Bombay colln.) (Wall.)

Family—COLUBRIDÆ.

Sub-Family—*ACROCHORDINÆ.*

Chersydrus granulatus (Schneider). *Rasp-skinned Water Snake.*

C. granulatus (Schneider) Boulenger, Faun. Brit. India, Reptilia, p. 335.

4 Bombay Harbour (S.H. Prater); 2 Bombay (B.N.H. S. coll.) 3 Bombay Harbour (H. M. Phipson, Journ. B. N. H. S., Vol. III, p. 49. Bombay Harbour (C. McCann.)

Form.—Body compressed stout, covered with small rhomboidal scales, about 100 round midbody, tail flat, paddle like, covered with small scales like body. Length 4 feet.

Colour.—Dark olive with pale rings.

Note.—Common in the harbour. Often washed ashore during the monsoon.

Habitat.—Coasts of India, from Bombay on the Malabar Coast and Hijli on the Coromandel coast to Tuticorin, coast of Ceylon, Burma, Andamans, Malay Peninsula to Cochin China, Malay Archipelago Papausia (Wall).

Sub-Family—*COLUBRINÆ.*

Nerodia piscator (Schneider). *The Checquered Water Snake.* "Pani Samp"

Tropidonotus piscator (Schn.) Boulenger, Fauna Brit. India Reptilia, p. 349; Wall, Common Snakes of India, Journ. Bom. Nat. Hist. Soc., Vol. XVII. p. 857.

Bombay (Col. Light); Bombay (P. M. D. Sanderson); Andheri, Salsette (K. R. Rane); Cumbala Hill, Bombay (Hon'ble Hill Trevor); Ghatkopar Salsette (H. Wise); Santa Cruz, Salsette (R. W. Dunlop); Andheri, Salsette (S. H. Prater); Bombay (Prof. J. P. Mullan); Malabar Hill, Bombay (Mrs. Bowen); 7 Bombay, H. M. Phipson. (Journ., Bom. Nat. Hist. Soc., Vol. I, p. 5; *Ibid* Vol. III, p. 51 *T. quincunctiatus.*)

Form.—Head oval, neck narrow, body stout, ridged owing to keeled condition of scales, tail round long and tapering. Scales in 19 rows ventrals 125 to 144, subcaudals 58 to 90. Length 4 feet 10½ inches.

Colour.—Variable, Ground colour dull green, olive green, olive brown, or brown of almost any shade dark or light. Some individuals are uniformly coloured, some show a checquering usually of black in the form of specks, spots or blotches.

Note.—Found in tanks, wells, streams and inundated rice fields.

Habitat.—Ceylon. Peninsular India. To Baluchistan in the extreme North-West. *N. W. Frontier.* To Malakand. *Western and Eastern Himalayas. Assam.* Abor Hills. *Burma.* As far North as Mansi, and Bhamo. *Andamans. Malay Peninsula. Siam. Indo-China. China* As far North as Fokien. *Malay Archipelago.* Sumatra. Borneo Java. *Formosa.* (Wall.)

Rhabdophis stolatus (Linn.) *Buff-striped Keelback.* "Nanati".

Tropidonotus stolatus (Linn.) Boulenger, Fauna Brit. India Reptilia, p. 348; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XX, p. 603. Description and coloured plate.

Sion, Bombay (B. N. H. S. coll.); Bombay (B. N. H. S. coll.); Santa Cruz, Salsette (Mr. Framjee); Andheri, Salsette (S. H. Prater); Bombay (N. B. Kinnear); Santa Cruz, Salsette (Col. Forbes).

Form.—Slender graceful with a long tapering tail; eye large and round, iris golden; skin rough owing to keeled scales. Scales in midbody 19 rows, ventrals 125-161, subcaudals 50-85. Length 2 feet 6 inches.

Colour.—Brown of various shades deep to light, a buff stripe beginning at the neck runs along each flank to the tip of the tail, cross bars of deeper tone more or less in evidence, lips orange yellow.

Notes.—Common during rains, grass lands, inundated fields, gardens, mostly in proximity of water.

Distn.—Ceylon. Peninsular India. Up to about 5,000 feet. As far North as Sind. *N. W. Frontier.* (Malakand F. W.) *Himalayas. Assam.* North and South of the Bramaputra. *Burma.* As far North as Myitkyina. (Lat. 260° Long. 96·3°). South to Tenasserim. *Andamans. Nicobars. Malay Peninsula. Siam. China.* Yunnan. *Formosa. Philippines.* (Wall.)

Polyodontophis subpunctatus (Dum. & Dibr.). *Jerdon's Polyodont.*

P. subpunctatus (Dum. & Dibr.) Boulenger, Fauna British India Reptilia, p. 303.

Bombay (S. D. Navalkar).

Form.—Head short, indistinct from neck, eye small with round pupil, body smooth and slender. Scales 17 rows; ventrals 151-220; subcaudals 47-76. Length 17 inches.

Colour.—Pale brown above with a line of black dots along middle of back; a dark line or series of dots along flanks, head black, lips yellowish, bands of yellow above and below nape, belly scales flanked with black dots.

Note.—Rare locally.

Distn.—Ceylon, Peninsular India. South of Rajputana, and South of the Ganges Valley. (Wall.)

Macropisthodon plumbicolor (Cantor). *Green Keelback.*

Tropidonotus plumbicolor (Cant.) Boulenger, Fauna. Brit. Ind., Reptilia, p. 351.

M. plumbicolor (Cant.) Wall, Comm. Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVII, p. 1, descript. and col. plate.

Parel, Bombay (Parel Laboratory); Bombay (B. N. H. S. coll.).

Form.—Stout, tail short and tapering rapidly, skin rough owing to keeled scales. Scales 23-27 rows, ventrals 144-160, subcaudals 35-50. Length the 2½ feet.

Colour.—Uniform dull green with faint black markings, young with broad chevron-shaped collar bordered posteriorly with bright yellow.

Notes.—Rare. In grass land.

Habitat.—India. Peninsular India. Except the Ganges Valley. In or near elevated terrain usually up to 7,000 feet. *Punjab.* Ambala (Stoliczka). *Sind.* (Murray.) *Ceylon.* (Wall).

Lycodon aulicus (Linn.). *Common Wolf Snake.*

Lycodon aulicus (Linn.) Boulenger, Fauna British India, Reptilia, p. 294; Wall, Common Indian Snakes, Journ., Bom. Nat. Hist. Soc., Vol. XIX, p. 87. Description and col. plate.

2 Bombay (B. N. H. S. coll.); Byculla, Bombay (S. H. Prater); Fort, Bombay (S. H. Prater); Colaba, Bombay (S. H. Prater); Cumballa Hill, Bombay (Raojee Kaneria); Girgaum, Bombay (P. F. Gomes); Malabar Hill, Bombay (W. S. Millard); Bombay (Capt. F. Hutchinson); Govt. Dock Yard, Bombay (B. N. H. S. coll.); Cumballa Hill, Bombay (E. C. Acworth); Apollo Street, Bombay. (Phipson & Co.); Malabar Hill, Bombay (G. A. D. Macbain); Bombay (In horse's shoe); Andheri, Salsette (W. F. Rutherford); Andheri, Salsette (S. H. Prater); Bombay (Mr. F. Powell); Malabar Hill (Mr. Harter); Bombay (Prof. J. P. Mullan).

Form.—Head, flat, snout, flat and depressed with swollen lips, spatulate in adult, body slender, skin smooth. Scales in 17 rows; ventrals 183-209, subcaudals 57-77. Length 2 feet 4 inches.

Colour.—Variable, uniform chocolate-brown with white linear bands or reticulations, lips white or spotted, belly white.

Notes.—Commonest snake in the locality, even in most populous areas in houses, store rooms, godowns and gardens.

Habitat.—Ceylon. Peninsular India. Sind. Larkhana. (Bombay colln.) *Himalayas.* Kulu to Sikkim. *Assam.* As far North as Dibrugarh. *Burma.* As far North as Myitkyina. South to Tenasserim. East to Shan States. *Andamans. Nicobars. Malay Peninsula. Indo-China. China.* Yunnan. Southern Provinces and neighbouring Islands. *Malay Archipelago.* Java to Timor. *Philippines.* (Wall.)

Ptyas mucosus (Linn.) *Dhaman or Common Rat Snake.*

Zamenis mucosus (Linn.) Boulenger, Fauna. Brit. India, Reptilia, p. 325; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVII, p. 272. Description and coloured plate.

2 Bombay (N. H. S. coll.); Cumballa Hill, Bombay (Mrs. Monteath); Malabar Hill, Bombay (W. S. Millard); 1 Mahim, Bombay (11 feet 9 inches J. W. Mason); 1 Bombay (E. R. Jackson); 1 Cumballa Hill, Bombay (Uniform black, B. N. H. S. col.); 1 Parel, Bombay (Col. G. Liston); Victoria Gardens, Bombay (*in copula* S. H. Prater, July); Andheri, Salsette (F. Hearn); Santa Cruz, Salsette (R. W. Dunlop); Borivili, Salsette (S. H. Prater); Bombay, (Prof. J. P. Mullan); 6 Bombay (H. M. Phipson, Journ., B. N. H. S., Vol. I, p. 4; *ibid* Vol. III, p. 51).

Form.—Head elongate, eye large and lustrous, body robust, tail long and tapering, skin smooth. Scales 17 rows, ventrals 180-213; subcaudals 95-146. Length 11 feet 9 inches, average 6-8 feet.

Colour.—Variable. Yellowish-brown, light wheat colour, a deep brown to black. Frequently black markings on posterior part of body. Scales of lips, sides of throat, belly and tail edged with black.

Notes.—Common. Fields, and in neighbourhood of dwellings.

Habitat.—Ceylon. Peninsular India. To the Himalayas. *Sind. Baluchistan. Afghanistan. Transcaspia. Assam.* North and South of the Brahmaputra. *Burma, Andamans. Malay Peninsula. Indo-China, S. China.* Including neighbouring Islands and Formosa. *Malay Archipelago.* Java. (Wall.)

Zamenis fasciolatus (Shaw). *Fasciolated Rat Snake.* "Nagina".

Zamenis fasciolatus (Shaw). Boulenger, Faun. Brit. India, Reptilia, p. 327; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXIII p. 34. Description and coloured plate.

1 Bombay (S. D. Navalkar); 1 Santa Cruz, Salsette (R. W. Dunlop); Parel, Bombay (Col. Glen Liston); 1 Juvem, Salsette (Col. Kirtikar). 1 Powai, Salsette (S. H. Prater).

Form.—Snout projecting, body, round and smooth. Scales 21-23 rows, ventrals 191-232, subcaudals 73-88. Length 3½ feet.

Colour.—Ground colour: Brown, dark to light yellowish with narrow black cross bars edged in white. Adult uniformly coloured or marking usually evident in the posterior part of the body ; belly and lips white or yellowish.

Notes.—Not common. Locally spoken of as the female cobra.

Habitat.—Ceylon. Peninsular India. To the base of the Himalayas. To Calcutta in the N. East. To the Punjab in the N. West. (Ambala, Bombay colln.) (Wall.)

Coluber helena (Daud.) *The Trinket Snake.*

C. helena (Daud.) Boulenger, Fauna Brit. India, Reptilia, p. 331; Wall, Common Snakes of India, Journ., om. Nat. Hist. Soc., Vol. XXII, p. 22. Description and col. plate.

1 Bombay (. N. H. S. coll.) ; 1 Bombay (Revd. Fr. Dreckman).

Form.—Head narrow, snout blunt, body compressed. Scales 23-27 rows, ventrals 217-265, subcaudals 73-100. Length 5 feet 3 inches.

Colour.—Adult brown with cross bands of squarish black spots, a vertical black streak below eye, oblique streak behind eye. Young pale brown with black cross bands supperposed with chains of white spots.

Note.—Not common locally.

Habitat.—Ceylon. Peninsular India. To Sind in the North-West, and Jalpaiguri Dist. in the North-East. *Western Himalayas.* Almora District. (F. W.) *Assam.* Naga Hills. (Samaguting. Ind. Mus.). (Wall.)

Dendrelaphis tristis (Daud.) *Indian Bronze-backed Tree Snake.*

Dendrophis pictus (Gm.) Boulenger, Fauna rit. India, Reptilia, p. 337.

Dendrelaphis tristis (Daud.) Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XIX, p. 775. Descrip. and col. plate.

Andheri, Salsette (B. N. H. S. col.). Andheri, Salsette (S. H. Prater.)

Form.—Head distinct from neck, eye large with round pupil, body long, smooth and slender, belly with marked ridges along either side, tail long and tapering. Scales in 15 rows, ventrals 163-205, subcaudals 110-150. Length 4 feet 4 inches.

Colour.—Bronze. A yellow stripe along the flanks from the neck to commencement of the tail.

Note.—Tree snake. In tree and scrub jungle. Uncommon.

Habitat.—Ceylon. Peninsular India. As far North as Sind (Brit. Mus.) *Bengal.* Jalpaiguri Dist. Kalna. (F. W.) *Eastern Himalayas* Darjeeling Dist. *Burma.* Mergui (Nos. 7684 and 7685, Ind. Mus.) (Wall.)

Oligodon arnensis (Shaw). *Banded Kukri Snake.*

Simotes arnensis (Shaw). Boulenger, Fauna Brit. India, Reptilia, p. 314. Wall, Common Snakes of India ; Journ., Bom. Nat. Hist. Soc., Vol. XXII, p. 749, Descript. and col. plate.

Bombay (B. N. H. S. coll.) ; Bandra, Bombay (N. B. Kinnear) ; Ville Parle, Salsette (Prof. J. P. Mullan). Bandra (A. Kirke Smith) ; Santa Cruz (Salim Ali).

Form.—Head short not distinct from neck, eye small with round pupil, body cylindrical. Scales smooth in 17 rows, ventrals 164-202, subcaudals 41-59. Length 24 inches.

Colour.—Greyish brown with regular black cross bands, an angular black band on the upper surface of the head between the eyes succeeded by a band on the back of the head and a third on the collar. Lower surface uniform yellowish.

Notes.—Uncommon.

Habitat.—Ceylon. Peninsular India. To Dera Ghazi Khan. (Bombay colln.) *N. W. Frontier* (Bannu. F. W.) *Western Himalayas.* Almora Dist. (F. W.) *Eastern Himalayas.* Nepal to Sikkim. (Wall.)

Oligodon taeniolatus (Jerd.) *Variegated Kukri Snake.*

Oligidon subgriseus (D. & B.). Boulenger, Fauna Brit. India Reptilia, p. 321; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XIX, p. 55. Descript. and col. plate.

2 Bombay (B. N. H. S. coll.); Bombay (Revd. Fr. Dreckman.)

Form.—Head short, body slender and rounded, the girth being evenly maintained throughout the body, tail short. Scales smooth in 15 rows, ventrals 160-218, subcaudals 38-56. Length 19 inches.

Colour.—Variable. Prevailing tone buff to brown with irregular shaped transverse dark markings.

Habitat.—Ceylon. Peninsular India. To Sind, Baluchistan, and N.W. Frontier. In the North-East to Bengal. (Karagola, Purnea Dist. Ind. Mus.). *Western Himalayas.* Garhwal Dist. (Dhikala. Ind. Mus.) (Wall.)

Series.—OPISTHOGLYPHA.

Sub-Family.—*HOMALOPSINÆ.*

Hurria rhynnchops (Schneider). *Dog-faced Water Snake.*

Cerebrus rynchops (Schn.), Boulenger, Fauna Brit. India, Reptilia, p. 374; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXVI, p. 89. Descrip. and col. plate.

1 Bombay (B.N.H.S. coll.); 1 Bombay (F. Spencer); 1 Bombay (B.N.H.S. coll); Juvem, Salsette (C. McCann); Mazagon, Bombay (E.R. Jackson); Bombay (Prof. J. P. Mullan); Juvem, Salsette (Revd. Fr. Dreckman); 4 Bombay Harbour (H.M. Phipson, Journ. B. N. H. S., Vol. III, p. 50); Bandra, Bombay (Mr. Kirke Smith); Backbay, Bombay (C. McCann).

Form.—Head narrow in front, swollen at the back, body stout, skin rough owing to keeled scales, tail short tapering rapidly to a blunt point. Scales 21-25 rows, ventrals 132-156, subcaudals 49-72. Length 3 feet 3 inches.

Colour.—Grey olive or blackish with black cross bars; lower parts white with black blotches.

Notes.—Common in local creeks and on the mudflats in fresh or salt water.

Habitat.—Coasts and tidal Rivers from Bombay to Indo-China. *Ceylon. Andamans. Nicobars. Malay Archipelago.* Sumatra to Celebes. Philippines. *Formosa.*

Gerardia prevostiana (Eyd. & Gerv.). *Gerard's Water Snake.*

G. prevostiana (Eyd & Gerv.) Boulenger. Faun. Brit. Ind., Reptilia, p. 379.

Backbay, Bombay (J. Mann.); Versova, Salsette (A. Coirodi); Chaupati Sands (Prof. J. P. Mullan); Sion, Bombay (Prof. J. P. Mullan).

Form.—Head small not distinct from neck, eye small with vertical pupil, body cylindrical, smooth scales in 17 rows, ventral 146-158, subcaudals 31-34.

Colour.—Above uniform dark olive, lower portion of sides whitish, belly white with dark edges to the scales.

Distn.—Coasts and Rivers of India. Alibag. (Bombay colln.) Bandora. (Brit. Mus.) Cannanore. (F.W.) *Burma.* Rangoon. (F.W.) Pegu. (Brit. Mus.) Amherst. (Ind. Mus.) *Ceylon.* Kelani River.

Sub-Family.—*DIPSADINÆ.*

Dipsadomorphus trigonatus (Schn.). *Common Cat Snake.*

Dipsas trigonata (Schn.) Boulenger, Faun. Brit. India, Reptilia, p. 358; *Dipsadomorphus trigonata* (Schn.) Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVIII, p. 525.

1 Cumballa Hill, Bombay (J. R. Needham); 1 Malabar Hill, Bombay (N.B. Kinnear); 2 Malabar Hill, Bombay (W. S. Millard); Bandra, Salsette (Prof. J. P. Mullan); Andheri, Salsette (Prof. J. P. Mullan); Santa Cruz, Salsette (Col. Forbes); Andheri, Salsette (S. H. Prater); Bandra, Salsette (R. W. Dunlop) Malabar Hill, Bombay (Sir Stanley Reed).

Form.—Head flat, heart shaped, neck slender constricted, eye large, body smooth slender gradually increasing in girth from the neck down wards, scales 21 rows, ventrals 229-269, sub-caudals 79-92.

Colour.—Light-yellowish-brown, back and sides with zig-zag white black-edged markings.

Note.—Bears a superficial resemblance to the saw-scaled viper, *E. carinata*, in shape and colour.

Habitat.—Peninsular India. To the Himalayas. *Punjab. Sind. Baluchistan. Transcaspia. N.W. Frontier. Western Himalayas.* Subathu. (Ind. Mus.) Almora. (F.W.) *Eastern Himalayas.* Sikkim. (F.W.) *Bengal.* As far East as Calcutta. *Ceylon.* Uva Prov. (Haldamulle. F.W.) (Wall.)

Dryophis mycterizans (Linn.). *Green Whip Snake.* "Hira Samp."

D. mycterizans (Linn.) Boulenger, Fauna British India, Reptilia, p. 370; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVI, p. 533. Coloured Plate.

Malabar Hill, Bombay (Major Kilkelly); Malabar Hill, Bombay (Lt.-Col. H. Child); Malabar Hill, Bombay (B.N.H.S. coll.); 1 Bombay (Revd. Fr. Dreckman); Ladies' Gymkhana, Malabar Hill (W.S. Millard); Parel, Bombay (Col. Glen Liston); Andheri, Salsette (S. H. Prater); Bandra, Salsette (Prof. J.P. Mullan); 1 Bombay (Prof. J. P. Mullan); Santa Cruz, Salsette (R. W. Dunlop); Bombay (F. Birkett 6′ 11″); Santa Cruz, Salsette (M. Fox).

Form.—Extremely slender and whip like, snout narrow and pointed.

Colour.—Bright Green, a yellow line along each flank. The skin between distended scales black and white.

Note.—On trees and shrubs, in gardens and open jungle.

Habitat.—Ceylon. Peninsular India. Excluding the Valley West of Patna. *Bengal. Eastern Himalayas. Assam. Burma. Siam. Indo-China.* (Wall.)

Series.—PROTEROGLYPHA.

Sub-Family.—*HYDROPHINÆ.* Sea Snakes.

ydrus platurus (Linn.). *Yellow-bellied Sea Snake.*

Hydrus platurus (Linn.) Boulenger, Fauna Brit. India, Reptilia, p. 397; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXVI, p. 803. Descript. and col. plate.

1 Bombay Harbour (S. H. Prater); 1 Bombay Harbour (Major C. H. Ward); 1 Bombay (Mr. Nigel Kerr); Bombay Harbour (Prof. J. P. Mullan); 7 Bombay Harbour (H. M. Phipson, Journ., Bom. Nat. Hist. Soc., Vol. III, p. 52; *H. bicolor*).

Form.—Eel like, head long; tail as in other sea snakes flat and paddle like. Scales 45-57 rows, ventrals not distinct.

Colour.—Variable. Usually uniform, black above, yellow beneath, tail yellow with black spots or cross bands.

Habitat.—Coasts of India. From the Persian Gulf to Tenasserim. *Malay Peninsula. Malay Archipelago. Formosa. Japan. Loo Choo Islands. N. Australia. New Zealand. South Africa. N. America. Pacific Coast. S. America. Pescadores.* (Wall.)

Microcephalophis gracilis (Shaw). *John's Sea Snake.*

Hydrophis gracilis (Shaw) Boulenger, Fauna Brit. India, Reptilia, p. 404.

1 Bombay (B. N. H. S. coll.); 1 Bombay Seas (H. E. Hefford).

Form.—Head very small, snout projecting considerably over lower jaw, anterior part of the body extremely slender, scales 19-21 round neck, 29-33 round midbody, ventrals distinct 225-294. Length 3 feet.

Colour.—Bluish-black or olive above, with light cross bands.

Habitat.—Coasts of India. From the Persian Gulf to Tenasserim. *Malay Peninsula to S. China. Malay Archipelago.* (Wall.)

Dolichodira diadema (Gunther). *Gunther's Sea Snake.*

Hydrophis obscurus, Boulenger, Fauna Brit. India, Reptilia, p. 401.

4 Bombay Seas (H. M. Phipson Vol. III, p. 85; *H. diadema*).

Form.—Head very small, body very long and extremely slender in front, 34-40 scales round neck, 45-50 round midbody, ventrals 332-438, length 3 feet 11 idches.

Colour.—Olive or dark green above, yellow cross bars forming complete rings round neck, a yellow spot on the snout, 2 yellow streaks on head.

Habitat.—Coasts of India, Gulf of Siam to Borneo.

Micromastophis fasciatus (Schn.) *Schneider's Sea Snake.*

Hydrophis fasciatus, Boulenger, Fauna Brit. India, Reptilia, p. 404.

4 Bombay Seas (H. M. Phipson, Journ, Bom. Nat. Hist. Soc., Vol. III, p. 53, *H. chloris*; *H. lindsayi.*)

Form.—Head very small, body long, extremely slender, scales 25-31 round neck; 40-48 round midbody, ventrals 345-500.

Colour.—Head and neck black; latter with yellowish cross bands; body pale, with black cross bands or annulis, which are broadest on back. (Boulenger).

Habitat.—Coasts of India. From Bombay to Tenasserim, *Malay Peninsula. S. China. Malay Archipelago.*

Leioselasma cyanocincta (Daud.) *The Chittul.*

Distira cyanocincta (Daud), Boulenger, Fauna British India, Reptilia, p. 410; *Hydrophis cyanocincta* (Daud) Wall, Common Snakes of India, Journ. Bom. Nat. Hist. Society, Vol. XXVI, p. 433. Descript. and col. plate.

2 Bombay Harbour (B. N. H. S. coll.); 1 Bombay (H. M. Phipson); 1 Juvem Salsette (Revd. Dreckman); 1 Versova, Salsette (J. P. Mullan).

Form.—Heavily built, head large, fore part of the body cylindrical. Scales 27-33 rows round neck, 39-43 mid body, ventrals 300-426. Length 6 feet.

Colour.—Greenish-olive above with black rings broadest on the back.

Habitat.—Coasts of India. From the Persian Gulf to Tenasserim. *Further East to China, Japan, Papuasia.*

Leioselasma mamillaris (Daud). *Broad-banded Sea Snake.*

Hydrophis mamillaris (Daud). Boulenger, Fauna British India, Reptilia, p. 401.

2 Bombay (B. N. H. S. coll.); 1 Bombay Harbour (S. H. Prater).

Form.—Head small, anterior body very slender, scales 25-29 round neck; 31-40 round mid body; ventrals distinct 287-316.

Colour.—Black with yellow rings.

Habitat.—Coasts of India; Bombay to Vizagapatam (Boulenger).

Leioselasma spiralis (Shaw). *Narrow-ringed Sea Snake.*

Hydrophis spiralis (Shaw) Boulenger, Fauna Brit. India, Reptilia, p. 401.

Bombay Seas (H. M. Phipson, Journ., Bom. Nat. Hist. Soc., Vol. I, p. 84 ; *H. robusta*).

Scales.—28-29 round neck ; 33-35 round mid body, ventrals 310-320 (Boulenger).

Colour.—Olive above yellowish beneath, with black rings, a series of round black dorsal spots between rings, head black above with horse-shoe shaped yellowish mark ; end of tail black.

Habitat.—Coasts of India, Persian Gulf to Tenasserim, Siam ? Malay Archipelago (Wall).

Polyodontognathus caerulescens (Shaw). *Meriems Sea Snake.*

Hydrophis caerulescens (Shaw) Boulenger, Faun. Brit. Ind., Reptilia, p. 400.

4 Bombay Harbour (Bom. Nat. Hist. Soc. coll.).

Form.—Scales 35-38 round neck, 48-50 round the mid body, skin rough owing to heeled scales, ventrals 294-309.

Colour.—Grey above, with black cross bands, broader on the back, head uniform black.

Habitat.—Coasts of India. Bombay to Tenasserim. *Malay Peninsula. Siam.* (Wall.)

Enhydrina valakadien (Boie). *Jew-nosed Sea Snake.*

E. valakadien (Boie) Boulenger, Fauna British India, Reptilia, p. 406, fig. Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXVI, p. 803. Description and col. plate.

3 Bombay Harbour (B. N. H. S. coll.); Bombay Harbour (S. H. (Prater) ; Bombay Harbour (Prof. J. P. Mullan).

Form.—Body robust, fore part cylindrical, hind part compressed and heavy ; chin deeply furrowed. Scales 47-61 neck, 50-70 mid body, ventrals 284-314.

Habitat.—Coasts of India. Persian Gulf to Tenasserim. *Malay Peninsula. Siam. Cochin China. Malay Archipelago. Papuasia. New Guinea.* (Wall.)

Lapenis curtus (Shaw). *Shaw's Sea Snake.*

Ehhydris curtus (Shaw) Boulenger, Fauna Brit. India, Reptilia, p. 396, Wall, Common Snakes of India, Vol. XXVI, p.

Bombay Seas (H. M. Phipson), Journ., Bom. Nat. Hist. Soc., Vol. III, p. 59 ; *H. curta.*)

Form.—Body short and stout ; scales all hexagonal or square, ventral scales hardly distinguishable on the posterior part of the body. Scales 30-38 (neck) ; 33-42 (mid body).

Colour.—Pale yellowish with transverse black bands, end of tail black.

Habitat.—Coasts of India, Persian Gulf to Tenasserim, Malay Peninsula. Malay Archipelago.

Sub-Family—*ELAPINÆ.*

Bungarus candidus (Linne). *Common Krait.* "Manãre".

B. caeruleus (Sehn.) Boulenger, Faun. Brit. India, Reptilia, p. 388.

B. candidus (Linn) Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVIII, p. 711 ; Description and col. plate.

Malabar Hill, Bombay (B.N.H.S. coll.); 3 Santa Cruz, Salsette (R. W. Dunlop) ; Bandra, Salsette (Mrs. F. A. Little) ; Malabar Hill, Bombay (Revd. R. M. Gray) ; Santa Cruz, Salsette (Capt. Bull) ; 5 Parel, Bombay (Col. Glen Liston); 1 Dadar, Bombay (killed a girl, G. Liston); Malabar Hill, Bombay (N. B. Kinnear) ; 4 Bombay (H. M. Phipson, Journ., B.N.H.S., Vol. III, p. 52, *B. arcuatus*) ; Bombay (Prof. J. P.

Mullan); Bandra, Salsette (F. Hearn); 2 Andheri, Salsette (S. H. Prater); Andheri, Salsette (T. B. Hawkins); Parel, Bombay (killed a coolie girl. "*Times of India*", Aug. 1923); Bandra, Bombay (L. H. Saville).

Form.—Body rounded, smooth and glossy; snout rounded, head merging gradually into body; tail tapering and slender, scales 15 rows, ventrals 220, subcaudals 40-51.

Colour.—Deep chocolate-brown to blue-black with narrow white cross bars more in evidence posteriorly.

Note.—Resembles *L. aulicus*, the common Wolf Snake, in general shape, colour and markings. Common in dwellings.

Habitat.—*Ceylon. Peninsular India.* To the Himalayas. North-East to Bengal. North-West to Sind and Baluchistan. *Western Himalayas.* Up to 5,000 feet. (Almora Bakloh F.W.)

Naia naia, var **caeca** (Merr.). *The Cobra.*

N. tripudians (Merr.) Boulenger, Faun. Brit. Ind., Reptilia, p. 420; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XXII, pp. 243, 550.

6 Bombay (H.M. Phipson, Journ., B.N.H.S., Vol. I, p. 85; Vol. III, p. 59, *Naga tripudians*; Bori Bunder, Bombay (H. Saxby); Port Trust Offices, Princes Dock (L. H. Saville); Malabar Hill, Bombay (N. B. Kinnear); Malabar Hill, Bombay (W. S. Millard); Colaba, Bombay (B.N.H.S. coll.); Apollo Street, Bombay (16 Nov. 1889 Times); Breach Candy, Bombay (N. B. Kinnear); Sion, Bombay (Col. Liston, killed a child); Victoria Gardens, Bombay (J. M. Doctor); Bandra, Salsette (B.N.H.S. coll.); Andheri Salsette (S. H. Prater); Bombay (Prof. J. P. Mullan); Palli Hill, Bandra (Col. Forbes); Bombay (Prof. J. P. Mullan); Palli Hill, Bandra (Col. Forbes); Malabar Hill, Bombay (Mr. Denso); Juvem, Salsette (Col. Kirkitar); Malabar Hill, Bombay (Mr. Panday).

Form.—Head flattened, not distinct from neck, hood commences just behind the neck, not readily noticeable till distended, smooth and glossy.

Colour.—Local variety. Brown with black and white spectacle marking on the hood; and black and white spot on each side of the under surface of the hood.

Habitat.—Variety. (*caeca*) Ceylon, Peninsula India, Punjab, Sind, Himalayas upto 5,000 feet, Bengal, Assam, Burma (Wall).

Callophis trimaculatus (Daud). *Slender Coral Snake.*

C. trimaculatus (Daud) Boulenger, Fauna British India, Reptilia, p. 384. Colaba, Bombay (H. M. Phipson); Bandra, Salsette (H. M. Phipson).

Form.—Body smooth; slender cylindrical. Tail short, head not distinct from neck, scales 13 rows, ventrals. Sub-caudals.

Colour.—Light buff, each scale with a brown dot, head and nape black with a yellow spot on each side behind the occiput. Lower parts uniform red, tail with two black rings.

Habitat.—*Ceylon.* Trincomalee. Tissamaharana. Matale. *Peninsular India.* Madras. Trichinopoly. Travancore. Anamalais. Mahableshwar. Walayar. Colaba. Bandora. Nagpur. *Bengal.* Jalna. Nerva. (Wall.)

Family—VIPERIDÆ.

Sub-Family—*VIPERINÆ.*

Vipera russelli (Shaw). *Russell's Viper.* "Ghoonas."

V. russelli (Shaw) Boulenger, Fauna Brit. India, Reptilia, p. 410; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., XVIII, p. 1, Description and coloured plate.

Parel Laboratory Grounds (12 specimen 1905-1910 Col. Glen Liston); Bandra, Salsette (W. S. Rodgers); Andheri, Salsette (F. Hearn); Santa Cruz, Salsette (R. W. Dunlop); Andheri, Salsette (C. Sharman); Bombay (J. P. Mullan); 3 Bombay (H. M. Phipson); Andheri, Salsette (M. V. Rane); Andheri, Salsette (J. Ali); Bandra, Salsette (W. Rodgers); Andheri, Salsette (Col. Kirtikar); Bombay (C. D. Baker); Andheri, Salsette; (S. H. Prater).

Form.—Stout, head flat, heart shaped, tail short, skin rough owing to ridges on scales.

Colour.—Various shades of brown three rows or chains or series of deep brown (light edged) diamond shaped markings which vary in intensity.

Habitat.—*Ceylon. Peninsular India.* Excluding the Ganges Valley. North-West to Sind and Baluchistan. *Western Himalayas.* Kulu to Western limit of Nepal. *Bengal. Burma. Siam.*

Echis carinata (Schn.). *The Saw-scaled Viper or Phoorsa.*

E. carinata (Schn.) Boulenger, Fauna Brit. India, Reptilia, p. 422; Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVIII, p. 525. Description and col. plate.

Bombay (N. B. Kinnear); Santa Cruz, Salsette (S. H. Prater); Andheri, Salsette (S. H. Prater); Bandra, Salsette (S. A. G.); Ghatkopar, Salsette (H. Wise).

Form.—Thick set; short rapidly tapering tail, head narrow in front, and broad behind, skin rough, scales heavily keeled, lateral scales with serrated keels, scales 29-35 (mid body); ventrals 132-195, subcaudals 21-40, length 2 feet 6 inches.

Colour.—Light shade of buff or tawny. Local specimens reddish-brown irregularly blotched or spotted with darker shades; an indulating line along the flanks and a dagger shaped mark on the head nearly always in evidence.

Habitat.—Ceylon, Peninsular India, except a small tract west of the Western flat and south of Karwar and the Ganges Valley, Sind, Baluchistan, Afghanistan, Transcaspia, Persia, Arabia, Africa north of the equator.(Wall).

Sub-Family—*CROTALINÆ.*

Trimeresurus gramineus (Shaw). *The Green Pit Viper.*

T. gramineus (Shaw) Boulenger, Fauna Brit. India, Reptilia, p. 429; *Lachesis gramineus*, Wall, Common Snakes of India, Journ., Bom. Nat. Hist. Soc., Vol. XVI, p. 536.

Borivili, Salsette (C. McCann).

Form.—Head blunt, narrow in front swollen behind, a pit or opening between the eye and the nostril, scales 21 rows, ventrals 145-175, sub-caudals 53-75, length 2½ feet.

Colour.—Uniform bright green with a white yellowish flank streak, dark cross markings sometimes evident.

Habitat.—Hills of Peninsular India, Himalayas Assam, Hills and Plains Burma, Hills and Plains Tenasserim, Andamans, Nicobar Malay Peninsula, Indo-China, S. China, Farmosa, Malay Archipelago, Sumatra, Java (Wall).

A NOTE ON THE WEAVERS AND FINCHES OF THE PUNJAB.

BY

HUGH WHISTLER, F.Z.S., M.B.O.U., C.F.A.O.U.

As in my previous note on the Corvidæ of the Punjab published at page 157 of Vol. xxix of ourJournal, my object in putting together this note on the Weavers and Finches of the Punjab has been two-fold; on the one hand the account collects together all available records to show the status and distribution of the various species; on the other it indicates directly or by implication the gaps in our knowledge and the points on which further information is necessary, and will I hope encourage the publication by our members of further records, so that in due course the history of our Punjab species may be accurately known.

As before, the Punjab, for the purposes of this note, has been taken as the area which falls within the political and administrative boundaries of the Punjab Government; but I have not hesitated to draw on records beyond those boundaries where their enumeration has helped to indicate the status of the species within my area.

The Common Baya Weaver—*Ploceus philippinus philippinus* (*L.*).

It is curious how incomplete is our information on this common bird.

It certainly does not occur throughout a large area of the northern and western Punjab but its exact limits are hard to define and there is also some doubt about its status.

According to Ward (Jour. B.N.H.S. xvii) it occurs in the plains of the Jammu Province; from here it stretches along the Himalayan Foothills through the Kangra Valley and Mandi State to Chandighar below Kalka and doubtless to the Jumna River. In this area it appears to be somewhat scarce and local, only a few small colonies being found here and there. In Mandi State at Dhelu and Drang I have secured specimens as high as 4,000′, but the majority do not go above 2,000′.

With the exception of a doubtful record of my own (22nd May) for Gujranwala, the most north-westerly locality for the plains proper is Lahore; here from the testimony of Dewar and Currie (Jour. B. N.H.S., xix., 627 and xxiv., 566) it is common and perhaps a resident.

From there it probably occurs throughout the whole of the Province west of the Sutlej, though details are lacking of some Districts. At any rate it is known to occur commonly at Ferozepore, Sirsa, Hissar, Ambala, Jagadri, and Gurgaon.

As to the status of the bird there is a good deal of uncertainty. At Lahore Currie states that it is a resident breeding from June to September. At Ferozepore I found colonies breeding in July. In Hissar District including Sirsa I met with the species from May to October, breeding in June and July and apparently growing scarcer from the end of August.

In Ambala district during the winter I saw no birds about Chandighar although the deserted nests in the trees shewed that it must be common some time in the hot weather or rains; on the Jagadhri side however some birds are certainly met with in the winter.

In the British Museum there is a specimen from Gurgaon dated 17th February.

In the Kangra Valley, with the exception of the Dhelu specimen obtained on 1st June 1910 and a breeding colony at Drang on 2nd August 1922, I have only met with Weavers in October and early November. Then I found a few young still in the nests of scattered and small colonies between Chakki and Nurpur and at Thorl between Palampur and Sujanpur Tehra. Nests and birds were seen about Indaura on 24th October but breeding appeared to be finished.

Further information about this bird is clearly wanted.

The Black-throated Weaver Bird—*Ploceus bengalensis* (L.)

The Catalogue of the British Museum mentions a female from Delhi (March 25th.) in the Hume collection.

Otherwise Mr. A. E. Jones is the only observer who has obtained this species in the Punjab. He first of all recorded (Jour. B.N.H.S., xxvi., 676) that he had obtained two specimens from a flock in the Ambala District. This was on 27th. February 1916 and the birds were in company with *Passer hispaneolensis*.

In the winter of 1921-1922 he again discovered the species in the Ambala District in the neighbourhood of Jagadhri. In a letter he informed me that he had found hundreds in a reed bed over water on 27th. November and 4th. December; they kept closely to the reeds and rushes, never venturing over dry land, and when disturbed scarcely topping the vegetation. They were still about as late as the 12th. March. He kindly procured a specimen for me, and allowed me to examine another in his own collection.

It is interesting to remember that this species has been found at Thall in the N.W.F. Province. Whitehead (Ibis, 1909. 226) writes :—"We have not met with this species in Kohat but Colonel Raltry records it from Thall (Jour. B.N.H.S., xii., 340), and writes as follows:—'appeared suddenly about the beginning of June in all the reed patches on the River banks; they fly about in flocks of 20 or 30 birds. On 25th. June 1898 I found a nest containing 3 eggs much incubated. There were at the same place numerous nests in various states of completion all attached to the reeds'.

Mr. Donald, the Political Officer, observed a flock in the reeds near Thall in March. Probably a resident species moving locally up and down the river."

The Striated Weaver Bird—*Ploceus manyar flaviceps* Less.

Like the last species this Weaver is exceedingly local in its distribution in the Punjab.

Currie has recorded (Jour. B xxiv. 604) that he found nests with eggs on Keishopur jheel (Gurdaspur) on the 11th. and 18th. August 1914. The nests were suspended from bull-rushes growing in water a long way from the land. I also found it very abundant at Keishopur on the 12th. September 1922 and found numerous nests, unfinished, with eggs, or with young.

Jones has obtained it not uncommonly about the neighbourhood of Jagadri in January and February and he has kindly presented me with 3 specimens.

At Delhi it is common. Bingham writes (N. and E. 2nd. ed. Vol. II. 122) :—"Breeds in numbers at Delhi in the long grass on the banks of the Jumna from July to September. In one patch of grass occupying about one hundred square yards I found on the 5th. September thirty-one nests of this bird some with full fledged young, some with fresh eggs, and others in course of constructions only". He goes on to give some details of the nidification which need not be quoted here.

The Spotted Munia—*Uroloncha punctulata punctulata* (L.).

I have found the Spotted Munia a comparatively common bird throughout the Kangra Valley from Chakki (1,200') below Nurpur to Dhelu in Mandi State, reaching a height of 4,000' along the southern base of the Outer Himalayan range (as at Dharmsala) and extending south at least as far as Ranital. It is not strictly speaking a migrant species as I have met with it at intervals throughout the year, but that it moves about locally is undoubted and there appears to be a noticeable increase in the numbers of the birds during the rains, when they breed in August and September. I saw a pair on the northern base of the Bhubu Pass in Kulu at 6,000' on 2nd July 1921.

A record of a pair of supposed *U. acuticauda* seen at Malikpur in the Gurdaspur District on 8th. August 1914 by A. J. Currie (Jour. B.N.H.S., xxiv., 604) probably refers to this species.

About Simla Jones says that the Spotted Munia is not a common bird and that it ascends to 6,000″ (Jour. B.N.H.S., xxvi., 610). He has since informed me that on 9th. October 1921 he met with a pair at Fagoo (8,000′). There is a juvenile from Koteghar in the Hume Collection in addition to some Simla specimens.

The only record from the Punjab plains is of a pair that I saw on 13th. July 1917 at Ludhiana (Jour. B.N.H.S., xvi., 588).

The White-throated Munia—*Urolonchа malabarica* (L.)

This dull little bird occurs throughout the whole of the plains portion of the Province, in the Salt Range, and in the Himalayan foothills up to a height of about 4,000′. It is common and apparently a resident species. I have records of its breeding in every month of the year, except January, but the majority of nests are perhaps to be found in the rains and early winter, i.e., from July till December. It is usually found in parties and small flocks, and a family seems to take up its abode in every weaver colony of any importance.

The Green Munia—*Stictospiza formosa* (*Lath.*).

This species has only been recorded in the Province from the Lawrence Gardens in Lahore by Currie (Jour. B.N.H.S., xxiv., 566 et 594) who states that he only met with it in August, when five nests were found on the 24th. and 28th. of that month. It appears extremely probable that this little colony had its origin in some escaped birds from the Zoo which is only a short distance away, and that the species does not occur with us in a truly wild state.

The Red Amandavat—*Amandava amandava amandava* (L.).

Owing to its preference for riverain grass jungles or reedy jheels, the Red Amandavat is somewhat local in its distribution. It probably occurs more or less throughout the Province as a resident species fairly common where it occurs at all, but I have as yet records of it only as follows:—Rawalpindi, Khanna jheel; Lahore; Ludhiana, Sutlej bridge; Ferozepore, Sutlej riverain; Hissar Ambala, Mubariqpur Chandighar, and Jagadri; Jhang, Chenab riverain.

In Nests and Eggs 2nd. ed. Vol. II. 147 it is expressly stated that it does not breed in the Punjab but this is incorrect. No eggs have to my knowledge been actually secured but in the above localities it is certainly a resident, while Currie notes (Jour. B.N.H.S., xxiv., 566) that he saw fully fledged young at Christmas at Lahore and Mr. A. E. Jones tells me *in epistola* that he found a nest building at Jagadri on 27th. November 1921.

Hume's Hawfinch—*Coccothraustes coccothraustes humii* Sharpe.

Our information about this race of Hawfinch is exceedingly vague and unsatisfactory. It was originally described by Bowdler Sharpe from 3 specimens collected at Attock in March 1869 and February 1870 by Colonel Delmé-Radcliffe (*vide* P.Z.S., 1886.,98: Ibis 1869, 456: S.F.,x., 514).This still remains the only Punjab locality for the species and it was not obtained there between the date of the original discovery and 1918 when Mr. A.E. Jones met with it and preserved several specimens. His account of it in the Campbellpore, Attock district (Jour. B.N.H.S., xxvii., 797) is worth quoting in full:—"By no means uncommon in the low hills and occasionally seen in the neighbourhood of Cantonments. Generally in small scattered flocks of three to six individuals. I however found their bathing pool in the low hills and here any number from a dozen to thirty or so could be seen, at a distance of a few yards, performing their ablutions. Usually a shy species, but with care could be approached to within a few yards. The call note uttered on the wing 'zitt' rather prolonged. The song might be represented thus Pittzwee". Mr. Jones has in addition informed me that he first met with it on 1st December 1918 and saw no birds after 16th February 1919.

From the neighbouring district of Kohat, but outside our boundary, we have the valuable account by Whitehead (Ibis 1909. 227) who writes:—"A winter visitor to the district in fair numbers from October till mid-April being especially common in the Miranzai Valley, but rare on the Samana. It generally occurs in small parties about wild olive groves, orchards, and gardens, feeding on berries, seeds and the kernels of fruit stones. The call note which is frequently uttered is a shrill tee, not at all what might be expected from so big a bird. I met with a party of 5 on the 5th May at 9,000′ on the Peiwar spur, possibly the bird nests about there".

According to Hartert this race is found in Afghanistan and Turkestan, in addition to the above Indian localities. The former locality is apparently based on Barnes' statement (st. ix. 457) that it is a permanent resident and very common in the hills about Chaman.

Meinertzhagen on the other hand (Ibis, 1920.137) states that he never saw it at Chaman. A study of the map however warrants the idea that the Attock and Kohat birds arrive from over the Afghan boundary. It occurs in Chitral Jour. B.N.H.S., xix) as Fulton obtained two specimens from Drosh in May at 4,000′ and Perreau thought he saw it near Gairat in May. The species is included in the list of local birds in the Hazara Gazetteer but I do not know on what evidence. The evidence for its occurrence in Turkestan is probably from Russian sources, but Scully does not include it in his account.

As regards Baluchistan the only very definite record is Meinerzhagen's statement (loc. cit) that he obtained a male at Quetta on March 1st.

Nothing seems to be recorded about the breeding of this race.

The Black and Yellow Grosbeak—*Perrisospiza icteroides icteroides* (Vig.).

Hume states (Lahore to Y. 257) that this Grosbeak breeds in May and June in all the Pine Forests from 6,000′ to 9,000′ south of the First Snowy ranges of the western Himalayas. This is correct but in Kashmir and Kulu at least it occurs also north of First Snowy range. In the Galis and at Murree it is abundant enough, and at Dalhousie too it is common. In Chamba it appears to be common (Marshall, Ibis, 1884. 420). Further east from Dharmsala onwards it appears to be less common and this is clearly due to the replacing of the pine forests by oak woods in this area. In Lahul and Spiti it certainly does not occur. In Kulu and Saraj it is not uncommon but local. About Koteghar and north of Simla it is common, but actually in the latter station it only appears during the winter months.

This species is in the main a resident between 6,000′ and 10,000′ but during the winter it moves to a slightly lower zone. In the winter of 1921-22 a number appeared as low as 4,000′ in the lower station of Dharmsala in January.

The majority of eggs are to be found in May and June but some individuals breed later and are perhaps double brooded. I shot a female at Dalhousie on 6th September 1915 which had an incubation patch and well developed eggs in the Ovary.

The Allied Grosbeak—*Perrisospiza affinis* (Blyth).

A specimen of this eastern form of the Black and Yellow Grosbeak labelled Dharmsala is in the Pinwell collection in the British Museum (Fauna B. I. ii. 99). This record is very likely correct, (though the bird was doubtless only a straggler) as it is widely distributed and locally common as near as Central and Upper Gharwal according to Osmaston (Jour. B.N.H.S., xxviii., 151). It is noteworthy too that Blyth originally described the race from "the Alpine Punjab," while Jerdon says (B. I., ii., 385) "it has only hitherto been sent from the extreme north-west, *viz.*, the Alpine Punjab." There is a clear statement in the *Zoologist* for 1886 p. 290 by Stewart that Blyth's types were "shot in the hills beyond Murree in the far N. W."

White-winged Grosbeak—*Perrisospiza carnipes carnipes* (Hodgs.).

In June 1921 I met with this Grosbeak in the Juniper Forests of Kyelang and Jispar in Lahul which lie at an elevation of between 10,000′ and 13,000; it was there not uncommon in pairs and small parties and was evidently about to breed in the Juniper trees. It was in the same locality in July 1922 and on the 19th. July 1923 I secured a fully grown young bird in the same area. It is not likely that this species remains in Lahul during the winter and it then doubtless moves down towards Kulu and the Outer ranges.

Apart from Lahul we have only three records. In the British Museum there is a skin from Simla, dated March 1867, in the Tweeddale collection and an undated skin from Dharmsala in the Pinwell collection. On 7th. June 1923 I found a pair about 11,500′—12,000′ above the Kareri lake west of Dharmsala. They were frequenting some patches of Juniper scrub above tree level on the open hillside and were noisy and restless, moving about the hillside a good deal.

Further west, but outside our area it breeds in small numbers in the Kaghan Valley (Whitehead, Ibis, 1909, 713 and Jour. B.N.H.S., xviii, 191) and also on the Sufed Koh mountain in Juniper scrub between 8,000′ and 12,000′ (Whitehead, Ibis, 1909, 228). It is common in the hills about Quetta breeding at Ziarat in Juniper Forest from 8,000′ to 11,000′ descending somewhat lower in winter, but never actually to the plains (Meinertzhagen, Ibis, 1920, 137, Delme-Redcliffe, Jour. B.N.H.S., xxiii, 753).

The Spotted-winged Grosbeak—*Mycerobas melanoxanthus* (Hodgs.).

This Grosbeak is a purely mountain species and our information regarding it is very incomplete, as I have already indicated in a separate note on the species in the Journal (xxix, 150).

Within our limits there is no definite record of the species having been obtained in the hills of the north-western corner of the Punjab; it may however be expected to occur about Murree as it has been obtained on several occasions just over the border in the Hazara hills and Rattray took the nest at Dunga Gali.

In the north-eastern corner of the province the bird cannot be described as rare though it appears to be somewhat erratic in its appearance.

The most westerly record here is from Chamba whence there is in the Hume Collection an undated skin obtained by Col. C. H. T. Marshall, who says (Ibis, 1884, 420) that he obtained 2 or 3 specimens one winter.

At Dharmsala it appears in the late winter in some numbers but apparently irregularly. Hingston did not meet with it at all and I did not find it in the winter of 1920-21. Early in 1922 however I met with a good many parties between 4,000″ and 4,500″ in the lower station between January 7th and February 8th in which period a series of 10 specimens was collected.

In 1923 they appeared again in the same area and I first saw a pair on February 11th. Observations were interrupted by my departure on a short tour but they were apparently about until the beginning of March and a single female was seen as late as the 15th. March.

Both the winters and particularly the early months of 1923 were remarkable for heavy snow-fall on the range above Dharmsala exceeding that of several previous years.

The bird does not occur in Spiti and Lahul but the Mission Babault obtained a pair on 6th. June 1914 at Ghary in the Parbatti Valley Kulu which from the state of the organs appeared to be breeding (Résultats Scient. 186).

For the Simla Hills there are several records. The Hume Collection contains undated skins from Koteghar and Simla and the Tweeddale Collection contains from Simla a male dated August 1876 and a female June 1876. Beavan (Ibis, 1867, 141) states that it is apparently far from uncommon at Simla. After that it was lost sight of for a good many years: Dodsworth did not meet with it nor

did Mr. A. E. Jones find it until the spring of 1922. He then met with a flock of about 40 birds on 2nd. April in the Glen below Viceregal lodge and secured two specimens. On the 14th. April he again met with them in the same locality if anything in larger numbers.

The Orange Bullfinch—*Pyrrhula aurantiaca* Gould.

The Golden Bullfinch is properly an inhabitant of the area from Afghanistan to Kashmir but it has been obtained at Murree from whence there are a male and female, dated May 1875, in the Hume collection. It breeds a few miles away from Murree though actually outside the Punjab boundary; for Rattray says "a few of these birds are to be found on top of Miranjani (a hill about 10,000′ by Nathra Gali) where they breed. I however failed to find nests. On one occasion at the beginning of July I saw a pair with 4 young ones just able to fly from tree to tree on top of a hill near Dunga Gali about 9,000′."

According to Marshall it occurs in Chamba between 6,000′ and 7,000′ of elevation but is rare (Ibis, 1884, 420).

The Red-headed Bullfinch—*Pyrrhula erythrocephala* Vig.

This beautiful Himalayan species does not occur in the north-western corner of our area but is confined to the mountains of the north-east.

According to Marshall (Ibis, 1884) it has been met with at Dalhousie in April.

At Dharmsala according to Hingston (Jour. B.N.H.S., xxvii, 564) it is found in summer on the Duala Dar range about the highest belt of trees, namely from 10,000′—12,000′ and moves down in winter to 6,000′. I have observed it occasionally from January to April rather lower down to about 5,000′.

Although Stoliczka states that it is common in Lahul I failed to meet with it in the course of three trips that I have made in that country; he says also that large numbers come down each winter to Kulu, and these birds doubtless breed in the higher ranges of the Kulu hills as I met with a pair in heavy forest at 10,000′ on the north face of the Jalouri Pass in Saraj on 16th. June 1922.

M. Guy Babault (Mission Babault R sultats Scient., p. 187) obtained specimens in May or June at Ghary and Pulga but he states that they were rare.

Stoliczka also states that it breeds about Koteghar from 6,000′—8,000′ but is found all through the Sutlej Valley up to the limit of the pine and cedar forests, large numbers coming in winter to the lower ranges. As the Hume Collection contains winter specimens from Koteghar this Bullfinch is doubtless not truly migratory but merely moves altitudinally according to season.

Mr. A. E. Jones met with a few at Narkanda in September. About Simla, he says (Jour. B.N.H.S., xxvi, 610) it is a common winter visitor, in particular frequenting the willow grown banks of streams, and leaving at the end of April and beginning of May. He shot a specimen at Fagoo on the 30th. October (1921).

The Brown Bullfinch—*Pyrrhula nipalensis nipalensis* Hodgs.

The Brown Bullfinch is certainly one of the least known of the finches on our list.

A female in my collection was shot on 28th. February 1919 by Captain Hingston on Dharmkote Hill at Dharmsala at 6,000′—6,500′ and this was one of a pair which were haunting oak and forest Rhododendron (Jour. B.N.H.S., xxvii, 564).

It is found in the hills north of Simla; Mr. A. E. Jones met with a family party at Baghi on 12th. September 1918 and also shot a couple of males on the Kamlor Dhar 10,000′ near Narhanda next day: one of these he kindly presented to me. There can be little doubt that the species breeds in those ranges.

The British Museum contains a pair from the Tweeddale Collection which are labelled "Simla" without further data.

The Himalayan Cross-bill—*Loxia curvirostra himalayensis* Blyth.

The crossbill is one of the rarest finches on the Punjab list and I have never been able to meet with it personally.

Stoliczka says (J.A.S.B., xxxvii, 1868) that it is "only to be found in the forests about Chini and towards the east; it is rare at Koteghar even in winter, but common in Lahul during the summer." This last remark seems very curious. In three different summers I have searched for it carefully in the juniper forests of Lahul, to which part the reference presumably applies, but without success. The Lahulis described to me a parrot-billed bird which they called the *Devi Dar* or Juniper bird and at first I thought that this species must be meant: further experience leads me to believe that the Grosbeak (or Missel-Thrush) is their Juniper bird so far as any one species is meant and I cannot help thinking that Stoliczka's statement may have been based on the same mistake as I made.

It occurs in Kulu as the Mission Babault (Résultats Scientifiques, p. 188) obtained a pair at Pulga in May and also saw the species at Manali at the end of June.

Mr. A.E. Jones has recorded (Jour. B.N.H.S., xxvi, 610) that in November 1916 he saw several small parties towards Kufri and identified them positively through glasses though owing to their restlessness he was unable to obtain specimens.

The Red-breasted Rose Finch—*Pyrrhospiza punicea humii* Sharpe.

As with many of the west Himalayan finches our knowledge of the distribution of this handsome bird is very incomplete.

It has not been recorded west of Gilgit and the Kaghan Valley. In Gilgit, Biddulph (S.F., ix, 351) implies that it is common and says that he never saw it below 10,000′ except during severe cold in the middle of January 1878 when some came down to the mouth of a ravine debouching to the plains.

Whitehead found the species common and preparing to breed between 12,000′ and 14,000′ in one wild precipitous valley of the Kaghan in May, June and July (Jour. B. N.H.S., xxiii, 107).

In Central Ladakh it seems to be scarce but the Abbott Collection contains an adult male shot at 16,000′ on the Khardong Pass on 14th. July 1893.

In Eastern Ladakh according to Ward it is common in summer and breeds in July about 14,000′ (Jour. B.N.H.S., xvii). Stoliczka says that in summer it is to be found in Ladakh and Spiti between 13,000′ and 17,000′ searching after food on the camping grounds (J.A.S.B., xxxvii); he adds that in winter it only occasionally comes down to Simla and Koteghar but is more common eastwards.

Mr. Whymper found it nesting near the Borrendia Pass in the Nila Valley Gharwal. An older specimen from this locality is in the British Museum.

For our area records are scarce. Stoliczka's statement that it occurs in Spiti has been reconfirmed by my securing two adult males at Tharcha, above Losar, 13,500′ on the 12th and 24th July 1922, but with the exception of a female in company with the first of these males I could find no more although always on the look out for the species. I was however lucky enough the same year to secure an adult female in Lahul at14,000′ just above Zingzingbar on the 8th. July and an adult male in Kulu at 13,000′ below the Hampta Pass on the 27th. July. In 1923 I obtained another adult male at Zingzingbar 14,000′ on 22nd. July and about the same date saw 6 or 8 about the Yunnan Lake and Kinlung (15,000′). All these birds were apparently on their breeding ground.

Major C. H. T. Marshall has recorded (Ibis, 1884) that he saw a pair of old birds feeding fully fledged young on the Sauch Pass in Chamba on 20th. Sept. 1881.

Stoliczka's statement that it comes occasionally to Simla and Koteghar in winter is partly confirmed by the presence in the Hume Collection of a male from the latter locality, dated 3rd. April 1869. It has not however been met with by any later observer in these parts. It is noteworthy that I obtained an immature male at 9,000′ in the Bagh Nala behind Palampur (Kangra) in February 1923.

The Red-mantled Rose Finch—*Carpodacus rhodochlamys grandis* Blyth.

The restricted range of this race of Rosefinch is given by Hartert (Vog. Pal. F., 101) as from Pushut in N. E. Afghanistan and the Karakorum mountains, Cashmere, and the Himalayas to Kumaon. Within our area it is not uncommon though apparently local and rather erratic in appearance.

In June 1921 I found it not uncommon in the juniper forest of Lahul from 11,500′ to 12,500′ in the neighbourhood of Jispar. Some of the birds were in parties but in an adult male procured, the testes were large and the birds were probably on their breeding ground. It was noted in the same forest in July of the next year. In Spiti however I did not observe it.

A male from Chamba (no date) is in the British Museum. There is apparently no record for Kulu or Saraj but about Chini in Bashahr it is not uncommon according to Stoliczka (J. A. S. B., xxxvii). Towards Simla it has been frequently procured. Blyth originally described the type from "Range beyond Simla near the Snow line" in 1849 (J. A. S. B., xviii, 810) and it may be to this that Jerdon refers (B. I. ii, 400) when he says that it has been obtained in the Tyne range of mountains between Simla and Mussoorie and in the Pubber Valley near the snow on the Simla side. The Hume Collection contains 2 specimens (no date) from Koteghar, a pair from Simla, November 1880, and a single specimen from Simla, dated 1st. December 1880. Stoliczka says that it is not very rarely met with near Koteghar (J. A. S. B., xxxvii). It cannot however come regularly to the Simla ranges in winter as Mr. A. E. Jones did not meet with it there until 30th. October 1921 when he saw a red male and two females or young males at Fagoo. I had however previously found a few about the ridge between Fagoo and Kufri about 8,000′ in November 1919 and secured a series of 7 specimens (Jour. B. N. H. S., xxvii, 102).

Further west along the outer ranges it appears to be scarce. Hingston did not procure it at Dharmsala though I saw a single male on 28th. November 1921 at 7,500′ just behind Dharmsala. This I shot but unfortunately lost. According to Hume (Lahore to Yarkand 259) it occurs in winter at Murree.

There is probably some west to east movement of the Afghanistan birds as Mr. A. E. Jones found it fairly common in December 1918 at Choi near Campbellpore (Jour. B.N.H.S., xxvii, 797); while the late Captain Whitehead obtained a female on December 15th. below Sardi in the Salt Range (Jhelum district).

The Pink-browed Rose Finch—*Carpodacus rhodochroa* (Vig.).

This Rose Finch is most strictly a mountain species, never being found below 4,000′ even in winter. In the ranges about Murree it is not known to occur but it is a common species in the N. E. corner of our area.

The most westerly locality from which it is recorded is Dharmsala.

Here during the summer and rains it may be found in the patches of Kharshu Oak (*Q. semicarpifoliata*) which form the highest line of tree growth about 10,000′—11,000′ on the outer slopes of the Duala Dar or Outer Himalayan range. The birds undoubtedly breed here although I have not found the nest, as specimens collected in July and August had the organs in breeding condition. After nesting they move gradually down the slopes and about the middle of November appear in the Civil station (4,000′—4,700′) where in December, January and February they are common enough in parties, leaving again by the middle of March.

According to Stoliczka (J.A.S.B., xxxvii) this Rose Finch is common in Lahul and Spiti but I failed to meet with it in those areas.

In Kulu I have met with it in summer in the Humpta Nala at 8,000′ on the Rhotang Pass at 10,000′ and on the Jalouri Pass at 10,000′, so it probably breeds through the higher ranges, moving down into the Beas Valley in winter where I met with it about Katrain in early December.

M. Babault (Mission B. Rès. Scient., 188) obtained specimens at Ghary (Parbati Valley) and he remarks that it must breed early as he saw a young bird on the wing on 11th. May.

Stoliczka considered it only a winter visitor at Koteghar.

In the hills about Simla it is a plentiful winter visitor, usually leaving in April, while a few stragglers continue on till May (A. E. Jones, Jour. B.N.H.S., xxvi, 610).

The Scarlet Grosbeak—*Carpodacus erythrina roseata* (Hodgs.).

The breeding range of this Eastern form of Scarlet Grosbeak is somewhat difficult to define; it appears however to breed at high elevations in most of the mountains that bound the Punjab both to the north-west and north-east. I have not traced it in summer further south than Quetta. Whether it breeds in the hills about Quetta is not clear. Marshall says that it is common at 9,000′ in May (Jour. B.N.H.S., xiv, 604) apparently referring to Ziarat and Meinertzhagen says that he frequently saw them round Quetta in summer. But this bird is such a late migrant from the plains and nests in portions of its range as late as August so that it is not safe to assume that these birds were on their breeding ground in the absence of definite evidence to that effect.

It apparently breeds however in the Valleys of the Safed Koh from 6,500′ to 8,500′ where Whitehead found it abundant and in song (Ibis, 1909, 229).

In the Kaghan Valley it breeds in abundance in June and many nests were taken there by Whitehead and Colonel H. H. Harington.

In Chitral, Fulton found them common and apparently breeding at the head of Turikko Valley from 15,000′ to 16,000′. In Gilgit, it is an abundant breeding species about 10,000′ in July and August and Biddulph took a series of eggs in the latter half of July (S.F., ix, 348).

The published records for Kashmir and Eastern Turkistan are so unsatisfactory and indefinite that there is no point in discussing them in detail: the species however appears to breed through a large portion of this area.

I have met with the Scarlet Grosbeak in small numbers in June and July in Lahul at elevations from 10,000′ to 12,000′ under circumstances that suggest that it breeds there but no nest was actually found. In Spiti however I found three clutches of eggs at 13,000′ near Kibar and Losar towards the end of July.

Mr. B. B. Osmaston found the species breeding in considerable numbers about 13,000′—13,500′ in the Girthi Valley on the Tibetan border of Gahrwal and obtained numerous eggs in the first ten days of August (Jour. B.N.H.S., xxvii, 157).

After breeding the Scarlet Grosbeak spreads over almost the whole of India and northern Burmah, going as far south as the Nelliampathy Hills south of the Nilghiris. I have collected a large number of published records which show that the species is most abundant on the central and western half of the Peninsula but the records are not extensive or detailed enough to enable me to trace the movements of the species satisfactorily. It is clear however that the south-eastern Punjab and Sindh lie out of the main line of migration only occasional stragglers reaching these parts. A marked line of migration passes along the northern Punjab and along this vast numbers of the Grosbeaks pass on passage, chiefly perhaps in spring. In the south-east many perhaps remain for the winter. This is shown by the following Punjab records, which I give in detail, as more information is wanted on the movements of this bird.

Attock.—One specimen without date is in the Hume Collection (of the neighbouring district of Kohat N.W.F.P. Magrath writes (Ibis, 1909, 229) "visits the district in considerable numbers on the spring and autumn migrations, passing through on the former in March and April and on the latter in September and October when mostly young birds are seen".)

Rawalpindi.—Very abundant on the spring migrations of 1911 and 1912 between 10th. April and 10th. May according to my own notes.

Jhelum.—" A common spring migrant, passing through from the second half of March until the second week of May. Not noted on the autumn migration" (H. W., Ibis, 1916, 66.)

Lahore.—" Passes through on migration in considerable numbers in April. Not otherwise seen." (Currie, J.B.N.H.S., xxiv, 566).

Ludhiana.—A flock observed by me at Khanna on 12th. September 1917.

Dharmsala.—" Large numbers seen to pass through in April" (Hingston, J.B.N.H.S., xxvii, 564).

Here I have also found them very abundant on the spring passage both along the Kangra Valley from the neighbourhood of Pathankote to Palampur, and about Dharmsala itself up to about 6,000′ at least. In 1921 the passage was observed from 16th. March to 16th. May, in 1922 from 7th. April to 14th. May, and in 1923 from 20th March to 19th May. With the exception of some doubtful records I have not found the species here on the autumn passage or in winter.

Simla.—According to Mr. A. E. Jones (*in epist.*) an abundant passage migrant passing leisurely through about April and early May, and rushing through in September. At Koteghar it is said by Stoliczka to be found in winter which appears curious.

Ambala—Specimens, dated April and November 1866, are in the Tweeddale Collection. Some years at any rate is very abundant in November.

Delhi.—A female, dated 2nd. April 1872, is in the Hume Collection.

Jhang.—I secured 2 males from a small flock at Jhang—Maghina on 18th. September 1918. (Ibis, 1922, 272).

Dera Ghazi Khan.—A specimen, dated March 1872, is in the Hume Collection.

For Sindh Ticehurst has only been able to find a record of 5 specimens. (Ibis, 1922, 648); 2 in December, 2 in January and one without date.

Sovertzov's Rose Finch—*Carpodacus sovertzovi* Sharpe.

The main stronghold of this beautiful Rose Finch is in Eastern Turkestan and about Yarkand and the Karakash River. In these regions Scully states that he first met with it between Mazar and the Chuchu Pass, and that after that it was often seen along the banks of the Karakash River from Kurgan Ali Nagar to Oibuk 10,700′—11,700′ (S.F., iv, 169).

Biddulph referring to the same region says that on the outward and return journeys of the Second Yarkand Mission he found it common in the Karakash Valley below Shahedulla (11,500′) and on the Yarkand side of the Sanju Pass (9,000′); also in Wakhan (9,000′); again in the Kulustan Valley (10,000-11,000) coming up to the Yangi-diwan Pass, where they were not very common. They were very abundant in June at Tutujalak (13,000′) between the Nubra Valley and the Tussia Pass (Second Yarkand Mission, p. 42).

Henderson obtained nearly fledged young at the Arpalak Valley. (Lahore to Yarkand 258.)

Outside this area we have very little information. Biddulph (S.F., ix, 348) met with it very commonly in Gilgit in flocks of 20 to 30 individuals from the middle of December to the beginning of March in the winter of 1877-1878, but adds that he did not otherwise meet it in that province.

In Chitral Fulton records a good many at Gharagar at 13,000′ just below the snow line on 10th. July.

It is apparently not uncommon in Ladakh. Henderson obtained a male at the Pardong Lake on 9th, October. Abbott shot an adult male in the Nubra Valley 11,000′ on 18th. July 1893 and later found it in pairs on the stony hill sides at Upshi 11,000″ in the Indus Valley (Proc. U.S. Nat. Museum, Vols. xviii and xxii).

In Rupshu, Stoliczka obtained a specimen below the Parang Pass leading into Spiti. There is some confusion about a clutch of eggs obtained by him at the

Tso Morari Lake (N. & E., ii. 154) but they apparently belonged to this species. Dresser however figured other eggs obtained in Ladakh on 31st. July, and 4th. August, by Major W. Corbett (Ibis, 1904,107), near Shushul (14,000′) 6 miles from the Pardong lake.

I have only enumerated the above records to explain the distribution of this Rose Finch, though none of them refer to the Punjab area. There is no record in print referring to the Punjab save the extraordinary statement by Jerdon (B. of I, ii, 398) that Mr. Blyth had received a specimen from Pind Dadan Khan. There is clearly some mistake here, possibly a misidentification of *Propasser grandis* which has been since obtained in the Salt Range near the town in question.

The species however is found in summer commonly enough in Spiti where I met with it in July from the foot of the Kunzum Pass along the Spiti River to Kibar at altitudes of 13,000′—14,000′. Here I obtained a nice series of eleven specimens which on dissection clearly proved that the birds were breeding though I was unable actually to find the nest. Two of the females dissected contained eggs which would have been laid within the next day or two.

It occurs also in Lahul for on the 6th. June 1922 I shot the female from a pair at Patseo 12,500′. In this case however the ovary was minute. In 1923 I saw a red male with 2 or 3 others in female plumage by the Tsarab bridge on 24th. July and next day a red male by the Phalang Danda on the Dingti Plain. A few Rose Finches seen in July 1922 on the Baralacha Pass and in the Upper Chandra Valley between it and the Mangan Pass, were possibly also of this Species.

M. Guy Babault (Mission B. Resultats Scient., p. 189) records that he obtained a male at Sumdeo near Kyelang and remarks on the apparent trust of the bird in its resemblance in colour to a certain flower as a means of concealment.

Stoliczka's Rose Finch is clearly a resident species in the area that it inhabits ; but in winter it doubtless moves to lower altitudes and the more sheltered valleys to escape the full severity of those upland winters.

The nest has not yet been found within British limits.

The Trumpeter Bullfinch—*Erythrospiza githaginea crassirostris* (Blyth).

The only record for the Trumpeter Bullfinch in the Punjab is that by Hume (S. F., vii, 454) who received a specimen from Mr. E. W. Cleveland which the latter had shot near Hattin in the Gurgaon district on the 16th December 1877.

This species was obtained by Hume at Jodhpur and it has been found not uncommonly in the Kohat district and in Sindh so it may be expected to occur occasionally in the south-western districts of the Punjab.

The Dark Rose Finch—*Procarduelis nipalensis* (Hodgs.).

I have been able to trace but very little information from any area regarding this handsome bird and its complete life-history remains to be written.

Within the Punjab it has been found only at Dharmsala whence there is a specimen in the Hume Collection. Here according to Hingston (Jour. B.N.H.S., xxvii, 564) it is "frequently seen in summer at high elevations on the snowy range. Associates in flocks that feed on the Alpine pastures. Usually found in summer between 10,000′ and 11,000′. Not observed in winter."

On the 30th and 31st July 1921 during the rains I found the bird common at Lakkar behind Dharmsala (evidently the locality referred to by Hingston) from 10,000′ to about 12,000′ as mixed flock of both sexes were seen feeding on a stony pasture close to the foot of the sheer summits of the main ridge ; otherwise I hardly saw a female though males were common feeding on the ground or sitting on the tops of the Kharshu Oaks that are the highest patches of tree growth along the main ridge. From the absence of the females and the huge testes of the males secured it may be safely assumed that the birds were on their breeding ground. They are somewhat sluggish and have a habit of sitting

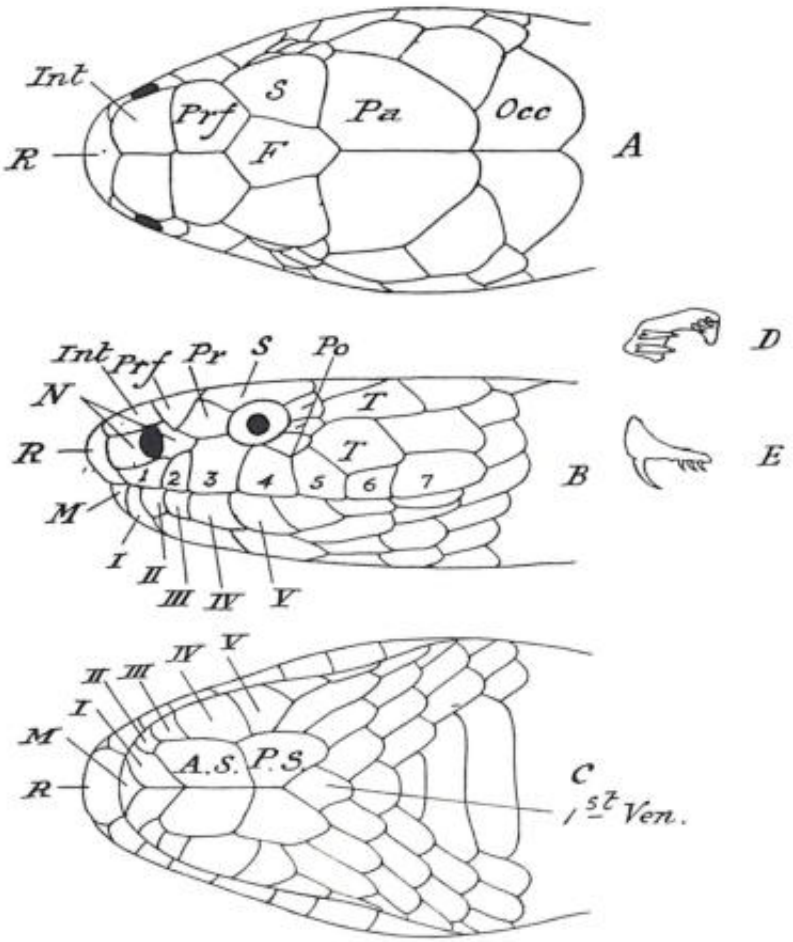
about on boulders. The birds however are not resident on this area as I failed to meet with them on various visits in spring and autumn.

On 26th August 1922 I could only find a couple of females in the very places where the birds were so numerous in July.

On June 6th, 1923, several parties were found feeding in the rhododendron thickets and oakwoods at 10,000′ about the Kareri Lake, west of Dharmsala.

In two years I did not otherwise meet with the species in the course of much wandering about the hills at various elevations and was fairly satisfied that during the winter they must migrate further east along the Himalayas. But after a heavy fall of snow on the main Duala Dar range I came across a few individuals on 14th January 1923 in two places, in a deserted garden near the Civil Hospital Dharmsala at 4,000″ and at nearly 5,000′ amongst bushes by the Sessions House. Two females were secured. One of these had the abdomen and vent covered with a cluster of large cysts containing filthy matter though the bird was otherwise in good condition with a little fat.

(To be continued.)



Naia hannah (Life size)

HEAD OF KING COBRA OR HAMADRYAD.

As, Anterior sublinguals ; *F*, Frontal ; *Int*, Internasals ; *M*, Mental ; *N*, Nasals ; *Occ*, Occipitals ; *Pa*, Parietals ; *Po*, Postoculars ; *Pr*, Praeocular ; *Prf*. Præfrontals ; *Ps*, Posterior Sublinguals ; *R*, Rostral ; *S*, Supraoculars; *T*, Temporals ; 1 to 7 Supralabials ; I to V, Infralabials; 1st Ven, 1st Ventral.

Fig. D Left maxilla ventral aspect.
„ E „ „ lateral aspect.

THE HAMADRYAD OR KING COBRA, *NAIA HANNAH*. (Cantor).

BY

COLONEL F. WALL, C.M.G., K.H.S., I.M.S.

(*With a plate*).

(*Read before the Bombay Natural History Society at a meeting held on the 22nd July* 1924.)

Many notes have appeared in this Journal from time to time on this remarkable snake, and allusion has been made to it by various authors in other publications.

Since I came to India 29 years ago I have collected a good deal of information concerning its habits which I have recorded in my note books. I have been careful, however, to accept information from reliable sources only. I think it may interest our Members to have all the available information about the species incorporated into a paper, from which they may learn what is already known, and how they may further advance our knowledge of its life-history.

SYNONYMY.—*Hamadryas hannah*. Cantor, Asiat. Research, XIX, p. 187, Plates X-XII (1836).

Naja bungarus. Schlegel, Phys. Serp., II, p. 476, Plate XVII, figs. 8 and 9 (1837) ; Schlegel and Muller, Verh. Overz. Bez. Nederl. Ind. Rept., p. 71, Plate X (1844); Peters, Mon. Berl. Acad., p. 690 (1861); Boulenger, Faun. Ind. Rept., p. 392 (1890); Cat., Vol. III, p. 386 (1896); Faun. Mal. Pen., p. 202 (1912); Sclater. List. Sn. Ind. Mus., p. 59 (1891) ; Wasey, Bomb. N. H. J., Vol. VII, p. 275 (1892) ; Ferguson, Bomb. N. H. J., Vol. X, p. 75 (1895) ; Primrose, Bomb. N. H. J., Vol. XII, p. 589 (1899) ; Wall and Evans, Bomb. N. H. J., Vol. XIII, p. 348 (1900) ; l. c. Vol. XIII, p. 616 (1901) ; Evans, Bomb. N. H. J., Vol. XIV, p. 409 (1902) ; Millard, Bomb. N. H. J., Vol. XVI, p. 395 (1902) ; Aitken, Bomb. N. H. J., Vol. XVI, p. 629 (1902) ; Craddock, Bomb. N. H. J., Vol. XV p. 143 (1903) ; Noble, Bomb. N. H. J., Vol. XV, p. 358 (1903) ; Bannerman, Bomb. N. H. J., Vol. XV, p. 407 (1904) ; Annandale, J. A. S., Beng., p. 176 (1905) ; Wall, Bomb. N. H. J., Vol. XVII, p. 303 (1906) ; l.c., Vol. XVIII, p. 331 (1908) ; l.c., Vol. XIX, p. 355 (1909) ; l.c., Vol. XIX, pp. 841 and 900 (1910) ; l.c., Vol. XXVI, p. 575 (1919) ; Pois, Sn. Brit. Ind., p. 26 (1907) ; l.c., p. 33 (1908) ; l.c., p. 31 (1913) ; Mocquard, Rept. L' Indo-Chine, p. 53 (1907) ; Sarasin, Zool. Jahr. Jena, p. 144 (1910) : Acton and Knowles, Jourl. Ind. Med. Res., p. 52 (1914) ; Parshad, Bomb. N. H. J., Vol. XXIII, p. 585 (1915) ; Fenton, Bomb. N. H. J., Vol. XXV, p. 151 (1917).

Hamadryas ophiophagus. Cantor, P. Z. S., p. 32 (1839) ; and Cat. Mal. Rept., p. 116 (1847).

Trimeresurus ophiophagus. (part) Dum and Bibr., VII, p. 1245 (1854).

Hamadryas elaps. Gunther, Cat., p. 219 (1858).

Trimeresurus bungarus. Jan., Rev. and Mag. Zool., p. 129 (1859,) and Icon. Gen. 44, Plate IV (1873).

Naja fasciata. Peters, Mon. Berl. Acad., p. 689 (1861).

Ophiophagus elaps. Gunther, Rept. Brit. Ind., p. 341 (1864) ; Stoliczka, J. A. S., Beng., XXXIX, p. 210 (1870) ; Anderson, P. Z. S., p. 188 (1871) ; Fayrer, Thanatoph. Ind., Plates VII and VIII (1874) ; Phipson, Bomb. N. H. J., Vol. II, p. 245 (1887) ; Boettger, Ber. Offendb. Ver. Nat., p. 86 (1888).

Naja elaps. Theobald, Cat. Rept. Brit. Ind., p. 209 (1876).

Naja ingens. Von Hasselt, Versl. A. K. Amsterd., XVII, p. 140 (1882).

Naja tripudians Var. Sumatrana. Muller, Verh. Nat. Ges. Basel., VIII, p. 277 (1887).

Ophiophagous bungarus. Beddard, P. Z. S., p. 355 (1904).

NOMENCLATURE.—(*a*) Scientific. " The generic name written as Naja was conferred by Laurenti in 1768, having been borrowed from Linne's earlier specific title given to the cobra in 1754. The name was evidently suggested by the Hindustani name for the cobra, *viz.*, " nag". Naja was retained for many years, but evidently altered to " *naia*" owing to the Latin alphabet containing no letter j.

(*b*) English.—It is familiarly known to all Europeans as the hamadryad or king cobra.

(*c*) Vernacular.—" Krishna Nagam " (Black snake) of Tamils in South India. " Karinchathai " of the jungle tribes about Travancore. " Karinagam " and " Krishna Sarpam " (King Snake) among Tamils in Travancore. " Karlinga haow" (Black snake) by the Canarese in Mysore State. " Nagin and Kalinagin " of North Canarese (Fenton). " Ai-raj " of Ooriahs in Orissa. " Sank-chor " and Sha-kha-muti (Cantor) of Bengalis. " Fetty sap" (" hooded snake " applied also to the cobra) of Assamese about Tezpur (Mr. Gardiner " in epistola "). "Mutti-fetty " of Assamese at base of Naga Hills (Mr. Gore " in epistola "). B'sein-yong " (" Black snake") of the Khasis about Shillong (Mr. Rita " in epistola "). " Gnan-bok ", and " Gnan-gnan-bok " of the Burmese (Evans). " Gnan-bok " and " Gnan-than-gwin-soh " of Burmese around Taungdawgye (Mr. Little " in epistola"). " Hkram-chang " (Black hamadryad), " Hkram-sit " (Yellow hamadryad), and " Hkram-mut " (Grey hamadryad) of the Kachins (Mr. Leonard " in epistola"). " Gni-son-an " of the Shans (Evans), and " Gni-thaw-plaw " and " Gni-thaw " of the Karens (Evans).

HISTORY.—The first allusion to it appears to be Cantor's in 1836. Schlegel was the next to mention it in 1837. Since then almost every writer on Indian Snakes has referred to it.

GENERAL CHARACTERS.—It is the third largest snake found within the limits of the Indian Empire. The head is moderate in size and markedly depressed. The snout is gently bowed in profile, rounded at its extremity, and shows little indication of a canthus. Behind the eyes the temples are swollen to correspond with the underlying poison glands. The nostril is fairly large, and occupies the full depth of the suture between the nasal shields. The eye is moderately large, being about the same diameter as its distance to the nostril. The pupil is rounded and the pupillary edge of the iris golden or golden-brown. A neck is barely evident. The body is fairly robust and roundish, and just behind the head is capable of expansion to form a " hood ", which is relatively less dilatable than in the cobra. The scales are glossy. The tail is moderate in length, being about one-fifth to one-sixth the total length of the snake.

IDENTIFICATION.—The pair of occipital shields are peculiar to this snake. The costals are in 17 to 19 rows two heads-lengths behind the head, 15 in mid-body, and 15 two heads-lengths before the vent and characteristic of this species with the one exception of the rare Bengal snake, *Elachistodon westermanni*. The latter has only two labials touching the nasals, (the 1st and 2nd) whereas the hamadryad has three (the 1st, 2nd, and 3rd).

COLOURATION.—In adults the prevailing dorsal colouration varies from a blackish-brown to a light olive-brown, but every gradation of hue is seen between these two extremes. There are from 32 to 43 lighter bands round the body, and from 11 to 13 round the tail. These are conspicuous in juvenile specimens, and gradually become less well-defined or even obscured as age advances, those in the posterior part showing these changes to a more marked degree. The bands involve one or two scales in the length of the snake, and the intervals from five to seven scales. The light shade in the band

is more conspicuous on that part of the scales that is overlapped, so that the bands are much more evident when the snake under excitement expands itself than at other times. In Burma the natives recognise two species, basing their views on the extremes of colour just referred to. Evans tells us that they call the dark variety "gnan-bok" and the light one with more conspicuous bands "gnan". The head is olivaceous-brown, the shields being narrowly edged with black. The throat is creamy to dull orange merging to a dark mottling which becomes further back a uniform slatish or brown.

Hatchlings are so different from adults that anyone unfamiliar with snakes, and relying on colour instead of shield characters, would unhesitatingly fail to recognise them as hamadryads. The prevailing colour is intense black, and the bands are pure white, so that they bare a very close superficial resemblance to Cantor's Krait. (*Bungarus bungaroides*). Further the head is intense black with white markings. These consist of a bar across the top of the rostral and anterior part of the inter-nasals, a thicker bar across the posterior part of the præfrontals, a thin bar at the back of the supraoculars and frontal interrupted at the fronto supraocular sutures, an oblique stripe converging with its fellow along the outer edge of the parietals, and an oblique stripe from the end of the last passing round the side of the throat.

Habits—(*a*) *Haunts.*—The hamadryad is a denizen of dense jungles, and in Peninsular India is confined to hills or their near vicinity. It frequently climbs into trees, and thus obtains a vantage point among the foliage, from which it can advantageously view its surroundings, and rush down upon any suitable victim moving in the scrub below, engage, overpower, and swallow it. It is frequently seen in or near streams, and will readily take to the water if pursued.

(*b*) *Disposition.*—This snake has earned for itself a very unenviable reputation for its aggressiveness and courage, and is probably unrivalled in the snake world for these disagreeable traits, with the single exception of the South African mamba, a snake of somewhat similar proportions.

I have collected a great deal of information about its character from reliable sources apart from what is available from snake literature. There is no doubt that the hamadryad will sometimes attack without provocation, other than being confronted in its natural haunts. A notable instance is that reported by Raby Noble in this Journal (Vol. XV, page 358) when one attacked a cooly woman. One could cite many other similar incidents. The female when disturbed in the process of brooding her eggs, seems to be specially sensitive, and usually attacks the intruder at sight. Several instances are recorded where a jungle path has become closed to the wayfarer, owing to a brooding female and her mate attacking any one attempting to pass. When actually molested the snake frequently accepts the challenge, and attacks with great determination and ferocity. On the other hand even a large hamadryad will sometimes fail to attack on great provocation, being more concerned for its own safety. A good instance is that narrated by Colonel Evans in this Journal (Vol. XXVII, page 955) where a large specimen was rudely hustled by natives with bamboos, and by barking dogs, but slunk off rather than fight. A good instance of its courage recently came to my notice. Major Fraser, I.M.S., motoring with his wife down the Gudalur Ghat in the Nilgiri Hills, saw a large snake crossing the road in front of him, which he took to be a python. He tried to go over it, and thinks that he may have gone over its tail. The snake erected itself in a flash, and Mrs. Fraser seeing its head on a level with the top of the door and in close proximity to her, threw herself across her husband who was at the wheel, to avoid being struck. Major Fraser stopped the car, got out and found the snake was in the middle of the road with its head reared and facing right and left in a very threatening manner. He hesitated—with only a butterfly net in his hand—how he should act, when the snake came straight for him down the road at an alarming pace. Major

Fraser wisely got back into the car released the brakes and free wheeled for a hundred yards or so, and again got out. The hamadryad was still in the road with reared head and expanded hood, but suddenly ceased its menacing attitude and slunk off into the scrub. When encountered and not molested there is no doubt many specimens will retire without attacking. Mr. Hauxwell of the Indian Forest Department, quoted by Evans, from his experience of the snake in Burmese jungles, seemed to be sceptical as to its aggressiveness and thought that in nine cases out of ten the snake sought retirement in preference to hostilities.

(c) *Striking Posture.*—Like the cobra, the hamadryad under excitement erects its forebody a considerable height from the ground, and flattens the body just behind the neck to form the so called "hood". At the same time it expands its body and presents a most formidable appearance. I have not been able to ascertain with any certainty to what degree it can erect itself, but would estimate this as equal to the same muscular feat in the cobra, *viz.*, about one a third its length. The incident referred to in which Major Fraser figured, shows that a large specimen can raise its head to about the height of the top of the door of a Ford car. This proves to be 3 feet 9½ inches.

The bite is a determined one, the snake maintaining its hold tenaciously. Mr. Raby Noble's account of one retaining its grasp on the leg of a cooly woman for eight minutes exemplifies this point, and those who have witnessed its encounter with other snakes have remarked upon this peculiarity.

(d) *Nocturnal or Diurnal.*—It evinces a markedly diurnal habit. Nearly all the encounters one hears about happen in broad daylight.

(e) *Progression.*—Its movements during attack are singularly rapid, and those who have fled before it in the jungles are very insistent that they had to use their utmost endeavours to escape.

(f) *Hissing.*—When alarmed and in an aggressive mood it hisses vehemently.

(g) *Sloughing.*—Cantor recorded that one in captivity desquamated every three or four months.

(h) *Longevity.*—Phipson (P.Z..S., 1887, page 639) mentions one that lived in Regent's Park for 12 years and 7 months.

Food—The staple diet of this species is snakes, but I have four records of lizards of the family *Varanidæ* (the iguanas of Europeans in India) being swallowed. Any snake seems to be victimised, whether harmless or poisonous, and even small species are not despised on account of their size. I have records of its practising cannibalism, and also of swallowing the following other poisonous snakes: the cobra (*Naia naia*), the banded krait (*Bungarus fasciatus*), and the white-striped coral snake (*Doliophis bivirgatus*). It will sometimes attack the python. Mervyn Smith in his book "Sport and Adventure in the Indian Jungle" (page 19) says he shot a hamadryad thirteen feet in length in the act of swallowing a python eight feet in length. Mr. Donaghy of the Survey of India sent me two dry snake skins to examine with the following history. When in the Toungoo District of Burma his coolies encountered two snakes in conflict. The smaller, a python, (*P. reticulatus*) had fastened its jaws upon the body of the larger snake which proved to be a hamadryad. The coolies killed them both. In the skin of the hamadryad there was a considerable rent where the python had seized its opponent. The hamadryad's skin measured ten feet, three and a half inches, and the python's seven feet eleven inches. As the python rarely if ever evinces a taste for other snakes in its natural haunts, it is probable the hamadryad was the assailant in this contest. Mr. Aitken in this Journal (Vol. XIV, p. 629) mentions one killed on the Goa Frontier in the act of eating a python, three feet of which was already swallowed. The hamadryad measured twelve feet one inch, and the python nine feet two inches.

Among harmless snakes the ratsnake (*Ptyas mucosus*) is frequently victimised, and others I have records of are the green whip snake (*Dryophis mycterizans*), Blyth's keelback (*Rhabdophis platyceps*), Anderson's wolf snake (*Lycodon fasciatus*), and Blyth's snake (*Blythia reticulata*). The two last were found inside the same hamadryad.

Major Firth wrote to me of a hamadryad encountered by a Gurkha sepoy at Takdah near Darjeeling, which was coiled round a "malsampra" (the pine martin, *Mustela flavigula*). The sepoy threw a stone at them, and the snake left its victim, and attacked the sepoy who luckily killed it with a stone. It seems probable that the snake had no intention of swallowing its opponent, but attacked and killed it as it is wont to do other creatures that cross its path. The late Major K.L.W. Mackenzie told me of an incident where a sepoy of the 62nd Punjabis at Buxa Dooars was stalking a khakur in the jungle which he shot. A hamadryad was—unknown to him at first—also stalking the khakur, and when the latter was shot the snake rushed at him. The sepoy killed it and it measured nine feet eleven and a half inches.

In captivity the hamadryad feeds voraciously. A specimen in Regent's Park ate eighty-two snakes in one winter, but refused all other food offered to it, *viz.*, eggs, lizards, rats, guineapigs, and pigeons.

BREEDING.—(*a*) *The Sexes.*—There is no evidence to show whether one sex grows to a greater length than the other. From my notes there is nothing to show that the ventral and subcaudal shields vary in the sexes.

(*b*) *Mating.*—Mr. Foster of Sallebile in the Kadur District, Mysore, came upon two in the act of mating at the beginning of March, and shot them. No record of their respective lengths is available. Mr. Jacob of the Indian Forest Service told me of two that were killed in the act of mating at the end of April or early May on a tea estate near Jalpaiguri.

(*c*) *Method of reproduction.*—There is definite proof that this species is oviparous.

(*d*) *Season.*—Eggs have been found in the months of April and May. Colonel G. H. Evans records two instances of nests containing eggs found at the end of April or early May in Burma. Mr. Millard told me of a female killed on eggs in Kanara in May 1892. Mr. Harrison told me of a female encountered on eggs in Assam in the middle of May 1907, and another killed in similar circumstances on the 15th of May 1908. All those who have met the hamadryad during the period of incubation have remarked upon the fact that the female has been coiled up on a nest of leaves, or vegetable rubbish. How this nest has been prepared there is no evidence to show, and it would be interesting to know if the snake gathers these leaves together, and if so how. It seems most probable she selects a chance accumulation of debris which she can appropriate for her use. The female from these reports remains with her eggs for sometime. In the instance reported by Mr. Wasey in this Journal (Vol. VII, page 257) where he shot a hamadryad on her nest, he says that the eggs contained embryos that were formed and breathing." Whether the dam remains with her clutch until they hatch is not known. During the incubation period there is no doubt at any rate in some instances, that the male is in close attendance on his mate.

The two hatchlings obtained for me in the Nilgiris were killed at the end of May, on either the 25th, 26th, or 27th. From this it is probable that eggs may be deposited earlier than April.

(*e*) *Period of gestation.*—Nothing known.

(*f*) *Period of incubation.*—Nothing known.

(*g*) *The eggs.*—I have records of six broods in which the eggs varied in number from 21 to 33. I have never seen the eggs nor do I know of any observations having been recorded of their measurements.

GROWTH.—(*a*) *The hatchling.*—The young snake on emergence from the egg measures about 20 to 21 inches. In 1917 I acquired two specimens killed in close proximity on the same day on Pilloor Estate in the Nilgiris. It seems almost certain therefore that they were newly hatched. These measured respectively 20¼ and 20¾ inches. Stoliczka also obtained a young specimen in Moulmein that was 20½ inches, but there is no record of the date of capture.

(*b*) *Maturity.*—I have no certain knowledge of the length of incubating females, but one of those referred to already, killed by Mr. Harrison in Assam, he reported to me was small "probably eight or nine feet."

(*c*) *Maximum length.*—I have two records of specimens over fourteen feet, *viz.*, fourteen feet five inches and fourteen feet six inches. Fifteen feet five inches is the largest authentic specimen I know of. This is on the authority of Mr. Millard. Another specimen killed in the Travancore jungles by Lieutenant Branson many years ago appears to have been just the same length from the cutting I have from "The Pioneer" where it appeared at the time of the incident. Colonel Pollok in his book "Wild Sports of Burma and Assam" (page 114) reports one "over sixteen feet", but as the specimen was alive on exhibit in the street of Shooyghein, the length must be accepted with hesitation as snakes, especially large ones, are very difficult to measure during life. I have had many stories told me of lengths exceeding this, but wherever I have been able to procure the skin of the specimen referred to, I have proved the reported length considerably exaggerated.

POISON.—(*a*) *Physical characters.*—Cantor remarks on the fresh poison that it is a pellucid, tasteless fluid, which slightly reddens litmus paper. When kept its acid reaction is intensified.

(*b*) *Amount injected at one bite.*—Rogers by laboratory experiment estimated with some doubt, that about ten lethal doses (for man ?) could be discharged at one bite. The amount injected however will vary with the length of time the bitten part is grasped, and I have already remarked upon the evil disposition of this snake to retain its hold.

(*c*) *Toxicity.*—Lamb by experiment on rabbits found the venom as virulent as cobra venom. Rogers by experiment on pigeons estimated the virulence as rather less than that of cobra venom.

(*d*) *Uncertainty of effects.*—Dr. Nicholson reported the case of a Burman snake catcher who was bitten by a ten foot specimen in good condition. He chewed some vegetable pulp, and applied it to the wound and was none the worse for the bite. Cases however that escape a lethal dose being injected into a wound must be rare.

(*e*) *Cause of death.*—Acting like cobra and other colubrine poisons, death is due to paralysis of the respiratory centre, and the terminations of the nerves which supply that important respiratory muscle the diaphragm, *viz.*, the phrenics.

(*f*) *Interval before death.*—Evans records the death of a man bitten by a specimen 9 feet 7 inches long in quarter of an hour. The cooly woman mentioned by Raby Noble, bitten by a specimen ten feet one inch, succumbed in twenty minutes.

(*g*) *Treatment.*—No antivenene is available as a curative agent against this poison. Even if there were, accidents are likely to occur in jungles far removed from medical advice. The interval between the bite and death usually leaves little time in which to act. The best that can be done is to keep the patient warm and give, if available, hot soup or hot coffee, hoping that the dose injected has been something sublethal. I know of no case of a bite in a European. No case has been reported giving medical notes of any value.

LEPIDOSIS.—(*a*) *Typical Rostral.*—Depth ⅔ to ⅔ the breadth; rostro-internasa and rostro-nasal sutures subequal and greater than the rostro-labials. *Inter nasals.*—A pair. The suture between the fellows ⅔ to ¾ that between th prefrontal pair. *Præfrontals* a pair; the suture between the fellows ⅓ to ½ th

length, of the frontal. *Supraoculars.*—Length subequal to præfrontal and internasal taken together, subequal to the frontal, $\frac{2}{3}$ to $\frac{3}{4}$ the parietals, rather greater than both temporals; breadth subequal to the frontal. *Frontal.*—Touches six shields; length subequal to the snout, $\frac{2}{3}$ to $\frac{3}{4}$ the parietals. *Occipitals.*—A pair. *Nasals.*—A pair. *Loreal.*—Absent. *Præocular.*—One. *Postoculars.*—Three. *Temporals.*—Two. Well developed and subequal. *Supralabials.*—Seven; the 1st, 2nd, and 3rd touching the nasals, 3rd and 4th the eye, 5th, 6th, and 7th the temporal. The 3rd is the deepest, and the 7th the longest of the series. *Infralabials.*—Five, the 4th and 5th which are subequal touching the posteror sublinguals. *Cuneate.*—None. *Sublinguals.*—Two pairs; subequal. The posterior is quite separated by a scale of about the same size. *Costals.*—Two heads-lengths behind the head 17 usually (sometimes 19); at midbody 15; two heads-lengths before the vent 15. The reduction of rows from 15 to 17 occurs about two and a half to three heads-lengths behind the head, and the fourth row above the ventrals is absorbed. The scales are smooth. Vertebrals slightly enlarged. Subjacent rows except the penultimate and ultimate oblique. *Ventrals.*—225 to 262 (215 to 262, Boulenger). *Anal.*—Entire. *Subcaudals.*—76 to 93 (80 to 117, Boulenger. These figures include specimens from the Malay Peninsula and Archipelago which have more numerous shields than Indian examples). They are mostly divided, but there are nearly always a few at the base of the tail entire, and some specimens after divided shields have been established show entire shields again interruptedly.

Dentition.—From six skulls in my collection. *Maxilla.*—Fangs 2; canaliculate, showing shallow groves on their anterior faces where the surrounding walls have coalesced, followed after an edentulous gap by 3 small teeth, isodont, and grooved on their outer faces. The fangs are relatively small. Those in a skull in my collection from a hamadryad 11 feet 5 inches only measure three-eighths of an inch. *Palatine.*—7 to 8; anododont, isodont, grooved on their inner faces. *Pterygoid.*—9 to 14; anododont, scaphiodont; ridged on their outer and inner faces. *Mandibular.*—14 to 18; anododont, scaphiodont; grooved on their outer faces.

Distribution.—(*a*) *General.*—Peninsular India to the Himalayas, Assam, Burma, Indo-China to South China. The Andamans. Malay Peninsula and Archipelago to the Philippines.

(*b*) *Local.*—In Peninsular India (except in Orissa and Bengal) its distribution corresponds to the mountain ranges and their near vicinity. Mr. Baini Parshad in this Journal (Vol. XXIII, page 585) records one from the vicinity of Lahore. This is the only evidence of the species occurring in the Punjab, except in or near the Western Himalayas, that I am aware of. In this Journal (Vol. XVII, page 515) is mentioned a skin of a specimen killed at Palanpur near Deesa. Mr. Millard wrote to me of another example killed by Colonel Woodhouse at Kolhapore twenty miles from any jungle. The occurrence of specimens in such unusual localities may be accounted for by transportation on drift by rivers. Colonel Woodhouse mentioned that the Panchganga river was in flood, and passed the lower part of his garden at the time he killed his specimen. As far as I am aware, it does not occur in the Central Provinces.

It is no where a common snake, in fact in my experience it is uncommon throughout its Indian distribution. When anyone kills a hamadryad he considers rather an event in his life. The incident is widely known to all his neighbours, and in many instances an account of the adventure finds its way into print. This probably accounts for it appearing a commoner snake than is really the case.

It appears to favour the lower elevations of hills, but has been met with over 6,000 feet in the Nilgiris, in the Western Himalayas, *viz.*, Teneriffe above Coonoor, the Park at Mussoorie, and at Muktesar. In Orissa, Bengal, Assam, and Burma it is found as frequently at plain level as elevated tracts.

A ROUGH AND TUMBLE WITH AN AFRICAN BUFFALO.

It has fallen to the lot of few to survive experiences such as befell me when at the mercy of a severely wounded Buffalo, experiences the reading of which sounds more like a fantastic fairytale than authentic happenings but which to the writer were a very grim reality. It was early in July 1921 that my comrade R. and myself decided to take a holiday from our farm life and spend a fortnight's shooting in the Cherangani Hills, some 60 miles East of Mount Elgon in Kenya Colony. The rains had broken and the grass was getting long on our farms but that did not matter as the grass in the hills keeps quite short at high elevations and the locality where we intended to hunt the Buffalo attained a height of 11,000 feet. Shortly after dawn on the 8th of July, we left our "Bandas" or mud dwelling-huts and started for the hills with a little army of Wagishu carriers transporting our kit, tents, rifles and provisions. Each man carried a load of 60 lbs. The day was hot and the track went up and down over a series of steep hills and through deep valleys, so we did not go more than 10 miles the first day. We had barely pitched our camp just after mid-day and stowed away the kit before a heavy shower of rain came on. Near by was a small Wanderobo village and we had previously arranged with these folk, who are hunters by profession, that they should provide us with guides when we went out after Buffalo. We had hardly arrived before we were visited by a deputation from the village, and their first request which is the same anywhere in this country—except in the case of certain tribes—was for meat. R. shot an Oribi and a nice Reed-buck, and I suddenly discovered that my rifles had inadvertently been left behind! Next day we moved our camp to a permanent site in the cedar forest about five miles further on and at a height of approximately 9,000 feet, while my missing weapons turned up during the afternoon. R. shot another Reed-buck. The Buffalo, cunning and dangerous though he may be when pursued or wounded, in reality is an extremely shy animal who shuns the haunts of man and just wants to be left alone. A little unusual noise in his habitat, or a glimpse of human intruders, and he will put many miles between himself and the possible danger. There was good news for us, as our Wanderobo trackers had been out all day and had come across fresh Buffalo spoor at no great distance from our camp. This meant an early rise the next morning and we turned in about 9 o'clock on a dripping evening, with the rain steadily coming down. Long before dawn we were up, having prepared everything overnight, and we were off by 5-30 a.m. Our party consisted of R. and myself, one young and two old Wanderobos with a couple of dogs, and two Wagishu gun-bearers. Our weapons were as follows: R. had a ·404 magazine H.V. Rifle and ·303 Sporting Magazine Rifle, while I had a D.B. ·450 cordite and a ·315 B.S.A. Magazine Rifle. Our permits allowed us each to shoot two Buffalo Bulls. We had only been out about half an hour when we found the fresh spoor of a large cow. Dawn had now broken and the day was getting brighter every minute. Just to the North of us was a bare table-like mountain, the biggest in the range, over 11,000 feet high, and a most conspicious land mark. That was our real objective, for all around it were patches of forest which were the well known haunts of Buffalo. The country here was undulating and grassy, while the forest was chiefly on the hill slopes and at the bottom of the valleys and there was hardly any elephant grass. The short grass was carpeted with small purple crocuses and a species of pink orchid, while here and there were trailing sprays of a yellow and orange musk-like flower. In the open marshy valleys the Red Hot Poker was common as well as a crimson type of everlasting daisy. About 6-30 a.m. we struck the fresh spoor of a large solitary bull, the real quarry of the sportsman as it is the lone monsters which carry by far the finest heads. We followed the spoor across open country for three quarters of an hour and then it lead straight into forest. As we were about to enter the cover, there was a loud crashing from just inside as some large beast galloped away. R. could not see it at all and a Wanderobo standing in front of me prevented me getting a shot at

the fine bull which I saw for a few seconds as he dashed away into the bamboo forest. This was a sad disappointment, but the day was still young being only just after 7 o'clock. We then went through a very thick forest at the bottom of a deep valley and proceeded some miles to visit several salt licks and wallows in the hope of finding fresh spoor but we drew a blank every time. Once again we descended into a deep valley and traversed thick forest. I am mentioning the type of country rather carefully in order to give some idea what I had to go through on the return journey when I was being carried on a makeshift stretcher. We next ascended a very steep grassy hill and then found ourselves looking down on to an extensive, undulating plain stretching for miles to the S. E. with deep forest clad valleys on either side of it. "Strange," said our Wanderobo guides as we pressed on, "Buffalo are nearly always out here grazing." They had hardly spoken when from close ahead there resounded a musical moo. We were skirting the edge of the forest at the time, so crept forward and peeped over the ridge in front of us. There, in a grassy hollow, was a herd of twenty to thirty Buffalo, right out in the open; some were standing up and grazing and others lying down and chewing the cud. There were a few nice bulls, many cows, heifers, steers and calves. I don't suppose any of them were more than 120 yards away while the wind was in our favour. R. selected a bull, and I told him I would also put a bullet into it to help him. The bull staggered to our shots but did not come down and with my second barrel I registered a hit on a fine bull in the centre of the herd. Then the unexpected happened, for the whole herd—which I had imagined would bolt at the first shot—advanced in most menacing fashion towards the sound of the firing. If they had caught a glimpse of us or got our wind, they would have charged. The situation was decidely awkward, so I whispered to R. that we had better make a bolt for it into the forest, while our Wanderobo guides, just like monkeys were already high up the nearest trees. No sooner had we retired than the Wanderobo were by our side saying that the herd was going off. Back we doubled and I just had time to have a snapshot at R.'s wounded bull, as it disappeared into the forest, but unfortunately I was a bit behind him. The rest of the herd was fast disappearing over a grassy ridge in the opposite direction. It is almost impossible to run at these high altitudes—especially uphill, and when we arrived panting at the top of the ridge, all that was left on the vast plain was one great bull, which was out of range. We knew that R.'s bull was desperately hit, so decided to follow him up. I had plenty of shikar experience in India with dangerous game, and had read and been told much about the cunning and ferocity of a wounded Buffalo, but I was quite prepared to pit my wits against his. Lack of experience in Buffalo shooting made us make two mistakes, which, as it transpired, nearly cost a human life. We knew the animal could not live long and so ought to have let him lie up in the cover and the Wanderobo could have gone out the next day and located the carcase. Also, we might have waited until the dogs—which had followed the herd—had been recovered, and they would have soon brought to bay the wounded bull and given us the opportunity of a fairly safe shot at him. At the same time I think there is something repugnant to the average Englishman in leaving a wounded animal to linger on in agony, while the element of danger present is more of an attraction than a deterrent. I lead, as I had the most effective weapon, and close behind me was my young Wagishu gun-bearer, who turned out to be an efficient tracker.

Little tracking was necessary, the soft soil being torn up by the huge hoofs while the undergrowth was smashed down and bespattered with blood. Hardly had we entered the forest when, not many hundred yards away, we heard the great brute bellow—a cry partly of fury but chiefly of pain, and we wondered how long he could last. The spoor lead down hill through fairly open forest and the conditions at first were all in our favour. Once we passed over a ridge covered with dense grass and I momentarily expected a charge, but we breathed more freely when the tell tale bellow boomed out some way ahead. The brute had

laid down under some dense bushes and left copious pools of blood and I was surprised he had not made a stand there. Another bad place was a dense thorny thicket full of grass, but this was in a bog where the bull had sunk in over his knees. We followed down hill steadily for nearly an hour, the descent becoming steeper and steeper and the wounded Buffalo was sliding most of the way leaving a track like that of a runaway traction engine, but, except for an occasional bellow, we never heard any sounds of his flight. The hill ended abruptly in a ravine with a mountain torrent at the bottom and there our quarry had been almost trapped. We missed a splendid opportunity by not arriving on the scene when he was helplessly struggling to get out of the ravine. It was not until his third attempt that he managed to ascend the steep slippery slope on the opposite side and when I followed along the ill defined track that he had taken, I realised that the Bull's turn had come and that he was bound to make a stand almost at once, and directly opportunity offered he would charge out on his relentless pursuers. The cover on either side of the path was a tall and thick jute-like growth and then I noticed that just ahead of me the track had turned a corner, and if I had been the Buffalo that is where I would have made a stand ; consequently I determined to make a slight detour up hill from the path which would again place the Buffalo at a disadvantage. I had barely left the track when there was an angry grunt just ahead of me and my foolish gun-bearer instead of running away, as usually happens on such occasions, darted ahead of me and with suicidal curiosity looked round the corner and showed himself to the infuriated Buffalo. That was what the bull had been waiting for and directly he caught a glimpse of one of his enemies he charged with the velocity of an express engine. The gun-bearer being between me and the charging animal prevented me from firing and possibly turning the brute, and all I could do was to try and dodge at the last moment. R. was not far behind me and I had to turn the charge from him if possible, so I tried to escape down the hill side of the path. But I was too late and with tremendous impact I felt the great brute's head crash into my back and down I went losing my precious rifle as I fell. *The mauling I received* resolved itself into five distinct phases, and the bull commenced by kneeling on me, or at any rate started to do so for his knees touched my shoulders, preparatory to kneading me into a pulp. I had no fear but it immediately struck me that I was for the next world, and I wondered how I should go out and if everything suddenly went black ! It is curious what one thinks about at a such moment ; thoughts of my parents flashed through my mind "What rotten bad luck for them!" But at the same time a touch of humour was added to the situation by the thought "Oh, well they'll get my insurance money !" Also "Here's a nice end to all your East African plans and ambitions." But for some reason the great knees never really came down on me—probably the bull's wounds hurt him too much—and instead of oblivion I found myself very much alive. That was Miracle No. 1. Having been spared so far I determined to lie absolutely limp and apparently lifeless, hoping to bluff my tormentor into thinking that I was done for and not worth touching. I next received a most unmerciful pounding on my back and shoulders from the horny boss, on his forehead, and he would take a step or two backwards and then charge in at me to make the blow more effective. However, he never touched my head which must have resulted fatally and this was Miracle No. 2. In the next phase I was flung on to my back by a dig from one of his horns and he then proceeded to rip to pieces all my clothes with a sideways motion of his horns. He tore to ribbons a thick serge tunic, flannel shirt and undervest, and the only thing left intact was one of the coat pockets in which I carried a piece of white heather that had been in my possession since 1915. My chest was slightly scored and rubbed raw with the fine tips of his horns but no real damage done—yet another miracle ! Once more I was thrown on to my face and the pitiless battering and pounding was resumed. By this time I was thoroughly weary of the whole performance and heartily wished that

he would either make an end of me or clear off. Then ensued the final act; the Buffalo also was apparently getting tired too and with a vicious sideways sweep of his head he swung me aloft on his horns and flung me several yards. As I fell to the ground, well clear of the bull, my companion fired and the great brute staggered down the hill into the ravine where he was quite helpless. I then realised that my right leg was extremely painful, in fact I thought the thigh was broken but luckily no such misfourtune had happened to me. When the bull tossed me his horns had laid open the back of my thigh, bruising and exposing all the muscles, without seriously damaging them—still one more miracle—and at the same time dug a horn deep into my right buttock. Other injuries were fractured ribs and a dislocated shoulder and collar bone, all on the right side. Naturally I was bruised from head to toe and had plenty of minor injuries, as well as being full of thorns, while my mouth and teeth were caked with earth, the result of my face being well ground into the soft soil. The telling of these events has taken some time but the actual occurrence was a matter of seconds. I thought it took about half a minute but my companion tells me it was even less than that. It was after R. had fired and the bull had disappeared that fear really came to me. I knew I was absolutely helpless lying on the ground and was terrified lest the brute should return to make another attack on me. When out shooting I always carry bandages, first field dressing and iodine, so R. was able to tend my injuries after he had finished off the Buffalo at the bottom of the ravine. The broken and dislocated bones had to be left for the time being. I soon discovered, to my great joy, that there were no internal injuries which I had feared more than anything. I could not be moved, and was lying in a most awkward position on a steep slope while the only level ground was at the bottom of the ravine where the stream flowed. The accident had happened just after mid-day and the Wanderobo were immediately sent back to the camp to bring my blankets and warm clothing for the night. There was some slight rain during the afternoon and evening, but on the whole it kept fine. Throughout the day and night I was constantly crying out for water, and it was lucky that there was a stream so near at hand. The only receptacle I had to drink out of was the plush lined leather case belonging to my binoculars. Night fell without any men having arrived from camp and by seven thirty we had given up all hope of seeing them before daylight but shortly after eight o'clock shouts were heard in the distance and lights could be seen flitting about the opposite hillside. R. fired off a rifle a few times as being the surest method of attracting the attention of the relief party and guiding them to us. Half an hour later they arrived. To me the chill air of the night was intensified by reason of my injuries, in spite of the fact that great fires were burning near my head and feet. The steep slope on which I was lying caused me the utmost discomfort and made me constantly slip down the hill, although logs had been placed at my feet. I was powerless to help myself as my right shoulder was just a mass of loose bones which flopped about in the most ridiculous fashion whenever I moved. R. was an absolute hero that night: I believe he sat by a fire clad only in a pair of shorts and a shirt, having given me all his thick clothing and his mackintosh in the hope of keeping me warm. The Wanderobo and Wagishu made the night hideous by consuming great lumps of meat carved out of the inside of the Buffalo, which were eaten half cooked after having been partially fried over one of the fires. They simply gorged themselves and kept it up the whole night, while the stench was horrible! At dawn next day R. made the men cut down some stout poles in order to improvise a stretcher, the rope that was used being strips of the tough bark of certain shrubs and creepers. At last at 7-15 all was ready and with much difficulty I was transferred to the stretcher. Then the awful journey began and for a start we ascended a sheer 2,000 feet, the greater part of it through thick forest and which took a couple of hours to accomplish. In spite of the unmerciful bumping I received at times, I look back with the

greatest admiration and gratitude on the efforts of the four Wagishu who carried me for nearly ten hours that day. None of them were accustomed to porter work; they were oddly sized, which made matters very awkward, and while two were strong and cheery the other two were weaklings and were only kept going by the example and entreaties of the others. Over hill and dale we went, through thick forest, ravines, streams and the most fearsome places, but the men were indefatigable in their efforts to give me as little trouble as possible. It was when I was let down to the ground to enable my carriers to rest that I suffered most, for my stern would touch the ground first followed by my back and shoulders, with the result that the loose bones would move about in a most painful manner. About 2 p.m. steady rain set in and continued on and off until we reached camp nearly three hours later. By the end of the journey the blankets had sagged so much that I was being carried like a trussed pig, which did not add to my comfort. Once in bed R. thoroughly cleaned my wounds and skilfully bound up the dislocations. Hot soup and tea were most welcome, and during the night R. gave me fresh lime squashes every two hours. The next day the 12th inst., R. spent most of the morning cleaning the rifles which had been neglected for 48 hours and were in a dreadful state though fortunately the barrels had not suffered much. At mid-day, a neighbour P. turned up and also B. who had stayed behind on one of our farms. At 3 o'clock that afternoon I started for civilisation accompanied by P. and R., B. being left in charge of the camp. The weak and oddly sized Wagishu were quite incapable of carrying the heavy stretcher—a wooden door that P. had brought for me—with myself on top of it and we had barely gone four miles by 6-30 though we had been steadily moving down hill all the time. R., who was thoroughly done up and had had no rest for 48 hours, went on back to P.'s farm, while P. stayed with me for the night. On the 13th, soon after dawn, we started off again but the Wagishu carriers were quite hopeless, though it was not exactly their fault, as it afterwards transpired that through an oversight they had not had any food for 24 hours. They were quite unable to carry the stretcher in normal fashion, did fairly well with it on their shoulders, but really preferred it on their heads which is their normal method of carrying loads. It was very terrifying for me when without warning several of the men would try and shift the stretcher from their shoulders to their heads, and on one occasion I would have been thrown out if it had not been for the straps that held me securely to the door! About 9 o'clock B. joined us on his way back to the farm. He then remained with me and P. returned to his shamba. About 11 o'clock R. turned up with a large basket of food, and what was better still, eight stalwart and evenly sized Kavirondos. I made a hearty meal and when we moved on again my new carriers picked up the heavy stretcher and myself as if it were no weight at all. The day was fine and hot and eventually we reached P.'s farm about 3-30 p.m. and found the Doctor waiting for me. I was soon patched up and put to bed and after a fairly good night started off for Eldoret Hospital about 40 miles away in the Doctor's Ford Car. I had been well doped with morphia, so I did not have such a bad journey in spite of the road being a mere track which traversed several marshes, and we eventually arrived at our destination about 3-30 p.m. The next day I was put under chloroform and my wounds were thoroughly explored and cleaned. Six weeks in Hospital restored me to health and healed my wounds and I am now as fit and active as ever, neither being disfigured, crippled, nor permanently disabled. I can never thank R. sufficiently for his devotion during those terrible days and nights, for his shot in the nick of time and his untiring attention for the 48 hours after the accident, not to mention his self-sacrifice on that first bitter night when I lay out in the forest, but for him I should not be here to write this tale. The head of the Bull now adorns the Hall of our Dining Hut and it turned out to be a fine trophy. I know that it looks simply immense being almost four feet across the widest part of the horns, and the more one sees of it the more it grows on one.

C. R. S. P.

REVIEWS.

I—The Fauna of British India Birds. Volume II (Second Edition). By E. C. Stuart Baker, O.B.E., F.Z.S., etc. (Taylor and Francis, London.)

In volume XXIX, page 261 of the Journal we duly chronicled the appearance of Volume I of Mr. Stuart Baker's badly needed new edition of the Birds in the Fauna of British India and we have now much pleasure in announcing the appearance of the second volume in a shorter time than was at first predicted. The author's preface holds forth hopes that the remaining volumes will be still more rapidly produced, and it contains also the welcome information that the preparation of a sixth volume has been sanctioned to provide the full synonomy of first references, the deletion of which has been regarded by many as an undesirable feature in this new edition.

This second volume is similar in format and method to the first, but slight additions have been made in indicating the type, type locality, and first reference, for the various genera and in indicating the connection between Indian races and ultra-limital typical forms. The standard of work set in the first volume has been closely adhered to and we have no hesitation in saying that Mr. Stuart Baker has again produced a volume which fills a crying want and will be of the utmost help and necessity to all who study the ornithology of our Indian Empire.

A year's use of Volume I and a necessarily shorter acquaintance with this volume have produced no change in the opinions which we expressed on the appearance of the first volume. The paragraphs on the subject of nidification and habits of the various species are inimitable, giving in a short compass pictures that could only have been drawn by the hand of a master naturalist. The paragraphs on distribution have however been placed too closely and do not give nearly as much information as is required either by the systematist or by the field naturalist; while in some instances the Indian distribution is given incorrectly and published information on this point has been overlooked. The interesting features of the migration of numberless forms have been virtually disregarded, and sufficient distinction has not been drawn between Indian and extra-limital information about various species. For instance as we write the book lies open before us at the page dealing with the Common Wheatear. Had we no previous knowledge of this bird we should have great difficulty in estimating from the author's text alone its position within our area.

It would be easy to point to mistakes in the text and to opinions on which we cannot agree with the author, but that is inevitable in a work of this nature. It would be more gracious once more to emphasis the fact that Mr. Stuart Baker's work will revolutionise the study of Indian Ornithology and enable it to come into line with the western progress behind which naturalists in India have lagged so long. There is food however for reflection in the fact that we can trace no single piece of information in the two volumes which can be attributed to the work of an Indian naturalist; with the elimination of the European element in India are we about to witness the stoppage of all scientific progress in the fertile fields of the orient, and is this work to be the Swan-song of Indian Ornithology? It is a dismal thought.

II—A Practical Handbook of British Birds. Edited by H. F. Witherby. (H. F. and G. Witherby, London). Volume I, Volume II, Parts 1 & 2.

With the issue of part XVIII in February 1924, the Editor and his numerous collaborators have brought to an end their long task commenced in 1913, and they have presented the public with what will remain indefinitely the standard text-book on British Birds. For those who desire to read about British Birds

there are numerous other works which cater according to their price for a variety of tastes; but for those whose aim it is to study British Birds the Practical Handbook will remain for a generation at least the one indispensable book. In it will be found every possible detail about the structure and life-history of the various species on the British list, given with the infinity of care and the authority guaranteed by the names of the Editor and his collaborators.

Each species is treated under a number of separate paragraphs. Its name is followed by a brief synonomy which, while not exhaustive, comprises a reference to the original description and several of the most useful references to the species in British literature. The first paragraph then deals with the descriptions of the various plumages of the species in full detail, indicating their moults and changes. The Editor claims with justice that these are the most complete descriptions that have appeared, and the only possible criticism is that some of the descriptions are too complete, clearness being sacrificed to detail; it would at any rate have been of value to preface the descriptions with a short sub-paragraph giving a brief word picture of the bird under treatment, sufficient to allow of the reader visualising its general appearance.

Measurements and structure and colours of the soft parts appear as a sub-paragraph and details will be found here that are available in no other book; yet it is curious that the colour of the mouth has been omitted in nearly every species, a point of more interest than many of those supplied.

The next two paragraphs dealing with the characters and allied forms and Field-characteristics are of great value; the former is of interest to us in India as indicating the salient differences between many Indian forms and their British representatives; while the paragraphs on Field-characteristics are a model of their kind and a feature which we should like to see incorporated in every book on birds. Separate paragraphs deal with Breeding-habits, Food, Distribution, and Migrations; these are an excellent summary of our knowledge on the subjects but a little more detail under the first and last of these heads would have been of value.

The usual keys and summaries of characters of families and genera are inserted in the appropriate places in the text. The two volumes are fully illustrated with coloured and half-tone plates and with figures in the text. The plates are by Gronvold and in clearness and drawing are excellent, but the colour reproductions are not altogether satisfactory. Instead of aiming at a series of merely beautiful pictures of striking forms, the authors have been careful to use the plates to elucidate their text and illustrate the distinctive differences between closely allied forms, and also to show the interesting types of juvenile plumage.

The text figures are by another hand and are not always up to the general standard of the book.

We have indicated above the few criticisms that occur to us after using the various parts as they have appeared in the last ten years. It remains only for us to state in no hesitating terms that the Practical Handbook has become the standard work on British Birds from the moment of its publication and as such is indispensable to the library of every working ornithologist.

III—Guide to the Birds of Europe and North Africa. By Colonel R. G. Wardlaw Ramsay. (Gurney and Jackson. 12/6d. net).

We have received for review a copy of the guide to the Birds of Europe and North Africa which was under preparation by Colonel Wardlaw Ramsay for some years previous to his death, and which has now been published owing to the co-operation of Surgeon-Rear-Admiral Stenhouse and Dr. William Eagle Clarke.

From the title of the work it might be objected that the book before us can hardly be of interest to the members of the Bombay Natural History Society, but to our mind the truth is far otherwise. The book will prove of great value

to all of our members who are working ornithologists. Indeed for many of them it will fill a crying want.

With the recent recognition of the essential value and necessity of the study of sub-species or geographical races, Indian ornithologists have had to come out of the isolation into which they had steadily been sinking since the ceasing of the labours of the great Hume, and endeavour to collate their studies with the general ornithology of the wider zoo-geographical regions with which India is connected. Their emergence has been difficult and the difficulties of it have caused many of the faint-hearted to fall by the way, for few have been earnest enough to face the only text-book available, which was written in the German language. We refer of course to that monumental work, "Die Vogelder Palaasktischer Fauna" of Dr. Hartert, which will remain for all time as one of the milestones of ornithological progress.

Indian ornithologists are to be congratulated therefore that their difficulties are now being cleared out of the way. For their area proper the new edition of the 'Birds' in the 'Fauna of British India' series is now in its second volume. And here in Colonel Wardlaw Ramsay's book they may be said to receive an English version of Hartert, a handy guide to link their Indian studies with their wider application.

For the book before us may in a sense be called a guide to Hartert. It is admittedly based on the systematic arrangement of that book and it has something of the same form ; but the descriptions are greatly abridged, often indeed to the point of insufficiency, the area dealt with is somewhat smaller and as a consequence the book is more handy and portable than the three great volumes of its prototype. But its value lies in the clear summary that it gives of the material before the worker, the rapid bird's-eye view of the fields that he has to traverse ; a summary and view that is greatly obscured in the German work by the mass of information provided, and for English readers by the language in which it is written. For ourselves we shall use this Guide as a guide, turning to 'Die Vogel' for fuller information on any special point : and this course we recommend to our readers.

The book is of a handy size, especially for the traveller, and is neatly bound in cloth with gold lettering. It is printed on good paper with clear type of varying sizes, so adapted as to mark the special significance of the different paragraphs and preserve the general unity of the book.

Brief descriptions of the family and genus are given and under the head of the genus the general habits and nidification of its members are indicated.

Each species is first of all dealt with under the name of its typical form, English and various continental popular names being given when the bird is of sufficient importance to have acquired them. A brief description with measurements in millimetres follows, indicating any important sexual or other variations. A second paragraph then defines in general terms the distribution of the species and its status.

The various races of the species follow in smaller type and in briefer terms ; the differences from the typical form are indicated and the habitat is given.

IV—"Butterflies of India". C. B. Antram. ($7\frac{1}{2} \times 10$: 242 pages : 417 uncoloured figures : published by Thacker Spink & Co., Calcutta, Rs. 30.)

The Title and the Publisher's advertisement are not altogether justified by the contents of this volume on Indian butterflies. Subject, however, to a recognition of its limitations, we may congratulate Mr. Antram on his work, which will certainly assist the beginner to name his captures ; the uncoloured figures are excellent and the descriptions are short and clear.

The butterflies of Ceylon, Burma, Baluchistan, Chitral and the Andaman and Nicobar Islands have been excluded. The *Lycænidæ* (Blues) and *Hes-*

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We have received for review a copy of the guide to the Birds of Europe and North Africa which was under preparation by Colonel Wardlaw Ramsay for some years previous to his death, and which has now been published owing to the co-operation of Surgeon-Rear-Admiral Stenhouse and Dr. William Eagle Clarke.

From the title of the work it might be objected that the book before us can hardly be of interest to the members of the Bombay Natural History Society, but to our mind the truth is far otherwise. The book will prove of great value

to all of our members who are working ornithologists. Indeed for many of them it will fill a crying want.

With the recent recognition of the essential value and necessity of the study of sub-species or geographical races, Indian ornithologists have had to come out of the isolation into which they had steadily been sinking since the ceasing of the labours of the great Hume, and endeavour to collate their studies with the general ornithology of the wider zoo-geographical regions with which India is connected. Their emergence has been difficult and the difficulties of it have caused many of the faint-hearted to fall by the way, for few have been earnest enough to face the only text-book available, which was written in the German language. We refer of course to that monumental work, "Die Vogelder Palaasktischer Fauna" of Dr. Hartert, which will remain for all time as one of the milestones of ornithological progress.

Indian ornithologists are to be congratulated therefore that their difficulties are now being cleared out of the way. For their area proper the new edition of the 'Birds' in the 'Fauna of British India' series is now in its second volume. And here in Colonel Wardlaw Ramsay's book they may be said to receive an English version of Hartert, a handy guide to link their Indian studies with their wider application.

For the book before us may in a sense be called a guide to Hartert. It is admittedly based on the systematic arrangement of that book and it has something of the same form ; but the descriptions are greatly abridged, often indeed to the point of insufficiency, the area dealt with is somewhat smaller and as a consequence the book is more handy and portable than the three great volumes of its prototype. But its value lies in the clear summary that it gives of the material before the worker, the rapid bird's-eye view of the fields that he has to traverse ; a summary and view that is greatly obscured in the German work by the mass of information provided, and for English readers by the language in which it is written. For ourselves we shall use this Guide as a guide, turning to 'Die Vogel' for fuller information on any special point : and this course we recommend to our readers.

The book is of a handy size, especially for the traveller, and is neatly bound in cloth with gold lettering. It is printed on good paper with clear type of varying sizes, so adapted as to mark the special significance of the different paragraphs and preserve the general unity of the book.

Brief descriptions of the family and genus are given and under the head of the genus the general habits and nidification of its members are indicated.

Each species is first of all dealt with under the name of its typical form, English and various continental popular names being given when the bird is of sufficient importance to have acquired them. A brief description with measurements in millimetres follows, indicating any important sexual or other variations. A second paragraph then defines in general terms the distribution of the species and its status.

The various races of the species follow in smaller type and in briefer terms ; the differences from the typical form are indicated and the habitat is given.

IV—"Butterflies of India". C. B. Antram. ($7\frac{1}{2} \times 10$: 242 pages : 417 uncoloured figures : published by Thacker Spink & Co., Calcutta, Rs. 30.)

The Title and the Publisher's advertisement are not altogether justified by the contents of this volume on Indian butterflies. Subject, however, to a recognition of its limitations, we may congratulate Mr. Antram on his work, which will certainly assist the beginner to name his captures ; the uncoloured figures are excellent and the descriptions are short and clear.

The butterflies of Ceylon, Burma, Baluchistan, Chitral and the Andaman and Nicobar Islands have been excluded. The *Lycænidæ* (Blues) and *Hes-*

periidæ (Skippers) which together comprise nearly half the butterflies of India have been relegated to a future volume.

In a short introductory chapter on collecting and preserving butterflies the author asserts that in India a collection of butterflies should be kept in papers: he gives no instructions for setting or for arranging in cabinets or store boxes. We are afraid that under such conditions beginners would soon give up the pursuit, and scientific study, except to the ultra-keen, would be extraordinarily difficult. No doubt in the districts with a heavy rainfall the keeping of a set collection presents difficulties, but our experience has been that with adequate care these difficulties can be overcome. We recommend the happy mean of keeping a pair of each species set and a reserve supply in papers. The time given for relaxing a dried butteffly prior to setting is in our opinion far too short.

The arrangement is based upon Bingham's "Butterflies" (Fauna of India) with the addition of the new species described in our Journal by Gen Tytler of butterflies from N. E. India. Following modern practice the Papilios have been placed first, headed by the genus *Armandia* and ending with *Parnassius*: actually these genera should come next one another being interconnected through the Palæarctic *Doritis* and *Luehdorfia*. The *Danaidæ* and *Satyridæ* have been retained under the *Nymphalidæ*, a procedure that is now old fashioned. There are no keys of any kind and their absence will render identification of closely allied species very difficult. Races are as a rule briefly mentioned under each species: in this connection there are several inaccuracies, viz., *polyctor* is mentioned as the Western race of *Papilio ganesa*, whereas Boisduval's *polyctor* is the older name: *axion* is given as a race of *eurypylus*, whereas it is actually a race of *Papilio doson*, the closely allied species *Papilio eurypylus* and *evernon* having been omitted.

There are a number of species that have been ignored, such as *Papilio polla* and *crassipes*: *Colias berylla* and *dubia*: *Mycalesis adamsoni, mystes* and *heri*: *Lethe lyncus* and *armandii*: *Maniola pulchra* and *cœnonympha*: *Erebia narasingha*: *Ypthima watsoni, persimilis* and *savara*: *Eulepis moori*: *Sasakia funebris*: *Euthalia cocytus*: *Dophla recta*: *Pantoporia larymna*: *Neptis nashona, antilope, aspasiar manasa* and *nucleus*: *Vanessa egea* and *l-album*: *Argynnis jerdoni* and *hegemone*, etc., etc. Inaccuracies are not infrequent; *Parnassius charltonius* extends to the Baspa valley; *Terias sari* is not an uncommon Sikkim butterfly; *Parage cashmirensis* is entirely dissimilar to "*Parage*" *gafuri*, which latter actually belongs to the genus *Lethe*.

A new species, *Parnassius sulphurus* has been described from a single specimen in the Author's collection from an unknown locality. The specimen has been figured and is probably an aberration of *Parnassius delphius lampidius*, Fruh. We deprecate the coining of a new name under such circumstances and unless the specimen is lodged in the British Museum, its identity will for ever remain in doubt.

The author acknowledges our assistance: we can only say we wish that it had been more freely asked for, since with a few modifications in arrangement and the elimination of the errors we have noticed above the book would have been considerably improved. Perhaps Mr. Antram will permit us to help him with his second volume, or a revised edition of the present volume when found necessary.

W. H. E.

V.—Proceedings of the Fifth Entomological Meeting, Pusa, February 1923.

This report of over 400 pages, accompanied by 37 plates and a group photograph, is divided into twelve sections: crop pests (25 papers), forest entomo-

logy (2 papers), medical and veterinary entomology (5 papers), household and shore pests (1 paper), lac (1 paper), silk (1 paper), life-histories and bionomics (10 papers), collection and preservation (1 paper), systematic entomology (9 papers), publications and organization (4 papers) and miscellaneous (2 papers). To attempt to summarise the contents of such a varied and numerous assortment within the limits of a brief review is clearly impossible. The volume bears substantial witness to the continued activities of the entomologists connected with the Government Agricultural, Forest and Medical Departments, and to the value of such meetings in enabling men from all over India to get together and discuss in person the problems with which their work confronts them.

VI.—Animal Life in Deserts. By P. A. Buxton, M. A. Illustrated, XV + 176 pages, published by Edwin Arnold & Co., London, 1923.

Dr. Buxton has given us a most interesting book, and one which should prove more than pleasant reading to all interested in zoology. The number of graphs illustrating climatic conditions, which figure at the beginning of the book, are perhaps a little alarming to the general reader, and might have been reduced especially, as the author himself admits, since they only depict the average, while it is the abnormal with which desert animals have to contend. An average of monthly rainfall in Sind over ten years does not sufficiently emphasise the fact that there may be two successive years entirely without rain.

In dealing with the colour problem Dr. Buxton is particularly interesting; and, although he has perhaps gone too far in entirely discarding "protective colouration" as an explanation, he presents his facts and arguments in the true spirit of scientific enquiry, and without any of contentious tendency which is often too apparent in scientific works involving disagreement with the beliefs of others. Under this head the author seems to have carried his argument too far when he includes "movement" as relative to "protective colouration". Any theory of protective colouration must be based on protection afforded when at rest.

The statement on p. 74, that "the toes of the Jerboa are reduced to two" is obviously a "lapsus calami" when compared with the figure on p. 76 and the list on p. 80. There is one problem of great interest which the author has not mentioned. How does the sandgrouse prevent the evaporation of the water he takes to his young by soaking his breast feathers? He may have to fly ten miles in the hottest weather from the watering-place to the nest. The interest of the book increases the further one reads, and it is full of facts and problems particularly affecting those who live in or near the desert areas of India.

C. H. S.

VII.—Fauna of the Siju Cave, Assam. By S. W. Kemp, B. Chopra and others. Records of the Indian Museum, Vol. XXVI, Part I.

This valuable addition to the literature of the cave faunas of the Oriental Region forms the first part of Vol. XXVI of the "Records of the Indian Museum," and is by far the most exhaustive account of any such fauna that has yet appeared. It has long seemed probable—and the report under review corroborates this—that the caves of the Oriental Region do not contain any extensive fauna of the specialised type characteristic of certain caves in Europe and North America, which perhaps accounts for the small amount of attention they have yet received from zoologists. They are, however, by no means devoid of special interest and the Siju Cave was found to contain large numbers of several species more rarely met with outside as well as one aquatic and one terrestrial invertebrate not known elsewhere with eyes reduced as in typical cavernicolous forms.

These two cavernicolous forms—a prawn and a snail respectively—are probably the most interesting of the inhabitants of the cave. The prawn, which was first discovered by Mr. Friel in 1919, has eyes of less than half the normal size. It is most abundant between 2,000 and 3,000 ft. from the entrance and does not appear to occur less than 500 ft. in. The snail, which was only found at 450-500 ft. from the entrance, has eyes in which the retinal pigment is reduced to a very variable extent, being absent in about 6 per cent. There are strong reasons for believing that the eyes are not merely degenerating but are being transformed into organs of some sense other than sight.

Twenty-three authors, dealing with different groups, have collaborated in the preparation of this report, which contains a plan and photographs of the cave as well as numerous illustrations of the fauna, which includes five new genera and about forty new species.

F. H. G.

A BRIEF REPLY TO SOME CRITICISMS ON THE SECOND EDITION OF THE AVIFAUNA OF BRITISH INDIA.

I have been so repeatedly asked why I do not publish a reply to criticisms on my first volume of the "Avifauna of British India" that now, on the issue of the second volume, I venture the following remarks, though with the greatest reluctance. Honest criticism is so useful, not only to the public but to the author himself who does not imagine himself to be infallible, that I would not wish to write anything to deter anyone making it.

The majority of the criticisms which have been written call for little comment, but all critics who have written from the point of view of the scientist have agreed on one point, which is, that the absence of synonymy is greatly to be deplored. In this, both the Editor and the author most heartily agree and, on account of the constant representations made by the former, the India Office have agreed to the addition of a sixth volume which shall include, together with corrigenda and addenda, a synonymy for the whole work.

Among others who have written criticisms of the "Avifauna", "An Eminent Ornithologist" in a very kindly review of the volume, has regretted that so little has been said in regard to the plumage of the young and that no information has been given about migration. Perhaps here it will suffice to repeat what has been said in the volume itself to the effect that the plumage of the young is like that of the adult and the birds dealt with are not migratory.

Some other criticisms are much of this type, the critics not having been able to spare time to read the volume before criticising it, but there is one criticism which requires answering more fully. This is the Review by Messrs. Robinson and Kloss which appeared in the Journal and Proceedings of the Asiatic Society of Bengal (New Series), XVIII, No. 10, p. 559 (1922). This criticism, which deals with only a small proportion of the birds in the volume criticised, is according to the authors, "somewhat hurried", though it apparently took them nearly as long a time to write as that allowed the author in which to write the whole volume.

A criticism of this kind, mainly on nomenclature, ought to be very valuable and it is only through such criticisms that we shall eventually get down to "rock bottom" in nomenclature so that it really does not matter much whether in this instance, the criticism is meant kindly or the reverse. We shall, all of us who write about birds, continue to use a certain number of wrong names for a long time to come, but if each scientist, as he comes across an older name than the one in use, publishes his discovery, we shall gradually get our nomenclature stabilized.

It would be impossible here to deal with each point brought forward by Messrs. Robinson and Kloss and I therefore refer but briefly to certain of them.

In the first place, Messrs. Robinson & Kloss object to the *ex cathedra* attitude which they complain I have adopted—I had hoped I had avoided it—and then adopt the same attitude more strongly themselves. It is, perhaps, very difficult to avoid such an attitude when space is limited and reasons for one's opinions and statements cannot be given in very great detail. It is unfortunate also that these gentlemen have not checked their own statements as carefully as, it must be presumed, they have checked those made by me. The result is that, in attempting to correct my alleged misstatements and wrong nomenclature, they have made confusion worse confounded, sometimes by correcting what is already perfectly correct or at other times by substituting one mistake in nomenclature for another. Nor is there any attempt made by these gentlemen to follow even the simplest rules of nomenclature. Thus they, in more than one instance, select the last named subspecies as the type of the species and relegate older names to the rank of subspecies.

If we take the first few names on Messrs. Robinson and Kloss' list of corrections (?) it will suffice to show the pitfalls into which these gentlemen have fallen in their kindly endeavours to save my readers from the quicksands of my ignorance. It will also show the value of their condemnation of my work as a whole.

Taking their first few corrections, we find—

p. 45. *Cissa chinensis*. They make an assertion that I am wrong in accepting China as the type locality because this bird does not occur in that country and they proceed to give a new type locality, "Southern Siam". But, as a matter of fact, this Magpie *is* found frequently in Yunnan, a province of Western China and it also extends even further East, such specimens being now in the British Museum collection. It is, however, quite true that it is wise to restrict type localities as much as possible, so we may now restrict it to "Yunnan".

pp. 52, 53. Messrs. Robinson & Kloss quote Oberholser to the effect that the name *Dendrocitta sinensis* cannot stand and that Oberholser's name *celadina* must take its place and they forthwith proceed to make *himalayensis* and *assimilis* subspecies of *celadina*. It is quite true that *sinensis* cannot stand, as the name *Corvus sinensis* is preoccupied, but had the critics carried out a little research on their own account, they would have found that there was another name *formosæ*, which can and does stand good. Moreover, under no circumstances can *himalayensis* and *assimilis*, which date respectively from 1865 and 1877 rank as forms of *Dendrocitta celadina* which dates from 1920.

p. 141. Here the writers merely add something to the distribution of *Drymastes chinensis leucogenys*, a very desirable point.

pp. 146-8. The distribution of *Garrulax l. diardi* and *G. l. belangeri* given by me is perfectly correct and is proved by specimens in the British Museum. Admittedly, however, the distribution is very confusing. The two forms will certainly not be found breeding together but, as yet, we do not know how they are separated. The division between the two forms may be one of altitude, type of forest or some other cause of demarkation not yet ascertained.

p. 150. Here we have Messrs. Robinson & Kloss adding a *probable* range to a species. In giving the distribution of a bird, it is hardly scientific to add probable or possible places to the habitat. In the "Avifauna" I have accordingly not recorded probabilities except in very rare cases.

p. 193-4. *Turdoides griseus griseus*. Here the writers correctly quote Oberholser as to the inadmissibility of this name and then proceed to repeat their previous mistake of adopting the newest name as specific.

p. 209. *Pomatorhinus olivaceus*. In this point all I can say is that I do not agree with my critics and that the material in the Tring and National Museums does not corroborate their conclusions.

In some other instances the matter is one simply of disagreement between critics and author as to the conclusions to be drawn from an examination of the material available. As a rule this is greater in the British Museum and in Tring than in the Malay States Museums. On the other hand, in some cases, Messrs. Robinson & Kloss have more local material available than I have had and it may well be that their conclusions are more correct than mine.

I have no doubt that in Volume II there will again be found a large number of names requiring alteration. In a work of this nature one edition is nothing more than a starting point for a further edition. Any fault which can be found out and exposed is an asset to the latter and no one will welcome more than I shall such corrections. If, however, each volume awaited issue until each single name had been worked out as thoroughly as it should be, no one author would live long enough to bring out the entire work.

As regards classification, I have been taken to task by some of my critics for making so few alterations from that adopted by Blanford & Oates. My scheme has been to alter as little as possible and it seems to me that to vary a classi-

fication that is good without the soundest of reasons is a very unwise and unnecessary proceeding.

I trust the five volumes of the second edition of the "Avifauna" which I have the pleasure of writing may prove an advance on the first edition and will, at least, form a basis for further improvement when a third edition is thought about.

E. C. STUART BAKER.

6, HAROLD ROAD,
UPPER NORWOOD, S. E. 19,
Dated 2nd May 1924.

WILD ANIMALS OF CENTRAL INDIA.

I am much obliged for your review of my book "Wild Animals in Central India" which appeared in Volume XXIX, No. 4. I am fortunate in having been reviewed by a person who is evidently thoroughly intimate with jungle life in all its aspects. Your reviewer has criticised my remarks as to how the bear attacks. I think this criticism is a just one as I have possibly underestimated the occasions on which they bite and, if I were to rewrite the page dealing with this matter again, I would lay stress on the point that it is in *Unprovoked* attacks by bears in which the claws are so often used. Biting is more frequent in cases in which man is the original agressor. I have seen quite a number of jungle folk with part of their faces or scalps torn off by a stroke of the claws. All instances of *unprovoked* attack. I recollect a case of a Forest Guard who had practically the whole of his scalp removed and was for weeks in hospital. He arrived before me the day it happened. We patched the fellow up eventually and no sooner had he returned to duty than he was encountered by a quack who undertook by means of a varnish to restore his hair in any desired shade. He chose a bright brick red and the day after the first application was back in hospital again in a worse state than ever.

As one paper in reviewing my book considered the story of the python and the chital somewhat "Tall" and as your reviewer is careful to point out that it does not rest on my own personal observation, I give the story in detail.

The head of a Chital Stag with horns was found bound to the base of a sapling by a strip of skin which belonged to the body of the Chital and which was still attached to the skull. The head had evidently been twisted off. Next day in a small jungle pool near by a python was found containing the body of a Chital. There can be no possible doubt that the head and the body of the Chital belonged to the same animal.

My sources of information are un-impeachable and I am prepared to vouch for the facts as stated. I am however entirely responsible for the interpretation put upon the facts *viz.*, that the python realized it could not swallow the Chital horns and all; and took this means of getting rid of the head. I have not yet heard of a better interpretation of the fact. This display of fore thought and reason on the part of an animal so low down the scale is admitted to be almost incredible. Let us remember that a big python may be some hundreds of years old—a lot could be learned in that time.

A. A. DUNBAR BRANDER.

IVY BANK,
BISHOPMILL,
ELGIN, N.B.

EDITORIAL.

It gives us great pleasure to announce that His Highness the Maharao of Cutch has recently signified his consent to become a Vice Patron of the Natural History Section of the Prince of Wales' Museum, of which H.R.H. the Prince of Wales is the Patron—and has generously contributed a sum of Rs. 5,000 towards the expenses of the Museum. His Highness, who is a Vice President of the Society, has consistently taken a kindly and active interest in its affairs, and, on behalf of the Committee and the members of the Society, we take this opportunity of thanking His Highness for the honour he has done us and for his generous donation.

The death of the late Mr. J. D. Inverarity, the veteran big game hunter and naturalist, has created a vacancy in the roll of the Society's Vice-Presidents—which vacancy, at the invitation of its Committee, has been filled by the Revd. Father Blatter, S.J., Ph.D., F.L.S. Father Blatter's connection with the Society has been one of long standing and it is our hope that we shall continue for many years to receive the benefit of his mature experience and advice. As a botanist of standing his fame is not confined to this country, but his greatest work has lain in the furtherance of education in India. His abilities as a great Educationist have been recognised by the Government of Bombay at whose earnest representations to the Vatican Father Blatter's impending transfer to Rome was anulled, whereby his services on the Bombay University Reform Commission and the continuance of his scientific work in this country have been for the present secured.

The Society's interest in the present Inquiry on University Reform in the Bombay Presidency centres chiefly on the questions dealing with the resources and facilities at present existent in the City of Bombay which would tend to place this City on a level with other seats of learning as a centre of Scientific Research.

A step towards the accomplishment of the purpose is indicated in that part of the questionaire issued by the Committee which deals with closer relation and co-operation between the Bombay University and the various Institutions and Societies in Bombay whose objectives are of a kindred nature. The Society's views in this connection have already been placed before the Reform Committee.

The extent and purpose of the University's contribution to the education of the adult non-collegiate population, as far as the Society's interests are concerned, are also indicated in the proposals put forward by the Society. These deal mainly with the publication by the Society, under the ægis of the University, of literature in the form of books, charts and pamphlets which would help students in schools in this Presidency to obtain a more intimate knowledge of the wild life of the country. The whole question is one in which the Society is deeply interested and has already expressed its willingness to co-operate with the Education Department and other Public Bodies. It is obvious however that the financial risk involved in the issuing of such publications is not a matter for a private Society to undertake without the assistance of Government or other public institutions, which would benefit by the work.

'Nature Study' is included in the curiculum of our primary schools but the instruction hitherto imparted has dealt for the most part with forms of animal and plant life foreign to the country in which the pupils reside. A lecture on 'British Birds' may be of absorbing interest but it cannot have any direct appeal to children who have never in their lives had the opportunity of seeing the subjects of the lecture in a wild state.

It must in the first place be understood that "Nature Study" does not concern itself with the teaching of Biology—its aim on the other hand is the training of the child in methods of open-eyed observation, especially of familiar animals and plants, the aim of which training is to teach the child to look at and *think* about what he sees.

Whether the instruction imparted will produce the desired effect is a matter dependent in a great measure upon the teacher and the methods adopted by him. From a study of local conditions the instruction of the teacher would appear to be the main problem. The average 'Nature Study' teacher in India is handicapped in so much that he is, through no fault of his own, unfamiliar with his subject, to which he is now probably introduced for the first time. Nature Study or even an elementary education in Natural History never found a place in the curicula of his school days. Hence the whole question is foreign to him and if his duties are carried out at all they are carried out as a matter of ordinary routine but his work lacks, and must lack, that personal interest in the subject which is essential if his teaching is to produce the desired result.

The average Indian boy takes a lesser interest in Nature than his Western brother. The causes may or may not be temperamental but obviously the boy in India is handicapped since although he has greater opportunities for observation he is unable to make use of them because of his lack of training in a subject with which the European child is trained to become more or less familiar from his earliest days.

Witness the number of school-museums in Western countries built up mainly by the efforts of the pupils, witness the increasing occasions in which school children are brought into contact with life out of doors under the supervision of trained teachers and, last but not least, remember that wealth of readable literature on the animal and plant life of their countries, provinces or towns that is the heritage of children in Western climes.

The essentials for the successful teaching of Nature Study in our schools would therefore appear to be primarily an efficient teaching staff, encouragement of an interest in Nature in the pupils by increased opportunities for out-door excursions, visits to Museums and the Zoological Gardens and, again last but not least, the provision of readable books, charts, etc., dealing with the Natural History of their own country.

The Boy Scouts and Girl Guides Associations have an unparalleled opportunity for rousing an interest and an active love of Nature in children brought under their influence. Out-door camp life and its attractions appeal irresistably to the child, and out-door recreation furnishes opportunities not only to gain abounding health and strength but also a wholesome understanding and love of nature. One asks how is this to benefit the child in years to come ? The answer is that such a training opens the child's eyes and broadens his field and places a never-failing source of pleasure and enjoyment to his life's credit.

To many of us the capacity to take pleasure in the simpler joys the study of Nature affords has been lost. Such desire, if it existed, has been crushed in the turmoil and strife which constitutes for some a struggle for bare existence and for others an overwhelming anxiety to seize by all means the largest possible share of the good things that a man-made civilization affords. Says Emerson "He who knows the most, he who knows what sweets and virtues are in the ground, the waters, the plants, the heavens and how to come at these enchantments is the rich and Royal man."

That mere material wealth is not however without its value is indicated in the Report of the Natural History Section of the Prince of Wales' Museum for 1923-24 which has just been issued. During the year under report the Natural History Section received a grant of Rs. 19,000 from Government. The annual grant, while sufficient to cover the maintenance charges of the Section, leaves little for the provision of show cases. It was fortunate therefore that a further sum of Rs. 11,977 was available against expenditure on show cases. These additional funds were due mainly to donations received from Sir Dinshaw Petit, Bart., Sir Fazulbhoy Currimbhoy and Messrs. R. D. Tata & Co. The generosity of these gentlemen made possible the erection of new show cases for the Bird Gallery

which were completed during the year at a cost of Rs. 10,438-14-5. The Curator in his report points out that "without this extraneous assistance it would have been impossible to undertake this urgently needed provision."

Readers of the Journal must by now be convinced that the officials of the Society are people with a 'permanent grouse'; we plead guilty, in extenuation it might be claimed that

> "The toad beneath the harrow knows exactly where each tooth point goes."

So our clamours must prevail until the waters of our importunity gladden the soil of our discontent and yield to us or to those that come after us the looked-for harvest.

We have recently been endeavouring to compile a record of the measurements of Indian Big Game, our sources of information being the Journals of the Society and works dealing on shooting in India by members of the Society and others. In compiling these records we were at once struck with the inadequacy of information dealing with records or measurements of Big Game obtained within more recent times. We are sure that a yearly publication in the Journal of records of Game shot during the season would be of general interest, and we propose that members of the Society should furnish measurements of heads, etc., of Game shot by themselves or by others. We hope that members will endeavour to assist in the collecting of the information required.

We regret we have to close on a note of sorrow but we, as Editors cannot refrain from expressing our sense of the loss we have suffered through the death of our friend and colleague Mr. H. F. Lodge, M. C., a former Treasurer of the Society and for many years a Member of the Committee. We have also to report with regret the death of an old member of the Society, Sir Currimbhoy Ebrahim, Bart., to whose generosity we referred in an earlier portion of this Editorial and without whose aid and assistance the Prince of Wales Museum for Western India would probably be non-existent

OBITUARY.

Nelson Annandale, 1876—1924.

By the sudden death of Dr. Nelson Annandale on the 10th of April 1924, Zoology in India has been deprived of one of its most capable and energetic workers.

Annandale was born on the 15th of June 1876 and was thus only 48 years of age at the time of his death. He was the eldest son of Professor Thomas Annandale, the distinguished Edinburgh Surgeon, and was educated at Rugby, Edinburgh University, and Balliol College, Oxford. In 1905 he was made a Doctor of Science of Edinburgh University. His official work in India was recognised in 1923 by the award of a C.I.E., and only during the present year his scientific ability earned for him the distinction of the Fellowship of the Royal Society.

He came to India in 1904 as Deputy Superintendent of the Natural History Section of the Indian Museum, and in 1907 was appointed Superintendent. Under his wise and energetic administration the Natural History Section throve apace, the scientific staff was increased, the "Records" and "Memoirs of the Indian Museum" were inaugurated, and in 1916 he achieved one of his principal aims in the foundation of the Zoological Survey of India, of which he was Director until the time of his death. The change to an Imperial Department brought with it much benefit, by it Zoology was placed on an official equality with Botany and Geology, while it placed beyond doubt Annandale's claim that the department should be an institution with research as its main object and the entire Empire as its field of work.

It is impossible here to give adequate notice of his very numerous scientific contributions—for Annandale was a most prolific writer on Zoological and Anthropological subjects. In spite of administrative pre-occupations he has left behind him a record of published work of which any man with twice his length of service in India might be proud. He was an authority of world-wide reputation on such diverse animals as sponges, polyzoa, barnacles and molluscs, but his interests spread far beyond these limits and there is scarcely a group in the animal kingdom on which he did not make original observations. Soon after his arrival in India he must have seen the necessity for detailed systematic work in a country where so few of the animals were known to science and to this task he brought all his energy and enthusiasm. But though he established a high reputation as a taxonomist and his purely descriptive work shows those touches of genius and insight that are characteristic of all his writings, it is doubtful if his real interests lay in the systematic side of Zoology—to him taxonomy was only a means to an end and not an end in itself. It was in the study of faunas as a whole, in the animal in its environment, its response to changes in that environment, its relations with its neighbours and its adaptations to special localities and peculiar conditions—these were the subjects which drew his attention and held his devotion.

He was an emphatic believer in the necessity for field work and, though himself of slight physique and, as we now know, harbouring for many years the malady that so largely contributed to his death, set the example with fortitude. In the field he was indefatigable; he penetrated to all corners of the Indian Empire and acquired a personal knowledge of its fauna which has surely never been equalled. Prior to the beginning of his Indian career he had travelled widely; he visited the Faeroes and Iceland while still an undergraduate, was a member of the Skeat Expedition to the Malay Peninsula in 1899, and subsequently revisited that country during the years 1901 to 1903. Most of the scanty leave which he allowed himself when in India was spent on Zoological research. In 1912 and again in 1921 he toured in Palestine, in 1916 he undertook a compre-

hensive journey to the Malay States, China and Japan, while in 1921 he visited Morocco.

Before his arrival in India his chief interest lay in Anthropology and on this subject, though overshadowed by his later activities in Zoology, he continued to make contributions throughout his life. On most of his later tours in other countries and in much of his recent work in India he was engaged in a comparative study of the faunas of Asiatic lakes. He had himself personally investigated the Sea of Galilee, the Hamun-i-Helmand in Seistan, the Chilka Lake in Orissa, the Loktak Lake in Manipur, the Inle Lake in Burma, the Tale Sap in the Malay Peninsula, the Tai Hu in China and Lake Biwa in Japan. In the "Records" and "Memoirs of the Indian Museum" and in the "Journal" and "Memoirs of the Asiatic Society of Bengal" numerous systematic papers dealing with the faunas of these lakes have appeared, many of them by his pen; but the final reports, in which it was his intention to summarize the results of the investigations, to institute a comparison between the different faunas and to discuss the diverse problems of their origin, had unfortunately not been written at the time of his death. The lack of these reports, in which opinions based on many years of patient observation would have found expression, will be deplored by every student of the subject.

Except for the Asiatic Society of Bengal, which owes much to his wise counsel and of which he was President in 1923, Annandale's interests during his twenty years' service in India were almost wholly concentrated on the institution that he administered with such conspicuous success. Consumed with nervous energy and of a highly strung temperament, his capacity for work was prodigious; but he made few intimate friends and only those who knew him well were fully acquainted with the breadth of his scientific outlook, his fearlessness in every rightful cause and his intense zeal for the advancement of science in India. To the members of his department he endeared himself by his kindly consideration for others and by the encouragement and active help that he gave so readily to all who required it.

MISCELLANEOUS NOTES.

NO. 1.—THE SLOW LORIS (*NYCTICEBUS COUCANG*).

(With a photo.)



Above is a photo of a Slow Loris sent to us by Capt. J. H. Green, 10/20th. Burma Rifles, caught in the Mountains above Mong Si, during a trip through the Kachin Hills, " North Hsenwi " Northern Shan States. Captain Green writes :—

" Whatever it may be there is no doubt that it is very very scarce in the Kachin Hills of Myitkyina, Bhamo, and North Hsenwi. The Kachins, who are wild hillmen living with nature, have generally speaking seen everything there is to be seen in their native jungles. The majority of the old men told me they had never seen one before, a few however said they had seen one once, but they did not agree as some said the last one they saw was black. After consultation they decided that it was a 'sangang' and that the 'sharu', a large type of mole, comes out of the ground, turns into this animal and lives up trees. They pointed out that the little finger nail of the hind paw was still very long and had not yet completely changed. They also stated that it lives without food or drink, runs away only when the wind blows, and dies if struck only once, but revives if the blows are repeated. I disabused them about the food and drink as it was quite willing to drink and eat plantains and cooked rice. It unfortunately escaped after 3 days."

The Slow Loris (*N. coucang*) is found throughout the countries east of the Bay of Bengal occurring in Assam, Burmah, the Malay Peninsula, Siam and Cochin China, Sumatra, Java, Borneo, and the Phillipines. It is a species of Lemur. Lemurs have a most remarkable distribution. There are about 50 species known out of which 36 are confined to Madagascar and its neighbouring islands, the rest occur in the Ethiopian and Oriental region. The Lorises are classed

in a sub-division of the family *Lemuridae* known as the *Lorisinae*, the species contained in this sub-family are separated in two genera, the Slow Loris (*Nycticebus*) and the Slender Lorises (*Loris*.) A characteristic feature in the structure lemurs is that the second toe is furnished with a sharp claw, unlike the flattened nails of the other fingers and toes.

We have had both Slow Loris and Slender Lorises in captivity in the Society's rooms from time to time. The little animals make extremely engaging pets. The Slender Loris from its emaciated appearance is perhaps less attractive but the Slow Loris is much sturdier in build and a much pleasanter looking fellow. It is impossible to describe the utter solemnity of its expression or the slow deliberation of its movements. You might liken its gait to that of a chameleon. Obviously it is a creature of nocturnal habits which possibly explains why it is so rarely seen. Our Loris used to spend his day curled up in a tight ball with his head bent low between his thighs and encircled by his arms ; usually he retired into the depths of his box but quite often he would be content to settle down on top of it. He could always be aroused from his torpor by the offer of a grasshopper—slowly he would uncurl himself and stare at you with his round brown eyes in a rather bewildered manner. Hunting grasshoppers was a mania with him—he would climb down from his perch, always holding the branch with both hands and never quitting his hold with his legs unless he was sure of his hand grip, he would then stalk his victim, with much deliberation and when, within the reach of it, would rise almost erect and balance himself awkwardly with both arms outstretched and literally throw himself forward and clutch at the insect with both his hands. Mostly his methods were successful but quite often he landed not on the insect but on the spot which it had just vacated. He was a clean animal and spent a good bit of his time cleaning and licking his fur. Our Loris hated wetting and soiling his hands. On one occasion when a grasshopper he was stalking hopped into his saucer of tea—I might say our Loris loved his 5 o'clock—the situation greatly troubled him. He wanted the grasshopper but getting it implied wetting his hands, finally his greed overcame his obsession and he took the plunge—the resulting splash intensely disgusted him and he retired to his perch and spent a great deal of time cleaning himself and scrubbing his wet hands on his furry thighs exactly as a little boy would do on his trousers. He permitted handling, but one could not be certain of his temper—above all things he loved his head and back scratched and would turn this way and that so as to allow you to perform the business thoroughly.

Blanford gives a variety of names applied by natives to this animal in different parts of the country. In Bengal it is called *Lajja banar* or Bashful Ape, in Hindi *Sharmindi Bili* (Bashful Cat), in Burmese *Myouk-Moung-Ma* (Monkey's concubine). Strange and curious superstitions are connected with this animal alive or dead. Mr. Stanley S. Flower in the P.Z.S. 1900 writes:—

> "There is hardly an event in the life of a man, woman or child or even domestic animal that may not be influenced by the Slow Loris or by any separate part of it. The Malay who runs amok or commits an unpremeditated crime may attribute his behaviour to the baleful influence of a particular part of the Slow Loris that an enemy has buried, unknown to him, under his threshold. A sailing ship with a Slow Loris on its prow need never fear of being becalmed. Possibly from its habit of sleeping with its head buried under its arms it has been deduced that 'the life of the Slow Loris is unhappy as it is continually seeing ghosts, that is why it hides its face with its hands.' The fur of the animal is used for curing wounds and in South India the eyes of the Slender Loris, according to Jerdon, are greatly esteemed by the Tamils as a remedy for certain eye diseases. The large beautiful brown eyes of the Loris have also attracted the Singalese who believe that from them it is possible to concoct a powerful charm and love potion. There are three species of Slender Loris

found in South India and Ceylon. In habit they are similar to the Slow Loris but in limb and general build they are very much more slender. The Tamil name is *Tharangu* or thin-bodied, hence according to more Jerdon deformed children or lean persons are referred to by the Tamils with the same epithet."

S. H. PRATER. C.M.Z.S.

BOMBAY NATURAL HISTORY SOCIETY,
15th May 1924.

NO. II.—A PANTHER SHOOT BEYOND CHAKRATA.

The Account of a Panther Shoot at Simla in the Journal of the 31st December 1923 reminds me of another Panther incident that happened about two years ago; two marches out of Chakrata at a place called Ringali.

We were held up here owing to a landslip in the road further on; and amused ourselves with what game there was about. Ghoral mostly and pheasants plus a 10½ inch Serow. One evening the Shikari came in and reported that a Panther had killed a bullock. I went down into the Nulla and sat over the kill but the Panther did not return; some days later at 11 a.m. he killed another bullock and pulled him down the Khud side for about 50 yards. I was out at the time and when I got back I found that my friend, who was on his first shikar trip and had never shot anything big, had a *machan* erected over the kill so I went down and sat with him. We were not 15 minutes in position when the panther returned and was missed by my friend whom I will call A. This was at 12 noon; it was a case of Buck fever. No more was heard of the panther until the evening of September 17th. A was then sitting in a *machan* erected on a big tree over a live goat. About 6-30 p.m. a slight noise on the right attracted his attention and on looking he saw, indistinctly, a panther lying in the scrub watching the goat. As he waited, a barking deer walked into the open from the opposite side and towards the goat; this was too much for the panther who charged straight at the barking deer who made off, pursued by his enemy, down the *Khud* side. I looked for a kill next day but could not find any, so the barking deer must have escaped.

As A had never shot a panther he went into the *machan* every evening for a week but the brute, being an old and very wily one, would not go near a tree likely to hold a Shikari. The next thing that happened was that the Jamadar's cow was seized and, but that the owner was on the spot, she would have gone the same way as the rest. She had a nasty gash on her throat when I saw her. It was now high time something was done as the brute became the terror of the place, so I arranged to have the goat tied up in an open clearing right away from trees, with only two thick bushes on the top side of it. One of these bushes I had hollowed out and cut brushwood was stuck into the open spaces, leaving a hole to creep in by and shoot through. At 3 p.m. I crept into the bush, the goat about 15 yards below me. I was there about half an hour when it came on to rain and, when in the act of putting on a waterproof, out of the bush on my right, 10 yards away, sprang a magnificent panther and in three wonderful bounds he landed on the goat; as he seized her he was exactly facing me and, owing to the formation of the ground, all I could see was his bullet head and back. So I let drive a charge of buck-shot (it was all I had) right between his eyes. On receiving this he reared straight up receiving the contents of the left barrel behind the shoulder, which knocked him over, but notwithstanding all this punishment he got up and disappeared over the *Khud* side. Getting out of the bush I followed up, finding blood tracks right away. The *Khud* side was very steep and covered with scrub which one had to hang on to at times, the situation was anything but pleasant, as a matter of fact it was decidedly ugly. After going down

some distance the blood disappeared, so making a "cast back" I picked it up again and, on going about 30 yards, I saw the panther lying on a ledge 10 yards away looking very wicked. A charge of buck-shot then ended his career. Between pegs he measured 7'-11" inches, a fine beast; he had killed 6 bullocks and no end of goats in a few months and there was great rejoicing amongst the hill men in charge of the herd of cattle when they knew he had passed to other hunting grounds.

BOMBAY,
12*th February* 1924.

F. O. BOWEN, Major.

NO. III.—PANTHER AT KHARAGHODA, AHMEDABAD DISTRICT.

Some short time ago a Panther visited these parts and mauled a Vagri (a member of a wandering tribe). A few Vagris were out hunting for pig and hare in a dry nullah about 14 miles from here, when a panther jumped out on them and mauled one of their number. The next day he was not to be found, and has never been seen since, although we have been out after him on many occasions. The tracks were those of a small leopard. It would be interesting to know from where it had come, and where it went as I understand that the nearest home of the leopard is in the Mount Abu Hills.

C. H. E. WILSON, Major.

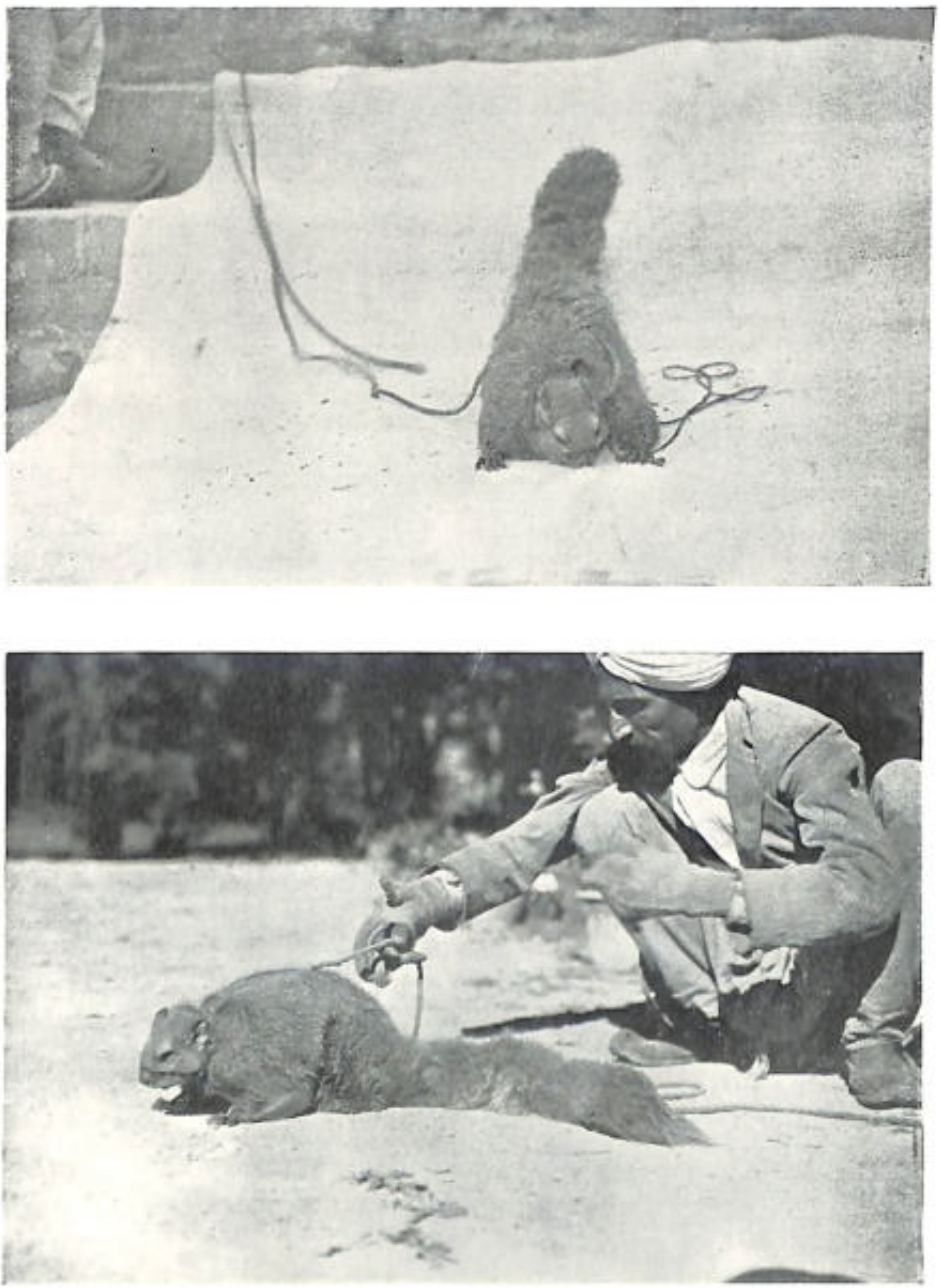
KHARAGHODA, AHMEDABAD DISTRICT,
B. B. & C. I. Rly.,
3*rd. April* 1924.

[Kharaghoda is situated on the borders of the Rann of Cutch. H. H. Prince Vijayarajji of Cutch, who is an experienced shikari of those parts, is of opinion that the occurrence of a panther in that locality is very unusual. He states that there are a few panthers in the north-west of Kathiawar and believes that the animal referred to by Major Wilson is more likely to have been a stray from that part. He adds that the occurrence of a cheetah or hunting leopard would not have been unusual in that locality.—EDS.]

No. IV.—INDIAN WILD DOGS ATTACKING A BEAR.

While out shooting with a friend on these hills (the Billigirirangans) the other day (we were out after bear) we heard a bear grunting and roaring in a most peculiar way and on approaching the spot an extraordinary sight met our eyes. A pack of wild dogs had surrounded a bear and were busily attacking and savaging it. The dogs kept quite mute the whole time and ran in and out and all round the bear with an apparent careless gait as if they did not really mean business, but that this was not the case was shown by the bear's hindquarters which were badly bitten. The actual biting was done by the dogs behind and on these the bear kept on turning: the dogs in front meanwhile heading it off and making feints at attacking it, but keeping just out of its reach. The bear was trying to make for a cave close by, and as it seemed to be very exhausted I doubt if it could have done it.

As it was a bear we wanted I am afraid we did not attempt to rescue it! It was too good a chance to be lost and the bear was bagged. It anyhow died a better death than the dogs would have given it. Unfortunately the dogs scattered and we did not get a shot at them.



THE WOOLLY FLYING SQUIRREL (*Eupetaurus cinereus*).

I remember several years ago a panther being killed by wild dogs, and I have heard two cases from the Sholagas on these hills of tiger being chased and killed by them.

Occasionally of course the reverse takes place: a panther recently killed (and ate) two wild dogs, but it was undoubtedly a case of *only* two dogs being there: I have frequently seen a single dog or a couple hunting.

ATTIKAN, MYSORE, R. C. MORRIS.
28th. May 1924.

[In his notes on the Indian Wild Dog in that most interesting and informative book "Wild Animals of Central India" Mr. Dunbar Brander writes: "I have never heard of their attacking a bear or a bison but I have no doubt that the latter are sometimes killed. There is a Burmah precedent for this. They respect hyaena and jackals as being blood brothers. They will attack both leopard and tiger not with the object of obtaining food, but as the result of a quarrel or for the sport of baiting these animals."—EDS.]

NO. V.—THE WOOLY FLYING SQUIRREL (*EUPETAURUS CINEREUS*).

(*With a Plate.*)

I enclose three photos of the Wooly Flying Squirrel while alive; the best I could get. It was very restless, so I had to have it in a strong light for a short exposure, and that I think made it more restless still.

After my animal was brought in I believe another (skin only) was brought. Both these came from the Sai Nalah, which is a right bank tributary of the Indus joining it opposite Bunji. The upper parts of the Sai Nalah are wooded (fir, pine, etc.), and I thought it was probably a tree-frequenting animal and used its flying apparatus for vol-planing down from the trees, but I am told it is also found in the Shishpar Nalah in Hunza where there are no trees. There it is said to fly circling round in the air. This is a little hard to believe, but then why should it go in for aeronautics at all? It is said to hang itself upside down by the feet when resting, somewhat like a bat.

It is called *chergē* in the Shina language and *bada* (plur. *badämuts*) in Bruushaski (the Hunza Nagir language).

Both Shina and Hunza people have a yarn that if you cook a flying squirrel and sit down and put the meat behind you and help yourself to it with the left hand, without saying 'bismallah" then the meat will never be finished.

But it is now considered "haram" (religiously not permissible food), which seems a pity in a poor country where meat is a luxury and an inexhaustible squirrel would be a real domestic and economic asset.

GILGIT, D. L. R. LORIMER, Major.
11th. May 1924.

[The accompanying photographs are probably the only ones in existence of this very rare and beautiful flying squirrel. So far it has only been recorded from Gilgit and nothing is known about its habits. Blanford inferred from its blunt claws that the animal lived "in rocks perhaps among precipices"—his conjecture has now been proved correct by Col. Lorimer's observations.—EDS.]

NO. VI.—AN UNUSUALLY LARGE COW GAUR. (*B. GAURUS*).

While following up tracks of a solitary bull gaur in Tenasserim last January with a view to obtaining a skin for the Prince of Wales' museum, the bull joined a cow, and, coming on her in thick jungle and not knowing that there was any other animal in the case, I shot the cow in mistake for the bull.

I have never shot a cow gaur before, but she seemed to be of abnormal size. She was also quite black with no trace of the usual brown in her body colour, and had a very large hump: both of these points are, I believe, unusual in cow gaur.

Her measurements were :—Height at shoulder 65 inches ; height at hump 70 inches. Horns, length 23 inches, widest outside 26 inches, girth at base 15½ inches. I have no other measurements of cow gaur and would be grateful for some others for purposes of comparison. She certainly seemed to me to be as large in body dimension as two of the bulls I have shot.

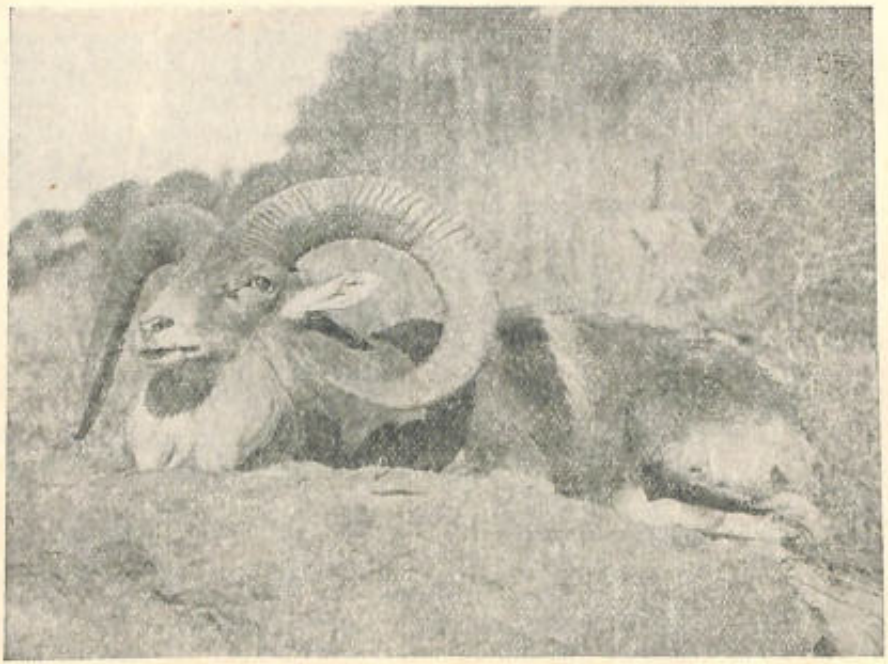
I kept the skull to present to the Society, but unfortunately a tiger took it out of my camp one dark and rainy night a week later ; thus I should say was in itself an unusual occurrence, as it had nothing but a particularly unpleasant smell to recommend it to any beast of prey all the meat having been cut off.

RAZMAK, N. W.F.P. C. H. STOCKLEY, MAJOR.

In his records of "Shooting in Cooch Bihar" H.H. The Maharaja of Cooch Bihar gives the details of a record 'bag' of Gaur obtained in a day's shooting. Three bulls and eight cows were accounted for—the latter included an exceptionally large cow which was mistaken for a bull. She measured 17 hands 1 inch at the shoulder while her horns taped 73½ inches round the curves. It is interesting by way of comparison to add that the most massively built bull obtained by H. H. stood 18 hands 3¾ inches at the shoulder with a horn measurement of 76½ round the outer curves—EDS.]

NO. VII.—COLOURATION OF THE PUNJAB OORIAL (*OVIS VIGNEI PUNJABIENSIS*).

[*With a Photo*]



With reference to the above photograph of an oorial ram shot in the Kala Chitta Range, near Campbellpur, last November, I should be most interested to know if other members have recently seen rams marked with

the very conspicuous black and white patch which is obvious on the side of the ram in the photo.

I have shot a great many oorial in the last twenty years, but have never before seen this patch so strongly marked or with white in it until last year when I saw several rams with a patch of this type, several with a black patch, and some which, although fully adult, had no trace of a patch.

Patches, whether black or pied, seemed to run in herds, and, conversely there were also herds whose rams showed no patch at all. They also seemed confined to adult rams.

While shooting down in Sind in the Khirthar Range, a month later, I saw some more oorial (or "gud" as they are called there) which were also marked with a black patch.

Have any members got notes on the occurrence of this patch? Is it seasonal, local or hereditary? I am inclined to think that it is all three, and if so is a strong argument for supposing that the rams mate with the same ewes year after year.

NOTE.—The horns of the ram shown measure 32 inches length.

RAZMAK, N. W. F. P.,
18*th*, *May* 1924.

C. H. STOCKLEY, MAJOR.

NO. VIII.—HORNS OF A VERY OLD MUNTJAC OR BARKING DEER (*CERVULUS GRANDICORNIS*).

A very old male Barking Deer was shot by me in Siam last February.

The horns had no front tines, were also very white at the ends and for half way down the beam, and at the base graded into the bony pedicles.

In my "Notes on Lydekker's Game Animals of India" published in the Journal (March 25th, 1922) I stated that this is the usual form of horn in very old males of this species. I previously obtained two specimens of this type in Upper Burma, but both were unfortunately lost.

I have heard that the same thing occurs in the Lower Himalayas, and there was a note to that effect in the Journal some years ago from a correspondent living, I think, somewhere in the vicinity of Mussouri.

I have presented the skull of this particular specimen to the Society.

2. I also shot another buck barking deer a few days later which carried no horns or any trace of their having ever been formed. The pedicles were exceptionally long, and there was no sign of the raw spot at the end, which is always present when the horns have been very recently shed, and there was no sign of new growth.

This skull is also now in the Society's collection.

RAZMAK, N.W.F.P.,
18*th*. *May* 1924.

C. H. STOCKLEY. MAJOR.

[In a note which originally appeared in the Field (July 1907) and which was reprinted in this Journal (Vol. XVIII, p. 490) Mr. E. R. Durnford recorded the occasional occurrence, in the neighbourhood of Darjeeling, of Muntjac horns in which the front tines were absent. He writes "They were merely sharp straight or slightly curved spikes of horn perhaps 1½ inches long. Mr. Durnford was told by his men, whom he was inclined to believe, that animals carrying this type of horn never shed them. The length of the pedicles varies very consider-

ably in these animals. In his "Wild Animals of Central India" Mr. Dunbar Brander states that a local variety carrying abnormally long pedicles occurs in the Bastar State. In extreme cases these measured quite 5 inches. The most primitive kinds of deer had no horns at all but one of the oldest known forms. The *Dinoceras* of the middle Miocene, appears to have been nearly akin to the living Muntjacs. The *Dinoceras*, the earliest Deer in which horns have been found, carried horns like those of the living Muntjac placed on very long pedicles.—Eds.]

NO. IX.—A BIRD PASSENGER ON A P. & O. LINER.

I sailed from Bombay (Ballard Pier) on the 28th February last on my way to England. At the time of embarking my attention was drawn to a Hoopoe sitting placidly on the stern deck, but little notice was taken of the incident as it appeared nothing very much out of the ordinary, but after a couple of days on the high seas the passengers were very surprised to find that the bird was still on board. This was more or less passed over by the belief that it probably was a very tame bird owned by one of the sailors. I however, was interested in the case and went about enquiring from the ship's officers, sailors and laskars concerning this bird and finally was led to believe that it was the first time such a bird had "embarked on their boat" and nobody could account for the incident.

When we arrived at Port Said and anchored for about 6 hours, I made it my special business to see if the bird was still on deck, but it was nowhere to be found, and I believed that it had gone away having seen land and being tired of the voyage; but this evidently was not the case, as three days later I again saw the Hoopoe occasionally flying far out to sea in a very strong wind and rain, following the boat all the time and settling on the main deck railings. Most, if not all the passengers were interested in its performance, as the bird appeared strong and quite fit—it was wonderful to see it skim over the waves sometimes about six inches above the water.

After we passed Gibralter I was disappointed in not finding the brave little Hoopoe again, however much I searched for it and I am of opinion that it had found a suitable landing ground somewhere in Spain, at any rate I hope it was nothing disastrous.

It makes me wonder as to how this bird obtained food and water while on board for over a fortnight, as being practically an insect eater there appeared to be no suitable food for it on board, moreover nobody seemed to have noticed it ever feeding even if it should have changed its diet. It all appears very clever, if not strange, for the bird to have adopted this mode of migrating and at a time of the year when the heat of India was many degrees higher than that of Spain.

We have heard of birds of passage but this may be called a bird of "free passage" as it came on board unbooked and uninvited, and seemed to have known that it was not catching the wrong boat.

The boat I had travelled by was the P. & O. S. S. "Assaye", hired by Government as a Military Transport.

I am very interested in the incident and would be glad to hear more about it in your Journal.

V. R. WRIGHT-NEVILLE.

London,
15*th April*, 1924.

[There are many instances of land birds taking refuge on ships at sea, in most instances such species have been blown out of their course by high winds and stormy weather. The present instance is possibly unique as the weather conditions obtaining in Bombay during the time of the vessel's departure could in no way have effected the Hoopoe's movements. Two species of Hoopoe are found in India, the Indian Hoopoe, (*U. indica*), a resident species, and the European Hoopoe (*U. epops*) which is found in summer throughout the Palearctic region including the Himalayas. It migrates in winter to Africa, Arabia and India.—Eds.]

NO. X.—THE DISTRIBUTION OF THE HIMALAYAN TREE-PIE (*DENDROCITTA FORMOSÆ HIMALAYENSIS* BLYTH).

In Vol. XXXVII of the Journal of the Asiatic Society of Bengal in 1868 Stoliczka published a valuable paper entitled "Ornithological observations in the Sutlej Valley." In this paper were mentioned a number of species which at that date had not been obtained by Naturalists working further west, and this fact led to the fixing of the Sutlej Valley as the Western boundary of distribution for these particular species. Subsequent observations have shown that the Sutlej Valley is not a natural geographical boundary, as at first seemed implied, and the boundary has been shifted further west in the case of most of the species referred to.

At page 53 Vol. I of the second edition of the Fauna, the Sutlej Valley has been kept as the Western limit of the Himalayan Tree Pie (*Dendrocitta formosæ himalayensis*). This however is incorrect. The species occurs fairly commonly both in Kulu and in Mandi State, from which localities I possess a series of skins.

In Kulu I have met it as follows:—

30th November 1922. A party at Aramghar 5,000′ in an Alder swamp, and a single bird at Dhobi, Beas Valley.

9th July 1923. A party including young of the year in the same swamp at Aramghar.

10th November 1923. A couple at 5,000′ in the Parbatti Valley above Thari.

In Mandi State it is more common:—

2nd August 1922. A party near Urla 4,000′ beside the Palumpur-Mandi road.

13th December 1922. A pair seen about 5,500′ in the Uhl Valley beyond Jhatingri on the descent to the bridge.

19th-22nd November 1923. Common all along the motor road from Pandoh to Mandi, Drang, Urla, and Harabagh at heights from 3,000′ to 4,000′.

I have no information of its occurrence west of this area and it does not apparently occur in the Kangra Valley foothills.

BATTLE, SUSSEX,
29th April 1924.

HUGH WHISTLER, F.Z.S.,
Indian Police.

NO. XI.—NESTING OF BINGHAM'S WHITE-HEADED BULBUL (*CERASOPHILA THOMPSONI*).

At last the discovery of the nest of *Cerasophila thompsoni* can be recorded.

Mr. F. S. Grose of the Burma Frontier Service found the nest on the Taunggyi Hill, Southern Shan States on the 28th April this year. The birds were not so numerous at this time as in the winter months and while nesting on the hill both before and after this date only one or two had been seen.

The elevation of the nest site is about 4,800 feet.

The nest, a fairly neat cup, built practically on the ground but attached to stems of a plant, was of coarse grass lined with fine grass and was situated on a steep slope just below a path on each side of which the grass and light scrub had been "cut back".

The nest was therefore in an exposed situation and in a somewhat abnormal and unexpected site. Its inside diameter was about 80 mm. The eggs, 3 in number, slightly incubated, by no means glossless, were typical Bulbul's eggs, the grey markings amongst the red being perhaps more numerous than usual, one egg was more boldly marked than the others; their average measurement is 23·0 mm. by 16·8 mm.

The nest was taken by me with Mr. Grose and Captain Livesey, and the bird, flying off the nest at our approach, was easily identified as it is well known to all of us.

Captain Livesey took photos but the result is as yet unknown.

P. F. WICKHAM.

MAYMYO,

17*th May* 1924.

[The occurrence of Bingham's white-headed Bulbul (*C. thompsoni*) within Indian limits was recently recorded in the Journal (*vide* Journ. B. N. H. S. Vol. XXIX, P. 559)—EDS.]

NO. XII.—LESSER WHITE SCAVANGER VULTURE (*N. GNIGINIANUS*) NESTING ON THE GROUND.

(*With a photo.*)



When shooting with a party in the Ganges Kadir last March we came upon a small white vulture with yellowish head sitting on a nest at the foot of either a Banyan or Pepul Tree. The vulture flew away a hundred yards on our

approach and settled on the ground. The nest contained one egg which is now in my possession. I enclose a photo taken by the wife of my G. O. C. You will notice guns, rifles, etc., in photo as we had tiffin under the tree.

W. P. PAYNTER,
MAJOR, R.F.A.

LAHORE CANTONMENT,
27*th May* 1924.

[The nesting site selected by this vulture is unusual, as though indifferent as to the location of its nest, which may be built on rocks, cliffs, parapets or cornices of buildings and more commonly on larger trees, their ragged clumsy structures are usually built at some height from the ground.—EDS.]

No. XIII.—SNIPE ON DRY STONY GROUND.

Just before the close of the shooting season I was out shooting partridge and hare on Jullunda, an island on the Rann of Cutch, and put up and shot a number of full snipe, *G. gallinago*, on perfectly dry and stony ground, quite four miles away from any water. Earlier in the day I had been over Snipe ground in the vicinity, but found no snipe.

C. H. E. WILSON, MAJOR.

KHARAGHODA, AHMEDABAD DISTRICT,
3*rd April* 1924.

No. XIV.—THE SOUTHERN RANGE OF THE GREAT INDIAN BUSTARD (*EUPODITES EDWARDSI*).

I received on the 25th February a full grown Great Indian Bustard, male, which was shot the previous day by native fowlers at Samayapuram, a village ten miles north of Trichinopoly. The bird has been mounted and put in the College Museum.

C. LEIGH, S.J.,
Curator, St. Joseph's College Museum.

TRICHINOPOLY,
28*th February*, 1924.

[Blanford gives the southern limits of the great Indian Bustard as South Mysore or *perhaps further south*. Trichinopoly would now therefore be the most southerly authenticated record.—EDS.]

No. XV.—CLOSE-BARRED SANDGROUSE (*P. LICHTENSTEINI*) NEAR KARACHI.

It may possibly interest you to know that four Close-barred Sandgrouse have been shot here this season.

1. Mr. C. C. Demetriadi, in January, shot two cock birds, out of a pack of six or seven, on the Las Bela road, a mile or two beyond the Habb river about 18 miles from here. The ground was rather close scrub country and this pack was the only one seen.

2. Last week end, at Chota Gadap, about 9 miles from Karachi I shot a cock and a hen "Close-barred." We were walking fairly open barbel-scrub along either side of a small steep nullah, hardly more than a fissure in the ground, when I saw three silvery and somewhat dove-like birds rise out of the nullah.

A moment's hesitation satisfied me that they were Grouse, and I was fortunate enough to get two of them. I examined them closely with the plate of them in Baker's "Game Birds of India" and most say the representation is practically perfect.

From the letterpress I gather that this species is very rare as far South-East as Karachi, and therefore pass you this note in case it may interest you.

G. T. B. HARVEY.

KARACHI,
March 6th, 1924.

[The occurrence of this bird in the plains of Sind is more or less casual, it is not found east of the Indus. Dr. C. B. Ticehurst (Birds of Sind, Ibis, Vol., p. 645. 1923) gives several records of its occurrence near Karachi. He states that it is common however in the Sind Hills near Karachi and believes that it is there a resident species.—EDS.].

No. XVI.—THE NIDIFICATION OF THE COMMON OR GREY QUAIL (*COTURNIX COTURNIX COTURNIX*).

Mr. Stuart Baker's remarks on the nidification of the Common Quail (Journ. B.N.H.S., Vol. XXIX., p. 581) prompt me to put on record my experience of its breeding in the Jhelum District of the Punjab. I have not been fortunate enough to find a nest myself, but I have had eggs taken for me as follows:—

7th March 1922.	.. ..	C–8. Fresh.
17th March 1922.	.. ..	C–7. Incubation just begun.
18th March 1922.	.. ..	C–8. Moderately well incubated.
19th March 1922.	.. ..	C–9. Fresh.
22nd March 1922.	.. ..	C–4. Fresh.
25th March 1922.	.. ..	C–12. The eggs when brought to me were rotten.
20th March 1923.	.. ..	C–11. Moderately well incubated.
23rd March 1924.	.. ..	C–10. Slightly incubated.

All these nests were found in the Jhelum Valley, between the river and the Salt Range, three being in fields of standing wheat, two in "mainra" grass; and two in a fodder crop known as "mehtra".

H. W. WAITE,
Indian Police.

JHELUM, PUNJAB,
7th May 1924.

No. XVII.—A NOTE ON THE EARLY ARRIVAL OF FLAMINGOES IN INDIA.

On the 19th of August last year, at Vizagapatam, I saw a large flock of Flamingoes (*Phœnicopterus ruber antiquorum*) flying past over the sea at a distance about a mile from the coast. It was at 12·30 midday. The birds came from the north and held their course, as long as they were within our sight, exactly straight for the southern point of the compass. They flew very low, almost touching the surface of the water. They flew in single column, but occasionally when they rose to a moderate height, the column broke into two, both converging in a point in front. The flock must have consisted of a hundred and fifty birds.

On the next day, *i.e.*, on the 20th, at about exactly the same time a similar flock again flew past, keeping at about the same distance from the coast.

On the 24th August, at 7-30 in the morning another flock, a larger one this time, was again noticed. This flock kept at a greater distance from land and with the naked eye was visible only as white specks. It must have been more than three miles out at sea. The birds were flying quite high in the air in their usual formation.

It struck me that these were the earliest batches of Flamingoes returning to India from their breeding haunts and were bound for their winter quarters. From what Messrs. Blanford and Stuart Baker have written, it would seem that it was too early for their inward migration. In the Fauna of British India (Birds), first edition, Blanford wrote "these birds are migratory, arriving about October and remaining, if there is water, till about May or June." Mr. Stuart Baker in his "Game Birds" says, "They generally leave Northern India in May or June, though they have been seen in July and the first few birds return in the end of September." In spite of this I think the birds I saw were coming back to India.

My reasons for this belief are (1) August is too late in the day for the beginning of their breeding season; and (2) they were bound for the south, a direction in which their breeding resorts are not known to exist. Besides, these birds that left India earliest (*i.e.*, in May), are quite likely to have finished their nidificatory duties by August.

An interesting question that naturally arises in this connexion is—where were these birds coming from? When one finds that a bird, which migrates out of India in May at the earliest, returning as early as the 19th of August, one is naturally led to suppose that the bird had been sojourning these few months somewhere in the close neighbourhood of India.

The Flamingoes as a rule affect salt-water. The sea-coast is therefore the place where they generally keep to, when there is no inland Salt-water lake or marsh in a country or continent. In Europe the birds frequent the Mediterranean area and are rarely, if at all, found in Central Europe, where there are no Salt-lakes. But in the Caspian Sea and in Turkestan which contains the Sea of Aral, the Flamingoes are plentiful. I do not think that the flocks I saw, which held their course for somewhere in the South of the Deccan or even farther, were coming from the Caspian area or Turkestan, the Vizagapatam route being very round about for them. Nor could they have been coming from the Mongolian, Chinese or Baikal region. "Mr. Dresser states that it has been shot once at Lake Baikal; but this is the only record I find of its occurrence in Siberia," says Legge, who further adds, "It is not found in the Mongolian or Chinese region." The reason is simple. In none of the above regions are there Salt-water lakes.

The only place on the borders of India and to its north (from which direction, the birds in question were coming) is Tibet the south-western regions of which have a number of Salt-water lakes. No record, however, exists of the occurrence of the Flamingo in Tibet. But it is a country of which the avi-fauna has been little studied. No ornithological traveller has probably visited the lake region I am speaking of between the months of May and September, the breeding period of the Flamingo. In the absence of evidence to the contrary, it is hard to ignore the possibility of the Salt-lake region of Tibet as a breeding-ground for Flamingoes in common with the Bar-headed geese (*Anser indicus*), evidence of whose nidification in the region is available.

S. C. LAW.

CALCUTTA,
April 10th, 1924.

[In Vol. VIII, p. 553 of the Society's Journal H. H. the Maharao of Cutch recorded the breeding of the Flamingo in the Rann of Cutch, which is the only record of these birds breeding in India.—Eds.]

No. XVIII.—THE RED-BREASTED GOOSE (*R. RUFICOLLIS*) IN MESOPOTAMIA.

I was out duck shooting with my party in the marshes at Abu Jisra on Sunday, the 17th instant and at the end of the day another party of two guns, whose bag for the day was 120 birds—my own personal bag being 64—brought me an uncommon bird for identification. It was a solitary bird and no others like it were seen. Never having seen the bird before, though I have shot in the Punjab and Bengal for 15 years and in this country for 5, I asked Flying Officer Crees who had shot it to let me take it back to Baghdad and identify it, which he allowed me to do. I first referred to the synoptical table in Finn's little book on ducks and soon got a clue and confirmed it with Stuart Baker's book as being a red-breasted goose, *Rufibrenta ruficollis*, in full plumage.

As this goose has not been reported as shot in this country before I have pleasure in informing you of it, but regret I cannot send you the skin as I know nothing about skinning and can get no one to do it properly for me.

I have shot and seen many geese, which, I consider, are dwarf geese and I am inclined to think they are more common than the lesser white-fronted goose which I do not appear to have shot at all or seen shot anywhere round Baghdad.

BAGHDAD,
19th February, 1924.

O. G. KIERNANDER, Major.

No. XIX.—A NOTE ON CANNIBALISM IN A GECKO.

I had occasion to visit Gurdaspur in the Punjab, in October-November 1918 in connection with work on Lantana insects and I stayed at the Rest House of the Government Agricultural Station. The cold was then gradually advancing and some time previously the caretaker had shut up the glasspanes for fear of the chill night air. The window had a wire gauze screen as well, in addition to shutters with glasspanes. One morning I observed that a fairly large-sized Gecko—which I then thought was *Hemidactylus leschenaulti*—had been imprisoned between the screen and the windowpane. It was evident it was not hibernating and it looked very much famished in appearance. Taking pity on the animal, I opened the window and released it, when it ran out. A few hours later, in the afternoon I met it running about actively on the beams along the ceiling of the verandah, and all at once I caught sight of it rushing at another smaller Gecko which looked very much like a halfgrown *Hemidactylus brookii*. In a moment it had caught it and in a short time it had begun to gulp it down its throat. I was not able to catch it with its prey as I had wished to and later on I had no opportunities of revisiting Gurdaspur.

From the remarks made in the paper "on the Reptilia and Batrachia of the Punjab Salt Range" in the Indian Museum Records, 1923, by Messrs. Hora and Chopra it is evident that the large Gecko, the assailant—was *H. flaviviridis* and not *H. leschenaultii* as I had supposed but I believed the prey was no other than *H. brookii*. Dr. Annandale assures me that *H. leschenaultii* does not occur in N. India. I wish to make a record of this observation, so as to know if similar incidents have been observed by other naturalists, since I have on another occasion noted *H. leschenaultii* trying to attack the young one of a *Lygosoma*.

COIMBATORE,
2nd April, 1924.

Y. RAMCHANDRA RAO,
Acting Government Entomologist.

[A fat-tailed Lizard (*E. macularius*) kept in captivity in the Society's rooms attacked and swallowed a young example of the same species which was put into its cage; two common skinks (*Mabuia carinata*) met with a similar fate. So far as it is possible to observe this lizard is an omnivorous feeder. Its diet includes biscuit crumbs, grasshoppers, cockroaches, spiders, scorpions, lizards and mice. An interesting comment on the age attained by these lizards is to be observed in the fact that the present specimen was presented to the Society in August 1915 and is still to-day, after 9 years, as live and vigorous as ever.—EDS.]

No. XX.—PYTHON AND MONITOR.

Some time ago Dr. Moorow-Campbell published an account, with a photograph, of a python which he had shot in the Southern Shan States and which contained a full-grown Gyi (or Barking Deer). The following incident however seems far more extraordinary and may be of interest as it would appear to be unique.

Early this month I was in the Mergui District of Lower Burma with a friend John D. and we were trying to reach the source of a tributary of the Little Tenasserim River in what is almost virgin jungle.

At the end of one day's march our coolies had just deposited their loads and were cutting bamboos to run up the rough shelters we were using at nights, as we were travelling light without tents. Some of the men were across the small stream we were following, when there came a cry of 'Mwe; Mwe;-Mwe gyi', (snake, snake, a big snake!)

One naturally thought that they had put up some large snake which had gone off, but they insisted that it was still there, just on the bank of the stream, which here was a pool over waist deep. As it had not been frightened or disturbed apparently by all this noise I thought they had probably lighted upon a Hamadryad, as these are not uncommon in the south of Lower Burma, so put together a gun and went across.

From the junction of a shallow stream I saw on the bank, but almost hidden by undergrowth, the huge girth of what was apparently an immense snake, and, climbing the bank within a few feet of it, found it to be an ordinary python (*Python molurus*?) lying gorged. From the size and shape of the 'bulge' I took it to be a Gyi, the four shoulder and hip angles being plainly visible and I called back to D. that it was a python with a Gyi* in it, asking him to come and lend a hand in hauling it down into the shallow stream, as not one of the Siamese-Shan coolies with us would touch it, even when it had been shot.

Having got it into shallow water I proceeded to cut open the belly down the ventral shields over the carcase within, with a Dah (the weapon between knife and sword used by all Burmans and Shans, etc., for every purpose). Expecting to come upon the reddish *hair* of a Gyi I was surprised to come upon a mottled scaly *skin;* and cutting further exposed a great clawed hand, whereupon I shouted back to D. who, like the coolies 'wasn't having any,' that it wasn't a Gyi but a young Crocodile inside and this I took it to be until I came to the head when I found that it was a monster Monitor Lizard (*Varanus* sp.).

Measurements carefully taken later by both of us with a steel tape gave the length of the Monitor as 5-ft. 9-ins. with a girth of 27-ins., (this after deflation; it was a very great deal more before being punctured, as decomposition had set in and it was greatly bloated, hence the enormous size it first appeared). The python was in perfect lustrous condition, having apparently but very recently shed a skin, and measured 14-ft. 11-ins. in length.

Now two things strike me as curious here. Firstly, that a python should attack a monitor at all, heavily armed as it is with powerful, sharp claws and a com-

---

* Muntjac or Barking Deer.

paratively formidable set of teeth, and secondly, that having attacked it, it should have been able to envelop its prey so rapidly that the brilliant new suit it was wearing was absolutely without a scratch or mark upon it.

One would have supposed that a fierce battle would have ensued on the first grasping of the lizard by the snake, and that the former would have torn and scatched the snake seriously especially considering the relative size of victor and vanquished, the latter seeming the more powerful by far of the two. But not a mark was visible upon the glossy iridescent new skin of the rock snake.

The body was swallowed head-first, the fore-arms being pressed close to the sides, the hind limbs being bent backwards along the tail. The head was partially digested, but this process had only just commenced, and all the parts of the lizard were intact and perfect, and *not a bone broken*! In all ordinary cases the crushing action of the python, when coiled about its prey and preparing it for swallowing, breaks bones freely, but this tough lizard was intact and after extraction the limbs soon returned to their normal positions, showing that even the articulation of the joints had not been affected.

Although all snakes are more or less ophiophagus under certain conditions the choice of a tough-skinned, horny-backed, and powerfully armed victim like the monitor seems very strange in a locality where more normal foods abound; it was in dense evergreen jungle where fowl, pheasant, the smaller cats, and all kinds of birds are plentiful.

I have no records of size, but although in India I have seen these *Varanidæ* up to what must have been possibly six feet in length, this one of 5-ft. 9-in. is the largest I have ever seen or heard of in Burma.

Unfortunately the photograph I took of the two, after posing them, is useless for purposes of reproduction, as owing to the density of the forest I gave about a second's exposure and shook the camera slightly with the result that it is difficult to make out which is which.

RANGOON, W. R. COLERIDGE BEADON,
April 17th, 1924.

[From the environment in which it was taken it is possible that the Monitor referred to is the Water Monitor (*Varanus salvator*) which is found in Bengal, Ceylon, S. China, Burma, the Malay Peninsula and Archipelago. The reptile frequents marshy localities or is found on trees overhanging rivers and streams. It grows to 7 feet in length. Two other species of Monitor occur in Burma, *Varanus flavescens*, the Yellow Monitor and *Varanus nebulosus*, the Clouded Monitor. The Monitor lizards are commonly miscalled Iguanas by Europeans in India. The Iguanas are entirely American, with the exception of two genera found in Madagascar. The Monitors are old world lizards. The term monitor is of curious derivation and is the result of an etymological error. The Arabic term for this lizard is "Ouaran", this has wrongly been interpreted as a warning lizard, hence the latin name Monitor.

The Python referred to by Mr. Beadon from the lustrous condition of the skin must have recently sloughed. Under these conditions the reptile is usually very hungry. Pythons in captivity are always very active after the process and quite ready for a meal and there is no knowing what a hungry python will not account for. An individual in the Society's rooms swallowed a black partridge, a brother python that had already commenced swallowing the same black partridge and a piece of red blanket which was entangled amongst its coils.—EDS.]

XXI.—GOOD BAG OF FRESH WATER SHARK (*WALLAGO ATTU*).

While touring north of Kharaghoda, I came across a small pool of water about 50 yards by 25 yards. My record bag for one day was 101½ lbs. of fish and the largest fish caught weighed 31½ lbs. All the fish were caught by trolling with spoon (Hog-back). As our last monsoon was a failure this was one of the very few pools of water left in the bed of the Bannas River. I tried these fish (which were all *Wallago attu* called *Pardi* in Gujerati) with all sorts of other bait but they would only touch spoon. They only took really well between 4 p.m. and 6-30 p.m. My bag for 9 days amounted to 58 fish, the total catch weighing 383½ lbs.

KHARAGHODA,
AHMEDABAD DISTRICT,
3rd April 1924.

C. H. E. WILSON, Major.

[Thomas' "Rod in India" recommends spinning for Wallago with a small fish the size of your forefinger or even with a small 1½" spoon. The best recorded bag in the "Rod in India" of *Wallago attu* is that of Mr. H. S. Durnsford "between 9 a.m. and 10-30 a.m. he killed 11 fish weighing together 40 lbs., the biggest being 10 lbs. After breakfast he killed 9 more weighing 45 lbs., the three biggest fish being 12 lbs., 10 lbs., and 8 lbs. Then trying another pond he took 12 more weighing 30 lbs., which makes a total for the day on one rod of 32 *Wallago attu* weighing 115 lbs., Mr. Wilson's bag averaging over six pound per fish is about double the weight per fish of Mr. Durnsford's bag.—EDS.]

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PROCEEDINGS.

PROCEEDINGS OF THE MEETING HELD ON 22ND JULY 1924.

A meeting of the members of the Bombay Natural History Society and their friends was held in the Prince of Wales' Museum, Bombay, on Tuesday, the 22nd instant, the Revd. Father Blatter, S.J., Vice-President of the Society, presiding.

The following 26 new members were elected since the last meeting :—Mr. W. T. de Graan, Bombay ; Lt.-Commdr. G. E. Boultbee, R.N., Bombay ; Lt. H. E. M. Newman, R.E., Bangalore ; Mr. N. B. Sujan, B.Sc., Hyderabad ; Major G. G. Tabuteau, D.S.O., R.A.M.C., Rawalpindi ; Major E. Clare Walker, R.E., Maymyo; Mr. Alex. L. Davenport, Calcutta; Major William A. Spong, R.A.M.C., Mhow ; Mr. T. D. Goord, Basra ; Mr. G. F. J. Cumberlege, D.S.O., Bombay ; Mr. John Shaw, B.F.S., Namshaw ; Major V. M. Phatak, Gwalior ; Capt. A. C. Moore, Lahore Cantt. ; The Mess Secretary, 10-8th Punjab Regt., Lahore Cantt. ; The Head of the Dept. of Botany of Allahabad University, Allahabad ; Mr. Eric Studd, Calcutta ; M. G. Grossenbacher, Bombay ; Mr. K. F. R. Dickins, Toungoo ; Capt. H. M. Alleyne, Maymyo ; Lt. P. Williams, R.A., England ; Lt.-Col. T. H. Howell-Jones, C.I.E., D.S.O., R.A.O.C., Simla ; The Honorary Secretary, Muktesar Shikar Club, Retani ; Mr. H. L. Shoveller, C.A., Bombay ; Capt. R. Forbes Pearson, Katra, Mewar ; Mr. F. L. Brayne, I.C.S., Gurgaon ; and Capt. N. S. Alington, Punjab.

In opening the proceedings, the Revd. Fr. Blatter stated that Mr. R. A. Spence, the Honorary Secretary, was unfortunately through illness unable to attend.

Father Blatter referred to the loss the Society had recently sustained by the death of Major H. F. Lodge, a member of the Managing Committee for many years and for some time its Honorary Treasurer. Major Lodge had consistently endeavoured to promote whenever possible the Society's interest. Father Blatter proposed a vote of condolence to Mrs. Lodge in her sad bereavement. The proposal being duly seconded was carried unanimously.

MAMMAL SECTION.

Mr. S. H. Prater, the Curator, acquainted those present with the progress that had been made in the Natural History section since they last had the opportunity of visiting the Museum. He referred to the annual report on the progress and present condition of the Natural History section during the fiscal year 1923-24. The various galleries were gradually taking shape and it was now possible for the visitor to obtain some idea of the system and plan on which the scheme of arrangement had been based. Several interesting exhibits had been added to the Mammal Gallery. Attention was drawn to the new Oorial group representing a male and female Oorial from the Salt Range, Punjab.

The ground work on which the animals are placed is a careful reproduction of the peculiar lime stone formation, characteristic of the hills where these animals are found ; a back ground is now being painted from actual photographs of the country where the animals were shot, so that when completed the whole group would faithfully tell the visitor, not only something of the colour and shape of this wild sheep, but would also give him an idea of its life and the conditions under which it had its being. These groups were not only popular, but were also instructive and he hoped to develop the type of exhibit as far as funds and condition of space permitted. A group illustrating animal and plant life in the Indian desert was now in course of preparation, and he hoped that the new group would be ready for exhibition in the gallery before long.

BIRD GALLERY.

As regards the Bird Gallery, no attempt had yet been made at any systematic arrangement of the birds. This was because of the paucity of material at their

disposal, but the work of mounting fresh exhibits was steadily progressing. One hundred and twenty-one birds had been mounted by the Museum Preparation Department during the past year and fresh birds were steadily being added to this series. Their attention was drawn to the beautiful series of Indian pheasants which had been completed—the series included all the commoner forms of pheasants found in the Himalayas and in Burma.

LACK OF FUNDS.

As regards reptiles, a number of casts of the common Indian snakes had recently been prepared. Attention was drawn to the beautiful casts representing the Banded Krait, the Common Krait and the Estuary Snakes. A number of models of local marine fish had also been completed. These had not been placed on exhibition as funds did not permit of providing the necessary cases for their exhibition. A cramping lack of funds continues to be their despair. We are at a serious loss to find proper accommodation for our invertebrate section. Insects and molluscs were now being shown in the bird gallery. Last year the verandah gallery on the Mezannine floor had been placed at our disposal for accommodating the invertebrate section, but experience had shown that the exposed nature of the gallery rendered it quite unsuitable for accommodation of the type of exhibits and the specimens were accordingly withdrawn from the verandah gallery.

THE KING COBRA.

The Curator then read a paper on the King Cobra or Hamadryad by Col. Wall, I.M.S. The Hamadryad might be described as the largest poisonous snake in the world. It is the third largest snake found within the Indian limits. The largest King Cobra known is an individual 15 feet 5 inches long, the skin of which is on exhibition in the Reptile Gallery. In India its distribution corresponds to the mountain ranges and their vicinity. It is principally a forest dweller though specimens have occasionally been killed far from any jungle. It is nowhere a common snake. The snake frequently climbs trees and thus obtains a vantage point among the foliage from which it can view its surroundings and rush down on any suitable victim moving in the scrub below, engage, overpower and swallow it. It is frequently seen near streams and will readily atake to water if pursued. The King Cobra has earned for itself a very unenviable reputation for its aggressiveness and courage and is probably unrivalled in the world for these traits with the single exception of the South African Mamba—a snake of a somewhat similar proportion. Col. Wall gave several authentic cases illustrating the aggressiveness and ferocity of the King Cobra. There is no doubt that the Hamadryad will sometimes attack without provocation, other than being confronted in its natural haunts. The female King Cobra, when disturbed in the process of brooding her eggs, seems to be specially sensitive and usually attacks the intruder at sight. On the other hand, even a large Hamadryad will sometimes fail to attack, in spite of great provocation. When encountered and not molested, there is no doubt many specimens will retire without attacking.

The staple diet of the King Cobra is snakes, though the snake is not averse to lizards, particularly the large monitor lizard. Col. Wall cited instances of the King Cobra preying on its own kind and said that it will also readily attack and devour poisonous snakes of different species ; the Cobra, Krait and Coral snakes were among its victims.

The Curator next read an interesting and exciting account of an adventure with an African Buffalo, written by Major C. R. S. Pitman, a member of the Society, now resident in East Africa. Major Pitman had a most thrilling escape and it was a wonder that he survived to tell the story of his remarkable adventure.

The two papers read at the meeting are published in full in the present issue of the Society's Journal.

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male

THE SNOW-PARTRIDGE
Lerwa nivicola.

female

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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U

PART XXXIX.

(*Continued from page* 11 *of this Volume.*)

Genus—LERWA.

Lerwa Hodgson, Madras. Journ. L. & S., V., p. 300 (1837). Type *Perdix lerwa.*

Type locality, Nepal.

The genus *Lerwa* contains a single species the plumage of which is constant throughout its range ; the wing is pointed and rather short ; the second primary is usually the longest, the first and third being equal and very little shorter ; in some specimens, however, the first primary is the longest and in others the three first are practically equal ; the secondaries reach to within about one inch of the tip of the wing. The tarsi are short and feathered for about half their length in front ; the tail consists of fourteen feathers and is slightly rounded at the end.

The sexes are alike in plumage but the male bird possesses a spur, generally short and blunt, occasionally well developed and sharp and, in rare instances only, with indications of a second spur.

LERWA LERWA.

THE SNOW PARTRIDGE.

Perdix lerwa Hodgson, P.Z.S. 1833, p. 107 (Nepal) ; Gray, Ill. Ind. Zool. II. pl. 44, fig. 1 (1834).

Lerwa nivicola Hodgs., Madras Journ. L. & S., 1837, p. 301 ; Gould, B. of Asia, VI., pl. 75 (1855) ; Jerdon, B. of India, III. p. 555 (1863) ;

Beavan, Ibis, 1868, p. 382 ; Swinhoe, P. Z. S. 1871, p. 400 (Moupin) ; Hume, Nests & Egg. Ind. B., p. 536, (1873) ; Hume & Marshall, Game B. Ind., II, p. 1. pl. (1879) ; Marshall, Ibis, 1884, p. 423 (Chamba) ; Oates' ed. Hume's Nests & Eggs. Ind. Birds, III, p. 428 (1890) ; Seebohm, Ibis, 1891, p. 380 (W. Sze-chuen) ; Blanford, Fauna. Brit. Ind., IV., p. 145 (1898) ; Walton, Ibis, 1906, p. 249 (S. Tibet) ; Ward, Journ. Bomb. N. H. Soc., XVII, p. 945 (1907) (Kashmir) ; Whitehead, Ibis, 1909, p. 714 (Kaghan Valley) ; Whymper, Journ. Bomb. N. H. Soc., XIX, p. 990 (1910), (Garhwal) ; Whymper, ibid, XX., p. 1160, (1911), (Garhwal) ; Whymper, Bull B.O.C., XXXV, p. 56 (1915), (Eggs) ; Hingston, Journ. Bomb. N. H. Soc., XXVII, p. 571 (1921), (Dharmsala); Osmaston, ibid, XXVIII, p. 160 (1921), (Garhwal).

Tetraoperdix (*Lerwa*) *nivicola* Hodgson, in Gray's Zool. Misc. p. 85, (1844).

Lerva nivicola Adams, P.Z.S., 1858, p. 501 (High Ranges of Cashmere) ; Adams, P. Z. S., 1859, p. 186. Ladak.

Lerwa lerwa Ogilvie-Grant, Cat. Birds B. M.,XXII, p. 100 (1895) ; Ogilvie-Grant, Handb. Game B., I, p., 80 (1895) ; Oates, Man. Game Birds, I, p. 196 (1898) ; Bailey, Journ. Bomb. N. H. Soc., XXI, p. 178 (1911), (Chumbi) ; Kinnear, Ibis, 1922, p. 500 (Mt. Everest) ; Whistler, Ibis, 1923, p. 628.

Vernacular Names—*Lerwa* (Bhutea) ; *Janguria* (Kumaon) ; *Quoir* or *Kur Monal* (Garhwal) ; *Golabi Bhair*, *Ter Titar* (*Bashahr*, etc.) ; *Barf-ka-Titar* (Kulu) ; *Biju* (Chamba).

Description.—Whole head, neck and upper plumage barred black and buffy white, the latter suffused with rufous chestnut to a varying extent, more especially on the scapulars and innermost secondaries ; primaries brown, tipped and speckled with dull white on the margins of the outer webs, the outermost primaries sometimes immaculate, probably in old birds ; secondaries brown mottled and barred with white on both webs and broadly tipped with purer white on all but the innermost ; tail barred with blackish brown and mottled bars of white ; below from the neck deep chestnut, the bases of the feathers marked with black and white ; on the breast the white hardly shows but on the flanks and lower abdomen it appears in broad buffy white streaks, extending to the whole of the outer webs on the feathers of the inner flanks ; vent and thigh coverts barred black and white and chestnut ; under tail coverts chestnut with black shaft stripes and broad white, or creamy white, tips.

Colours of Soft Parts.—Iris brown red to blood red ; bill bright coral red ; legs and feet orange red to deep red, deepest and brightest in the breeding season.

Measurements.—Total length about 375 to 400 mm. ; wing 180 to 205 mm. ; tail 118 to 138 mm. ; bill 18 to 20 mm. ; tarsus 38 to 40mm. The female is about the same in size as the male.

"Weight 16 ozs. to fully 22 ozs." "I have one bird noted as 25 ozs." (Hume.)

Young birds appear to have the chestnut feathers of the breast centred and, more rarely, edged with black.

Young in first plumage are mottled above with dull brown and buffy white, the shafts of the feathers white, showing conspicuously on the scapulars and innermost secondaries; below the whole plumage is mottled pale brown and buffy white with white central streaks on breast and flanks.

Nestling.—Centre of crown and nape, round the eye and posterior cheeks velvety black; remainder of head, throat and sides of neck soft silvery white; upper plumage chestnut brown, a blackish mark down the centre of the back and thighs; below pale buff to chestnut buff.

Distribution.—The Himalayas from the Frontiers of Baluchistan and Afghanistan, East through Sikkim and Tibet to Moupin and Ta-tsien-lu in Western China. This Snow-Partridge seems to be confined to a comparatively narrow strip of country running for an immense distance East and West along the first two or three outer Snow ranges of the Himalayas, it is, however, possible that in Eastern Tibet its area of habitat may broaden out very considerably as Col. F. M. Bailey has met with, and more often heard of, what he believes to be this bird over a very widely scattered area. It is absent from the cultivated and broad plains of Central Tibet though common in Sikkim and the adjacent Ranges South.

Nidification.—The Snow-Partridge breeds throughout its range between 10,000 and 15,000 feet, but apparently much more often above 12,000 feet than below this height. In Garhwal where Mr. S. L. Whymper took a number of nests they were nearly all found at about 14,000 feet; Capt. C. H. T. Whitehead obtained their eggs in the Khagan Valley between 12,500 and 14,000 feet and Col. R. H. Rattray took a nest near Mongtba at about 10,000 feet. In Ladak their eggs have been taken at about 14,000 and in Tibet they certainly breed as high as 15,000 feet. I have also an egg in my collection taken by Buchanan at Parachinar at an elevation of about 11,000 feet.

The site selected for the nest seems invariably to be a steep or even precipitous hillside, devoid of forest but with a scattered growth of grass and perhaps a few bushes and more or less covered with rocks, boulders and loose stones. As a rule quite a good nest is made of moss, grass, leaves, etc., placed in a hollow under the protection of some rock or more than usually rank tuft of grass. The hollow may be either a natural one or one made by the birds but, whether the one or the other, it is nearly always placed near the crest of the hill and always to the leeward side of it. Occasionally the eggs are deposited

in a hollow without any nest at all, such as that taken by Whitehead in the Khagan Valley, but this seems to be exceptional.

The nests are well concealed, being frequently quite hidden by projecting ledges of rock, and the hen bird is a very close sitter, but Mr. Whymper says that the site is generally given away by the anxiety of the cock-bird at the approach of anything he considers dangerous. Even when not anxious, however, he proclaims the fact that his wife is sitting somewhere close at hand by calling and strutting about in her vicinity.

The breeding season seems to be a long one. Whitehead obtained chicks, well advanced, and fresh eggs on the 2nd and 3rd July respectively on the Afghan Frontier, and Whymper took fresh eggs between the end of May and late June.

The eggs number three to five, perhaps in some cases six or seven, as Wilson records such numbers of chicks seen by him in coveys. In appearance they are very like small, poorly marked eggs of the Khoklas Pheasant. In colour they are a fairly warm buff, the markings consisting of numerous fine frecklings and tiny spots of reddish distributed fairly evenly over the whole surface of the egg. In some cases the specks become small blotches and are then less numerous, though in one or two eggs only are they at all bold or conspicuous. In a few eggs there are also secondary specks and markings of pale lavender and grey, but these are hardly noticeable unless carefully looked for. In shape the eggs are long ovals, in some rather pointed but in the majority rather obtuse.

Fifty eggs average 54·6 × 35·0 m.; maxima 57·2×35·6 and 54·7×37·0 m.; minima, 48·6×31·6 m.

General Habits.—The Snow-Partridge is essentially a bird of the Snowy ranges whose lower slopes are well covered with forest and where, on the steep and rocky region below the snow line, there is a certain amount of grass, bush, moss and other vegetation. Where there are wide desert plateaus, more or less level or undulating and practically devoid of all green growth on account of the want of rain, the Snow-Partridge will not be found. This is well shewn by Col. Bailey's list of Game-birds shot during four years in Chambi and Gyantse, which contains not a single record of *Lerwa*. It is a bird of the highest levels and in Summer will rarely be found below 12,000 feet, whilst it must be noted that the members of the Everest Expedition, according to Wollaston, did not observe it, even at this season below 17,000 feet. In Winter it is said to occur as low as 7,000 feet but presumably this must be most exceptional.

The Snow-Partridge is entirely vegetarian, living on moss and the young shoots of plants, but doubtless from time to time they also eat a certain number of insects and, possibly, as with all the true partridges, the chicks are fed on insects only at first.

Their call is a loud harsh whistle, constantly repeated, and both the alarm note and ordinary call, one to another, seems only to vary in loudness and harshness. When with the young both sexes have a lower, softer note, the chicks replying with a " cheep " much like that of the baby barn-door fowl.

Since Hume's time we have learnt a good deal more about the nidification and distribution of this handsome bird and it is also undoubtedly known to a much wider circle of sportsmen now than it was in his time. Alas, none of these sportsmen have attempted to record the results of their experience and we are still left with Hume's account of the shooting of the Snow-Partridge as the only one available. It is, however, one of the most charming of his many charming notes and is more than well worth repetition. He writes :—

> " Although in severe winters, and after heavy falls of snow, crowds of Snow-Partridges may be met with at from 7,000 to 9,000 feet elevation, Indian sportsmen, as a rule, never meet with them, except in their summer haunts, at elevations of from 10,000 to even 14,000 feet ; and they are so invariably seen in grounds frequented by Tahr and Burrel, that, though one of the very best of Indian birds for the table, they are but rarely shot.
>
> It is generally close up under the snow, amidst grey crags and hoary precipices, or on tiny plots of stunted herbage, girt round by huge boulders and rugged blocks of rock, amidst which the snow still lies thickly, and at an average elevation of 11,000 feet (at any rate from May to September) that this Ptarmigan-like Partridge is to be found.
>
> It is very locally distributed ; you may march for a couple of days, passing through or near the most likely spots and never see or hear a bird ; and again you may see a hundred in a day's march, or one party, or at most two parties, daily for a week.
>
> Like many others of our game birds, they are (where not worried) tame enough where they are numerous (as if they realized that a few more or less would not endanger the continuance of the race), while, where scarce, they are apt to be shy and wary. Along routes frequented by sportsmen, and after they have been shot at for several successive days, I have found them (*pace* my old friend Wilson, whose remarks I shall quote later) the reverse of tame.
>
> In the spring they are usually in pairs, but it is not uncommon to find a dozen such in a couple of hours' walk. Later they are in coveys of from seven to thirty, old and young, and by the end of September many of the latter are almost full grown.
>
> Their flight is rapid and strong, much like that of a Grouse ; and if met with in comparatively unfrequented spots, they often

afford superb sport. Out of a good covey, you get at first no doubt only a right and left, and even though somewhat scattered, the whole of the birds rise at the second if not the first shot; but though they go off at a great pace and sweep down towards the valley for a while, they soon curve upwards again and alight at no great distance from where you flushed them, and at much the same level as before. If it be a smooth bare hill side, near the limits of vegetation—and you do find them in such places—the same process has to be repeated, and the trudge after each shot becomes longer and longer; but if they alight (then usually much scattered) amongst rocks and stones, where they can squat unseen, you may get half a dozen in single and double shots (the birds often fluster-ing up close to your feet) before the remainder make up their minds to a simultaneous change of quarters.

Glorious sport may be enjoyed after the Snow-Partridge. Above, snowy domes and peaks, glistening sharp-cut against the blue sky; below, almost under one's feet, and stretching away for miles, a sea of green forest; in front, alternate patches of close shaven mossy turf, starred with a few alpine blossoms, and bare slaty slabs, those in the shade still silvered by the morning's frost—all sloping at a frightful angle, and traversed by little silent snow runlets and long streaks of partly discoloured snow, running down tiny gorges. As you halt to reconnoitre and rest a moment, perfect stillness seems to reign around. There are few signs of life; one little yellow butterfly fluttering here and there; by the mossy margin of a tiny trickling rill a few delicately-tinted Horned Larks (*Otocorys longirostris*) and a flock of Snow Chats (*Grandala coelicolor*), the males glistening sapphire-like against the snow as they dart away on powerful wings. From the depths beneath, the lowing of cattle steals upwards, mellowed by the distance and mingled with faint murmurs from the torrents below; a bee or two pass humming softly; a stone clatters down over the shale; the surging murmur of some distant avalanche creeps along the hill side, and then again a stillness as of death pervades the scene.

Suddenly from the bare rocks in front out rings a loud whistle and then another, and another; and again all is still. It is not good walking; and just between you and the whistlers, stones and snow keep every now and then coming down, as if preparatory to an avalanche; you have to mind your feet; it is impossible to say which is more slippery, the stones or moss, and a single false step would shoot you some two or three thousand feet into the birch trees below; but the whistle bursts out, not fifty yards away with redoubled energy, echoing harshly amongst the crags. You push on, half sliding, to a little plateau close to where the whistle sounded; you scrutinize intently the purplish grey stones in front;

you cough, raise your gun; still nothing is to be seen. But the dog's eyes, as he stands(his chain held by a Pahari) shivering with excitement, are almost starting from his head; a look to the man and the old smooth-haired, liver-coloured setter (ah! dear companion of many, many happy days!) is sneaking forward, almost like a prowling cat; but only for a few paces then he stands immoveable. Again you wait; a few steps only and the foothold may be such that firing would be impossible; a Pahàri heaves a big stone a few yards in front of the dog's nose; presto! as if by one impulse, in one lump, with the clatter of a hundred Partridges, up springs a covey; they rise perpendicularly about three yards and your first barrel rakes them, dropping three; the second catches the hindermost bird as they sweep down the hill-side. The first three lie amongst the rocks, the last first touches ground five hundred feet below. But there is no time to think of him. Before the echoes of the shots have died away, a growl, as if of anger at being disturbed, at first low, but growing louder every second, floats down the peaks above; a rolling cloud, a confused mist of snow, in which a few black specks are discernable, is coming straight down on you. You reach the birds, when with a surging swish and mighty clatter, down rushes the avalanche, stray fragments of stone striking, and the skirts of the snow sweeping, even the little plateau whence you fired. A near thing, but the birds have been marked down less than a quarter of a mile ahead, a little higher and in much better ground than that where you found them; and sending a man, and dog down to recover the bird below, you push on recklessly over ground that, at other times, you would cross at a snail's pace, until again the harsh whistle warns you that the game is at hand. And now, if you have luck, you will get, within the space of two hundred yards, from three to six as fine shots, singles and doubles as ever gladdened the heart of a sportsman; and even if you cannot follow this covey up a third time, you may probably, if you are in one of their head quarters, find another, and another; and besides picking off three or four Snow Cocks with a rifle, and possibly (because all the firing in the world will not at times prevent such suddenly cropping up before you) a Tahr or a Burrel, you may take ten to fifteen brace of these splendid Snow-Partridges down with you to your camp in the forest below. A few days later, discussing some of these (cooked gipsy fashion) beside the perfumed blaze of a deodar bon-fire, the most miserable victim of ennui would be compelled to confess that there was still something to live for."

[We are pleased to be able to announce that Mr. Stuart Baker proposes to continue this interesting and popular serial with a series of illustrated articles dealing with the Wading Birds.—EDS.]

A HAND-LIST OF THE SNAKES OF THE INDIAN EMPIRE.

By

F. Wall, C.M.G., K.H.S., C.M.Z.S., F.L.S., F.A.S.B., H.C.Z.S.I., Colonel, I.M.S.

(*Continued from page 24 of this Volume.*)

Part V.

Family.—COLUBRIDÆ—(*Continued.*)

Series.—PROTEROGLYPHA.

Sub-family.—HYDROPHIINÆ.

Genus.—Hydrus *Schneider.*

Genus.—Naia, *Laurenti.*

288. (486) **Naia hannah** (Cantor). *The Hamadryad or King Cobra.*

Ophiophagous elaps. *Phipson, Bomb. N. H. J. Vol II, p* 245.

Naia bungarus. *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 52; *Aitken, Bomb. N. H. J. Vol XIV, p* 629; *Annandale, J.A.S., Beng.*, 1905, *p* 176; *Bannerman, Bomb. N. H. J. Vol XV, p* 407, *Boulenger, Cat. Vol III*, 1896, *p* 386; *Craddock, Bomb. N.H.J. Vol XV, p* 143; *Evans, Bomb. N. H. J. Vol XIV, p* 409; *Fenton, Bomb. N. H. J. Vol XXV, p* 151; *Ferguson, Bomb. N. H. J. Vol X, p* 75, *Millard, Bomb. N. H. J. Vol XIV, p* 395; *Noble, Bomb. N. H. J. Vol XV*, 358; *Parshad, Bomb. N. H. J. Vol XXIII, pp* 585; *Primrose, Bomb. N. H. J. Vol XII, p* 589; *Sarasin, Zool. Jahr. Jena*, 1910, *p* 144; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 59; *Wall and Evans Bomb. N. H. J. Vol XIII, pp* 348 *and* 616; *Wall, Bomb. N. H. J, Vol XVII, p* 303; *l. c. Vol XVIII, p* 331; *l. c. Vol XIX, pp* 355. 841 *and* 900; *l. c. Vol XXVI, p* 575; *Pois., Sn. Brit. Ind.* 1907, *p* 26; *l. c.* 1908, *p* 33; *l. c.* 1913, *p* 31; *Wasey. Bomb. N. H. J., Vol VII, p* 257.

Hamadryas vittatus. *Blyth, Andaman Islanders, p* 365.

Ophiophagous bungarus. *Beddard, P. Z. S.* 1904, *p* 355.

Length.—4,700 mm. (15 feet, 5 inches).

Lepid.—Costals. Two heads-lengths behind the head 19 or 17, midbody 15, two heads-lengths before the vent 15. Ventrals. 225 to 262. Subcaudals. 76 to 117.

Distn.—Peninsular India. Hills or their near vicinity. *Western Himalayas. Eastern Himalayas. Bengal. Assam. Burma. Andamans. Malay Peninsula. Indo-China. S. China. Malay Archipelago. Philippines.*

289. (485) **Naia naia** (Linné). *The Cobra.*

N. tripudians. *Abercromby, Sn. of Ceylon*, 1910, *pp* 32, 48 *and* 81; *Spol. Zeylan.* 1911, *p* 205; *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 53; *Annandale, J.A.S., Beng.*, 1905, *p* 176; *Bannerman, Bomb. N. H. J. Vol XVI, pp* 363, 407 *and* 638; *l. c. Vol XVII p* 1031; *l. c. Vol XVIII, p* 208; *Jourl. Ind. Med. Res.* 1914, *p* 149, *Bannerman and Pocha, Bomb. N. H. J. Vol XXI, p* 1337; *Barnard, Spol. Zeylan.* 1910, *p* 174; *Bassett-Smith, Bomb. N.H.J. Vol XI, p* 546; *Beddard, P. Z. S.* 1904, *p* 359; *Bobeau, Spol. Zeylan.* 1913, *p* 16, *Boulenger, Cat. Vol III*, 1896, *p* 380; *Brook-Fox, Bomb. N. H. J. Vol XVI, p* 369; *Fraser, Bomb. N. H. J. Vol VIII, p* 307; *George, Bomb. N. H. J. Vol XV, p* 174; *Goring-Jones.*

Bomb. N. H. J. Vol XIII, p 376; *Luard, Bomb. N. H. J. Vol. XXV. p* 510 ; *Levett-Yeats, Bomb. N. H. J. Vol XXIV, p* 370 ; *Millard, Bomb. N. H. J. Vol XIV, p* 395 ; *Mitchell and Pocock P. Z. S.* 1907, *p* 791 ; *Pearless. Spol. Zeylan.* 1909, *p* 54 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 132 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 59; *Smith, Bomb. N. H. J. Vol XXII, p* 789 ; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 348 *and* 617 ; *Wall, Bomb. N. H. J. Vol XV, p* 524 ; *l. c. Vol XVI, pp* 313 *and* 395 ; *l. c. Vol XVII, pp* 126 *and* 299 ; *l. c. Vol XVIII, p* 330 ; *l. c. Vol XIX, pp* 355 *and* 840 ; *l. c. Vol XX, p* 1042*a* ; *l. c. Vol XXII, p* 243 ; *l. c. Vol XXVI, p* 575 ; *Spol. Zeylan.* 1905, *p* 3; *l. c.* 1921, *p* 402 ; *Ind Med. Gaz.* 1909; *Pois., Sn. Brit. Ind.* 1907, *p* 22 ; *l. c.* 1908, *p* 28 ; *l. c.* 1913, *p* 26 ; *Oph. Tap.* 1921, *p* 459; *Watson, Bomb. N. H. J. Vol XXV, p* 510.

N. sputatrix. *Evans, Bomb. N. H. J. Vol XVI, p* 170.
N. oxiana. *Wall, Bomb. N. H. J. Vol XXI, p* 141.

N. naia oxiana (Eichwald.) *Eichwald's Cobra.*

Length.—1,525 mm. (5 feet).
Lepid.—Costals. 21 (rarely 19) in midbody. Ventrals. 185 to 213. Subcaudals. 60 to 70.
Distn.—*Punjab. Baluchistan. N. W. Frontier. Afghanistan. Transcaspia*

N. naia sputatrix (Boie.) *Boie's Cobra.*

Length.—1525 mm. (5 feet).
Lepid.—Costals. 19 to 21 in midbody. Ventrals. 163 to 191. Subcaudals. 44 to 49.
Distn.—*Burma. Malay Peninsula. Indo-China? S. China. Malay Archipelago.*

N. naia caeca (Gmelin.) *Gmelin's Cobra.*

Length.—2,135 mm. (7 feet).
Lepid.—Costals. In from 21 to 25 rows in midbody (23 to 25 in South India and Ceylon, 21 to 23 in the Central Provinces and further North) Ventrals. 176 to 200. Subcaudals. 50 to 64.
Distn.—*Ceylon. Peninsular India.* To Punjab. and Sind. *Himalayas.* Up to 5,000 feet. *Bengal. Assam. Burma.*

N. naia fasciata (Gray.) *Gray's Cobra.*

Length.—1,970 mm. (6 feet, 5½ inches).
Lepid.—Costals. In from 21 to 23 rows in midbody. Ventrals 177 to 194. Subcaudals. 51 to 62.
Distn.—*E. Himalayas. Bengal. Assam. Burma. Indo-China. S. China.*

Genus.—HEMIBUNGARUS *Peters.*

290. (476) **Hemibungarus nigrescens** (Günther.) *Günther's Coral Snake.*

Callophis nigrescens. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 384 ; *Ferguson, Bomb. N. H. J. Vol X, p* 74 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 56.
Hemibungarus nigrescens. *Boulenger, Cat. Vol III,* 1896, *p* 394; *Sarasin, Zool. Jahr.* 1910, *p* 138; *Wall, Bomb. N. H. J. Vol XVII, p* 309 ; *Vol XXII, p* 638 ; *l. c. Vol XXVI, p* 576 ; *Pois. Sn. Brit. Ind.* 1907, *p* 32 ; *l. c.* 1908, *p* 40 ; *l. c.* 1913, *p* 37.
Length.—1,220 mm. (4 feet).
Lepid.—Ventrals. 218 to 252. Subcaudals. 30 to 44.

Distn.—Hills of S. India. From the vicinity of Poona to Travancore *Ganjam Hills.*

Genus.—CALLIOPHIS *Gray.*

291. (474) **Calliophis trimaculatus** (Daudin.) *The Slender Coral Snake.*

C. trimaculatus. *Boulenger, Cat. Vol III,* 1896, *p* 397; *D'Abreu Bomb. N. H. J. Vol XXII, p* 634; *Phipson, Bomb. N. H. J. Vol II, p* 248; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 131; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 56; *Vidal, Bomb. N. H. J. Vol V, p* 66; *Wall, Bomb. N. H. J. Vol XVII, p* 307; *Spol. Zeylan.* 1910, *p* 37; *Pois., Sn. Brit. Ind.* 1907, *p* 30; *l. c.* 1908, *p* 38; *l. c.* 1913, *p* 35; *Willey, Spol. Zeylan.* 1903, *p* 84; *l. c.* 1906, *p* 233.

Lepid.—Ventrals. 228 to 274. Subcaudals. 24 to 36.

Distn.—Ceylon. Trincomalee. Tissamaharana. Matale. *Peninsular India.* Madras. Trichinopoly. Travancore. Anamalais. Mahableshwar. Walayar. Colaba. Bandora. Nagpur. *Bengal.* Jalna. Nerva.

292. (475) **Calliophis maculiceps** (Günther.) *The Small-spotted Coral Snake.*

Call ophis maculiceps. *Boulenger, Cat. Vol III,* 1896, *p* 397; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 56; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 344 *and* 612; *Wall, Bomb. N. H. J. Vol XVII, p* 308; *Pois., Sn. Brit. Ind.* 1907, *p* 31; *l. c.* 1908, *p* 39; *l. c.* 1913, *p* 36.

Length.—485 mm. (1 foot, 7 inches)

Lepid.—Ventrals. 178 to 205. Subcaudals. 20 to 32.

Distn.—Burma. Rangoon. Moulmein. Kawkareit. Amherst. *Malay Peninsula. Indo-China.*

293. (477) **Calliophis macclellandi** (Reinhardt). *McClelland's Coral Snake.*

Call-ophis macclellandi. *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 56; *Annandale, Rec. Ind. Mus.* 1912, *pp* 37, 50 *and* 54. *Boulenger, Cat. Vol III,* 1896, *p* 398; *P. Z. S.* 1899, *p* 166; *Sclater. List. Sn. Ind. Mus.* 1891, *p* 56; *Venning, Bomb. N. H. J. Vol XX, pp* 342, *and* 775; *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 611; *Wall, Bomb. N. H. J. Vol XVII, p* 306; *l. c. Vol XVIII, pp* 333 *and* 780; *l. c. Vol XIX, pp* 266, 356, *and* 842; *l. c. Vol XXII, p* 693; *l. c. Vol XXV, p* 628; *Pois., Sn. Brit. Ind.* 1907, *p* 29; *l. c.* 1908, *p* 36; *l. c.* 1913, *p* 34.

Length.—812 mm. (2 feet, 8 inches).

Lepid.—Ventrals 182 to 244. Subcaudals. 20 to 36.

Distn.—Variety *nigriventer* Wall. *Western Himalayas.* Kasauli. Variety *univirgatus* Günther. *Eastern Himalayas.* Nepal. Sikkim. Variety *gorei* Wall. *Assam.* Jaipur. *Burma.* Manipur. Variety *typicus* Reinhardt. *Assam.* Abor Hills. Khasi Hills. Naga Hills. Sibsagar. *Burma.* N. Chin Hills. Manipur. Pegu Yomas. S. Shan States. *Indo-China. S. China. Formosa.*

294. (478) **Calliophis bibroni** (Jan.) *Bibron's Coral Snake.*

Call-ophis bibroni. *Boulenger, Cat. Vol III,* 1896, *p* 399; *Ferguson Bomb. N. H. J. Vol X, p* 386; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 138; *Wall, Bomb. N. H. J. Vol XVII, p* 305; *l. c. Vol XXVI, p* 575; *Pois., Sn. Brit. Ind.* 1907, *p* 28; *l. c.* 1908, *p* 35; *l. c.* 1913, *p* 33.

Length.—775 mm. (2 feet, 6½ inches).

Lepid.—Ventrals. 219 to 228. Subcaudals. 25 to 39.

Distn.—Western Ghats. Nilgiris. Wynad. Travancore.

Genus.—DOLIOPHIS *Girard.*

295. (*Nil.*) **Doliophis bivirgatus** (Boie). *The White-striped Coral Snake.*

Doliophis bivirgatus. *Boulenger, Cat. Vol III*, 1896, *p.* 400; *Wall, Bomb. N. H. J. Vol XVII, p.* 70; *Pois., Sn. Brit. Ind.* 1907, *p* 21; *l. c.* 1908, *p* 27; *l. c.* 1913, *p* 25;

Lepid.—Ventrals. 244 to 295. Subcaudals. 34 to 53.

Distn.—Burma. Malay Peninsula. Cochin-China. Malay Archipelago. Sumatra. Borneo. Java.

296. (479) **Doliophis intestinalis** (Laurenti.) *The Belted Coral Snake.*

Doliophis intestinalis. *Boulenger, Cat. Vol III*, 1896, *p* 401; *Wall Bomb. N. H. J. Vol XVII, p* 71; *Pois., Sn. Brit. Ind.* 1907, *p* 22; *l. c.* 1908, *p* 28; *l. c.* 1913, *p* 26.

Distn.—Upper Burma (Stoliczka.) *Malay Peninsula. Indo-China. Malay Archipelago.* Sumatra, Borneo, Java. Celebes.

Family 8.—AMBLYCEPHALIDÆ.

Genus.—AMBLYCEPHALUS *Kuhl.*

297. (514) **Amblycephalus monticola** Cantor. *Cantor's Slug Snake.*

Annandale, J. A. S., Beng., 1905, *p* 176; *Rec. Ind. Mus.* 1912, *pp* 37, 50 *and* 54; *Boulenger, Cat. Vol III*, 1896, *p* 443; *Sclater. List Sn. Ind. Mus.* 1891, *p* 66; *Wall, Bomb. N. H. J. Vol XVIII, p* 334; *l. c. Vol XIX, pp* 356 *and* 843.

Length.—705 mm. (2 feet, 3¾ inches).

Lepid.—Ventrals. 181 to 198.

Distn.—Eastern Himalayas. Sikkim. *Assam.* Sibsagar. (Ind. Mus.) Jaipur. (F. W.). Hills North and South of the Bramaputra.

Note.—I have examined de Roepstorff's specimen in the Indian Museum labelled "Nicobars", and can confirm the identification, but I doubt the locality. (*Vide* note to *Polyodontophis sagittarius.*)

298. (*Nil.*) **Amblycephalus moellendorffi** (Boettger.) *Boettger's Slug Snake*

Boulenger, Cat. Vol III, 1896, *p* 443; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 67.

Lepid.—Ventrals. 136 to 159. Subcaudals. 31 to 50.

Distn.—Burma. Tenasserim. (Ind. Mus.) *Siam.* (Malcolm-Smith.) *Cochin China. S. China, and Coastal Islands.*

Note.—I have examined the Tenasserim specimen in the Indian Museum and can confirm the identification.

299. (*Nil.*) **Amblycephalus hamptoni** Boulenger. *Hampton's Slug Snake.*

Boulenger, Bomb. N. H. J. Vol XVI, p 236.

Type.—In the British Museum from Burma.

Length.—555 mm. (1 foot, 9¾ inches). Tail, 150 mm. (5⅞ inches).

Lepid.—Ventrals. 202. Subcaudals. 96.

Distn.—Burma. Mogok. (Lat. 23°. Long. 96·5°)

300. (518) **Amblycephalus macularius** (Theobald.)

A. macularius *Boulenger, Cat. Vol III*, 1896, *p* 444. *Sclater List. Sn. Ind. Mus.* 1891, *p* 67. *Wall Rec. Ind. Mus.* 1909, *p* 149; *l.c. Vol XXIV, p* 24.

A. modestus. *Boulenger, Cat. Vol III*, 1896, *p* 444; *Sclater, List Sn. Ind. Mus.* 1891, *p* 66.

A. andersoni. *Boulenger, Cat. Vol III*, 1896, *p* 444 ; *Bom. N.H. J. Vol. XVI, p* 235; *Wall and Evans. Bom. N.H.J. Vol XIII, p* 61 ; *Wall. Bomb. N.H.J. Vol XVIII, p* 783.

Type.—In the British Museum. Co-types in the Indian Museum.
Length.—419 mm. (1 foot, 4½ inches). Tail, 60 mm. (2⅜ inches).
Lepid.—Ventrals. 161 to 170. Subcaudals. 40 to 51.
Distn.—Burma. Tenasserim. (Martaban.)
Note.—I have examined four examples .

301. (*Nil.*) **Amblycephalus carinatus** Boie. *Boie's Slug Snake.*

Boulenger, Cat. Vol III, 1896, *p* 445; *Sclater, List. Sn. Ind. Mus.* 1891 *p* 67.
Length.—603 mm. (1 foot, 11¾ inches). Tail, 120 mm. (4¾ inches).
Lepid.—Ventrals. 161 to 199. Subcaudals. 53 to 92.
Distn.—Burma. Tenasserim. Mergui. Tavoy. Burma-Siam Hills. (Ind.) Mus.) *Siam.* (Malcolm-Smith.) *Cochin-China.* Lao Mountains (Brit. Mus.). *Malay Archipelago.* Sumatra. (Ind. Mus.) Java. (Brit. Mus.)
Note.—I have examined nine specimens in the Indian Museum.

Family.—VIPERIDÆ.

Sub-family.—VIPERINÆ.

Genus.—AZEMIOPS *Boulenger.*

302. (519) **Azemiops feæ** Boulenger. *Fea's Viper.*
Azemiops feæ. *Boulenger, Cat. Vol III*, 1896, *p* 471; *Wall, Bomb. N. H. J. Vol XVII, p* 332; *Pois, Sn. Brit. Ind.* 1907, *p* 56 : *l. c.* 1908, *p* 67 ; *l. c.* 1913, *p* 65.
Distn.—Burma. Kachin Hills.

Genus.—VIPERA * *Laurenti.*

303. (521) **Vipera lebetina** (Linné.) *The Levantine Viper.*
Vipera lebetina. *Boulenger, Cat. Vol III*, 1896, *p* 487; *P. Z. S.* 1919, *p* 306; *Sclater, List. Sn. Ind. Mus.* 1910, *p* 68; *Wall, Bomb. N. H. J. Vol XVII, p* 331; *Pois. Sn. Brit. Ind.* 1907, *p* 55 ; *l. c.* 1908, *p* 65 ; *l. c.* 1913, *p* 62.
Lepid.—Subcaudals. 26 to 51.
Distn.—N. W. India. Kashmir. *Baluchistan. Afghanistan. Persia. Mesopotamia. Syria. Transcaspia. Asia Minor. Greek Archipelago. Cyprus. N. Africa.* Egypt? Tunis. Algeria. Morocco.

304. (520) **Vipera russelli** (Shaw). *Russell's Viper.*

Daboia elegans. *Brook-Fox, Bomb. N. H. J. Vol VIII, p* 565 ; *Phipson, Bomb. N. H. J. Vol II, p* 248 ; *Traill, Bomb. N. H. J. Vol. VIII, p* 316.

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*Stejneger (Herp., Japan, 1907, p. 443) shows that the type of Linné's *Coluber* is the common British Viper, and that this snake should be known as *Coluber berus* instead of *Vipera berus*. Correct as this appears to be I think the matter should be put up for a decision from an international tribunal before admitting such a drastic change in nomenclature. It would be extremely inconvenient to change the name of the genus in this instance, as it would necessitate substituting the name *Colubridæ* for the family all herpetologists have accustomed themselves to know as *Viperidæ*. The confusion such a proposition would create would be immense for all time. Herpetologists for many decades have accustomed themselves to speak of the Colubrine as opposed to the Viperine snakes, and past literature would become most perplexing if the old names are to be reversed, and Viperine snakes are in future to be known as Colubrine.

Daboia russellii. *Bannerman, Bomb. N. H. J. Vol XV, p* 406.
Vipera russellii. *Abercromby, Sn. of Ceylon,* 1910, *pp* 29, 48 *and* 52; *Spol. Zeylan.* 1911, *p* 206; *l. c.* 1913, *p* 144; *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 56; *Bannerman, Bomb. N. H. J. Vol XVI, p* 363; *l. c. Vol XVII, p* 808, *l. c. Vol. XVIII, p* 208; *Bassett-Smith, Bomb. N. H. J. Vol XI, p* 546; *Cholmondeley, Bomb. N. H. J. Vol XII, p* 765; *Dreckman, Bomb. N. H. J. Vol XVIII, p* 435; *Fenton, Bomb. N. H. J. Vol XX, p* 173; *Ferguson, Bomb. N. H. J. Vol X, p* 75; *Fletcher, Spol. Zeylan.* 1908, *p* 100; *Millard, Bomb. N. H. J. Vol XIV, pp* 396 *and* 614; *Mosse, Bomb, N. H. J. Vol XV, p* 134; *Pearless, Spol. Zeylan.* 1909, *p* 54; *Rao, Bomb. N. H. J. Vol XXV, p* 307; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 131; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 67; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 353 *and* 620; *Wall, Bomb. N. H. J. Vol XV, p* 526; *l. c. Vol XVI, pp* 34 *and* 374; *l. c. Vol XVII, p* 328; *l. c. Vol XVIII, p* 1; *l. c. Vol XXVI, p* 575; *Spol. Zeylan.* 1905, *p* 147; *Pois. Sn. Brit. Ind.* 1907, *p* 52; *l. c.* 1908, *p* 62; *l. c.* 1913., *p* 59; *Oph. Tap.* 1921, *p* 504.

Length.—1,677 mm. (5 feet, 6 inches).
Lepid.—Ventrals. 153 to 180. Subcaudals. 41 to 64.
Distn.—*Ceylon. Peninsular India.* Excluding the Ganges Valley, North-West to Sind and Baluchistan. *Western Himalayas.* Kulu to Western limit of Nepal. *Bengal. Burma. Siam.*

Note.—In my book on the Poisonous Snakes of British India I included the Eastern Himalayas within its range of distribution. It is a mistake which I have since rectified (Oph. Tap. 1921, p 528).

Genus.—ECHIS *Merrem.*

305. (522) **Echis carinata** (Schneider.) *The Saw-scaled Viper.*

E. carinata. *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 48; *Bannerman, Bomb. N. H. J. Vol XX, p* 406; *Boulenger, Cat. Vol III,* 1896, *p* 505; *Branford, Bomb. N. H. J. Vol XXIII, p* 378; *Candy, Bomb. N. H. J. Vol V, p* 85; *Dymock, Bomb. N. H. J. Vol VI, p* 454; *Heath, Bomb. N. H. J. Vol XII, p* 784; *Jolly, Bomb. N. H. J. Vol XXI, p* 1340; *Major, Bomb. N. H. J. Vol XXV, p* 308; *Millard, Bomb. N. H. J. Vol XVI, p* 758; *Mosse, Bomb. N. H. J. Vol XXI, p* 1339; *Phipson, Bomb. N. H. J. Vol II, p* 248; *Reinhold, Bomb. N. H. J. Vol XX, p* 524; *Sarasin, Zool. Jahr. Jena.* 1910, *pp* 135 *and* 144; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 69; *Vidal. Bomb. N. H. J. Vol V, p* 92; *Wall, Bomb. N. H. J. Vol XIII, p* 184; *l. c. Vol XVII, p* 323; *l. c. Vol XVIII, pp* 526 *and* 804; *l. c. Vol XIX, p* 266*a*; *l. c. Vol XX, p* 1042*a*; *l. c. Vol XXIII, p* 377; *l. c. Vol XXVI, p* 575; *Ind. Med. Gaz. Aug.* 1909; *Pois, Sn. Brit. Ind.* 1907, *p* 47; *l. c.* 1908, *p* 57; *l. c.* 1913, *p* 54; *Oph. Tap.* 1921, *p* 531; *Whistler, Bomb. N. H. J. Vol XXIV, p* 607; *Young, Bomb. N. H. J. Vol XVI p* 504.

Length.—915 mm. (2 feet, 6 inches).
Lepid.—Ventrals. 132 to 195.
Distn.—*Ceylon.* Mullaitivu. (Ferguson.) *Peninsular India.* Except a small tract West of the Western Ghats and South of Karwar; and the Ganges Valley. *Sind. Baluchistan. Afghanistan. Transcaspia. Persia. Arabia. Africa.* North of the Equator.

Genus.—ERISTOCOPHIS *Alcock and Finn.*

306. (*Nil.*) **Eristocophis mcmahoni** Alcock and Finn. *McMahon's Viper.*

Eristocophis mcmahoni. *Alcock and Finn, J. A. S., Beng.*, 1896, *p* 564 ; *Annandale, J. A. S., Beng.*, 1904 *p* 211 ; *McMahon, Bomb. N. H. J. Vol XVIII, p* 945; *Wall, Bomb. N. H. J. Vol XVII, p* 326 ; *l. c. Vol XX, p*1042 *a* ; *Pois. Sn. Brit. Ind.*, 1907, *p* 50 ; *l. c.* 1908, *p* 60 ; *l. c.* 1913, *p* 57.

Types.—In the British and Indian Museums from the Perso-Baluchistan borders.

Length.—610 mm. (about 2 feet).

Lepid.—Costals 25 to 27 in midbody. Ventrals 132 to 143. Subcaudals 27 to 32.

Distn.—Baluchistan. Persia. Afghanistan. Desert, South of Helmund. (Brit. Mus.)

Genus.—PSEUDOCERASTES *Boulenger.*

307. (*Nil.*) **Pseudocerastes bicornis** Wall. *Smith's Horned Viper.*

Pseudocerastes bicornis. *Wall, Pois. Sn. Brit. Ind.* 1913, *p* 64.

Type.—From Kajuri Kach, Waziristan. In the Bombay collection.

Length.—618 mm. (2 feet and ¼ of an inch). Tail, 76 mm. (3 inches).

Lepid.—Costals. Two heads-lengths behind the head 24, midbody 21.

Note.—Only the head and anterior part of the body are preserved, but Major O. A. Smith has given me details of the whole snake. He omitted to count the ventrals and subcaudals. He tells me that he showed the specimen to Mr. Boulenger who decided that it was not the next species (*P. persicus*).

Distn.— Waziristan. Kajuri Kach.

308. (*Nil.*) **Pseudocerastes persicus** (Dumeril and Bibron.) *The Perso-Baluch Horned Viper.*

Pseudocerastes persicus. *Annandale, J. A. S., Beng.*, 1904, *p* 211 ; *Boulenger, Cat. Vol III*, 1896, *p* 501 ; *Wall, Pois. Sn. Brit. Ind.*, 1908, *p* 66 ; *l. c.* 1913, *p* 63 ;

Lepid.—Costals. Two heads-lengths behind the head 23, midbody 23 to 25, two heads-lengths before the vent 19. Ventrals. 145 to 158. Subcaudals. 34 to 49.

Distn.—Baluchistan. Kacha Thana. Sib. Putak. Manquli. Cach-Zar. (Bombay colln.) *Persia.*

Genus.—ANCISTRODON *Beauvois.*

309. (524) **Ancistrodon hypnale** (Merrem.) *Merrem's Hump-nosed Viper.*

Hypnale nepa. *Phipson, Bomb. N. H. J.* 1887, *p* 249.

Ancistrodon hypnale. *Abercromby, Sn. of Ceylon*, 1910, *pp* 46 *and* 69 ; *Spol. Zeylan*, 1911, *p* 205 ; *l. c.* 1913, *p* 144 ; *Boulenger, Cat. Vol III*, 1896, *p* 528 ; *Ferguson. Bomb. N. H. J. Vol X, p* 76 ; *Pearless Spol. Zeylan.* 1909, *p* 54 ; *Sarasin, Zool. Jahr. Jena*, 1910, *p* 128 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 70 ; *Wall, Bomb. N. H. J. Vol XVII, p* 312 ; *Spol. Zeylan.* 1921, *pp* 403 *and* 406 ; *Oph. Tap.* 1921, *p* 549.

Ancistrodon millardi. *Wall, Bomb. N. H. J. Vol XVIII, p* 792 ; *l. c. Vol XXVI, p* 578 ; *Pois. Sn. Brit. Ind.* 1907, *p* 35 ; *l. c.* 1908, *p* 43 ; *l. c.* 1913, *p* 41.

Length.—483 mm. (1 foot, 7 inches).

Lepid.—Ventrals. 136 to 157. Subcaudals. 30 to 47.

Distn.—Ceylon. Western Ghats. Belgaum to Travancore.

Note.—When describing *A. millardi* I had not seen Merrem's description

of *hypnale*. The snake I found so common at Hakgalla I erroneously concluded must be *hypnale* and in consequence I have reversed the names of this and the next species in previous publications.

310. (*Nil.*) **Ancistrodon millardi** Wall. *Millard's Hump-nosed Viper.*

Ancistrodon hypnale. *Wall, Spol. Zeylan.* 1905, *p* 146; *Pois Sn. Brit. Ind.* 1908, *p* 45; *l. c.* 1913, *p* 43.
Ancistrodon millardi. *Wall, Oph. Tap.* 1921, *p* 554.
Length.—387 mm. (1 foot, $3\frac{1}{8}$ inches).
Lepid.—Ventrals. 116 to 138. Subcaudals. 27 to 39.
Distn.—*Ceylon.*

311. (523) **Ancistrodon himalayanus** (Günther.) *The Himalayan Pit Viper.*

A. himalayanus. *Acton and Knowles, Jourl. Ind. Mad. Res.* 1914, *p* 47; *Boulenger, Cat. Vol* III, 1896, *p* 526; *Boyd, Bomb. N. H. J. Vol XX, p* 864; *Fenton, Bomb. N. H. J. Vol XIX, p* 1002; *Gleadow, Bomb. N. H. J. Vol XII, p* 577; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 69; *Wall, Bomb. N. H. J. Vol XII, p* 411; *l. c. Vol XVII, p* 311; *l. c. Vol XX, p* 65; *l. c. Vol XXI, p* 142; *Pois. Sn. Brit. Ind.* 1907, *p* 34; *l. c.* 1908, *p* 42; *l. c.* 1913, *p* 40.
Length.—648 mm. (2 feet, $1\frac{1}{2}$ inches). 864 mm. (2 feet, 10 inches. Stoliczka.)
Lepid.—Ventrals. 143 to 175. Subcaudals. 32 to 52.
Distn.—*The Himalayas.* From Chitral to Sikkim. *Assam*? Khasi Hills. (Jerdon.)
Note.—I have raised doubts about the reliability of some of Jerdon's localities, notably *Trachischium monticola* and I think his authority for the Khasi Hills for this species calls for confirmation.

Genus.—TRIMERESURUS* *Lacepede.*

312. (534) **Trimeresurus macrolepis** Beddome. *Beddome's Pit Viper.*

Trigonocephalus macrolepis. *Ferguson, Bomb. N. H. J. Vol X, p* 77.
Trimeresurus macrolepis. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 431; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 73.
Lachesis macrolepis. *Boulenger, Cat. Vol III,* 1896, *p.* 560; *Sarasin. Zool. Jahr. Jena.* 1910, *p* 138; *Wall, Bomb. N. H. J. Vol XVII, pp* 6 *and* 314; *Pois. Sn. Brit. Ind.* 1908, *p* 37; *l. c.* 1908, *p* 47; *l. c.* 1913, *p* 45.
Lepid.—Ventrals. 133 to 143. Subcaudals. 44 to 56.
Distn.—*Western Ghats.* South of the Palghat gap. Anamalais to Tinnevelly.

313. (533) **Trimeresurus trigonocephalus** (Daudin.) *The Ceylon Pit Viper.*

Trimeresurus anamallensis. *Phipson, Bomb. N. H. J. Vol II, p* 249
Trimeresurus trigonocephalus. *Abercromby, Sn. of Ceylon,* 1910, *pp* 49 *and* 69; *Spol. Zeylan.* 1911, *p* 206; *l. c.* 1913, *p* 144; *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 431; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 73; *Wall, Oph. Tap.* 1911, *p* 560.
Lachesis trigonocephalus. *Boulenger, Cat. Vol III,* 1896, *p* 559; *Pearless, Spol. Zeylan.* 1909, *p* 54; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127. *Wall. Bomb. N. H. J. Vol XVII, p* 321. *Pois. Sn. Brit. Ind.* 1907, *p* 45; *l. c.* 1908, *p* 55; *l. c.* 1913, *p* 52.

* This appears to be the correct name for this genus and I endorse Steineger's view (Herp, Japan, 1907, p 465).

Length.—1,320 mm. (4 feet, 4 inches) (Abercromby).
Lepid.—Ventrals. 145 to 170. Subcaudals. 53 to 69.
Distn.—*Ceylon.* Hills.

314. (526) **Trimeresurus strigatus** Gray. *The Horse-shoe Pit Viper.*

Trimeresurus cantoris. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 427; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 70.
Lachesis strigatus. *Boulenger, Cat. Vol III,* 1896, *p* 549; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 138; *Wall, Bomb. N. H. J. Vol XVII, p* 315; *l. c. Vol XXVI, p* 578; *Pois. Sn. Brit. Ind.* 1907, *p* 38; *l. c.* 1908, *p* 48; *l. c.* 1913, *p* 46.
Length.—483 mm. (1 foot, 7 inches).
Lepid—Subcaudals. 31 to 42.
Distn.—*Western Ghats.* Bombay Hills. Nilgiris. Anamalais.

315. (532) **Trimeresurus anamallensis** (Günther.) *Günther's Pit Viper.*

Trimeresurus anamallensis. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 430; *Ferguson, Bomb. N. H. J. Vol X, p* 76; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 73 (*part*) (*except No* 4122).
Lachesis anamallensis. *Boulenger, Cat. Vol III,* 1896, *p* 558; *Rao. Rec. Ind. Mus.* 1917, *p* 12; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 138; *Wall, N. H. J. Vol XVII, p* 322; *l. c. Vol XXVI, p* 579; *Pois. Sn. Brit. Ind.* 1907, *p* 46; *l. c.* 1908, *p* 56; *l. c.* 1913, *p* 53.
Lachesis malabaricus. *Rao, Rec. Ind. Mus.* 1917, *p* 13.
Lachesis coorgensis. *Rao, Rec. Ind. Mus.* 1917, *p* 14.
Length.—1.017 mm. (3 feet, 4 inches).
Lepid.—Ventrals. 137 to 158. Subcaudals. 44 to 63.
Distn.—*Hills of S. India.* Travancore. Cochin. Anamalai. Palni. Shevaroy. Nilgiri. Wynad. Coorg. Bombay Ghats. (Mahableshwar. Bombay colln.)

316. (531) **Trimeresurus gramineus** (Shaw). *The Green Pit Viper or Bamboo Snake.*

Trimeresurus gramineus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 429;

Sclater, List. Sn. Ind. Mus. 1891, *p* 72; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 350 *and* 619.
Trimeresurus viridis. *Blyth, Andaman Islanders, p* 365.
Trimeresurus anamallensis. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 73 (*part, No* 4122).
Lachesis gramineus. *Acton and Knowles, Jourl. Ind. Med. Res.* 1914, *p* 48; *Annandale, J. A. S., Beng.,* 1905, *p* 176; *Rec. Ind. Mus.* 1912, *pp* 37, 51 *and* 54; *Beddard, P. Z. S.* 1904, *p* 366; *Boulenger, Cat. Vol III,* 1896, *p* 554; *Rec. Ind. Mus.* 1913, *p* 338; *Dreckman Bomb. N. H. J. Vol XVIII, p* 434; *Kinnear, Bomb. N. H. J. Vol XXI, p* 1336; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 144; *Venning. Bomb. N. H. J. Vol XX, p* 343; *Wall, Bomb. N. H. J. Vol XVI. p* 536; *l. c. Vol XVII, p* 320; *l. c. Vol XVIII, p* 337; *l. c. Vo. XIX, pp* 357, 758, 843 *and* 900; *l. c. Vol XXIII, p* 378; *l. c. Vol XXVI, p* 578; *Pois. Sn. Brit. Ind.* 1917, *p* 44; *l. c.* 1908, *p* 54; *l. c.* 1913, *p* 51.
Length.—1,135 mm. (3 feet, 8 inches).
Lepid.—Subcaudals. 45 to 75.
Distn.—*Hills of Peninsular India. Himalayas.* From Ladak to Sikkim, *Assam.* Hills and Plains. *Burma,* Hills and Plains. Tenasserim. *Andamans. Nicobars. Cocos. Malay Peninsula. Indo-China. S. China. Formosa. Malay Archipelago.* Sumatra. Java. Timor.

317. (527) **Trimeresurus jerdoni** Günther. *Jerdon's Pit Viper.*
Trimeresurus jerdoni. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 427; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 71.
Lachesis jerdoni. *Boulenger, Cat. Vol III,* 1896, *p* 551; *Venning, Bomb. N. H. J. Vol XX, pp* 343 *and* 775; *Wall, Bomb. N. H. J. Vol XVII, p* 319; *l. c. Vol XVIII, p.* 337; *l. c. Vol XX, p* 231; *Pois. Sn. Brit. In.* 1907, *p* 43; *l. c.* 1908, *p* 53; *l. c.* 1913, *p* 50.
Lepid.—Ventrals. 163 to 188. Subcaudals. 44 to 69.
Distn.—*Assam.* Khasi Hills. *Burma.* N. Chin Hills. *S. China.* Ichang. Sze-Chuen.

318. (525) **Trimeresurus monticola** (Günther.) *Stoliczka's Pit Viper.*
Trimeresurus monticola. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 426; *Millar, Bomb. N. H. J. Vol XV, p* 729; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 70; *Wall and Evans, Bomb. N. H. J. Vol XIII, p* 619.
Lachesis monticola. *Annandale, Rec. Ind. Mus.* 1912, *pp* 37, 50 *and* 64; *Boulenger, Cat. Vol III,* 1896, *p* 548, *Dreckman, Bomb. N. H. J. Vol XVIII, p* 434; *Venning, Bomb. N. H. J. Vol XX, pp* 343 *and* 775; *Wall, Bomb. N. H. J. Vol XVII, p* 316; *l. c. Vol XVIII, p* 334; *l. c. Vol XIX, p* 356; *l. c. Vol XXI, p* 284; *Rec. Ind. Mus.* 1907, *p* 157; *Ind. Med. Gaz. Nov.* 1907; *Pois. Sn. Brit. Ind.* 1907. *p* 39; *l. c* 1908, *p* 49; *l. c.* 1913, *p* 47; *Wright, Bomb. N. H. J. Vol XXVI, p* 681.
Length.—972 mm. (3 feet 2⅛ inches).
Distn.—*Thibet. Eastern Himalayas.* Nepal to Sikkim. *Assam.* Abor Hills. Khasi Hills. *Burma.* Kachin Hills. N. Chin Hills. S. Shan States. Tenasserim (Mt. Mooleyit). *Malay Peninsula. S. China.* Sze-Chuen.

319. (530) **Trimeresurus purpureomaculatus** (Gray.) *Gray's Pit Viper.*
Trimeresurus purpureomaculatus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 429; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 71.
Lachesis purpureomaculatus. *Annandale, J. A. S., Beng.,* 1905, *p* 176; *Boulenger, Cat. Vol III,* 1896, *p* 553; *Wall, Bomb. N. H. J. Vol XVII, p* 318; *l. c. Vol XVIII, p* 784; *Pois. Sn. Brit. Ind.* 1907, *p* 42; *l. c.* 1908, *p* 52; *l. c.* 1913, *p* 49.
Distn.—*Eastern Himalayas.* Sikkim. *Lower Bengal.* Sunderbands. *Assam. Burma. Andamans. Nicobars. Malay Peninsula. Siam.* (Brit. Mus.) *Malay Archipelago.* Sumatra.

320. (529) **Trimeresurus cantoris** (Blyth.) *Cantor's Pit Viper.*
Trimeresurus cantoris. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 428; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 71.
Lachesis cantoris. *Annandale, J. A. S., Beng.,* 1905, *p* 176; *Boulenger, Cat. Vol III,* 1896, *p* 551; *Wall, Bomb. N. H. J. Vol XVII, p* 317; *Pois. Sn. Brit. Ind.* 1907, *p* 40; *l. c.* 1908, *p* 50; *l. c.* 1913, *p* 47.
Distn.—*Andaman and Nicobar Islands.*

(528) **Trimeresurus mucrosquamatus** (Cantor.) *Swinhoe's Pit Viper.*
Trimeresurus mucrosquamatus. *Boulenger, Faun. Brit. Ind.* 1890, *p* 428.
Lachesis mucrosquamatus. *Boulenger, Cat Vol III,* 1896, *p* 552; *Wall, Bomb. N. H. J. Vol XVII, p* 319; *Pois. Sn. Brit. Ind.* 1907, *p* 43; *l. c.* 1908, *p* 53; *l. c.* 1913, *p* 50.
Lepid.—Ventrals. 65 to 92.
Distn.—*Assam?* *Naga Hills. *Indo-China. Formosa. Loo Choo Islands.* (Brit. Mus.)

**Note.*—I very strongly suspect that there is a mistake in this locality. I have shown good reasons to doubt several of Cantor's records (*vide* note to *Typhlops bothriorhynchus*).

ERRATA.

For "Ophites" read "Lycodon" (Hand list of Snakes of the Indian Empire, Part II., Bombay N. H. Jourl., Vol. XXIX, p. 612).

Mr. S. H. Prater has called my attention to a correction made by Stejneger to his footnote in The Herpetology of Japan, 1907, p. 356. In the Proceedings of the United States Natural History Museum, Vol. 38 p. 107, this authority says:

"In this latter work (p. 356, footnote) I stated that inasmuch as Boie himself, in 1827, fixed *L. audax* as the type of *Lycodon* which was established in 1826 without designated type, this generic name must be retained for the South American *Lycognathus*. It appears, however, that Fitzinger (Neue Class Rept., 1826, pp. 29, 30, designated *Coluber aulicus* as the type of the genus, consequently previously to Boie, and as not even the latter himself, under the international code, could undo the previous action of Fitzinger, the name *Lycodon* must be retained in 'the sense adopted by Boulenger."

Note.—This Hand list was compiled and completed about the middle of the year 1921. There was some delay in the commencement of its appearance in print, and it has been presented in five parts. During this lapse of time various articles and notes have appeared in various journals, which it has not been possible to incorporate in the bibliography

F. WALL.

ADDENDUM.

The following species was omitted by an oversight:

180 (a) (Nil) **Oligodon hamptoni** Boulenger.

Oligodon hamptoni, *Boulenger, P. Z. S., Lond.* 1918 *p.* 9.

Type.—From Mogok, North Shan States, Burma, in the British Museum.

Length.—540 mm. (1 foot, 9 inches). Tail 70 mm. (3 inches).

Lepid.—Costals 15. Ventrals 160. Anal divided. Subcaudals 32; divided. Nasal. Entire. Loreal. One.

Temporal. One. Supralabials 5 the 2nd and 3rd touching the eye.

Distn.—Burma. Mogok. Lat. 22°·9. Long. 96°·5.

Rhabdops bicolor (Blyth)

Distn.—Assam. Khasi Hills. *Burma.* Kachin Hills (F.-W.). *China.* Yunnan.

Plagiopholis blakewayi Boulenger.

Lepid.—Ventrals 125 to 132. Subcaudals 20 to 31.

Distn.—Burma. Kachin Hills (F.-W.). S. Shan Hills.

Trirhinopholis nuchalis Boulenger.

Lepid.—Ventrals 130 to 141. Subcaudals 22 to 27.

Lycodon jara (Shaw.)

Distn.—Under *Bengal* add Purnea. (F.-W.)

Oligodon herberti Boulenger.

Lepid.—Ventrals 186 to 212. Subcaudals 35 to 40.

Distn.—Burma. Kachin Hills. N. Shan Hills.

Oligodon torquatus (Boulenger.)

Lepid.—Ventrals 144 to 161. Subcaudals 25 to 34.

Bungarus multicinctus Blyth.

Lepid.—Subcaudals 44 to 55.

Distn.—Add Namhkam, N. Shan States.

Bungarus niger Wall.

Length.—1,257 mm. (1 foot, 1½ inches)

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES.

BEING NATURAL HISTORY NOTES.

BY

COL. A. E. WARD.

PART III.

(*Continued from page* 131 *of this Volume.*)

(*With four plates*)

Family CERVIDÆ (The Deer).

Sub-family *CERVINAE.*

Males belonging to this family have horns with the exception, if we include it in this group, of the Musk Deer. Females are hornless in all Indian deer. The horns are solid and are shed yearly, generally at the same time when the winter coat of hair comes off.

The lachrymal glands are present, but as a rule the groin glands are absent. Deer stand on their two central toes, the toes at the back of the foot are rudimentary and are not part of the bony structure.

The growth and decay or drying up of the horns is a curious arrangement. The horns have a broad base and are supported on a pedicle, after they are dropped the pedicle or bony support is encased in a hairy covering which contains blood vessels, these supply the material which forms the horn; as this is being built up it is covered by the fine hairy growth which is called the "velvet," this encircles the whole and covers the different divisions of the horns.

During this growth the horns are very soft and easily damaged, hence the stag forsakes the undergrowth, and lives mostly in the open ground which is shaded by rocks or trees, there they wander about just below the snow line.

When the development of the antlers is complete, the blood vessels are closed by a hard substance, the velvet dries up and the stag begins to "burnish" and rubs off the covering. The horns become set, the rush of the blood to the head ceases, a gummy substance exudes from the glands below the eyes and the stag begins to call and challenge. When angry, the throat is swollen and various snorts are to be heard as the animal attacks.

Genus—*CERVUS.*

The genus Cervus is split up into various groups of which the Elaphine group or sub-genus of deer has several races in the countries over which these notes range, all can be referred to the typical red deer of Europe (*Cervus elaphus*). Their habitats in the near and far east extend from the Crimea—Asia Minor, Northern Persia, Turkestan—Siberia, Mangolia to Manchuria.

As the Central Asian and other races of the Red deer are found over a huge area, where the climatic influences are very different, there are naturally great variations in size, and colouring, all are however large animals, and all carry big complex horns.

With the exception of Thorold's Deer (*Cervus albirostris*) which has no beztine, the normal antlers of all the other races carry, brow, bez and trez points, this absence of the bez in the case of Thorold's Stag is a distinctive mark. If we can judge from the few heads that have been seen, without going so far as to assert that the shape of the horns gives no lead to the distinguishing of the various races of this deer, it can safely be said that the more specimens we see, the more are theories upset. Still it is a fact that in certain confined areas the horns are often of one pattern.

There are distinctive marks in the shape of the beam which in the case of the Shou bends forward, this is also common in the Yarkand Stag (*C. yarkandensis*).

By working upon colouring, size and the shape of the Antlers, Naturalists have separated the races of these deer as follows :—

From the Westward to the Eastward if we start in the Crimea we get the—

1. Eastern Red Deer, the Maral (*Cervus elaphus maral*).
2. The Yarkand Stag (*Cervus yarkandensis*), by some styled (*C. kashmirinensis yarkandensis*). This for many years was known as the Maral of "Maralbashi."
3. The Central Asian Wapiti (*C. canadensis songaricus*).
4. Thorold's Deer (*Cervus albirostris*) which at one time was known as Prezewaliski's Deer.
5. The "Shou" { *Cervus wallichi wallichi* or *Cervus wallichi affinis* } which was originally called the Sikkim Stag, but this name was correctly abandoned as it conveyed a wrong impression of the distribution of this deer.
6. The Kashmir or Hangal Stag (*C. cashmirianus*) completes the list.

As the habits of all these Red deer are very similar and are narrated in considerable detail when dealing with the Kashmir Stag, there is no necessity to do so when describing the other races.

I include a few observations on the Kashmir stag in captivity. To his friends he was known as "Bhudu."

Plate I shows a stag before he cast his horns in March 1923, he was picked up in Trahal Game Reserve before he could run away, in 1911.

Plate II shows horns cast by 'Bhudu' in his 9th, 10th and 11th year.

Together with several other Kashmir deer, 'Budhu' passed 4 years of his existence at the edge of a forest, where the herd wandered about in the day time and returned to their evening feed before dark. At night they were all housed in a shed which was surrounded by a fence in order to save them from leopards.

As they grew older the males began to fight and 'Bhudu' together with a few hinds came to the farm near Srinagar, there he and his harem used to wander about in the low hills and by the river Jhelum. Every evening these deer returned to their sheds, but after the farm and plantations increased, they had to be enclosed in paddocks where they have done well, and bred freely.

Now and again they get loose, and sometimes are approached by joyous pariah dogs—at first the deer will run away, but they soon turn on their pursuers who flee for their lives before the hinds who strike ferociously with their fore feet. 'Bhudu' is a small stag, he measures barely 48" at the shoulder and probably scales 320 to 350 lbs., but he has a son of 4 years old which stands nearly 2" higher.

When first caught the fawns are a little difficult to feed, they will suck a sponge soaked in milk, it is however a tedious business for the first fortnight, after that they can be fed with a baby's bottle and then given a foster mother as soon as a complacent Nanny Goat can be found—and after a time parched and finely ground flour in water can be given.

Kashmir deer do very well in semi-captivity provided the enclosures are not too small, and part of it is roughly covered with stones, these are best placed near the fences where the animal mostly stand. If the ground of the paddocks is smooth and soft the hoofs will grow very long, and eventually have to be cut.

The enclosures must be sufficiently large to allow of the deer running round, this they almost invariably do in Winter especially when snow is falling.

GROWTH OF HORN IN KASHMIR STAG IN 3 SUCCESSIVE YEARS.



At 9 years
39½″ × 6″

At 10 years
39½″ × 6½″.

At 11 years
40½″ × 7″.

The above are horns shed by "Bhudu" during 3 successive years in captivity.



KASHMIR STAG. HINDS WANDERING IN SNOW-COVERED GROUND.



HORNS OF YARKAND STAG (*C. yarkandensis*)
(*Hume Collection*).



KASHMIR STAG (*C. cashmirianus*).
A 13 Pointer shot by Col. C. B. Wood.

A variety of food is necessary, mulberry and hawthorn leaves are appreciated, sweet hay, lucerne, sugar-beet and turnips, also horse chesnuts cut into pieces—Sugar-beet and carrots seem to be the favourite foods—Bran and salt have to be provided but grain is not necessary, about two pounds of bran will suffice.

The horns are shed regularly in March except in the case of quite young stags of 2 or 3 years old which often carry their horns up to the middle of May. In September thick poles must be put into the ground in order that the velvet may be rubbed off by the deer, large branches may be thrown into the enclosure, which the stags will throw about and play with and thus aid the burnishing. When offered food through the palings of the paddock the stag comes "sidling" up and will then lower his horns and rattle them against the fence: in September and October they are not to be trusted. In captivity a stag will "call" until the end of November.

Plate I shows the hinds wandering about the open ground when snow was on the fields.

Unless the paddocks are very big, so that the stags may live a practically natural life, the horns, although they will grow to a large size, will not weigh nearly so much as they would have done if they had come from a wild stag.

The variations in the colouring of the hair does not seem to differ much from that of the wild animal, but the long greyish-brown hair which is assumed in winter comes away very gradually, this is probably due to the absence of scrub and bushes, it is not possible to have these in the enclosures because the deer would not only eat them down, but would break them to pieces in the pairing season, at that time even the feeding troughs have to be taken out of the way of the deer and the water buckets directly they have drunk, it should also be remembered that many gallons of water will be required every day for each animal, and if a hollow can be made where a mud bath can be got the captive deer will be greatly pleased.

The Yarkand Red Deer—*Cervus yarkandensis.*

Male—*Boach.* Female—*Maral.*

The Yarkand stag was first brought to notice about the seventies by reason of the horns sold in Yarkand and Kashgar, these mostly come from Maralbashi to the eastward of Kashgar and north eastward of Yarkand, still further east it is found north of the desert to where the Tarim river turns southward to Lobror marshes.

Westward of Kashgar this stag must nearly if not quite meet the Eastern Red deer or Maral (*Cervus elaphus maral*). Lydekker justly states that the Yarkand Stag approaches the Shou in the shape of the antlers, for the beam comes forward at the third tine. Undoubtedly all the races of Central Asian Red Deer blend into one another, hence to try and differentiate between the horns of the various races is in most cases very unsatisfactory.

The head figured on plate II was in Mr. H. O. Hume's famous collection. If compared with a number of Kashmir stag heads the Yarkand horns are more upright for some distance above the burr and instead of continuing sideways in one curve they tilt forward, but in a Hangal's head from Achhabad Game Reserve (Kashmir) the Yarkand and Kashmir horns are much alike, in both the terminal tine is pointing at right angles to the central line of the skull, and yet this formation is considered by some writers to be a distinguishing point of difference between the two races, and the instance I have given is not a case of a single comparison for, on looking over a very large number of horns, I have found several from Kashmir with terminal tines pointing forward, but only one or two with the beam inclined forward.

The caudal disk is yellowish orange, the surface of the tail is lighter in colour than that of the Hangal, these differences in colouring are marked at all times,

otherwise it is hard to say how these two deer differ in colour, and this applies to all the races under discussion ; if comparisons are to be of any value they must be made from specimens obtained at somewhat similar attitude and climate at corresponding seasons of the year, and also between animals not differing greatly in age.

The finest antlers I have seen are probably those figured in Rowland Ward's Records (eighth edition), but this is not a typical specimen as it has 6+6 tines plus a snag, most horns have 5+5 tines. Except for this head I have come on no horns over 40" in length—the record is thus probably 41½. (Hume's)—There were and probably now are many horns in the Yarkand Bazaar. The measurement is much less than that of many Maral antlers from Asia Minor, *C. kashmirianus yarkandensis* is the name given by some naturalists to the Maral, probably when it was considered to be a race of the Hangal or Kashmir stag. When we get to size, there is a considerable difference between the Yarkand and the Kashmir Stag, for the Yarkand Stag is 52" and more at the shoulder, I doubt any Hangal being over 50 inches. At any rate the Kashmir stag carries the finer antlers of the two, while Maral heads nearly approach in size those of the Kashmir deer.

The Maral, the Yarkand and the Kashmir stag are very closely allied, the Yarkand race showing signs of its affinity to the Shou.

The Central Asian Wapiti of the Tian Shan—*Cervus canadensis songaricus.*

Male. *Boach—Bogi*—Female "*Maral*"—this name of the female seems to be applied to various races of deer.

Habitat.—The country near Kulja north of the Tian Shan mountains—approximately 400 miles northwards of Yarkand with variations in the races (which have apparently been established by size of the animals and the shape of the horns) towards the Baikal lake in Southern Siberia and into Manchuria.

Description.—This is the finest race of the Central Asian red deer, and is closely allied if not identical with the North American Wapiti—compared with the Hangal it is quite 300 lbs. heavier and stands 10" or 11" higher at the shoulder—although probably smaller than its Rocky Mountain brother it is a gigantic deer.

In Winter and late Autumn the Tian Shan or Altai Wapiti is grey in colouring, but in Summer when it loses its thick coat it assumes a reddish or yellowish brown colouring. The caudal disk is orange coloured, the tail brown above.

The largest head I have seen is that shot by the late Mr. P. Church, it is an eleven pointer (figured on plate III) with a measurement on the outside curve of 54" and a girth of 7¼". Mr. Church also gave a nice head to the Srinagar Museum where it can be seen by visitors. These heads were obtained in the Tekkes south of Kuldja.

According to Rowland Ward the record horns are 60×8½" girth with 19 points, owing to the kindness of the owner Capt. J. N. Price Wood the photograph of this very grand head is available for these articles.

The stag shot by the late Mr. P. Church—this also I think is mentioned in Rowland Ward's Records—is perhaps the more typical as it shows the large size of the fourth tine on both antlers which is a pronounced indication of the Wapiti—on the left antler of the record head the fourth tine is very thick. Mr. Andrews Chapman in the Natural History Journal of the American Museum September-October 1920 remarks "this species of Wapiti or Elk of Northern China will soon be extinct" This was the dictum of shikaries many years ago, hence it is refreshing to find that Mr. A. C. and his

CENTRAL ASIAN WAPITI (*Cervus canadensis songaricus*).



Length 54″. Girth 7¼″. Points 11.
(*Shot by Mr. P. Church.*)



Length 60″. Girth 8½″. Points 19.
(*Shot by Capt. Price Wood.*)

measured by Mr. A. O. Hume, they were given to a friend by the late Maharaja Gulab Singh but no one now knows anything about this, and as far as I could make out when at Jammu, there is no record; these horns are alluded to in Rowland Ward's book (Records of Big Game).

There is endless variety in the shape of the horns, the normal head has 5 + 5 times, some of the best are ten pointers. Royals with the three points at top have not the cups, very rarely has one cup been seen, and as far as I know never two. Sixteen tine antlers have been got—fourteen are rare, but 13 and 11 are common.

A 14 tine head is shown in Plate II, Bombay Natural History Society's Journal, December 30, 1921.

The head figured on plate IV is of an 'eight point' head nearly the thickest horn ever recorded being close on 8" at the middle of the beam.

Plate V shows Capt. J. Y. Allans 12 pointer—a grand royal from Ringhet in the Dandwar Valley. The brow antlers are extraordinarily developed, as a rule one of the peculiarities of the Hangal is the short brow tine.

Of the two other heads figured the one on plate II is Col. C. B. Wood's stag (7+6 tines) the other on plate IV is a beautiful head of 47" with a girth of 6" and an outside spread of 50". It will be seen that the "Cup" on the top is present on one horn, and there is a tendency to this formation on the other horn. The stag was shot by Mr. M. Macnamara in 1923.

Lydekker figures a head of a Kashmir deer showing the brow tine starting some distance above the "Beam," and also mentions that this is characteristic of the race. My experience is that it is a very rare formation, if however a reference is made to the Society's Journal of December 30, 1921, opposite page 48, an example will be seen. Now and again horns show slight palmation. This is very rare.

The skull of a very large Kashmir stag measures in extreme length 15½" with a breadth of 7¾".

The skull of a big Sambhar [*Cervus* (*rusa*) *unicolor*] is in extreme length 17" in breadth 7".

All the skulls of mature Kashmir stags I have measured are shorter than those of the Sambhar, but are broader. An average sized Sambhar will measure 53" to 54" at the shoulder, some more, hence it will be noted that the Hangal is much the smaller of the two, but it is larger than the Swamp deer [*Cervus* (*Rucervus*) *duvaucelli*].

For purpose of comparison it may be said that the Hangal is as much larger than the Swamp deer, as it is smaller than the big Rusine deer (the Sambhar) and it is not until Central Asia is reached that we get deer the size of the Sambhar.

The colouring depends a great deal on the elevation at which the deer lives and also on the age.

The hair on the neck is coarse, long and sometimes thick, this is much less marked on the female than on the male—the hair on the lower part of the neck of the stag is very long and rusty and in an old animal very dark brown. The caudal disk is white, rarely with a light tinge of yellow, the lips are white and the chin nearly white, the inner part of the buttocks is white. The Winter Coat is very long, generally greyish brown, some animals are more rufous in colouring, in the Summer the hairs are speckled and present a curious appearance particularly when the dense Winter Coat is being shed in patches. The hair on the stomach especially of old stags is dark brown. the flanks are lighter brown than the back.

One stag in its winter coat was practically chesnut in colouring round the front and back of the horns. A hind had a well defined black line from the forehead almost to the nose, and smaller hinds have a dark dorsal line. The young are speckled white, but these spots are obliterated by the winter coat. Yearlings have a very decided fringe round the throat. Old hinds are often marked

KASHMIR STAG (*Cervus cashmirianus*).



Capt. J. Y. Allan's Grand 'Royal' from Ringhet. Note the extraordinary development of the Brow Antlers.



KASHMIR STAG "BHUDU."
Before casting horns in March 1923.
(*Vide* Plate I.)

with white flecks rarely are white markings to be seen after the first year on males. Big stags cast their horns about March 15th to April 1st, young ones often carry their antlers into May. After shedding their horns most go up hill and congregate under the snow line, as soon as the weather gets warm they cross the passes which lead to Kishtwar or the Wardwan, or else summer in the very highest ravines in the Sinde, Liddar or in the passes leading to Baltistan, etc. As the goat herds come upwards, the deer take to secluded and often very rocky ground which is interspersed with narrow grass-grown ravines. When the rutting season commences about September 15th all except the oldest and finest stags come down fairly low, there they remain with the hinds until about the end of October, then they wander off to horse-chesnut forests at about 8,000′ elevation. The disturbance caused by the goat herds and the shepherds acts in a dilaterious way on the best stags, as they keep up high, seldom consorting with the herds.

In every hard winters when the snow falls heavily in Autumn the stags come down low, they also do so when the green grass begins to grow in March, but heavy snow in February or early March does not cause them much inconvenience for the buds of the birch and other forest trees are beginning to swell and on these they can browse. There can be no doubt the deer are much shyer than they were, it it not to be wandered at, for nearly every goat-herd has a gun and uses it whenever he gets a chance. Still it is unlikely that the open shooting ground will be ever absolutely devoid of stags, as the closed ground which form the Rukh Game Reserves holds large herds, members of which must from time to time stray out of these reserves.

(To be continued.)

NOTES ON THE ACRIDIDÆ (ORTHOPTERA) OF CENTRAL ASIA, WITH DESCRIPTIONS OF NEW SPECIES AND RACES.

By

B. P. Uvarov, F.E.S.

This paper is based on an extremely interesting collection of grasshoppers belonging to the Turkestan Entomological Station in Tashkent and forwarded to me for study by my friend V. I. Plotnikov, Director of the Station, to whom my most sincere thanks are due*. A satisfactory critical study of the collection proved to be impossible, without examining certain types of species described by Saussure from Turkestan and Persia and, owing to the kindness of Dr. Zenay and Professor R. Ebner, I have been fortunate to receive such of them as are preserved in Brunner's collection at Vienna.

The types and allotypes of new species and subspecies described below will be deposited in the Zoological Museum of the Academy of Sciences, Petrograd; paratypes, when available, are distributed between the British Museum collection and that of the Turkestan Entomological Station.

Subfamily Acridinæ.

Chrysochraon dispar major, sbsp. n.

Differs from the typical (Central European) form by its much larger dimensions, as follows :—

	dispar. ♂	dispar. ♀	major. ♂	major. ♀
Length of body	18mm.	25mm.	23mm.	38mm.
„ pronotum	3	5	4	6
„ elytra	10	7	14	10.5
„ hind femora	12	15	13.5	17.5

Described from 2 ♂ ♂ and 2 ♀ ♀ from Khumsan, distr. Tashkent, 9, viii, 1920. Although there are no structural or colour characters separating the Turkestan specimens from the European ones, the difference in dimensions between them is so striking that I feel quite justified in describing the new subspecies.

Arcyptera flavicosta turanica, sbsp. n.

Apparently closely allied to *A. f. transcaucasica*, Uv. (Bull. Mus. Caucase, xi, 1917, p. 281). Very uniformly coloured. Pronotal keels not marked with pale lines. Elytra in the male extending a little beyond the middle of hind femora, in the female not reaching their middle. Hind femora with the upper fasciæ scarcely perceptible in the upper inner area only, entirely obsolete outwardly; knees unicolorous, with only semilunar spots on the lobes black.

	♂ (type)	♀ (paratype)
Length of body	25mm.	35mm.
„ pronotum	5	6.5
„ elyta	12.5	14
„ hind femora	15	19

Male (type) is from Langar, distr. Osh, prov. Ferghana, 22. vi, 1913; female (paratype) from Tchimgan, distr. Tashkent, 8-9. vi., 1912.

This is a very distinct race of the common *A. flavicosta*, Fisch. It seems to be closely related to *A. f. crassiuscula*, Zub., from the Semiretchye province, but differs from it, as well as from the Transcaucasian subspecies, by its more abbreviated elytra and uniform coloration.

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* I must thank here also another kind friend Professor V. P. Pospelov who took the trouble to bring the collection from Russia by hand, as it was impossible to send it otherwise.

I have recorded this insect from Tashkent under the incorrect name *A. labiata*, Brulle (Revue Russe d'Entom., xii, 1912, p. 208). Brancsik's record (Jabresh naturviss. Vereins Trencs. Com., xxi-xxii, 1899, p. 133) of *A. labiata* from Askhabad is almost certainly referable also to *A. f. turanica*.

Subfamily ŒDIPODINAE.

Thalpomena pilosa (Sauss).

This insect has been very briefly described by Saussure (Prodr. Œdipod., p. 201), as a variety of *Sphingonotus cærulans*, but an examination of the type sent from Vienna showed that it is strikingly different from any known *Sphingonotus* and must be placed in the genus *Thalpomena*, although certain of its characters do not agree with the present conception of the genus. I feel it necessary to give here a detailed description of the type.

♀. *Antennæ* much longer than head and pronotum together. *Head* compressed laterally, moderately prominent above pronotum. Face distinctly reclinate, in small scattered punctures; frontal ridge straight in profile, broad, somewhat constricted at the fastigium, subparallel in the rest, widened and obliterate close to clypeus; its margins scarcely raised, thick, obtuse; surface of the ridge slightly convex, punctured above the ocellum, shallowly impressed at and below it. Fastigium of vertex sloping and forming a distinct obtuse, rounded angle with the frontal ridge, nearly twice as long as broad, feebly impressed; margins scarcely raised; no carina separating fastigium from the frontal ridge. Temporal foveolæ not impressed, punctured. Eyes elliptical, distinctly higher than long, prominent sideways but not upwards; their height scarcely exceeds the subocular distance; interocular distance equals the width of frontal ridge and is half of the horizontal diameter of an eye. Occiput distinctly sloping backwards. *Pronotum* compressed laterally, strongly narrowed anteriorly, but not much constricted in the prozona, scarcely selliform; disc practically flat, forming distinct rounded angles with the lateral lobes, although no lateral keels are developed; first transverse sulcus well expressed, broadly sinuate; second sulcus obsolete in the middle; third sulcus deep and narrow, slightly angulate in the middle and subsinuate laterally; metazona fully twice as long as prozona, about as broad as it is long, broadly rounded behind; surface of metazona slightly impressed at the shoulders, finely rugose, median keel low, but sharp and tectiform in front of the first sulcus, interrupted between the sulci, linear in metazona; lateral lobes half again as deep as long, with the anterior angle obtuse, lower margin subsinuate, hind angle near 90°, broadly rounded. Episternum with the lower margin rounded-angulate. Mesosternal interspace about as broad as one of the lobes. *Elytra* almost reaching the apex of hind tibiæ, broad, parallel-sided, with the apex obliquely truncate; discoidal vein well developed, incrassate, sinuate and approached apically to the radial, but not touching it; no false vein in the interulnar area; reticulation of the basal half, including the discoidal and interulnar areas dense and very irregular, the cells being very variable in shape, but all more or less as broad as long, not elongated as in typical representatives of the genus; reticulation of the distal half regular, except near the stigma, cells subquadrate. *Hind femora* short, broad. Hind tibiæ somewhat shorter than the femora.

Coloration reddish-ochraceous. Pronotum with a faint trace of pale x-shaped design. Elytra with irregular brownish spots; veins and veinlets reddish-ochraceous. Wings hyaline, very faintly bluish near the inner margin. Hind femora with blackish dots on the outer side, especially along the lower outer carina, with three indistinct brownish fasciæ on the upper areas; their inner face including the inner lower sulcus, shining chocolate, with a pale pre-apical ring; the inner knee-lobe pale, marginated with chocolate from above. Hind tibiæ dirty pale ochraceous outwardly, and brown with the postbasal ring and

apex pale, inwardly ; tarsi whitish. Body and legs in long, dense whitish hairs.

Length of body	.. ..	23mm.
,, pronotum	.. ..	5
,, elytra	.. ..	23
,, hind femora	.. ..	11

The type is the only known specimen ; it is from Shahrud, N. Persia (Brunner's collection, No. 14665).

As may be seen from the above description, this curious insect is not a quite typical member of the genus *Thalpomena ;* indeed, Saussure's mistake in referring it to *Sphingonotus* is quite excusable, the two genera being very close to each other. I refer the insect to *Thalpomena* only temporarily, until a thorough revision of both genera and their allies may be undertaken.

Th. pilosa is very close to *Th. hirtipes* recently described by me from Palestine (Entom. Month. Mag., 3rd ser., ix, 1923, p. 84), but differs from it in larger size, pronotum less constricted and with a very long and broadly rounded behind metazona, in the venation of elytra and in the coloration of hind legs.

Leptopternis gracilis (Ev.).

1884. *Sphingonotus angustipennis*, Saussure, Prodr. Oed., p. 201.

The type of *S. angustipennis* from Shahrud, Persia, has been examined by me and proved to be undoubtedly conspecific with *Leptopternis gracilis* (Ev). There is a difference between that type and specimens of *L. gracilis* from other localities, but in the general coloration only ; the type is of pale ochraceous color, practically without the pattern characteristic for the species, but it is impossible to say whether this is due to an individual variation, or this type of coloration should be regarded as characteristic for a distinct subspecies to which the name *angustipennis* may be then applied.

Leptopternis iliensis, sp. n.

♀. Resembling in the general appearance to *Sphingonotæ mecheriæ*, Kr., but more slender. *Antennæ* slightly longer than the head and pronotum together *Face* distinctly reclinate. Frontal ridge in profile convex and slightly prominent between the antennæ, straight in the rest ; its margins sharp, raised, practically parallel throughout, only slightly approximated near the fastigium and divergent quite close to the clypeus. Fastigium of vertex moderately sloping, forming an obtuse rounded angle with the frontal ridge, moderately prominent in front of eyes, about twice as broad as the frontal ridge ; lateral margins distinctly raised ; median keel scarcely perceptible. Temporal foveolæ rounded triangular. Eyes somewhat prominent sideways, but not upwards, short oval, about as high as the subocular distance ; interocular distance subequal to the horizontal diameter of an eye. Occiput sloping backwards. *Pronotum* short, distinctly constricted in the prozona ; anterior margin sinuate enveloping the head like a collar, with the submarginal sulcus well developed, especially on the sides ; all sulci deep, the first one continuous, sinuate, in the middle, the second straight, interrupted in the middle by the double transverse impression with callous slightly raised margin, the third straight ; prozona between sulci with callous convexities; metazona as long as prozona, nearly twice as broad in shoulders as it is long, very broadly rounded behind ; with slightly perceptible lateral keels in the anterior part; its surface feebly rugulose, somewhat impressed anteriorly on both sides and feebly convex posteriorly ; median keel absent in prozona, linear in metazona ; lateral lobes more vertical than in *S. mecheriæ*, not much deeper than long, with the lower margin bi-sinuate, ascendant, anterior angle obtuse, rounded, posterior angle near 90° and

broadly rounded. Episternum elongate triangular, more than twice as long as broad; its lower margin with a very obtuse and broadly rounded angle in the front third; anterior angle rounded. Mesosternal lobes about twice as broad, as long, parallel-sided, oblique; their interspace transverse but not broader than one of the lobes. Metasternal interspace about one half again as broad as long. *Elytra* with their apical fourth extending beyond the hind knees; scapular field with a very irregular false vein not extending beyond the basal third of the area; discoidal area broad, with sparse, but very irregular reticulation; discoidal vein not thick, parallel to the radial and well distant from it in the basal third, then bent towards it, being nearest to it, but still quite distinctly separated, at the base of the apical third, where it is slightly bent backwards and runs parallel to the radial. Interulnar area distinctly narrower than the hind discoidal one, with the cells in two very irregular rows but without a false vein. Apical half of elytra with sparse venulation and subquadrate cells throughout. *Wings* narrow; principal veins not incrassate. *Hind femora* slender. Hind tibiæ with 10 inner spines including the apical one, and 9 outer ones; the last outer spine removed nearly twice as far from the apex, as from the preceding spine; spurs slender, gently curved, the inner ones distinctly longer than the outer ones and nearly as long as the first tarsal joint. Tarsi slender, long; tubercles on the underside of the first joint strongly prominent, triangular in profile; pulvillus between the claws very minute. Lower valvæ of the *ovipositor* each with a strong acute, rounded apically, teeth; the apices long, curved.

General *coloration* pale sepia. Antennæ whitish. Face heavily dotted with black. Fastigium with chocolate dots on its disc and large black ones on the margins. Occiput with a chocolate median fascia, including a fine pale line, and chocolate dots becoming darker and larger in its anterior part; cheeks with indefinite brownish dots; pale convergent backwards postocular fasciæ forming the anterior portion of x-shaped design on the pronotal disc, more pronounced on the metazona, where it is marginated from inside by blackish-brown spots fading inwards. Prozona between the pale fasciæ of the ground color before the sulci, whitish between them, densely punctured with chocolate brown. Lateral lobes dotted with chocolate, more densely along the lower margin of upper pale fasciæ; with a row of blackish dots along the front margin, a not sharply defined dark-brown spot below the middle and 2-3 brown spots on the hind margin; an indistinct fascia along the upper third of prozona and the lower margin of metazona greyish; sulci dark brown. Elytra with the membrane milky-white, not hyaline; their ground color very pale buff; base pale sepia-coloured proximally, chocolate distally, the distal margin of the fascia oblique, interrupted (as is the whole fascia) in the interulnar field, which is pale sepia throughout; a broad submedianfascia, chocolate in the pre-radial areas, not interrupted on the radials, gradually fading backwards and extending in the anal field in the shape of a small infumate spot close to the anal vein; the apical part (more than a third) with a not sharply defined but quite distinct dark-sepia longitudinal fascia along the middle and 1-2 small spots of the same color in front of it; the part of elytra behind the fascia milky-white. Wings perfectly hyaline, with veins and some of veinlets brown. Hind femora greyish-white on the outside (partly brown in the type, but this is obviously due to deterioration of the fat); all keels with blackish dots; upper areas sepia colored, without definite fasciæ; inside black with a pale sepia preapical band. Hind tibiæ grey, on the underside with the base and broad pre-median fascia black, and also somewhat blackened apically; spines and spurs with black tips.

Length of body	.. ..	21mm.
„ pronotum	.. ..	3·5
„ elytra	.. ..	21
„ hind femora	.. ..	11

Described after a single female from Ak-Togoi, valley of the river Ili, prov. Semiretchye, 10 vi, 1914.

The genus *Leptopternis*, as already stated by Vosseler (Zool. Jahrb., Syst., xvi, p. 379) is very close to *Sphingonotus*, and the new species is particularly interesting as it gives new evidence of the intimate relationship of the two genera. In fact, *L. iliensis* is extremely alike, when examined superficially, to a *Sphingonotus*, and especially to *S. mecheriæ*, owing to its relatively short and heavily fasciated elytra. At the same time, however, its very slender hind femora and the length and shape of hind tibial spurs, as well as the structure of hind tarsi indicate clearly that it is a true *Leptopternis*, though strongly different from the genotype, *L. gracilis* (Ev.). I might mention here also, that there is a good, apparently generic, character common to *L. gracilis* and *L. iliensis*, separating them from *Sphingonotus* in the relative width of the mesosternal interspace which is distinctly broader than one of the lobes in *Sphingonotus* and narrower than that in *Leptopternis*. The lower valvæ of the ovipositor in the two species of *Leptopternis* are exactly alike (see description above) and differ from those of *Sphingonotus* in much more acute and strongly prominent basal teeth and long, slender apical parts.

L. iliensis differs strikingly from the three* other species of the genus (*L. gracilis*, Ev., *L. maculata*, Voss. and *L. vosseleri*, Bal.) by its fasciated elytra, apart from numerous structural characters.

Sphingonotus cærulans maculatus, subsp. n.

Differs from the typical (European) race by the head being strongly prominent upwards; larger eyes; pronotum more constricted in the prozona and with the metazona more broadly rounded behind; elytra with the basal fourth, two well defined complete transverse fasciæ and several spots in the distal part, dark sepia brown. Hind wings faintly bluish basally. Hind tibiæ greyish-white.

	♀ (type).	♂ ♂ (paratypes).	♀ ♀ (paratypes).
Length of body	26mm.	17-21mm.	23-27mm.
,, pronotum	4	3-4	4-5
,, elytra	26	17-20	20-27
,, hind femora	13	8-9	10-13

The type is from Savatskaya volost, dist. Khodzhent; paratypes (7 ♂ ♂ and 7 ♀ ♀) from Tashkent; Golodnaya Step; Tuz-kane, S W. of Dzhizak; Tashlan and Jangi-Mazar, distr. Khodzhent; station Darbaza; Shachimardan, distr. Skobelev; Romanovka, prov. Semiretchye; Novo-Michaylovka, distr. Tashkent; Kshtut, Buchara.

All specimens of *S. cærulans* from Turkestan possess a very different appearance from the European ones, owing mainly to slight differences in the shape of head and pronotum and to heavily marked elytra. As there are, however, no well defined structural characters separating them from the typical form, I regard them as only a local race of the species.

Males of *S. cærulans maculatus* are often more strikingly adorned than the females, possessing a whitish face, a pale x-shaped design on pronotum, a blackish spot on the prozona of lateral lobes and very sharply banded elytra.

Sphingonotus rubescens (Walk.)

1870. *Œdipoda rubescens*, Walker, Zoologist (2), v, p. 2301.
1884. *Sphingonotus coerulans*, var *aegyptiaca*, Saussure, Prodr. Oedipod., p. 200.
1923. *Sphingonotus rubescens*, Uvarov, Novit. Zool., xxx, p. 67, Fl. i, figs. 1, 2.

* Some other species originally described as *Leptopternis* are removed now to *Hyalorhipis*.

I have shown in the paper quoted above that *rubescens* is a good species and not a mere variety of *S. cærulans*, and I have given numerous records of its occurrence in various parts of the Desert region. Those records did not, however, include Turkestan, where the species also occurs; I have seen specimens from the following localities; Tedzhen, Transcaspia; Kerki on the Amu-Darya and Savatskaya volost, distr. Khodzhent.

Sphingonotus callosus, Fieb.

With reference to this species I must correct here my former statement (Revue Russe d'Entom., xiv, p. 220) that it should be regarded as merely a form of *S. cærulans*, as well as Ramme's proposition (Arch. Naturgesch., 86, Abt A, 12 Heft, pp. 94-99) to consider it a subspecies of the latter species. At that time I did not know what the true *S. callosus* is like, and I believed the only difference between it and *cærulans* to be in the band of hind wings, while in fact there are some very important characters in the morphology of head and pronotum which make it quite clear that no close relationship exists between the two insects. My mistake has been partly caused also by the study of a species of *Sphingonotus* from the river Kuma, N. Caucasus, which is very near *cærulans* in the morphological characters but differs from it in the banded wings; I have no specimens of this insect before me now, but I am perfectly certain that it has nothing to do with *callosus* and represents an obviously undescribed species (or subspecies of *cærulans*).

S. callosus has been recorded from Transcaspia, but not yet from Turkestan; I have before me a specimen from Dzhety-Say, Golodnaya Steppe and another from Tuz-Kane, dist. Dzhizak. It occurs also in Transcaucasia whence there are some specimens in Burr's collection (Oxford University) from Geok-Tapa prov. Elisavetpol.

Sphingonotus mecheriæ, Vir.

I have already recorded this species, described originally from Algerian Sahara, as occurring in Central Asia, as well—Amara and Baghdad in Mesopotamia and Amman in Transjordania. Now I have before me specimens from the following localities in Asia: Jericho and Bethlhm. Palestine; Fao, Persian Gulf; Kazwin and Shahrud, Persia; many localities in Turkestan (Bir-Kazan, Perovsk prov.; Asche-Su, Ferghana; Tchardara) and Bairam-Ali, Transcaspia. There is also in British Museum a specimen from Astrakhan, while the northernmost locality whence the species is known, is Kalmykov, Uralsk province; I have recorded from the latter locality what I thought a variety of *S. cærulans*, but what really is *S. mecheriæ* (Horae Soc. Ent. Ross., xxxix, 1910, p. 375, var. 1.).

Sphingonotus halocnemi, sp. n.

In my paper on Orthoptera of the Uralsk province I described briefly, without a distinctive name, what I supposed to be a variety of *S. cærulans* (Horae Soc. Entom. Ross., xxxix, 1910, p. 375, var. 2), but what must be a good species. I propose here the name *S. halocnemi* for it, and its diagnosis, (a translation of my description quoted above supplemented by some characters communicated to me by Miss E. Miram who examined the types for me) is, as follows: Small, delicately built; head relatively large and strongly prominent upwards; frontal ridge sulcate; fastigium of vertex sloping, impressed, with sharply raised margins and a median keel; pronotum with a distinct low median keel throughout; elytra tender narrow, equally broad throughout, with thin hyaline or slightly darkened veins; discoidal vein parallel to radial; wings hyaline (or very slightly bluish basally), veins dark.

		♂ ♂
Length of body	.. .. ..	13-15 mm.
,, ,, pronotum	.. .. ..	2·9-3
,, ,, olytra	.. .. ..	14-15
,, ,, hind femora	.. ..	7-7·2

The types have been all collected by myself, in clumps of *Halocnemum strobilaceum* on damp salt-pans at the shores of the lake Tungurluk-Sor, prov. Uralsk, 20, vi, 1909; the larvæ have been found feeding on the same plant.

Sphingonotus nebulosus (F.-W.)

1846. *Œdipoda nebulosa*, Fischer Waldheim, Orth. Imp. Ross., p. 290, pl. xxxii, fig. 1.
1884. *Sphingonotus nebulosus*, Saussure, Prodr. Oedipod, p. 205.
1884. *Sphingonotus persa*, Saussure, *l.c.*, p. 205.
1888. *Sphingonotus persa*, Saussure, Addit. ad Prodr. Oed., p. 86.
1888. *Sphingonotus intutus*, Saussure, *l.c.*, p. 87.
1888. *Sphingonotus nebulosus*, Saussure, *l.c.*, p. 87.

I have already made an attempt to clear up the synonymy of this insect (Bull. Mus. Caucase, xii, 1919, p. 157) but the conclusions I arrived at then must be considered incorrect, since I have based them mainly on doubtful literature records accepted without necessary criticism and caution; besides, I paid then no attention to morphological characters and relied entirely on the coloration of wings. As a result, I thought it possible to compare *S. balteatus* Serv. with *nebulosus*, *persa* and *intutus*, while in fact, *balteatus* is a species extremely well defined by some purely morphological characters (see Uvarov, Journ. Bombay Nat. Hist. Soc. xxix, 1923, p. 645; and Bull. Min. Agric. Egypt, No. 41, 1924, p. 24) and quite distinct from the other three insects. These latter I consider now as conspecific, although they may represent different geographical races which cannot be decided until long series of specimens from different localities are studied critically.

There seem to be some mistakes in Saussure's treatment of *persa*, and *intutus* in his two papers. Thus, he described *persa* in *Prodromus* as having the discoidal (intercalate) vein more removed from the radial (media) than it is in *nebulosa*, while in *Additamenta* he says quite definitely that the discoidal vein of *persa* is developed as in *balteatus* and strongly sinuate, and *intutus*, is separated from *persa* by the vein straight, irregular. Moreover the typical localities for *persa* are quoted in *Prodromus* as Shahrud and Ordubat, while in *Additamenta* no locality whatever is given for *persa* and *intutus* is described from Shahrud. I am inclined to think that Saussure has had, no types of *persa* before him when writing *Additamenta* and since the type (Coll. Brunner No. 14660, selected as single type of *persa* by me) agrees with the original description in *Prodromus* of *persa* (but not with its re-description in *Additamenta*), and also with that of *intutus*, I consider these two names as absolute synonyms. The name *persa* may be accepted as a subspecific one for the race inhabiting Northern Persia and differing from the Turkestan specimens by the more vividly bi-colored base of hind wings and more rugose pronotum with the hind angle not rounded, almost sharp.

Sphingonotus savignyi, Sauss.

This species distributed apparently all over Palearctic deserts exhibits a considerable variability in the general dimensions and in the width and intensity of the wing fascia, as well as in the development of the apical spot on the wings. It is not an easy matter, however, to decide whether these variations or any of them, are geographical. Saussure was inclined to regard them as characteristic for local forms, while he described what he called a "stirps *apicalis*" from Turkestan and Persia and a var. *major* from Transcaspia. The name *apicalis*, however, has been

used by Saussure himself for another species of *Sphingonotus*, two pages before, and cannot be used for any form of *S. savignyi*; apart from that, I do not see from specimens in the British Museum any constant and definite difference in the wing fascia and their apical spot between insects from Egypt (type locality) and Persia or Turkestan. A rather striking difference is observed only in specimens from the Persian Gulf and Karachi, which are small and have got the wing fascia very narrow (and accordingly well separated from the hind margin), but they belong, perhaps, to an undescribed race. Specimens from Algeria which I examined are usually with a narrow fascia and without the apical spot, but Vosseler (Zool. Jahrb., xvi, 2, p. 378) records also "*apicalis*" from Laghouat. As for the size of insects, the variability in this respect among Egyptian specimens is considerable, and some of them are even larger than var. *major* of Saussure, while Vosseler (*l.c.*) also recorded some large specimens from Gafza, Algeria. It seems, therefore, that it would be more advisable not to attempt a division of the species into geographical forms until really long series of specimens may be studied, and the extent of purely individual variations established in each case.

Sphingonotus obscuratus apicalis, Sauss.

1884. *Sphingonotus apicalis*, Saussure, Prodr. Oedipod, p. 206.

1888. *Sphingonotus apicalis*, Saussure, Addit. ad Prodr. Oed., p. 87.

Thanks to my friend Professor R. Ebner I had an unique opportunity of studying the original types of *S. apicalis*, Sauss., a male and a female from Shahrud, Persia, and of comparing them with specimens of *S. obscuratus* Walk., from other localities (for the synonymy of the latter species see my paper in this Journal, xxix, 1923, p. 644). Although the differences between them are quite considerable, I am convinced that they are not of specific value, but dependent on geographical variation, and I regard therefore the *apicalis* as only a subspecies of *obscuratus*. The essential characters of *apicalis* not sufficiently described by Saussure are, as follows:

The head relatively small and narrow, when viewed in profile only slightly projecting above the pronotum. Pronotum is also narrow and strongly narrowed anteriorly, almost conical; its anterior margin practically straight, with a shallow submarginal sulcus; the first transverse sulcus well expressed throughout, the second one obliterate in the middle, the third practically straight, deep and narrow; no submedian tubercles between the sulci; median keel scarcely perceptible before the first sulcus, obliterate in the rest of prozona, fine and linear in the metazona; metazona almost twice as long as prozona and somewhat longer than broad, convex (Saussure says "dorso a latere viso subrecto," but it is not so in the male type, while in the female the prozona is less constricted and the metazona more, but not quite, straight in profile); the hind angle very near 90° and but little rounded in the male, obtuse and rounded in female. Elytra relatively very long and narrow, reaching beyond the apices of the hind tibiae; discoidal vein well developed, distinctly sinuate and strongly approximate distally to the radial vein, but not quite touching it; the hind discoidal area broad, not densely, but irregularly reticulated. Wings more than one half again as long as broad in the male, somewhat shorter and broader in female; the width of their fascia equals to about one third of the wing length, with the inner margin not sharply defined but fading gradually. Measurements of the types are, as follows:

	♂	♀
Length of body	32mm.	39mm.
,, pronotum	6.5	8
,, elytra	35	42
,, hind femora	14	17
Maximum width of wing fascia	12	14

There may be noticed some discrepancy between my measurements of the types and those given by Saussure who gives the total length as 40 mm. for the male and 36 mm. for the female, and the length of elytra as 34 mm. and 40mm. respectively, but as the identity of the types is beyond any doubt, we must admit a serious carelessness on Saussure's part which is, by the way, apparent in good many places of his on the whole excellent work.

It is obvious from the above re-description of types that *apicalis* differs from *obscuratus* both in the shape of pronotum, and in the shape and position of discoidal vein. Nevertheless, I cannot regard them as specifically distinct, as a specimen before me, from Abaden, S. Persia, recorded by me in this Journal before (xxix, 1923, p. 644) as *S. obscuratus* presents characters most obviously intermediate between typical *obscuratus* from Egypt and *apicalis*. I believe, therefore, that *apicalis* is only a good geographical race of *obscuratus*, known at present from Shahrud only; the above quoted specimen from Abaden is also nearer to *apicalis* than to *obscuratus*.

Sphingonotus obscuratus latissimus, subsp. n.

1898. *Sphingonotus brunneri*, Zubovsky, Ann. Mus. Zool. Acad. Imp. Scien., St. Petersburg, iii, p. 97.

Zubovsky described specimens of *S. obscuratus* (=*S. brunneri*) from the river Ili in Semiretchye, E. Turkestan, as having the wing fascia extremely broad, occupying the whole basal part of wings, except a small pale-bluish strip along the anterior margin. As obviously all specimens from that locality examined by him possessed this character, I feel fully justified in regarding the form as a distinct subspecies deserving a name. Morphological characters of the subspecies are not mentioned by Zubovsky at all, but he says that the elytra are provided with only feebly, or not at all, developed apical spots.

Sphingonotus obscuratus transcaspicus, subsp. n.

1914. *Sphingonotus apicalis*, Uvarov, Revue Russe d'Entom, xiv, p. 221.

In the paper just quoted I described briefly a local form of what I then considered to be *S. apicalis*, but I hesitated to give it a name without sufficient knowledge of the true *apicalis*. Now that I have studied the latter considered by me a subspecies of *obscuratus* (see above) and compared it with a specimen from practically the same locality in Transcaspia as the one described in that my paper, I feel convinced that this is a very well defined local race of *obscuratus*; its description is, as follows:

Distinctly smaller than *apicalis*. Head more prominent above the pronotum than in *apicalis*; especially the eyes are much more projecting upwards. Pronotum slightly more selliform than in *apicalis*, as in the latter without submedian tubercles between the sulci; metazona longer than the prozona, with the apical angle less acute and more rounded than in *apicalis*; lateral lobes broadly rounded behind. Elytra with the discoidal vein strongly sinuate, closely approximated distally to the radial, but not touching it, marked with indefinite pale ochraceous small spots, without the apical spot. Wings pale bluish basally; their fascia narrow, the maximum width being equal to about one fourth of the length of a wing; the fascia leaves a very narrow hyaline margin behind and does not reach the inner margin.

	♂
Length of body	29mm.
" pronotum	5·5
" elytra	30
" hind femur	11.5
Maximum width of wing fascia	7

Described from a male from Ivanovka in the Kopet Dagh mountains, Transcaspia, 18, vi, 1913.

My previous record of this subspecies (*l.c.*) was from Nuchur, also in Kopet Dagh mountains.

A remarkably narrow wing fascia and relatively small size give this insect an appearance somewhat dissimilar to other races of *obscuratus* but it is undoubtedly close in its morphological characters to sbsp. *apicalis*. It is very noteworthy that two substantially distinct subspecies should occur not very far, comparatively, from each other as *apicalis* (Shahrud) and *transcaspicus* (Kopet Dagh) do.

Key to subspecies of S. obscuratus.

1 (4). Metazona scarcely longer than prozona; the latter with two distinct submedian tubercles. Discoidal vein practically straight and almost parallel to the radial. Apex of elytra without a spot.

2 (3). Wing fascia strongly narrowed anteriorly; apical spots small, subobliterate.—Algeria.

lameeri, Fin.

3 (2). Wing fascia not strongly narrowed anteriorly: apical spots large and well developed.—Egypt, Sinai.

obscuratus (Walk.)

4 (1). Metazona distinctly longer than prozona: the latter without submedian tubercles. Discoidal vein sinuate, almost touching distally the radial.

5 (8). Wing fascia very broad. Size large.

6 (7). Wing fascia leaves the whole basal third of wing clear. Elytra with an apical spot.—Shahrud.

apicalis, Sauss.

7 (6). Wing fascia leaves clear only a small strip along the anterior margin of wing base. Elytra without an apical spot.—Semiretchye.

latissimus, subsp. n.

8 (5). Wing fascia narrow, not broader than one fourth of the length of wing. Size small. Elytra without an apical spot.—Kopet Dagh, Transcaspia.

transcaspicus, subsp. n.

I do not know the form described by Saussure as *S. brunneri* and undoubtedly belonging to this species; it may represent another subspecies.

Tmethis tartarus montanus, subsp. n.

Differs from the typical form (from the plains of Turkestan) by the hind femora and tibiæ being pale yellowish, not red, on the inside.

1 ♂, 1 ♀ from the Tchatkal mountains, distr. Tashkent, 22, vii, 1919.

Although the difference between the two forms is only in the color of hind legs, it is, according to communication by Mr. V. Plotnikov who collected both of them, quite constant and must be considered of subspecific value, since the distribution of the two forms is different.

Tmethis karatavicus, Uv.

I think now that *karatavicus* described by me as a subspecies of *T. bilobus*, St. (Revue Russe d'Entom, xii, 1912, p. 212) is a good species.

Tmethis transiens, sp. n.

Very similar to *T. bilobus* (St.), but differing from it in the structure of pronotum and other characters.

Size rather small for the genus: moderately rugose. *Antennæ* longer than head and pronotum together. *Head* as in *T. bilobus*. *Pronotum* less compressed laterally and shorter than in that species; its anterior margin very ob-

tusely angulate, scarcely projecting over the occiput; median keel in prozona less raised, thick, seen in profile its first lobe is feebly ascendent, equal in length to one half of the prozona; second lobe is higher than the first, triangular in profile, thick with two divergent forward keels on the upper surface delimitating two impressions; third lobe lower than the second, triangular; metazona less than half again as long as prozona (in *T. bilobus* nearly twice), not longer than it is broad at the shoulders, feebly convex, with the median keel fine linear throughout; hind margin not lamellate; hind angle about 90°, rounded, with the sides distinctly convex; the whole surface of pronotum, lateral lobes included, covered not densely with round callous tubercles. *Elytra* extending a little beyond the hind knees. *Wings* with the venation exactly like that in *T. bilobus*. *Hind femora* with the upper carina feebly and gradually lowered in the apical third; lower carina feebly wavy.

Coloration greyish-brown. Elytra with a few scattered, scarcely perceptible small dark spots. Wings infumate throughout, except the two apical lobes and some cells in the middle which are only slightly darkened. Hind femora and tibiæ bright brick-red inwardly.

♀(paratype). As the male, but the elytra only reaching the hind knees.

	♂(type)	♀(paratype)
Length of body	25 mm.	30 mm.
,, pronotum	8	9.5
,, elytra	21	19
,, hind femora	13.5	15

Described from 4 ♂ ♂ and 4 ♀ ♀ from Vuadil, prov. Ferghana, 28 v, 1913.

I have once recorded this insect under the name *T. bilobus* (Revue Russe d'Entom., xiv, 1914, p. 225), but a careful comparison with the latter shows important differences which justify separating them. It is, of course, not impossible that *T. transiens* is only a subspecies of *T. bilobus* (original locality Daghestan, Caucasus), but the metazona of pronotum is very differently shaped in the two insects, and I preferred to describe *transiens* as a distinct species. The most important feature of *T. transiens* is the short metazona with the margin not lamellate, as it is in *T. bilobus* and *T. muricatus*, but rather thick, approaching to the type which may be observed in *T. semenovi* (Zub.).

Tmethis ferghanensis, sp. n.

♂. Resembling *T. tartarus* (Sauss.) but much smaller. *Antennæ* (in a paratype, in the type they are broken) distinctly longer than the head and pronotum together. *Face* vertical; frontal ridge between antennæ parallel, sulcate, below the ocellum suddenly constricted, further down widened and obliterate; vertex sloping, slightly longer than broad, scarcely impressed, with the margins obliterate and no trace of median keel. *Pronotum* only feebly compressed laterally, slightly narrowed anteriorly, but not constricted in prozona; anterior margin very obtusely angulate; median keel in the prozona thick, less elevated than in *T. tartarus*, not deeply cut by the sulci; viewed in profile the first lobe of the keel is shorter than half of the prozona, with the upper margin not strongly ascendent, slightly concave and the hind angle near 90°, rounded; the second lobe very thick, rounded, with the usual upper double impression hardly perceptible; the third lobe low, obtusely concial, with the hind margin sloping backwards and forming an obtuse angle with the metazona (not reclinate and forming an acute angle as in *T. tartarus*); metazona as long as prozona, sellate owing to a deep transverse impression of its anterior part and to the incrassate posterior part; median keel in metazona linear; hind angle obtuse, rounded; hind margins thick, feebly convex; the surface of pronotum, including the lateral lobes, is covered

with scattered, low, round callous tubercles. *Elytra* extending to the apex of the distal third of femora; their maximum width beyond the middle; the apex broadly rounded. Wings circular; their venation as in *T. escherichi* (Kr.) *Hind femora* with the upper carina serrulate, not strongly and not suddenly lowered in the apical third. *Abdominal tergites* with only slightly cristate hind margins and a lateral row of scarcely perceptible tubercles.

Coloration greyish-ochraceous. Antennæ whitish. Elytra with fairly numerous small brownish spots. Wings in the pre-radial part subhyaline with a narrow blackish submarginal fascia leaving a narrow hyaline margin; post-radial part infumate throughout. Hind femora inwardly dark-blue at the base, pale yellowish in the rest. Hind tibiæ bright brick-red inwardly.

♀(paratype). Pronotal keel still lower and thicker than in the male, the hind margin of its hind lobe, when viewed in profile, forming a very obtuse (about 160°) angle with the metazona; the latter less sellate. Elytra not quite reaching the apex of the second tergite, separated from each other at the back. Tergites with a low linear median carinula and a lateral row of small tubercles. Coloration reddish-ochraceous.

	♂ (type.)	♀ (paratype)
Length of body	32 mm.	40 mm.
„ pronotum	10.5	11
„ elytra	9	8
„ hind femora	17	19.5

Described after 2 ♂♂ and 2 ♀♀ from Asha Ba, prov. Ferghana, 4.vii.1913.

Although I compared this insect with *T. tartarus*, I did so simply because that species is better known than the recently described specimen from the Syr-Darya province *i.e. T. nigrescens*, Pylnov (Revue Russe d'Entom., xiv, 1914, p. 107), which seems to be very closely related to *T. ferghanensis*. The latter differs, however, from *T. nigrescens*, as far as it may be judged by description and figure of pronotum of Pylnov's species, in the still lower pronotal keel, sellate metazona, larger size and coloration of hind legs. It is not impossible, of course, that the two insects as well as *T. crassus*, m., represent only different races of the same species.

Tmethis crassus, sp. n.

♂. Allied to *T. ferghanensis*, Uv. *Antennæ* slightly longer than head and pronotum together. *Head* thick; face vertical, rugose; frontal ridge between antennæ parallel, sulcate, below the ocellum constricted, widened gradually and sulcate further down, almost reaching the clypeus; vertex sloping, rugulose, feebly impressed, with the margins irregular and an interrupted median carinula. *Pronotum* very thick; anterior margin scarcely angulate at all; median keel in prozona very low and thick, with the median line irregular; transverse sulci shallow; first lobe of the keel subequal to half of the prozona, seen in profile its upper margin is horizontal; second lobe slightly lower than the first, thick, with the upper foveolæ distinct; hind lobe quite low, conical; its hind margin forming a very obtuse angle with the metazona; metazona equal in length to prozona, very feebly impressed anteriorly and as feebly gibbose behind, distinctly broader than it is long, with the hind margins rounded; the median keel linear and irregular, the whole surface in longitudinal ridges and elongate tubercles, with distinct ridges in the place of lateral keels; prozona and lateral lobes in dense rounded tubercles. *Elytra*

not quite reaching the middle of hind femora, broadest in the middle with the apex parabolic. *Hind femora* as in *T. ferghanensis*. Abdominal tergites scarcely carinulate.

Coloration greyish-brown. Prozona of pronotum and the hind part of metazona somewhat blackish. Elytra blackish-brown. Wings infumate throughout, more darkly near the margin, but the margin itself is narrowly whitish. Hind femora and tibiæ sanguineous inwardly.

	♂ (type.)
Length of body	31 mm.
„ pronotum	10
„ elytra	11
„ hind femora	17·5

A single male from Berkara, distr. Aulie-Ata, pro. Syr-Darya, i. vi, 1922.



Nest of the Southern Crow Pheasant.

(*Centropus sinensis parroti.*)



Nest and eggs of the Punjab Sirkeer Cuckoo.

(*Taccocua sirkee sirkee.*)



Nest and eggs of the Indian Hoopoe.

(*Upupa epops orientalis.*)

A DESCRIPTION OF THE NESTS AND EGGS OF THE COMMON BIRDS OCCURRING IN THE PLAINS OF THE UNITED PROVINCES.

Part VI.

(*Continued from page 970 of Vol. XXIX.*)

By

E. H. N. Gill, F.Z.S.

(*With a Plate.*)

Upupa epops orientalis	.. .. ..	The Indian Hoopoe.
Local name	.. .. ..	Hoopoe, Hudhud.
Anglo-Indian name ..	.. .. ..	The Common Hoopoe.

The Indian Hoopoe is a familiar bird in every district of the Province, and is met with in most localities. Throughout the winter months the birds are comparatively silent, but by February and March they become decidedly vociferous, and their melodious notes of *hoop-hoop, hoop-hoop-hoop*, are infallible signs of the approaching hot weather with all its attendant evils and discomforts.

Domestic operations commence in February and continue, according to locality, to May and June; during which period two, and sometimes three, broods are raised in the one nest. The birds are prolific breeders, and, in spite of their attractive plumage coloration, are in no danger of extinction at the hands of snarers or collectors.

In particulars of nidification the Hoopoe seems to differ from most other feathered species in respect of the curious fact that the serious aspect of reproduction, to begin with at any rate, is realised only by the male, who experiences no little difficulty in passing this knowledge on to his refractory bride. The choice of a suitable hole in a tree or wall seems to devolve on him, and even when this important detail has been settled he still has his work cut out to shepherd his seemingly unwilling mate into the nest.

This curious behaviour may be observed several days before the eggs are actually laid, the male mounting guard outside the nest-hole, and the female making good her escape at every opportunity afforded her. But so soon as the first egg is laid the female takes up her position in the nest and never leaves it until the young are hatched.

During the period of incubation she is fed assidiously by the male, who is tireless in his efforts to keep her adequately supplied with nourishment. The way he sticks to his self-imposed task is truly remarkable and worthy of the highest praise. But even this model of domesticity is not without his weak moments, for I have seen him making romantic overtures to some charming damsel from the next compound while his honoured wife sat contentedly on her eggs quite oblivious of his carryings on.

As soon as the young are hatched she joins her mate and assists him to feed the young, but the period of inaction, having somewhat dulled the sensitiveness of her bill, it takes some days for her to acquire her old efficiency. It is therefore a common sight to see the male offering her choice morsels at frequent intervals in spite on the fact that his callow brood require all his attentions. His is verily a hard life from a domestic standpoint.

The female, during the period of incubation, is a close sitter, and can be captured on the eggs without the least difficulty; though I would not recommend the experiment to anyone afraid of soiling his hands, as the Hoopoe has a most disconcerting habit of ejecting an offensive fluid when thus handled. Whether this habit has been acquired as a weapon of offence or defence, or whether it is merely the involuntary discharge of fluid excrement due to fright or sudden alarm is not quite clear; but it certainly has the effect of damping, in no small degree, the ardour of intending robbers.

Once the female begins to lay her eggs the desire to incubate them is so great that she will often continue to lay eggs as fast as they are removed from beneath her. I call to mind one particular bird which fancied a hollow paw of one of the stone lions at La Martiniere College, Lucknow, situated immediately above a spiral staircase leading to one of the dormitories.

This nest was known to at least a dozen youthful hooligans, who, at an appointed hour each evening, when the door was opened, fought as only small boys can fight to get at the nest first. It would be difficult to arrive at even an approximate estimate of the amount of young blood spilt in violent struggles for possession of the single egg, nor the number of eggs laid by that obliging bird for the benefit of those budding oologists; but bleeding noses and gory faces were of such frequent occurrence at intervals throughout the breeding season that I have often wondered whether that bird, in addition to its many natural attributes, was not possessed of a certain sense of humour as well.

The eggs are, without exception, deposited in holes in trees and walls at varying heights from the ground, but of nest there in none to speak of, and neither is there any sign of the orifice being built up after the fashion of the Nuthatch. Filth and vermin reign supreme in these elementary nurseries, which sets one wondering at an inscrutable decree of Nature which allows a species of such laudable domestic habits and attractive appearance to so disregard fundamental and essential laws of hygiene.

The eggs are up to six in number, in shape typically rather long ovals, always a good deal pointed towards one end. The ground-colour, when the egg is quite fresh, is a delicate pale greyish blue without spot or blemish of any kind. The shell, however, becomes greatly stained during incubation, and when exposed to the light for any length of time fades very rapidly. A normal egg would measure about 0·97 by 0·66 inch.

Liopicus mahrattensis..	..	.. The Yellow-fronted Pied Woodpecker.
Local name ..	..	.. Unknown.
Anglo-Indian name ..	..	.. The Spotted Woodpecker.

This interesting and sprightly bird occurs either singly or in pairs and is pretty evenly distributed throughout the plains, though it is nowhere common. It is a nervous, highly-strung creature, always on the move; while the ease with which it can manoeuvre round the branches of trees adds considerably to its ability for concealment.

On several occasions, whilst looking for nests, my attention was drawn to a curious vibrating sound like the creaking of a branch in a strong wind. But as there never was any breeze to speak of I investigated the matter and found to my surprise that the author of the mysterious sounds was this little Woodpecker, and that it was brought about by the bird vibrating its bill against some decayed branch or dry stump.

Later I ascertained that this was done with a specific object. The violent vibrations apparently had the effect of dislodging minute insects from the cracks and crevices of the wood, which were then collected and devoured by the bird. Quite an ingenious method really, but how the bird contrives to work its bill so rapidly has always greatly puzzled me.

The nesting season is from about the end of February to the beginning of May, according to locality; and the eggs are deposited exclusively in holes in trees at varying heights from the ground. Sometimes the branches in which the holes are drilled are dry and decayed, and sometimes quite green and robust. Sometimes quite perpendicular, and sometimes slanting in accordance with the bird's particular fancy.

The aperture is circular, and about an inch and an half in diameter. It goes straight into the branch for a couple of inches, and then turns downwards to a depth of six or eight inches; the egg-cavity at the bottom usually being hollowed out and lined with bits of wood and bark.

Both birds assist in buiding the nest and feeding the young, and it is quite common for the same nest to be used for several years in succession.

The eggs are glossy white, and invariably three in number. The shells are fine and delicate, and, when fresh and unblown, present a pink tinge on account of partial translucency. They are typically slightly elongated ovals, though spherical varieties occur sometimes. A normal speciman would measure about 0·86 by 0·65 inch.

Iyngipicus hardwickii .. .. The Indian Pigmy Woodpecker.
Local name .. .. .. Unknown.
Anglo-Indian name .. .. The Small Woodpecker.

This vivacious little species seems to be pretty evenly distributed throughout the Western districts of the Province, more sparingly in the Eastern districts. It is, on account of its small size and characteristic habits, quite unmistakeable though the amateur will almost invariably find it a most difficult business to locate the nest. In all my experience I have seen but half a dozen, and even these were found more by good luck than judgment.

The birds evince an almost uncanny faculty for avoiding close observation, which is rendered much more acute as the period of nidification draws nigh. I suppose I must have watched hundreds of Woodpeckers, at one time or another, constructing their nests; but never have I seen a Pigmy Woodpecker engaged in the operation.

There does not appear to be any reason, however, why they should not. Though if the opportunity offered they would not be averse from appropriating the handiwork of the other allied species.

The full complement of eggs is four, though it is not often that they all survive to hatch; one or two usually being addled. In shape they are typically blunt ovals, unusually round for a Woodpecker, and large for the size of the bird. They are pure white in colour and moderately glossy, and a normal egg would measure about 0·7 by 0·55 inch.

Brachypternus aurantius aurantius .. The Northern Golden-backed Woodpecker.
Local name .. .. Unknown.
Anglo-Indian name .. .. .. The Royal Woodpecker.

This species is perhaps the commonest, most familiar, and certainly the most beautiful of the Woodpeckers of the plains. Not only is its plumage coloration most striking, but its strong, undulating flight, raucous voice, and cheeky demeanour are unmistakeable.

A very curious instance of this bird's behaviour is related by Hume. "I caught a bird" he says "(a male) in its hole, with two fresh eggs, very pyriform, and now when blown just like highly polished alabaster. I had the live bird 24 hours in a box, and when I popped him on to the trunk of a large peepal tree overhanging my portico, instead of flying away he ran about a foot up the tree and, taking no earthly notice of me, set to work devouring black ants at a great rate; whilst in the hand he erected his crest, screamed lustily, and pecked most vigorously at my fingers, or indeed anything put near him; he was a very bold bird."

They breed from March to July, and do not seem to depart in any way from the ordinary habits of the family.

The usual complement of eggs is three, and they are rather characteristic of the species. Typically they are long and pyriform in shape, and like polished

china when blown. When fresh the shells are suffused with a delicate salmon-pink on account of partial translucency. A normal egg would measure about 1·1 by 0·8 inch.

Thereiceryx zeylanicus caniceps .. The Northern Green Barbet.
Local name .. .. Kotur.
Anglo-Indian name .. .. .. The Large Green Woodpecker.

This species is very commonly distributed throughout the Province, and is a familar and vociferous garden bird, which seems to provide the Chiria-mar with quite a lucrative source of income. There is, to my mind, however, something about its appearance that is sinister and curiously reptilian; an opinion which has been influenced to a great extent by the amount of damage which these birds have wrought in my tomato beds. Living almost entirely on fruit and seed they are invariably met with on the various kinds of *Ficus*, but are not averse from trespassing in vegetable patches whenever opportunity offers.

Domestic operations are commenced in April and continue till May. The nest is the usual Woodpecker type, and is constructed in almost any kind of tree usually quite low down, though preference is given to dry stumps and branches which are soft and brittle and easily bored. Both birds assist in building the nest and incubating the eggs, while old nests are used regularly year after year.

The full complement of eggs is four, more often three, and sometimes only two. In shape they are typically rather regular ovals, somewhat elongated; in colour a dead white and slightly glossy. A normal specimen would measure about 1·2 by 0·8 inch.

Xantholæma haemacephala indica .. The Indian Crimson-breasted Barbet.
Local name .. .. Kat-Khora, Bussunta lisora.
Anglo-Indian name .. .. .. The Small Green Woodpecker.

The Coppersmith, like the preceding species, is very commonly distributed throughout the Province, and occurs in most gardens where the food supply is sufficient; its pleasing call-notes and sprightly habits being unmistakeable.

Domestic operations are commenced in April and continue till May, the particulars of nidification being identical with the last species, save that the Coppersmith evinces a curious habit of sitting for hours at the entrance of the nest-hole with just its head peeping out, in which position it presents rather a humourous spectacle. Both birds assist in building the nest and incubating the eggs, but old nests are seldom used. Indeed the birds seem to attach considerable importance to the selection of a nesting site, for several half finished nests may be rejected and abandoned before they are eventually suited.

Normally three eggs are laid, often only two. In shape they vary a good deal, but are typically almost cylindrical, tapering somewhat towards one end. The shells are white and do not present any appreciable gloss, and are so fragile as to be almost transparent. The greatest care has to be exercised when extracting them from the nest, as the smallest piece of wood falling on them is liable to crack them beyond repair.

The eggs vary considerably in size, but a normal specimen would measure about 0·9 by 0·7 inch.

Coracias bengalensis bengalensis .. The Northern Indian Roller.
Local name .. .. Nilkant, Sabzak.
Anglo-Indian name .. .. .. Jay, Blue Jay.

This bird is commonly distributed throughout the Province, and is too well known already to require any introduction. There is not much to be added to current literature on the subject, save to say that the birds are vociferous and aggressive and very intolerant of other species in the vicinity of their breeding grounds. When they commence their courtship the whole world knows about it. The loud, raucous cries of the male are unmistakeable; and if one desires to investigate further, one may observe the mad aerial gyrations in which he indulges, the specific purpose of which I know not.

When left in peace the female sits quietly at the end of a dry, lateral branch and pursues her ordinary vocation; when, without any apparent reason, the male soars suddenly overhead and dashes at her repeatedly in the most intimidating manner, causing her to dodge this way and that to avoid a collision. Then, seemingly satisfied, he flaps away to the nest-hole and indulges in an impromptu concert, where he is eventually joined by the female, who adds to the awful din. And this curious behaviour is continued practically throughout the period of nidification.

Domestic operations are commenced, as a rule about March, and continue till July. The eggs are laid in holes in trees and walls, and sometimes in hollows under the eaves of bungalows. Sometimes the eggs repose on a few rags and feathers, though more often than not there is no attempt at any sort of lining. The art of nest construction seems to have passed them by.

Normally four eggs are laid. In shape they are broad ovals, occasionally almost spherical. They are a bright china-white in colour with a brilliant gloss; and a normal specimen would measure about 1·35 by 1·07 inch.

Merops orientalis orientalis .. .. The Common Indian Bee-Eater.
Local name .. .. Harrial, Patringa.
Anglo-Indian name .. .. .. The Small Wire-bird.

This sprightly little bird occurs quite commonly in open spaces and gardens throughout the Province. Being a bird of such characteristic appearance and habits, it cannot be mistaken for any other; while its keen sight, and ability for judging pace and distance are truly remarkable. It perches constantly on twigs and telegraph wires and takes its prey on the wing, in the doing of which it is even more expert than the Drongo, the viscous snap of the mandibles being quite audible even at a distance. Sometimes they are found singly or in pairs, but more often in parties of a dozen or more. Indeed, in certain favoured spots hundreds may be found together.

Domestic operations are commenced in March and continue till June, and the eggs are deposited exclusively in holes in the perpendicular faces of mud banks, cliffs, and irrigation channels, which the bird excavates for itself with bill and claws; both sexes assisting in the operation.

The channel, which is circular and about two inches in diameter, is driven straight into the cliff face to a depth varying from two to five feet. It widens perceptably towards the egg-chamber at the other end, which is hollowed out with a well-shaped compartment to hold the eggs. Occasionally the tunnel may be found to diverge in either direction, but this only happens when an obstacle like stone or kunkur impedes the straight line.

The eggs are usually four in number, occasionally five. In shape they are quite spherical, pure white in colour and brilliantly glossy. A normal specimen would measure about 0·75 by 0·71 inch.

Merops superciliosus javanicus .. The Blue-tailed Bee-Eater.
Local name .. .. Bara-patringa.
Anglo-Indian name .. .. .. The Large Wire-Bird.

This species seems to be common in some parts of the Province, and is rare n others. In Allahabad, Cawnpore, Etawah, and other Western districts I

have found them breeding together in certain localities in large parties, whereas East of Benares, although I have seen them occasionally, I have never come across their nests; though they undoubtedly breed there sometimes. I have examined many a nest in the stop butts at La Martiniere College rifle range at Lucknow, and the various rifle ranges at Allahabad, where the birds took not the least notice of the hundreds of bullets thudding into the earth around them.

It breeds at the same time as the last species, the particulars of nidification being almost identical, save for the fact that *javanicus* evinces a tendency to breed in colonies, and often lines the egg-chamber with fine grass and feathers.

The eggs, four or five in number, are merely larger additions of *orientalis*, and a normal specimen would measure about 0·85 by 0·76 inch.

Ceryle rudis leucomelanura .. .. The Indian Pied Kingfisher.
Local name .. .. Koryala, Kilkila.
Anglo-Indian name .. .. .. The Common Kingfisher.

This sprightly and interesting bird is commonly distributed throughout the Province, more abundantly perhaps in the well watered tracts. Its conspicuous black and white coloring and cheery call-notes are unmistakeable, and it is a fascinating bird to watch as it hovers over patches of water to descend suddenly in a rapid nose dive on to some unsuspecting fish swimming near the surface.

Sacred tanks with the inevitable pole in the centre are this bird's delight. On the pole a pair will perch for hours and wait patiently for their victims; flying off every now and then on a tour of inspection round the pond, and returning again with their captures which are bashed to death and swallowed whole.

Domestic operations are commenced about February, and continue, in accordance with locality, till May. The birds breed freely along the precipitous mud banks of the Ganges and Jumna and various other streams and lakes in the Province, and the eggs are deposited in holes driven horizontally into the cliff-faces at distances varying from two to twenty feet from the water, and anything up to seven feet in depth. The entrance to the tunnel is about three inches in diameter but the other extremity is widened and hollowed out to accommodate the sitting bird in comfort. There is very little pretence at a nest, though occasionally a little grass and fish bones are scattered about indiscriminately.

The full complement of eggs laid is six, though I have frequently found only four, sometimes five. In shape they are typically broad ovals, sometimes almost spherical, and occasionally distinctly pointed towards one end. The shells are pure white with a high polish; usually quite unmistakable for anything but a Kingfisher's. The eggs vary a good deal in size, but a normal specimen would measure about 1·2 by 0·95 inch.

Alcedo atthis bengalensis .. .. The Common Indian Kingfisher.
Local name .. .. Chota Kilkila, Nika machrala.
Anglo-Indian name .. .. .. The Small Blue Kingfisher.

This beautiful little bird is distributed throughout the Province in suitable localities, though it is nowhere common; occurring in most places either singly or in pairs. Its small size, brilliant plumage, and curious habit of bobbing its head, are sufficiently distinctive for correct identification; but being a frequenter of silent and secluded places it is seldom met with. It captures its prey from some favourite perch, and, unlike the Pied Kingfisher, hovers only very occasionally.

The period of nidification varies considerably in accordance with locality, the most favoured months being March, April, and May. The nests are found,

as a rule, in the most secluded places, and are merely smaller additions of those already described. Both sexes assist in building the nest and incubating the eggs, and are extremely energetic during the whole period of nidification.

The eggs, up to six in number, are distinctly oval in shape, sometimes almost spherical like those of *Merops veridis*. When fresh the shells are suffused with a pink tinge, but when blown they are a pure china-white and brilliantly glossy. A normal specimen would measure about 0·79 by 0·69 inch.

Ramphalcyon capensis gurial .. The Brown-headed Stork-billed Kingfisher.
Local name .. .. Unknown.
Anglo-Indian name .. .. .. Unknown.

This bird, easily recognised by its conspicuous coloring, large bill, and raucous voice, is very sparingly distributed in the Province. The only place I have seen it in any numbers is a strip of wild and rugged country South of Allahabad and Mirzapur bordering on Baghelkhand. In the submontane districts, and along the foot-hills of the Himalayas, the birds are comparatively common; but that is an area outside the scope of these papers.

I have never actually taken their eggs, though the jungle natives of Baghelkhand have assured me that the birds do breed in the cliff-faces of forest streams in the wildest and most secluded spots.

Halcyon smyrnensis fusca .. .. The Indian White-breasted Kingfisher.
Local name .. .. Kilkila.
Anglo-Indian name .. .. .. The Large Blue Kingfisher.

This conspicuous bird is somewhat sparingly distributed throughout the Province, but is, if anything, even more retiring in its habits than the Common Kingfisher, and certainly much more arboreal. It loves to haunt heavily wooded forest streams, and is quite an adept at avoiding observation by concealing itself amongst thick foliage. It is met with either singly or in pairs, and feeds more on insects and other vermin than fish.

They breed at the same time as the other Kingfishers, and construct a nest of the usual type, the holes being driven into the cliff-faces of forest streams, tanks, and the perpendicular sides of disused earthern wells. The presence of running water, as in the case of the other species, is not at all essential.

The eggs are up to six in number, and pure glossy white in colour. In shape they are typically spherical, and large for the size of the bird. A normal specimen would measure about 1·1 by 1·0 inch.

Lophoceros birostris .. .. .. The Common Grey Hornbill.
Local name .. .. Dhanesh.
Anglo-Indian name. .. .. .. The Toucan.

This familar bird is common throughout the plains, and is met with either in pairs or small parties of from four to six. The parties, however, do not occur until late in the breeding season, and are merely the parent birds with their four or five offspring. The curious way in which they follow each other from tree to tree in search of food is a peculiarity of the species.

Domestic arrangements are commenced, as a rule, in April, and continue till June; but though the birds are so commonly met with, to find the nest is not so easy. The eggs are deposited in holes and crevices in large trees, usually at great heights, and the orifices built up with clay and excreta so as to completely imprison the female bird, save for a small slit through which she is fed by her mate throughout the long period of incubation. Food is often procured from long distances, which is one reason why the bird is so difficult to follow. The masonry work round the orifice is removed after the young are hatched, but

the same nesting site, if not disturbed, is used by the one pair of birds year after year.

The eggs are up to five in number. In shape they are typically broad, rather perfect ovals, without any gloss. When fresh the shells are a dull white, but become stained during incubation with shades of dirty brown and yellow. A normal specimen would measure about 1·75 by 1·25 inch.

Micropus affinis affinis .. .. The Common Indian House-Swift.
Local name .. .. Ababil, Hawa bilbil.
Anglo-Indian name .. .. .. The Common Swallow.

This sprightly bird is very commonly distributed throughout the Province. It is essentially gregarious in its habits, and so domesticated as to require no introduction whatever.

The breeding season commences in February, and continues spasmodically till August. The nests are confined to the roofs of old buildings, mosques and temples, caves, railway stations, and under the eaves of bungalows; and wherever they occur large numbers are either clustered together in a small area, or scattered over a wider area in small, compact groups. The birds are constantly flying in and out of the nests, so that the bustle and noise at sunrise and sunset is prodigious, and quite incapable of description.

The nests vary considerably in both shape and size in accordance with the positions which they occupy, but normally they are more or less globular with their edges stuck firmly on to the under surface of the wall. They are composed throughout of fine grasses and the feathers of various birds firmly bound together with saliva, and are rather wonderful structures.

The bottom of this little habitation, which forms the egg-compartment, is not more than a quarter of an inch in thickness, quite devoid of any internal lining, and yet so strong as to withstand considerable pressure from without. Some nests have just a small circular entrance, while others have a distinct tubular attachment projecting from the side of the same material as the nest.

Normally three eggs are laid, very occasionally four. In shape they vary a great deal, but are typically elongated ovals, pointed towards one end; pyriform varieties being quite common. The colour is a spotless white, and the variation in size pretty considerable; but a normal specimen would measure about 0·85 by 0·55 inch.

Tachornis batassiensis batassiensis .. The Palm Swift.
Local name .. .. Tari ababil, Talahatta.
Anglo-Indian name .. .. .. The Palm Swallow.

This curious little bird is distributed throughout the Province in suitable localities; but is much more abundant in the Eastern districts where, unlike the Common House-Swift, it evinces a liking for open spaces usually removed from human habitations. The birds are always met with in small or large parties, and are unmistakable on account of their slim and delicate appearance; reminding one more of a bat than a bird.

Domestic operations are commenced about February and continue till July, during which period two broods are probably reared. The nests are confined exclusively to Toddy-palms and are most ingenious structures; being constructed between the ribs of the leaf after the stem has drooped downwards and the edges of the leaf become compressed towards its centre.

The nest is composed throughout of soft vegetable down and fibre, with the addition of a few feathers, cemented firmly together with the bird's saliva, and if one can visualise a small watch-pocket about two inches in circumference and an inch in depth, surmounted by a stiff braiding round the opening and having one of its sides glued to the under surface of the leaf, one then gets a correct conception of what the nest really looks like. The structure is, in fact,

so frail and small that from beneath the sitting bird looks as though it were suspended in air, or clinging to the leaf in an awkward position.

It is quite common to find several pairs breeding together in the one tree even though Vultures and other birds of prey may be seen to perch there regularly. The nests, however, are not easy to get at. The services of an expert climber have to be requisitioned for the job, and even he often succeeds in bungling the business badly.

The eggs, three in number, are almost perfect miniatures in shape and colour of the last species; and a normal specimen would measure about 0·65 by 0·45 inch.

As regards the Family *Căprimulgidae*, so far as my experience tells me, there are only three species which breed at all commonly in the plains of the Province. These are—

Caprimulgus monticolus	.. ..	Franklin's Nightjar.
Caprimulgus asiaticus	.. ..	The Common Indian Nightjar.
Caprimulgus indicus indicus	..	The Jungle Nightjar.

and as their general habits and particulars of nidification are the same in each case, I shall deal with them all together.

C. monticolus occurs most commonly in the Eastern districts, extending right down into Bengal. *C. asiaticus* is a straggler in the plains, but is met with regularly in the Doon and submontane tracts, while *C. indicus* is very common throughout that wild strip of country lying South of the Jumna, comprising more or less the Jhansi, Hamirpur, Jalaun, Banda, Mirzapur, and part of the Allahabad districts. The birds are nocturnal in their habits, and are consequently only seen in flight or after they have been flushed.

The breeding season commences about March and continues till June. The eggs are deposited on the bare ground, sometimes right out in the open and sometimes under a bush or at the roots of grass and shrubbery without the least sign of a nest or even a depression in the ground to hold the eggs. The birds are extraordinarily tight sitters, and are so protectively coloured as to be almost impossible of detection till flushed. It is only by mere chance that the eggs are ever discovered. I once took a clutch of *C. indicus* from a mass of bare shingle above a stream in the Jhānsi district, which was only discovered by the sitting bird flying off from almost under my foot. There wasn't a blade of grass or cover of any description within ten yards of the eggs.

The eggs, never more than two in number, are in shape typically long ovals, somewhat cylindrical. The shell is fine in texture and exhibits a certain amount of gloss. The ground-colour is a delicate salmon-pink, pretty thickly blotched and streaked with various shades of pale brown and purple, underlaid by secondary markings of neutral shades; and normal eggs of the three species would measure, respectively, about 1·15 by 0·85, 1·0 by 0·75 and 1·17 by 0·88 inch.

Hierococcyx varius	.. .. ..	The Common Hawk-Cuckoo.
Local name	.. .. ..	Pupiya.
Anglo-Indian name	.. .. ..	Brain-fever Bird.

The Brain-fever Bird is commonly distributed, and the author of those crescendo call-notes, which, on a hot summer's night, make one's exasperated brain rock with giddiness. Night and day they call unceasingly, and are a veritable plague in every district.

This bird is unique for the remarkable resemblance, it bears to the *Shikra*. All the markings of the hawk are reproduced exactly in the cuckoo, even the flight of both species being absolutely identical. And as the cuckoo is parasitic on babblers it experiences no difficulty in simulating the bullying tactics of its redoubtable double when foisting its eggs on the dupe.

While the sitting babbler dashes in terror from the nest pursued by the supposed hawk in the shape of the male cuckoo, or while several babblers combine together against a common enemy, the female cuckoo lays her eggs in the unguarded nest, and makes good her escape before the babblers have time to return. And so the good work is carried on.

The birds are present in their usual haunts from about February to October, after which they appear to carry out local migrations. The period of nidification is quite an extensive one, from about March to August; and it is a very unusual occurrence to find more than a single egg in the one babbler's clutch. Both *Argya malcolmi* and *Turdoides terricolor terricolor* seem to be freely victimised

The eggs are somewhat elongated ovals, very blunt at both ends. The shell is fine and glossy, and of a uniform dark greenish-blue colour. A normal specimen would measure about 1·0 by 0·78 inch.

Cacomantis merulinus passerinus ..	The Indian Plaintive Cuckoo.
Local name	Unknown.
Anglo-Indian name	Unknown.

This species is very sparingly distributed throughout the plains, and is rarely met with; at least that has been my experience. I should not care to include it amongst the common birds, and make but casual mention of it in these papers.

Its curious call-notes, small size, and swift, hawk-like flight are quite characteristic; but being a frequenter of heavily wooded and forest country it does not lend itself to close observation; and is a difficult bird to follow.

The period of nidification is from about June to September, and the few eggs which I have taken were all found in the nests of *Prinia inornata inornata*. In shape they are more or less elongated ovals, with a smooth and moderately glossy shell. The ground-colour is a pale greenish-blue sparingly blotched and spotted with reddish-brown, which have a tendency to form an irregular zone at the large end. A normal specimen would measure about 0·8 by 0·55 inch.

Clamator jacobinus	The Pied-Crested Cuckoo.
Local name	Pupiya, Chatak
Anglo-Indian name	Shower-Bulbul.

This conspicuously coloured species makes its appearance in the Province with the advent of the monsoon; its melodious notes, white under parts, white wing bar, and crested head being unmistakable. Like the Brain-fever Bird it is also parasitic on babblers, though, along with other enthusiastic observers, I still have to see exactly how the nefarious deed is accomplished.

On one occasion I saw the deed attempted, but not successfully. Wandering in the public gardens one morning, I was about to examine a babbler's nest, when, carefully concealed in the foliage a few feet distant, I spied my friend the Cuckoo.

By the careful manipulation of a pebble the babbler was startled off the nest. Immediately the Cuckoo was all attention, but the plan miscarried. The cries of the startled babbler attracted its mate to the spot, and the Cuckoo was accidentally discovered and driven off. I was thus unfortunately deprived of witnessing an interesting spectacle, for I feel certain the Cuckoo was merely waiting for the nest to be left unguarded in order to deposit her own egg therein.

The period of nidification is from about July to September, and it is very rarely that more than the one egg is found in a nest. The round, almost spherical shape of the egg is very characteristic, and save for the colour closely resembles a Bee-Eater's. The colour is a uniform, pure blue of more or less intensity; and a normal specimen would measure about 0·95 by 0·75 inch.

A fact I should like to mention in regard to this species is that I have often watched the adult birds feeding a fully-fledged youngster; which is something I have not noticed with either the Brain-fever Bird or Plaintive Cuckoo; though I have frequently seen the Koel doing it.

Eudynamis scolopaceus scolopaceus .. The Indian Koel.
Local name .. .. Koel, Kokil.
Anglo-Indian name .. .. .. The Koel.

It is not necessary for me to say that this bird is common. It dominates one's domestic surroundings throughout the hot weather and rains, when it is always very much in evidence. This redoubtable parasite victimises no less an adversary than *Corvus splendens splendens*, and this in spite of the fact that the victim is fully alive to the fraud practiced on it, and endeavours to prevent it. There is a good deal to be said, therefore, for the Koel's courage and ingenuity.

The Koels seem to become most vociferous about June, which is about the time they commence their campaign against the crows. The loud, persistent call-notes of the male Koel seem to aggravate the crow intensely, so that while he treats the occupant of the nest to as much loud abuse at his command, his mate, trusting to her dull speckled plumage to escape observation, conceals herself in the vicinity of the nest.

Sooner or later the crow, thoroughly exasperated, dashes at the koel, and a hot chase round the countryside ensues. Meanwhile the female Koel pops into the unguarded nest, lays her egg, and makes off in the opposite direction as fast as she can.

In due time the egg is hatched along with those of the dupe, and very soon after the young crows are pitched out of the nest by the foundling to die of exposure and starvation. And now comes the most wonderful part of the whole business, for the nestling Koel, to begin with, is draped in black so as to resemble a nestling crow; and it is not till it is fully-fledged and well able to take care of itself that the speckled plumage of the female is developed. A most remarkable instance of protective mimicry.

The most favoured months for the eggs are June and July, and they are deposited exclusively in the nests of *Corvus splendens splendens*; and it is quite common to find two eggs in the one nest, and occasionally three. The eggs, though they resemble somewhat those of a Crow, are decidedly smaller and quite unmistakable. Even the most casual observer would tell the difference at sight.

The ground-colour varies from a pale stone colour through different shades of green to a pale olive-brown. The markings which consist of spots, specks, streaks and clouds of reddish brown shades, are scattered all over the egg, but have a tendency to gather round the large end in an irregular zone. As a rule it is considerably darker than the eggs along with which it is laid.

In shape the eggs are typically moderately broad ovals, somewhat compressed towards one end; and a normal specimen would measure about 1·2 by 0·95 inch.

Taccocua sirkee sirkee .. .. The Punjab Sirkeer Cuckoo.
Local name .. .. Jungli tota.
Anglo-Indian name .. .. .. The Brown Bird.

This species is sparingly distributed throughout the plains, and is quite unmistakable on account of its striking resemblance to a Mongoose. It is essentially terrestrial in its habits and a great skulker, haunting low scrub and leafy undergrowth and seldom taking to flight.

Domestic operations are commenced about March and continue, according to locality, to July and August. The nest is quite typical, but one of the most difficult to find, on account of the birds being so difficult to follow, and the female such a remarkably close sitter.

The nests are almost invariably confined to large thorny bushes or leafy trees at no great distance from the ground. It is a frail structure if small sticks thrown carelessly together with a thick padding of green leaves to contain the eggs, the leaves being constantly replenished with green ones. Both birds assist in building the nest and feeding the young, but the eggs seem to be incubated almost entirely by the female. They are shy birds and will desert a nest quite readily.

Only two eggs are laid, and occasionally three. In shape they are typically elongated ovals, somewhat obtuse at both ends. When fresh the shells are a dull white and of a chalky nature, but often become stained and somewhat polished during incubation. The size of a normal specimen would be about 1·4 by 0·08 inch.

Centropus sinensis parroti .. .. The Southern Crow-Pheasant.
Local name .. .. Mahoka.
Anglo-Indian name .. .. .. The Crow-Pheasant.

This handsome bird is commonly distributed throughout the Province, and is a familiar bird in most groves and gardens as it struts about amongst the under growth in search of small frogs and vermin. Its loud call-notes are quite unmistakable, and a familiar sound throughout the summer and rains.

Domestic operations are commenced about June and continue till September, and the nests are typical of the species. They are huge, globular structures of grass, straw, and sugar-cane leaf up to about eighteen inches in diameter, lined inside with the same materials, and having a small circular entrance at one side. They are placed usually in thorny scrub and busy trees quite low down, and are, normally, quite easy to find. Both birds assist in building the nest and incubating the eggs.

The eggs, up to six in number, are typically broad ovals in shape with both ends very rounded. When fresh they are pure white and chalky in appearance, but become stained and somewhat polished during incubation. A normal specimen would measure about 1·45 by 1·15 inch.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

By

T. R. Bell, C.I.E., I.F.S. (Retd).

(*Continued from page* 150 *of this Volume.*)

Part XXXIII.

(*With one text figure.*)

Family—HESPERIIDÆ.

Subfamily (2).—Ismeninæ—*continued.*

216. Hasora chabrona, Plötz.—Male. *Upperside*: dark olive-brown; cilia of both wings greyish-white with brown bases. Fore wing with some brown hairs at base and shorter ones beyond; a small, ochreous white, subapical, semihyaline dot or small spot at base of interspace 6; a similar spot in interspace 3 a little before its middle touching vein 4; sometimes another, similar spot inwards in interspace 2. Hind wing, the base and abdominal areas with long, brown hairs and shorter ones beyond. *Underside*: pale-brown with a violaceous-grey tint. Fore wing with the hinder marginal interspace near the anal angle somewhat paler than the rest, a dark shade along middle of wing from base to disc bent at right angles up to costa; the spots as above, all within the darker shade. Hind wing tinged with purple, with a narrow, white, transverse, sometimes obsolescent band in an even, inward curve, its hinder edge even, minutely serrate, its outer edge somewhat diffused, extending to the anal angle and broken just before its end by the upper side of a large, anal, black patch; the base of the wing and an indistinct, broad, discal fascia rather darker than the ground colour; a rather prominent, white anteciliary line from the outer edge of the anal patch becoming obsolescent upwards to apex. Females like the male above and below but somewhat paler, the semihyaline spots in interspaces 2, 3 of fore wing always much larger. *Underside*: the hinder-marginal space larger and much paler, its upper end touching the lowest spot on the fore wing. Hind wing with the base and outer portions somewhat more purplish than in the male. Antennæ black, the shaft below the club dull ochreous beneath, the inside of crook reddish; palpi ochreous or greyish-white with a brown line on each side and the third joint black; head, thorax, abdomen above concolorous with wings; below concolorous with the grey-brown of the underside of wings, the abdomen banded somewhat obscurely. Expanse 50mm.

Egg.—The egg is dome-*shaped*, lowly semiovoid; the *surface* slightly shining. There are from 14-17 meridional, thin, linear ribs or ridges running from the base to the apex where they end round the small micropyle. The diameter is very close on 0·75 mm. and the interspaces between the ribs at the middle are about 4 × the breadth of the ridges themselves. The base on which the egg stands is quite flat, the height is about equal to the diameter. The *colour* is white or whitish. B: 0·6; H: 0·4

Larva.—Is very similar in every way to those of *Hasora alexis* and *H. butleri* —the colouring, pattern and everything else. The body is, in *shape*, on the whole, cylindrical, but narrows considerably forwards to the head in segments 4, 3, 2; less so backwards from segment 12 to the hinder extremity; segments 13, 14 are hardly distinguishable except by a dotted green colour-line and segment 13 is similarly separated from segment 12 besides by a fold; segment 14 is a piece in the shape of a quarter-sphere; no chitinized area; the free curve of flap lies very nearly on the resting surface overlapping the anal claspers; segment 2 is rather narrow and has a chitinized collar which is dark reddish brown or nearly black, is nearly the length of the segment and has the two edges raised, the middle in consequence sunk or grooved; it is longest in

the dorsal line (or broadest) and becomes narrower towards the spiracles, finishing above them and just in front of them. *Head* a good deal broader and higher than segment 2, about the same diameter as segment 4 at its front margin, round in shape, with a broad somewhat shallow sinus, acute in the dorsal line, separating the two lobes on vertex and a surface which is roughened by numerous, small, cylindrical, short, tubercles from each one of which comes a fine, curved and sometimes slightly waved, longish, white or light grey hair, these hairs being as long as the false clypeus is high; true clypeus an equilateral triangle about one-third as high as head; the false clypeus a broad band outside it, round topped, a little more than half as high as head, hardly distinguishable while the true one is very distinct; the colour either black-brown or yellowish-orange; in the latter case with a large, black, round patch, dorsolateral, just above false clypeus-apex and another filling up the eye-curve inside, the true clypeus in this latter case also nearly black; the labrum whitish, small, the ligula dark brown and shortly horse-shoe shaped; the mandibles orange with broad dark brown points; the eyes dark, four in a perfect curve, the fifth forming the centre of it, more or less, inside. *Spiracles* oval, more or less flush, light yellow in colour except that of segment 2 which is dark brown; those of segments 2 and 12 larger than the rest, the former largest. *Surface* rather oily-looking when the larva is full fed, with many more or less erect, whitish, long, fine, soft hairs, about one-third as long as greatest breadth of larva (which is at the middle), those round the anal end most numerous and longest—hairs giving the larva a slightly soft, fluffy look; there are, as usual, some transverse, parallel, depressed lines on the posterior portion of each segment. *Colour* a sort of mauve soiled orange tinged with a flush of light brown, spotted minutely and distinctly with small, circular, white points; a double, subdorsal and single supra-and subspiracular, light yellow, longitudinal line or very narrow band from head (not included, neither is the collar of segment 2) to segment 13 end, the thin dorsal line left somewhat greenish, also the spiracular regions between the lines; ventrum also glaucous green; the prolegs the same; the true legs brownish, the front pair darkest; segment 2 at sides brown crossed by the supra-and subspiracular, yellow lines; besides the above yellow lines there are, on each segment, three short, transverse, parallel, yellow lines on the hinder half of each segment 7-10 (sometimes on other segments too), placed between the transverse depressed lines, stretching from the outside one of the subdorsal longitudinal lines to the supraspiracular, longitudinal line; there is generally a rather large black, lateral patch on segment 3 and 6 nearly touching the front margins and stretching back one-third the length of segment, above touching the subdorsal outside line, below the supraspiracular line—and there may be a similar patch on some of the other front segments also. L: 35mm.; B. at middle: 7mm.—when more or less at rest.

Pupa.—The chrysalis is very like that of *Hasora alexis*, the larva of which feeds upon *Pongamia glabra*, the Indian Beech. It is of the same *shape* and colour. It is a stout pupa, more or less cylindrical from the shoulders to segment 10, thereafter decreasing in diameter to segment 13 which is rather more suddenly narrower, the cremastral segment as if stuck on to it, a broad, short triangle with an oblong apical continuation which is nearly half the breadth of the triangle base and nearly as long as that base, thickened at the extremity slightly into a knob which bears all the little suspensory hooklets which are short; this cremastral segment with the sides concavely curved and thick or deep through; underneath this cremastral segment has two extensor ridges running forward, diverging, from the oblong apical portion, one on each side, short and embracing with their extremities the somewhat heart-shaped area representing the leg-scars—the two leg-scars not being distinguishable one from the other but forming one piece raised above the surface; segment 13 is a

dorsal piece, quite as long in the dorsal line as segment 12, extending from just below the dorsoventral line on one side to the other, the ventral part hardly existing, and is in shape a convex, depressed semicircle with a rounded sinus running into it on the dorsal line of the front margin; the segment is very distinct because somewhat broadly margined with jet-black and roughened on the bordering. The front portion of the pupa, the head and segment 2 together, is broadly and somewhat convexly square in front forming the front extremity, the sides of this portion parallel and straight, the whole very little narrower than the pupa at shoulders; the eyes large and convexly prominent, the portion very slightly constricted behind them, the vertex of *head* in the same plane of ascent as segment 2 and the anterior slope of thorax, rather convex with a small, low, more or less hemispherical knob on its apex (so to speak) which knob is directed up and forwards; the frons of *head* slightly ventrally inclined; the dorsal slope of head-vertex, segment 2 and thorax, anterior portion is in a plane of 30° or less to the longitudinal axis of the pupa; the hinder margins of head and segment 2 is an absolutely straight line, neither of them curved in the very slightest degree; so that segment 2 is a perfectly parallel-sided strip, not as broad as the (as long that is) head vertex measuring along the dorsal lines; segment 2 is moderately convex transversely to the length of the pupa and very slightly perhaps also at right angles to that direction; the thorax is stout and evenly convex in all directions, highest at about two-thirds its length from front margin, whence it descends to the hinder margin which is nearly a semicircular curve (somewhat parabolic) which meets the wing line in a widely open, not deep angle of a little less than 90°; there is a slight dorsal constriction at segment 4 but no lateral constriction; the body is about the same breadth from shoulders to segment 8; the proboscis over-reaches the wing ends very slightly. *Spiracles* of segment 2 with a raised, low and short ridge behind each on surface of segment 3 and a still shorter, slightly more prominent ridge behind that; the other spiracles narrowly oval, pointed at the extremities, sloping up to the central slit from each side, not small, jet black underneath the white powdering. *Surface* of pupa is slightly shining underneath the white cereous powder, quite smooth generally and covered with somewhat sparse, more or less erect, whitish or reddish, fine hairs of the same length as those of the larva everywhere except on the wings and the segmental membranes where exposed; the front of segments 9, 10, 11 showing this membrane rather broadly; the knob on the vertex of head, the dorsal borders of segment 13, all four edges of the cremaster (broadly) and the extreme knob and ventral extensor ridges of cremaster rugose; each hair rising from a minute, brown depression. *Colour* of pupa is very light green, covered all over with a powdery, cereous, white excretion: with the following jet-black markings, a round spot at the inner margin of each eye, one-half infringing upon base of mandible; one, somewhat smaller, at the junction of base of antenna, eye and vertex of head; a similar one on dorsal line on hinder margin of segment 2, a longer one along dorsal line of thorax from front margin backwards and from hinder margin forwards, the latter shorter and rounder; the knob on head-vertex, all the spiracles including those of segment 2, the rough, broad bordering of segments 13 and 14 also jet-black. L: 24 mm.; B: 7 mm.

Habits.—The habits are very much the same as for others of the genus. The eggs, rather small for the insect, are laid singly on any part of the plant: old leaves or young shoots and generally on the undersides of the leaves or in or near the axils of the young ones, or on a point. The young larva, emerging, through the side of the egg, turns over a large portion of the end of the leaflet—always a young one—making the midrib the hinge for which

purpose it eats from the edge to the midrib at the required distance from the point in a line and fixes the part against the opposing upper-surface by silks round the edges. It generally lies on or near the midrib. This style of cell is continued throughout its life, older leaves being chosen as it gets larger and, finally, a whole leaflet being used. It wanders short distances to feed and feeds fairly constantly. It is fairly active. The eggs are very much parasitised ; the young larvæ are much preyed on by spiders and birds and by hymenopterous *Fossores*, probably *Eumenes*. The pupation, after wandering to some other plant generally, takes place in a rolled or doubled leaf with tail-attachment and the usual body-band. The foodplant of the larva is *Millettia racemosa*, Bentham, a very large and extensive climber common in the jungles of Bombay and extending to Behar and Central India where a near relative, *Millettia auriculata*, takes its place. The butterflies are plentiful enough in the Kanara District of Bombay but is very difficult to separate from *H. alexis* without actually slaying it and examining it in the hand. It has identically the same habits but is not found on the sea-coast. Neither is it particularly partial to water. Up in the Kanara Ghats it is occasionally locally extremely common and one year comes to memory in which there was not a leaf left on a single *Millettia* climber for two months on end in the hot weather. The larvæ and pupæ could be picked up in hundreds, in thousands if anybody had wanted them. Swinhoe gives the habitat of the species as Malacca, Java, Borneo, Sumatra, India, Burma, Ceylon, Andamans, Tonkin, Hongkong and the Philippines. The type came from Malacca ; it is, he says, a common species fairly well distributed all over India and Burma.

217. Hasora alexis, (*Fabricius*).—(Parata alexis according to Swinhoe and others).—(Pl. N. figs 81 ♂, 81a ♀).—Male. *Upperside* : dark olive-brown, nearly black in fresh specimens, always with a slight vinous tint ; the base of the fore wing and the basal, abdominal third of the hind wing covered with bluish-brown hairs that fade to ochreous brown later on. Cilia brown with pale tips. Fore wing with the outer margin paler than the rest of the wing ; an inwardly-oblique, shining streak of glandular raised scales below the cell ; otherwise immaculate ; there are short, brown, appressed hair over most of the wing surface and very little fringe along the inner margin. Hind wing : apex broadly dark-brown, as dark as the interior portion of the fore wing ; abdominal fold pale ; otherwise the wing immaculate. *Underside* : pale purplish-brown. Fore wing with a very dark shade in the middle from base to disc, expanding outwards, its upper, outer end paler, extended at right angles to the costa ; hinder-marginal area narrowly ochreous ; a submarginal, curved, grey-clouded fascia from costa to about middle of outer margin. Hind wing with the abdominal fold pale ; a narrow, nearly straight, discal bluish-white band with irregular ledges from the costa to the anal angle broken by the upper side of a large, anal, black patch ; a rather prominent, white, anteciliary line from the outer side of the anal, black patch becoming indistinct upwards to costa ; ground colour of both wings dull. Female. *Upperside*

more evenly coloured than in the male and browner, the base of the fore wing and the basal and abdominal third of the hind wing with the hairs a little more ochreous. Fore wing with a very minute, ochreous-white, subapical dot and two large, discal spots of which one is at the lower end of cell, the other inwards in the next lower interspace. Hind wing immaculate, the abdominal fold usually paler than in the male. *Underside*: as in the male, but the semihyaline-whitish spots of fore wing as on the upperside; the hinder marginal space whiter. Antennæ black, the crook dull-reddish inside; palpi with the third joint black, the second dull-ochreous with a few rather short, black hairs and a thin, black band on the sides; abdomen, head and thorax above concolorous with wings; below the abdomen is dull-ochreous with brownish segmental bands; pectus ochreous, legs brown above and ochreous beneath; the thorax above is covered with longish greenish-grey hairs, the abdomen has obscure, darker cross bands. Expanse 50mm.

Egg.—More or less hemispherical in *shape*: every slightly flattened on top where, in the centre, is situated the deep, circular micropyle; the greatest diameter is immediately above the base. *Surface* moderately shining and there are 16-18 meridional ribs all from the base to the edge of the micropyle-depression; these ribs all beaded and strong, the surface between them finely, transversely striate paralleledly. Diameter of micropyle-depression about 0.08mm. *Colour* pinkish, light green when first laid, finally dirty white; the ribs always white. B: 0·6mm; H: 0·4mm.

Larva.—Subcylindrical in *shape*; that is the body from segment 2 to segment 12 is circular in transverse section, though it is fattest in the middle, fining gently to both ends, the anal segment and 13 flattened more than the rest ventrally and sloping gently to extremity, finishing off in a rounded curve; segment 2 narrower and lower than head: the *head* rather small for a skipper, squarely rounded seen from in front, thick through, slightly lobed, its surface covered with minute, erect, black, and a few proportionately longish, erect, fine, light hairs; the colour yellow or fuscous-red; when yellow, a black spot including the eye-area; true clypeus equilaterally triangular, half the height of face, with the apex acute; false clypeus rather broad, forming a narrow, semiellipical arch over it, reaching three-quarters height of face; labrum half length of true clypeus, as broad as it, rusty with the front margin white; ligula kidney-shaped, rather small, the sinus moderately large blackish; mandibles blackish, their cutting edges entire; eyes: *1*, 2, 3, 4, 6, in a gentle curve, equi spaced 5 behind and nearly on a level with 4, all black on a black spot; antennal basal joint opaque white, second joint shining black, segment 2 with a dorsal, black, chitinized broad collar, greenish with a lateral, black spot: anal segment with the extremity dorsally shining chitinized black. *Surface* with segments well marked, slightly oily shining, covered with a coat of very fine, rather long (for skippers) erect, whitish hairs. *Spiracles* rather longly oval, large, and white in colour. *Colour* dark mauve on the dorsal half-somites, suffused with whitish-yellow dorsally; a dorsal pure mauve line and a more or less indistinct, subdorsal similar one; a broad, lateral, yellowish-green band bordered above and below by a white line; ventrum greenish-yellow; there may be a lateral black spot of some size on each or any of the segments 5 to 9, the ones on the middle segments generally the largest. L: 30mm. or slightly more; B: 6.25mm.

Pupa.—In *shape* transverse section circular from segment 2 to segment 12; thorax stout, convex, humped in the usual way, shoulders somewhat narrower than head, pupa decreasing gradually in diameter from shoulders to anal end with a slight constriction at base of cremaster, the cremaster small and nearly cubical; segment 13 longest dorsally, contracting to a point in spiracular region, raised along the front margin with a triangular, dorsal sinus; segment 14 with a semi-circular basal portion which also has a sinus on dorsal line; segment 2 rather long; *head* high, *i.e.*, with the irons in a plane to the longi-

tudinal axis of pupa, with a conical boss on the vertex between the very prominent eyes, pointing forwards and upwards : this boss short ; the clypeus ventral, moderately small, diamond-shaped and nearly as broad as long, between the bases of the proboscis-halves ; the ligula in continuation with it rather large, broadly oval, its two ends very pointed,3× or 4×the length of clypeus ; the proboscis reaching ends of wing, the antennæ and mid legs extending to a little over half, the fore legs to about one-third. *Surface* shining, finely and distantly transversely wrinkled, covered with more or less numerous, fine hairs, erect on the anterior part of the body, appressed on the posterior parts : ventrally these hairs are erect. *Spiracles* of segment 2 linear ; rest rather large, longish ovals, light-brown in colour. *Colour* green, generally sprinkled with white powder and with a yellowish tinge on the abdomen ; the sinuses on segments 13, 14 edged shining-black . L : 22mm ; B : 6·25mm.

Habits.—The eggs are laid singly amongst the young parts in the axils of leaves ; the larva feeds on the young leaves altogether and makes a cell by doubling the leaf or part of it from the top backwards over along the midrib. Pupation often takes place in the final cell—the leaves are, by that time, of more or less firm consistency. The larva, especially when young, is rather moth-like in its habits, being active and running out of its cell when disturbed, falling to the ground while emitting a silk; the pupa also wriggles considerably when touched. The growth of the larva is very rapid and the whole development takes about a fortnight or less from the laying of the egg to the emergence of the imago or butterfly. The butterfly is quick on the wing, flies, with a 'skipping' motion, the sound or flutter of the wings being distinctly audible at close quarters in passing ; it basks on leaves with the wings partially opened and rests on the undersides with the wings tightly closed the fore wings slightly sunk between the hind wings when in complete repose. It visits flowers but rarely and is not often seen at water. It is not averse to sunlight and frequents the more open parts of the country both in the hills and the plains from sea-level upwards in regions of heavy as well as light rainfall. The foodplant is *Pongamia glabra*, Vent. (*Leguminoseæ*), a tree of medium size growing commonly along water courses but also elsewhere and known as the Indian Beech. The habitat is given as Java, Borneo, Pulo Laut, China, India, Burma, Andamans and the species is common all over India, Ceylon and Burma and has been recorded from numerous localities.

Aurivillius says : "The type which is drawn with the description given above and with the words '*H. alexis*, ex-Museum Tottianum' corresponds almost with Cramer's and Moore's figures of *H. chromus* and, moreover, is not the species which was named *H. alexis* by Butler Jone's figures of the species in foreign museums are of no consequence. *H. Alexis*, Butler (nec Fabricius) I name *Hasora butleri*."

The figures 81 and 81a on Plate N represent the male and female of the species respectively and are moderately good though too dull and too pink in tint ; the white fascia on the underside of the hind wing of the female should not run up the inner edge of the abdominal

fold but should run down from the inner upper side of the black, anal patch to the inner margin.

218. Hasora butleri, *Aurivillius.*—(*Parata butleri* of Swinhoe, *Lepidoptera Indica*).—Male. *Upperside*: dark olive-black; base of fore wing and basal and abdominal-marginal portions of hind wing with dull ochreous-brown hairs. Cilia dark-brown at base, white or ochreous externally. Fore wing with an inwardly-oblique, glandular streak, obscured by the long hairs that cover base of wing, of laxly-raised scales below the cell; sometimes a small, semihyaline dot in interspace 2. *Underside*: much darker than in *H. alexis* and clouded with slaty-bluish. Fore wing with the hinder marginal area narrowly pale and a dark-brown shade in the middle of the wing expanding from base to disc, its upper, outer end running up towards costa; the costal space above the median vein as far as the postdiscal, transverse, purplish white band dark slate-blue with a slight lustre; a discal, very obscure, paler shade. Hind wing with a pure-white, somewhat sinuous, very clear-cut band from costa to abdominal margin broken by the upperside of a large, anal, black patch; the white band broader, much more prominent and more clearly-defined on the edges and nearer the base of wing than in *H. alexis*; the area inside the band dark steely slate-blue; a short, anteciliary, white thread from the outside of the anal black patch upwards.—Female. *Upperside* somewhat paler than in the male; the apex of the fore wing blunter; a single, small, ochreous white spot in interspace 3 a little before middle and, sometimes, another inwards in the next lower interspace. *Underside*: very slightly paler than in the male. Fore wing with the hinder-marginal space similar; both discal spots always present. Both wings with markings as in the male but the slate-blue parts duller. Antennæ black with the crook slightly ochreous beneath; palpi with the second segment ochreous mixed with brown towards tip and a thin row of longish, black hairs laterally from top to bottom; third joint black; abdomen, thorax, head brown above, the thorax with long greenish-brown hairs; below the pectus is mixed ochreous and brown, the abdomen is ochreous with brown bands; legs with whitish hairs. Expanse 38-44mm.

Both wings in this species are shorter and, therefore, comparatively broader than in *Hasora alexis*, (Fabricius).

Egg.—The *shape* of this egg is that of a low dome with a 0·1mm. wide, circular, quite flat apical area that is very slightly rugose in the centre of which is the micropyle. The *surface* is shining and sculptured with 24 meridions about half of which reach the circular apical flat space, although none of them anastomose; the ribs are low and broad, not sharp crested and are about as broad as the interspaces between them which means about 0·05mm. wide and the ribs are slightly tuberculate with minute little dots, the intervals are still more minutely punctate, rough and without cross-rays. The *colour* is honey-yellow but very pale when first laid, becoming deeper as time progresses, the apical flat surface becoming then orange; finally the whole becomes grey-blackish, ribs and all, just before the emergence of the larva but the little tubercles on the ribs stay whitish to the last. B: 0·65mm; H: 0·35mm.

The surface of the egg is very obscured by the dried spittle-like liquid in which it is deposited and this has to be picked off or washed away before a description can be properly effected.

Larva.—Is exactly like that of *Hasora alexis*, F. both in general colouring and in *shape*; the body is fat and somewhat oily-looking, thickest in the middle, decreasing very little backwards to the widely-rounded anal segment that is more than half the breadth of body at middle and overlaps the anal claspers, has its dorsal line inclined at 45° to the longitudinal axis of body when at rest and is as long as segment 12 or twice segment 13, has the distal half pale shining-ochreous with the basal half brownish-mauve like the rest of the body and is clothed with well-isolated, somewhat numerous pure white hairs

that are erect and about half the length of the segment; the shanks of the claspers are conical, short, green with the ancles hardly distinguishable from them, the feet also greenish and shortly two lobed; prolegs similar to claspers; true legs ochreous; *head* round with a slight dorsal sinus dividing it into two very broadly-rounded, slight lobes, the surface shallowly, cellularly rugose, somewhat shining and covered sparsely with fine, white hairs that are somewhat erect and some of them nearly as long as half the width of the head; colour of the head is a somewhat dull brick-red with the eye patch black as well as the whole of the upper half except laterally; the true clypeus is equilaterally triangular, the apex acute, red with upper part black, reaching rather more than one-third the whole length of dorsal line of head; the false clypeus is not easily perceptible, is also triangular, the apex acute; the labrum is dull-ochreous, soiled, shining, an oblong piece with straight front and hinder edges, as broad as clypeus at base, distally widening somewhat, the length half the width; the ligula is semicircular, the same colour as labrum and as wide or nearly so as labrum, as long as labrum, the sinus half-depth with the angle of sinus 45°; antenal, basal joint the same colour as ligula or a bit lighter, the third rather darker; the mandibles are also the same colour with the cutting edge narrowly black and quite entire; the eyes are arranged: 1 to 4 and 6 in a wide curve, all spaced equally and number 5 behind on a level with 4 and twice as far away from it as any of the others are from each other; all the eyes are black. *Surface* of body is covered sparsely with fine, short, white hairs, all erect, each from a tiny, white dot, varying from one spiracle-length to two, those round the dorsoventral margin somewhat longer and, perhaps, more thickly disposed; slightly shining (the surface), the segments quite distinct although never constricted at margins, the front margin of 14 slightly waved; segment 2 with a shining-black collar with a subdorsal, longitudinal line on the collar. *Spiracles* whitish-yellow, oval, rather pointed at both ends, about one eighth of a segment-length long and half as broad as long; those of segment 2 twice the size of the others, those of 12 hardly larger than the others. *Colour* green, suffused with brownish, darkish mauve as far down as a supraspiracular, white, longitudinal line; the whole dotted with the white dots bearing the hairs; a coal-black, lateral, round patch or spot about a third of a segment length in diameter on the front third of segments 6, 8 and 10 and sometimes, on 4 and 12 as well; finally a series of four, longitudinal, white lines that are equally spaced from and including segment 3 to 12 inclusive, the inner subdorsal, the outer dorsolateral, these latter a little broader; there is also, generally, a white or yellow subspiracular line the whole length of the body; the ventrum is green. L: 32mm; B. 6.3mm; the breadth of head is 4mm.

Pupa.—This is the exact counterpart of that of *H. alexis*, F., in general aspect. The *shape* is practically the same; the eyes prominent and rounded; a very slight boss between the eyes on frons; this frons in a plane perpendicular to the longitudinal axis of the body; segment 13 quite distinct, transversely lozenge-shaped, the front margin convex forwards, the hinder margin nearly straight with a dorsal, semicircular, small sinus in the former, this sinus thinly black bordered as well as the front margin all along; anal segment triangular with the cremaster short and long-cubical and dorsally black with the front margin also black thinly running back to the black of cremaster leaving the middle or dorsal part of margin unmarked; the suspensory hooklets are bunched at end of cremaster and short, ventrally the segment shows as a semicircular plate that is somewhat extensively produced forwards; the shoulders are somewhat prominent causing a slight constricted between thorax and the narrower segment 2; the thorax is slightly humped, broad, its hinder margin somewhat narrowly semicircular meeting the wings in a widely open, broadly-rounded, rather deep angle of about 75°; proboscis reaches ends of wings, even a little beyond as a triangular point; the mid legs reach three quarters length of proboscis, the

fore legs about half; the distal end of frons is compressed into a triangular piece by a large rounded lobe of the eye-covers on each side; the clypens is quite ventral beyond, a diamond-shaped, longitudinal piece; the ligula is a much longer, broader piece beyond reaching three-quarters the length of fore legs, also diamond shaped; the eye-crescent is a comparatively broad, perfectly shining-smooth crescent dividing off the outer third from rest. The *surface* of pupa is shining, more or less smooth on wings where the veins are obtusely prominent; the rest also nearly quite smooth except for some obscure, transverse striæ; the whole covered with fine erect, soft, slightly crinkled, white hairs (except on wings); the segments are well marked; segment 2 is a perfect transverse oblong pointed at lateral ends and about three spiracle-lengths long; the hairs are about two spiracle-lengths long. *Spiracles* of segment 2 light slits with a black surface behind on thorax; the rest are brown, thin-lipped, mouth-shaped about one-sixth of a segment-length long, situated upon slight swellings that are rather broader though hardly longer. *Colour* light, clear green throughout, covered with a white cereous powder—the spiracles brown, the black markings on thorax at spiracles and on segments 13, 14 as already described. L: 23mm; B: 6·3 mm; 6.3 m.m. at thorax, the highest part.

Habits.—The habits are somewhat peculiar as to the laying of the eggs and for a long time it was rather difficult to discover these. The butterfly is not common, that is it is not often seen and probably keeps more to the high trees than its relations, the other members of the genus *Hasora*. Its foodplant, *Derris scandens*, Bentham, of the *Leguminoseæ*, is a tall climber that grows in more or less ever-green jungles, spreading over the tops of large trees. It is easy enough to find, especially when in young leaf, these young leaves, even when fully opened, being either white or brownish-red with all intergradations. Ordinarily it somewhat resembles another climber called *Connarus ritchei* of the next family *Connaraceæ*, especially in the matter of the young leaf of the white or whitish variety. The fruit of one is a flat pod however, of the other a one-seeded, fat and somewhat woody one, always conspicuous and easy to recognise—when fruits happen to be present. After several years of trying in a more or less desultory manner, it was only the final despairing efforts that were successful as generally happens when the mind is really set upon any achievement. Several plants were discovered growing in masses on the ground where a recent clearing had been made. The bottom parts of the stems had been left when the overhead trees were cut and these sprouted producing by degrees many shoots and plentiful young leaves in the beginning of the rains and cold weather. These were assiduously visited without much result for some time. Butterflies were seen occasionally but, when that happened, no net was available. When a net was taken, there were no butterflies. A thorough search for eggs in all possible places resulted in the discovery of various specimens belonging evidently to moths. Amongst others some laid, often in pairs, on the opening leaf-buds, right in between the still hardly recognizable leaf-beginnings, immersed in a kind of spittle resembling that of certain kinds of hemipterous insect-larvae. There were a good many false alarms

and much time and work was wasted in the quest. There were various surprises but the greatest of all was when it was ascertained beyond doubt in the end by actual breeding that the spittle-eggs were those of the species sought!

The little egg-larva, immediately it emerges, is honey-yellow with a black head that leaves no doubt, from its size, as to its belonging to a skipper. It eats its way out though a hole gnawed through the top and it takes six hours or more gnawing it for the shell seems extraordinarily leathery and tough from the efforts of the strong toothed jaws or mandibles when watched. One egg that has been doused with benzine also produced a larva all right! Immediately the larva appears it starts eating into a very young, still longitudinally-folded leaf inside which it takes up its abode, eating the substance inside but not the outside cuticle. It generally changes its first skin in this original leaflet and seeks another during its second stage. This second leaf is always more advanced although very little; but the growth of the foliage is extremely rapid once the buds really begin to expand. The growth of the larva, therefore, has to be quick too for it only eats tender leaves and will not touch any that are at all hard. The normal cell would always be a leaflet (there are of course several to each leaf) folded longitudinally with the midrib as hinge but, as a rule, many of them are eaten partially by other things or get drawn together with webbing of some spider, or other caterpillar with the result that this caterpillar has to make the best of a bad job and make its house out of whatever is available. And so it happens that it is often to be found in a cluster or bunch of two or three or more leaflets joined together in the most, for it, convenient manner. The young larva is active enough but the full grown one is very lazy and slow-moving. The pupation takes place either amongst the young leaves or between two older ones or even on the ground among the fallen leaves of any plant. The caterpillars are much preyed upon by hymenopterous wasps of the genus *Eumenes* that take them away as provender for their grubs; and parasitized by *Diptera*, eaten by spiders and birds and lizards—they have many enemies. The butterfly is very strong and a powerful, wonderfully quick flier; it likes shady places in the jungles, goes little to flowers or water and rests on the undersides of leaves with its wings folded or closed perpendicularly over its back. It basks occasionally on the upper side of a leaf in the sun with its wings partially opened. The habitat is South India, Ceylon and South Burma. Swinhoe says:—"We have it from Mhow and the Khasis Hills; in the subspecies described by Frühstorfer as *bavara*, the chalybeous areas on the underside are brighter than in the examples taken further south, but they are *butleri* and not *malayana*. We have it also from Candy in Ceylon from which our descriptions are taken. We took it at Poona, Karachi and in several places about Bombay. Betham records it from the Central

Provinces, Fergusson from Travancore, Evans from the Palni Hills and Elwes from the Karen Hills."

The butterfly is probably confined to the hills and regions of heavy rainfall and the localities Poona and Karachi are probably a mistake. In Kanara District the insect is not uncommon but is certainly not found to the east where the rainfall is under 40" in the year.

Genus 13.—Bibasis.

Antennæ.—Much as in the genus *Hasora* but with the terminal portion of the club usually much more hooked.

Palpi.—As for the subfamily.

Hind tibiæ.—Not fringed but thickly scaled above and with two pairs of spurs.

Fore wing.—Vein 12 reaching costa almost opposite end of the cell; vein 5 slightly nearer to 6 than to 4; upper discocellular minute; middle and lower subequal, almost erect and in a straight line; vein 3 three times as far from base as from end of cell, 2 from 3 more than twice the distance between 3 and end of cell, 4 from the end; cell only slightly more than half the costa; outer margin longer than inner.

Hind wing.—Vein 7 nearer to 6 than to 8; discocellulars faint and slightly outwardly-oblique, the lower the longer; vein 2 closer to end of cell than to base. Wing not so broad as in *Hasora* with the lobe less conspicuous. (*Watson*).

Egg.—Larva, pupa, habits.—See under the species.

There is only a single species, characterised from all other members of the subfamily by vein 3 of hind wing originating immediately before the end of the cell; by vein 1 of the fore wing not being distorted downwards near the base and, separating it from *Rhopalocampta*, by its having vein 5 of the hind wing well-developed. In general facies the species resembles, on the upperside, *Ismene fergussoni*, but has no stigma on the fore wing in the male; it is the same deep-brown colour as that species and has the same orange fringe to the hind wing. On the underside it recalls the species *alexis, butleri, chabrona* of the genus *Hasora* in the presence of a broad, white, transverse band from the costa of the fore wing to the hinder angle of the hind wing.

291. **Bibasis sena,** Moore.—Male. *Upperside*: ochreous olive-brown, the subbasal portions of both wings slightly paler than the costa and outer margins; *cilia* grey. *Underside*: the costa itself narrowly orange; dark vinous-brown. Fore wing with a large, white patch a little beyond the middle of the hinder margin attached to a large, obscure purplish-grey patch from the costa which narrows as it touches the white patch. Hind wing with a broad, pure-white, discal band from the costa to near the hinder angle, its inner edge even and slightly outwardly curved below the costa, its outer edge somewhat diffused; the *cilia* round the anal angle ochreous and a small patch of that colour on the inner, anal edge. Antennæ black, ochreous beneath, crook pale ochreous; palpi dull ochreous with a black lateral line, third joint black; head and body above and below concolorous with the wings; legs brown, dull or ochreous beneath; tarsi and abdomen beneath orange to dull ochreous, the latter with obscure, brown and ochreous bands; tip of abdomen ochreous.—Female. Like the male above and below; the wings a little broader. Expanse of both 45mm. to 50mm. In the male the fore wing has the surface clothed with decumbent, golden-brown hairs, long on the basal areas, the outer margin broadly bare; the hind wing has

always a blackish patch from base between veins 8 and 6, reaching one-third the length of wing outwards ; the whole wing except the outer margin and above vein 8 clothed with decumbent hairs, black on the patch and outward from it, golden brown elsewhere, reddish toward anal angle. The clothing on the female is similar but not so extensive outwards ; the black patch non-existent.

Egg.—In *shape* it is like a dome, broadest immediately above the base, with a small, 7 sided, flat, apical minutely rugose space about one-eighth the diameter of the whole egg, which is limited by thin walls : from each angle of the heptagon a short ridge runs downwards for about the same length as a diameter of the heptagon or rather less : all seven being exactly of the same length, each short ridge beaded minutely ; the whole surface of the egg below the line where these short ridges end is divided up into spaces by 13 meridional ridges or ribs all starting from the base of egg and running up to the line where the 7 begin ; the tops of these ridges being all discontinuous with the 7 short ones above ; all ridges are minutely beaded ; the distance between the ribs at the middle of the egg is about five rib-thicknesses—the ribs are all thin, rather high. *Colour* when first laid a rich honey colour ; the ribs all white ; later on blotches of darker appear and the yellow becomes paler. B: about 0·7mm.; H : about 0·5mm.

Larva.—The *shape* is identical with that of *Ismene fergussoni* and the colouring of head and body very similar. *Head* much larger than segment 2 in height and width nearly about the same as the transverse section of the body at segment 5, deep in the longitudinal direction of body, very nearly round except that it is little higher than broad, the dorsal line of vertex shallowly and narrowly triangular-sinuate ; the true clypeus longly triangular, about one-third the height of head, the false clypeus outside it about half the length of face, the two difficult to distinguish one from the other, both with the apices acute ; the labrum rather small, concave in front, light red-brown ; ligula large brownish, circular with a large, triangular sinus in front; antennal basal joint white, the second soiled ; mandibles light orange with dark-brown tips, very strong and big ; eyes disposed in a curve, the 6th furthest apart, the 5th behind forming an equilateral triangle with 4, 6, black ; the colour is brick-red with the whole central portion of the face to the dorsolateral line and the lower frons, including the clypeus-area as far as the labrum black sending out a large ovoid branch to near the hinder margin of head on the vertex and about one-third of the way down ; also a thin black line widening out inside the eye-curve and a thin line along the edges of the mouth-opening ; the surface of head is shining and rather coarsely rugose and covered with many, rather minute short, decumbent, soft hairs which are easy to see against the light but not otherwise. Segment 2 greyish with a broad black, shining collar across the middle of it a short, black, dorsal band behind front margin, a transverse, black, lateral band along that margin and a short black space in front of spiracle ; the anal segment is semicircular in shape, segment 13 hinder margin, however, encroaching convexly into it dorsally (also slightly incrassated above it) so that the semicircle is narrowed dorsally, yellowish-grey in colour with a large central oval, chitinized, shining, brown space occupying nearly the whole dorsum down to the lateral region : this segment overreaches the perpendicular, short, anal claspers somewhat and there is a short, black line behind the front margin reaching down from the black dorsum to the lateral region ; true legs soiled light green, short ; prolegs similar in colour with lobed feet. *Surface* velvety, dull, covered all over with many extremely short, hardly visible, light, erect hairs except on anal flap where they are quite visible, bristle like, erect and on extreme dorsoventral margin and legs where they are also longer, light in colour, soft; there are two impressed lines parallel to each other in front of the hinder margin of each segment. *Spiracles* oval, small, with an extremely fine, shining, black border and a central, dark slit; those of segment 2 twice the size and black

those of segment 12 somewhat smaller than those of segment 2 and also inclined to be black. *Colour* of body is a watery looking soiled, very light green thickly overlaid with:—a broad dorsal, smokey-black band, well defined, reaching to the dorsolateral line and centred with two subdorsal, light-blue, well-defined (one on each side), thin lines; a bright-yellow, thin dorsolateral line flanking this band and sending a much thicker, short offshoot downwards into the posterior part of a large, oval or square, velvet-black, lateral patch occupying most of the side of each segment to the supraspiracular region and with two parallel, black streaks parallel to hinder margin of segment immediately behind it, these streaks or transverse lines reaching from the yellow dorsolateral line to just above and behind the spiracles (on segment 12 only one, coalescent with the patch and reaching below spiracle)—these streaks occupying the interspaces between the two parallel, impressed lateral lines, mentioned above, of ground colour; below the patches there is a very light-yellow band just reaching the tops of spiracles into which the patches and lines run; and a subspiracular, white band which is well-defined above and below; finally, a brick-red, dorsolateral oval spot or small patch on centre of segment 13; ventrum grey-green. L: 35mm. when moderately stretched; B: 5·5mm.

Pupa.—Very like that of *Ismene fergussoni* in *shape*; stout, the front of head perfectly square with a prominent, short, stout, rounded protuberance between the eyes in the middle of the frons, the protuberance directed upwards, a stout, humped thorax, a dorsal constriction behind it but very little lateral constriction; shoulders not prominent but quite rounded; highest point is the apex of thorax, broadest the middle of pupa though very little broader than at shoulders which, again, are not much broader than the front of pupa; dorsal line backwards from thorax convex, ventral line throughout nearly straight; diameter decreasing evenly from middle to anal end; segment 13 a transverse piece as long as segment 12 dorsally but disappearing laterally, with an impressed, dorsal, small, square sinus on front margin which is filled in solid in the middle; segment 14 with a short, solid, thick basal piece in continuation of which, very little narrower, is the base of the cremaster, a shortly transverse, thick oblong, slightly lower than segment 13 with a similar dorsal sinus on front margin, continued backwards by a down-curved, stout, longitudinally oblong piece about half the width and double the length of the basal portion, the extremity bluntly square and set with the usual hooklets. *Head* is square in front as the eyes are prominent, with the vertex above the frontal knob nearly as long as segment 2 and inclined at an angle of 70° to the longitudinal axis; the frons nearly perpendicular to that axis, the knob as thick as half its breadth; hinder margin of head is straight; segment 2 inclined at an angle of 60° or less, short, longitudinally convex as well as transversely, its hinder margin straight, thorax with its front dorsal slope at 45° to the longitudinal axis, the apex and everything evenly and broadly rounded, the apex about one-third the length of segment from hinder margin, the hinder slope, thus, about equal to the front slope in declivity, the hinder margin a quarter-circle curve meeting the wings in a very widely open, rounded angle of about 75°; and slightly raised above segment 5; segment 5 equal to 6 in length, perhaps somewhat shorter, the lowest point of pupa at hinder margin; wings quite smooth; proboscis reaching to very near ends of wings. *Surface* dull, smooth, the bevilled edges of segments 8, 9, 10 short though distinct; other segment margins clearly visible. *Spiracles* of segment 2 indicated by a slight thickening of hinder margin of segment 2 and an opposing slight tubercle (which is black) on front margin of segment 3; rest small, oval, colour of body with central, black slit. *Colour* clean, watery, light green with a lateral, black spot on segments 9-11, 4, 5; cremaster black; the whole body covered with a white, cereous excreted powderwhich leaves alarge,oval patch of the light-brown body-colour isolated on the front slope of the thorax, this patch reaching from front margin to close to apex and being slightly narrower transversely; the ground-

colour is brown here, light green everywhere else. L: 22 mm.; B: 5·5 mm.; H at thorax apex: 6·5mm. *Pupæ* are sometimes pinkish instead of greenish.

Habits.—Egg is laid on young leaves and shoots; the larva makes a little cell by turning over a triangular portion of leaf from the edge on to the top, fixing it down more or less tightly with silks all round and lining with silk inside; when full grown, doubles a leaf longitudinally along the midrib and makes a cell out of that; turns to a pupa inside the cell as often as not. Of course the leaf used is then an older one; often a very old one is chosen to pupate in. The egg is always laid singly, though often quite a number are deposited upon the same plant, an extensive climber of the moist forests of Bombay, Ceylon and Malay with hard, elliptic, pointed, shining, opposite leaves which are dark-green when old but pink or brownish-pink to green-pink when young, common in the Kanara District of Bombay near streams in the forests from sea-level upwards. Its name is *Combretum extensum*, Roxb., and it is belonging to the family *Combretaceæ*. The larva has never been found on *C. ovalifolium*, likewise a climber and common in the drier open country as well as in forests where the rainfall is heavy; neither does it feed on any other member of the family: *Terminalia*, *Calycopteris*, etc. The little larva is active enough, running into its cell with great activity when alarmed in the open, but is, nonetheless, very liable to attack from birds which account for a great number of them. The main feeding-time is at night or in the early morning. The full grown larva is much more sluggish and seldom ventures far beyond its cell for the time being. The pupa is attached strongly by the tail and has a rather loose body-band which is attached by a thread to the top of the cell by the middle and kept stretched. The butterfly is extremely rapid in its flight at all times and the males may be found haunting small glades in the forest, generally on hill-tops, in the early hours of the day before the sun becomes hot, flying in the ordinary 'skipping' way, backwards and forwards on one short beat, always returning to the same leaf to rest; at such times it sits on the top of the leaf, often with its wings half open and goes for passers-by; ordinarily the insect is not often seen and the females are not often met with. Neither go much to flowers nor are they addicted to water. Ordinarily they rest on the undersides of leaves, the wings being held closed over the back. As butterflies go, *Bibasis* is an early riser, being one of the first to appear on the wing in the mornings on the play-grounds on the tops of hills in Kanara. It comes out at 8 o'clock and remains until 9 or 10, basking on the tops of leaves and chasing other butterflies that go by; it also flies backwards and forwards just to pass the time. It is very difficult to catch on the wing but may be captured quite easily when settled as it generally choses a leaf within five or six feet of the ground for that purpose. The above habits are those of the male; the female does not bask nor does she

ever seem to amuse herself by chasing anything. The only place to catch her is at the foodplants and that will not be often; she rarely visits the tops of hills; at any rate in open spaces and is really rather hard to find. Swinhoe gives the habitat of the species as India, Ceylon; and remarks "the type male is marked Bengal; the type female, Ceylon; we have it from Sikkim, Khasia Hills, Raniket, Ceylon and Kanara; Betham records it from Matheran, Hannyngton from Kumaon, de Rhé-Philipe from Masuri, Elwes from the Karen Hills, Aitken and Comber from the Konkan, Wood-Mason and de Nicéville from Cachar."

Genus 14.—Badamia.

E. Y. Watson, in P.Z.S., January 17th, 1893, describes this as :—

Antennæ.—Short, hardly half the length of the wing with the club moderate, usually bent into a hook, sometimes only at right angles, tapering to a point.

Palpi.—As for the subfamily.

Hind tibiæ.—Fringed and with two pairs of spurs.

Fore wing.—Vein 12 reaching the costa before end of cell; 5 equidistant between 4 and 6; upper discocellular minute, lower and middle discocellulars subequal, inwardly-oblique and in a straight line; vein 3 three times as far from base of wing as from end of cell; 2 twice as far from 3 as from base of wing; cell very long and narrow, more than two-thirds the length of costa; outer and inner margins subequal; without a discal stigma.

Hind wing.—Vein 7 nearer to 6 than to 8; middle discocellular slightly outwardly-oblique; 5 well-developed; 3 from before end of cell, 2 equidistant from end of cell and base of wing; excavated on outer margin at vein 2 and produced into a prominent lobe at anal angle.

Egg, larva, pupa, habits.—See under.

The fore wing is narrow and elongated, the costa slightly arched at base; the exterior margin is very oblique and slightly convex below the apex; the cell is very long and narrow extending three-quarters of the wing....Thorax stout; abdomen rather long, attenuated with the head broad; palpi broad and flattened in front, bristly on the outer edge, third joint long, projected forward, cylindrical; fore tibiæ tufted beneath, femora slightly pilose beneath; antennæ with a lengthened club and a long pointed tip. (*Moore*).

The type species, which is the sole representative of the genus, is of very wide distribution, the series in the British Museum being from localities ranging from Australia to the N.W. Himalayas. (*Watson*).

220. Badamia exclamationis, (*Fab*).—Plate N., fig. 82 ♂, 82 ♀—Male. *Upperside*: dark-brown with a slight purple tint. Fore wing: with bluish-grey hairs at the base and out above inner margin, shorter brown hairs the same colour as the wing over its whole surface except above the subcostal vein and along outer margin: no fringe along inner margin; three semihyaline, slender, elongated spots on the disc in a nearly straight line, the first beyond base of interspace 2 against vein 3, the second in interspace 1 in the angle where vein 2 branches off, the third and innermost just above and resting on the median vein in the middle of the cell, all three rather inconstant in size and some or all may be wanting. Hind wing: without markings, the abdominal space pale and covered with long, decumbent greyish hairs which stretch up to vein 8 and with shorter hairs beyond; *cilia* dark-grey with short brown base. *Underside*: pale greyish-brown. Fore wing: the hinder, marginal space pale in the middle, a darker fascia from base outwards above the pale mark reaching two-thirds of the length of wing outwards; the spots as on the upperside. Hind wing: with a large dark-brown, anal patch and a dull whitish spot above it. Antennæ brown, speckled ochreous at the base inside; the crook reddish; palpi pale-ochreous with a black line

down the side of second joint, the third joint black; thorax above covered with long, decumbent, ochreous, grey hairs, the abdomen dark-brown with yellow segmental bands and ochreous anal tuft; beneath the thorax is grey, the legs are ochreous and the abdomen is the same as it is above.—Female. Like the male but darker above, the basal hairs more ochreous and the shorter hairs do not cover so much of the wings; the semihyaline spots are much larger, the middle one oblique, an extra streak often above the submedian vein about its middle; the hinder, marginal space on the underside of fore wing is whiter, the dark medial fascia darker. Expanse 45mm. to 60mm.

Egg.—Exactly like that of *Bibasis sena* in appearance and *shape*: dome shaped. *Surface*, transversely minutely wrinkled irregularly, very shining between 13 thin, high, triangular, minutely beaded--tuberculate, meridional ridges: the space between the ribs slightly transversely concave, the distance apart of ribs at middle of egg about ten ribwidths, at the lower edge of lid about four. *Colour* light green, the ribs white. B: 0. 5mm; B: 0. 35mm.

Larva.—Body cylindrical, very nearly the same breadth throughout; anal segment high (not applied to the surface upon which the larva is resting), rounded at extremity slightly overreaching the anal claspers, dull black with a shining black hinder margin; neck considerably narrowed, *Head* heartshaped, broader than long, rather thin through; moderately large; yellow in colour, with a broad, black band across the upper face; the top of the triangular clypeus filled in with black; an oval, black patch on each side of this central one and at the same height, these three black marks with a black eye-patch on each side forming an interrupted black band across middle of faces; surface shining with a few short erect hairs. Segment 2 a good deal narrower than the head, black with a collar of two yellow bands. *Surface* of body shining with some very minute, erect hairs; some much longer hairs, though still quite short, erect on anal margin, segments well marked with a few parallel, transverse lines towards hinder margin of each. *Spiracles* oval, black, on the yellow band, of ordinary size. *Colour* is yellow with a blue-black spiracular and dorsal band; the segments densely spotted with black and lined transversely on each segment with black; ventrum brown; legs tipped with yellow; true legs black.

Another description:—*head* yellow with the bands in the above description divided into spots: three in the upper, five in the lower. *Colour* of body bright greenish-yellow, chocolate towards bases of legs; an interrupted black, dorsal line except on segment 2; each segment with a broad, black band along front and hinder margins, broadening out spiracularly to include a white spot except on segments 2, 3, 14 and there are four, thinner, black bands on each segment parallel to the margins between the broad, marginal ones. L: 40 mm; B: 5 mm.

Pupa.—The *head* is quardate, produced between the prominent, laterally slightly flattened eyes, into a short, triangular process with a spherical knob at the end of it. Segment 2 rather short, convex, slightly constricted posteriorly; thorax humped, apex nearly perpendicularly above hinder margin; the constriction behind thorax very slight laterally, more accentuated dorsally; greatest breadth of pupa at shoulders, greatest height at apex of thorax; abdomen circular in transverse section decreasing gradually in diameter to anal end; anal segment small with a long, down-curved cremaster of oblong form; all segments very clearly marked, each slightly raised close to its front margin. *Spiracles* of segment 2 with a prominent knob-shaped process behind, a flat sunken velvety surface in front of it; others flush with surface light in colour, situated on black blotches. *Surface* shining and sparsely covered with short, erect, reddish hairs; the eyes with longer hairs; the whole covered with a white, cereous powder-excretion. *Colour* light yellowish-brown; abdomen nearly white and speckled dorsally with rather large, black spots; wing-cases with the veins marked with brown thorax, vertex of head and eyes brownish, segment 2 brown-yellow. L: 24mm.; B: 6mm.; H: 7mm.

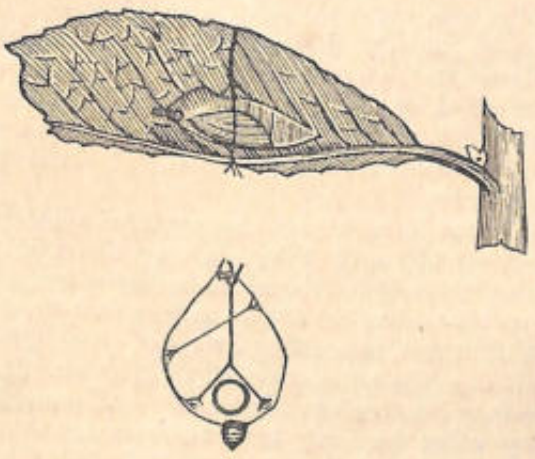
Habits.—The eggs are laid on the young shoots. The larva makes, at first, a strong, cylindrical cell by turning over an oblong strip from the edge of the leaf and fixing it down with silks on to the upper surface. The growth is rapid and the period of the pupal stage is short. The full-grown larva makes a lax cell by doubling a leaf or part of a leaf longitudinally. When ready to pupate, it wanders and changes in a very laxly made cell formed of the leaf of any plant it may select for the purpose. The caterpillars are active at all stages and drop by a silk when alarmed, running out of the cell for that purpose. Mr. G. C. Dudgeon in the Western Duars observed more closely the transformation of this butterfly which he published at pp. 144-146 of J.B.N.H.S., Vol. X, part 1, quoted below.*

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* "A hesperid larva was found on the Fagoo Tea Estate in the Western Duars at 1,500 feet elevation above the sea. It had formed the usual case or shelter by webbing the edges of a leaf together. Superficially it was somewhat like the figure of the larva of *Hasora badra*, Moore, given in Horsfield and Moore's Cat. Lep. Mus. E. I.Co., but was without the long hairs. Length rather more than an inch. Colour velvety-black with transverse patches of yellow striations on the middle of each segment divided dorsally by a black line. The segmental interspaces are yellowish and the front of each segment is black, with a lateral row of yellow spots, one on each segment, those black portions are broadest on the 2nd, 3rd, 5th, 7th, 9th and 11th segments. Head yellow-ochre with two transverse rows of rectangular, black spots, five in each row, those of the lower row being somewhat rounded and more separated; the two first of the upper row being conjoined. There is also a lower, black spot out of line on each side. The larva feeds on a species of *Ficus*, called by the Nipalese "Barrha".

Pupa formed in the same manner as that of *Rhopalocampta benjamini*, Guerin, that is to say, within a rolled-up leaf, across the inner portion of which some thick, white webs or strands of silk are stretched; round the abdomen the web is fastened in a way I did not notice before which can be seen from the accompanying sketch.

As I was fortunate enough to observe the change, I saw that although the anal prolegs of the larva were attached to a tuft or pad of silk in the usual way and remained so until the whole skin had been shuffled off, yet, when the last segment had to be taken out and the pupa drew it entirely away from the skin and lifted it over the empty skin and by a series of contortions similar to those made by an insect when depositing an egg, it soon reattached its anal segment or tail to the web, throwing away the cast-off skin by wriggling its body about. When it had first changed, most of the black markings of the larva were still present though reduced to spots, the ground-colour being dark yellowish. The head, as in *Choaspes* (*Ismene* and *Rhopalocampta* apud Watson), has a distinct knob. After a few hours, the pupa having become hardened, it is covered with a chalky white substance, leaving the first two abdominal segments only without a covering. In appearance the pupa is similar to that of *Choaspes* (*Ismene*) *gomata*, Moore; being longer than, but of a similar type to, that of *Rhopalocampta benjamini*, Guerin. The imago emerged on th 19th of May, 1895."



The butterfly is an extremely fast, powerful flier and darts about so quickly that the eye cannot follow it. The flight is up and down in jerks, the distance travelled between each being often of considerable length; but, sometimes, it is a perfectly straight line when the insect is really travelling. For, as a rule, when observed, it is put up from the underside of a leaf by the way-side to which it generally returns if allowed to do so and it is at these times that its flight may be observed. It always rests on the undersides of leaves and, invariably, when thus seated, the wings are closed over the back tightly, the fore wings being sunk far down between the hinder so that everything visible is of one uniform brown-grey colour. The insects come rarely to flowers but are sometimes found at moist places in nallas and on roads. They hardly ever bask and the females are as plentiful as the males. The foodplant of the caterpillar is mainly *Terminalia bellerica* of the family *Combretaceæ* and, in Kanara, the most southern district of the Bombay Ghats, it is often a positive pest. In some years, in certain localities, there is hardly a single Goting, (in Kanarese : Tare) that has any leaves. The caterpillars eat only the young, red, succulent leaves when beginning to expand and often completely denude the tree so that, to save themselves from starvation, they have to emigrate. This they do down the trunk and cover the surface at times so thickly that it would be difficult to touch the bark with the tip of a finger. Some idea may be formed of their numbers when it is stated that the Goting is one of the very largest and commonest trees in the forests where this phenomenon has been observed. Specimens of over 100′ in height and 6′ in diameter at breast height with a proportionate crown of leaves are of frequent occurrence. Of course, in such cases, many thousands of the larvæ must come to grief through starvation—and it is, perhaps, as well that it is so; generally, also, many more are parasitized and are thus destroyed ; birds, lizards, ants, predaceous beetles, too, no doubt take their toll. Mr. Dudgeon, in the note below, states that the larva feed on a species of *Ficus* called by the Nipalese ' Barrha.' It is more than probable that ' Barrha ' is not a fig but a member of the same family as Goting. No other foodplant has ever been observed in Bombay but *Terminalia bellerica*.

Badamia exclamationis cannot be, as a butterfly, confused with any other species ; the narrowness and length of the fore wing, the rapidity of flight, its ubiquity, the numbers of individuals occurring where it is found, its habit of sitting on the undersides of leaves along paths in the jungles, its aspect when thus at rest, resembling a note of exclamation in itself, accentuating as it does the narrowness of wing by considerably depressing the fore wings between the hinder ones—all separate it off, not only from any other butterfly but even from any other of its tribe. It does not go to flowers at all, may occasionally be seen at water and when it is ever seen sucking at anything it is at a bird-dropping or similar object on a leaf. It is on the wing principally in

the morning times from 8 until 10 and keeps to trees and herbage; it never seems to visit open hill-tops. The male occasionally basks on the upper surface of a leaf and, on such occasions, opens the wings slightly. Whether the name "*exclamationis*" originated in the largest mark on the fore wing or from the general shape of the insect it is not possible to say but a very suitable name for it was invented by a former official of the Civil Service in Kanara, namely "Papilio damn" —he said it fitted the insect and expressed one's state of mind when trying to catch it. As already stated, it is excessively strong and quick on the wing and always settles on the undersides of leaves, generally in thick places low down amongst vegetation; it gets up suddenly, darts away amongst the leaves and off into the open and—escapes. There are generally plenty of specimens and one tries again—and fails again. One out of ten is about the percentage of successes and the result is generally much bad language with very little to show for it and that, also, generally, of inferior quality for caught specimens are often much damaged. However, the insect is common and by degrees a decent series is got together. But the simplest way is to breed them; caterpillars are easy to find and in certain years very plentiful; once the foodplant is known all difficulty disappears. The habitat is the whole of India, Burma and Ceylon wherever there are jungles and hills and a fair rainfall.

The male and female are represented respectively by figures 82 and 82a on plate N. They are both too pink, the bases of the upper-sides of the wings are too dark, so is the thorax of the male; both the undersides are much too dark and the black, anal patch too prominent in the female—it is really dark brown and more diffused, the white mark above it should also be more diffuse; the light space in the middle of the abdominal (inner) marginal area is glossy-shining and not ochreous as in the picture; and that is the case in both sexes.

Genus 15.—RHOPALOCAMPTA.

E. Y. Watson gives this as :—

Antennæ.—Club moderate; about as long as the shaft, crescent-shaped, not bent into a hook, very similar to those of *Ismene* but less robust and with a longer shaft.

Palpi.—As for the subfamily.

Hind tibiæ.—With two pairs of spurs and furnished in the male with a long tuft of hairs attached close to the proximal end and reaching well beyond the distal end of the tibia

Fore wing.—Vein 12 reaching the costa before the end of cell, vein 5 nearer to 6 than to 4; upper discocellular minute, lower and middle discocellulars almost erect and in the same straight line, the lower the longer; vein 3 three times as far from base of wing as from end of cell; cell just more than two-thirds the length of costa; inner and outer margins subequal; costa evenly and gently arched, apex subacute.

Hind wing.—Vein 7 emitted twice as far from base as from extremity of cell, twice as far from 8 as from 6; discocellulars very faint, almost erect; vein 5 wanting; 3 from before end of cell, 2 from before the middle; outer margin lobed at anal angle.

Egg, larva, pupa, habits.—See below.

E. Y. Watson enumerated 18 species from Africa, the Malay Archpelago, India, China and Japan. Swinhoe gives 7 as occurring outside Africa and only 2 as Indian—occurring in India and Burma. One only of these two is found in India proper, namely *R. benjamini*.

221. Rhopalocampta benjamini, (*Guerin*).—Male. *Upperside*: dark blackish-brown with purplish hairs on the basal portions of both wings. Both wings with the cilia brown with grey tips, orange-ochreous on the hind wing from 3, increasing in width backwards and very broad at the anal angle, the colour continued still more broadly for nearly one-half up the abdominal margin which is covered with orange ochreous hairs. *Underside*: somewhat glossy and greyish-green with the veins black. Fore wing with the entire space below vein 2 brown and without gloss. Hind wing with a large, anal, orange patch limited on its upper end by a black band with a broad bar back from its middle with its lower end running outwards parallel to the outer part of the bar above it; the extreme outer edge of the orange patch has three black spots on it. Antennæ black; the palpi orange with black stripe on the outer sides, the last joint black; head and body above concolorous with the wings; head and thorax covered with dull greenish hairs; below: the pectus and lower part of abdomen orange, rest of body and legs greenish-black.—Female. *Upperside*: olive-brown, altogether of a paler and different colour to the male, the basal third of the fore wing and the basal half of the hind wing covered with bluish-grey hairs, the orange portion at the anal angle of the hind wing more limited; both wings are narrower than they are in the male. *Underside*: colour and markings as in the male but the hinder marginal space on the fore wing is usually much paler. Expanse up to 57mm.

Larva.—This has never been described but has been figured in volume XI of the *Journal of the Bombay Natural History Society*, 1897-1898, in Plate W, facing page 585, figures 30a, 30b, showing two larvæ of different colour-pattern and figure 30c, depicting the pupa. The larva is black in colour with broad yellow intersegmental (?) bands and a blue lateral spot in the middle of each segment, segments 13, 14 and the head being red-vermillion as well as apparently, the prolegs; the head has three black marks on it, one on the upper part of each lobe, the other in the clypeus or lower centre of face. That is one type of the caterpillar. In the other the intersegmental lines or bands are wanting medially which is to say only the part in the region of the spiracles and that on dorsum is left, the spiracular parts being continued into a spiracular, yellow band the whole length of the body while the dorsal part is confined to an elongated triangle of yellow on the dorsal line occupying the hinder half of each segment 3 to 13, segment 14 remaining all black, segment 2 black with a dorsal and lateral line and the blue, lateral spots are present on all segments as in the other type. L: 45mm; B: 8mm or nearly.

Pupa.—This is much of the type of that of *Ismene fergussoni* seemingly, the colour being the same with, evidently, the same covering of white powder; the general colour pinkish with a black spot under antenna on the eye and another on base of proboscis; one towards extremity of the cell of the wing; a lateral series on abdominal segments, one to each as well as a lateroventral series. The pupa seems to be peculiar in having a black, curved (backwards), erect process laterally on the front part of the thorax which is quite as long as a segment of the abdomen, a prominent, pointed, short beak to the frons between the eyes and two prominences of about the same size on the dorsal line of thorax, one behind the other, behind the middle. These thoracic prominences are, if they really exist, very unusual in hesperid pupæ; indeed they would seem to be quite nique.

The series of three papers on the *Butterflies of Mussoorie* from which the information is gathered was written by Philip W. Mackinon and Lionel de Nicéville who had the larvæ painted by Major M. Fawcett, 5th Lancers. The authors give the foodplants of the larva as *Sabia campanulata*, Wall., in Mussoorie (Masuri) and *Meliosma ungens*, Wall. Swinhœ says, quoting Mackinnon and de Nicéville in the paper alluded to but attributing it to deRhé-Philipe, probably by mistake, "Larva common at Masuri and in the Dun from March to September; feeds on *eliosma pungens* Wall. and *Sabia companulata*, Wall, both of the natural order *Sabiaceæ*. Two types of larva have been bred and are here figured. Further observations are necessary to determine conclusively whether these very differently marked (the colours in both are the same) larvæ really produce the same species of butterfly; and, if they do, if the colour is sexual."

Swinhœ gives the distribution of the insect as "Khasia Hills, Simla and Sikkim; Watson says it is common in the Nilgiris, Evans records it from the Palni Hills, Elwes from the Naga Hills, Hannyngton from Kumaon, de Rhé-Philipe from Masuri, Moore from Tenasserim and Kangra, Manders from the Shan States, Wood-Mason and de Nicéville from Cachar, Elwes and de Nicéville from Tavoy; it does not appear to have been recorded from anywhere in the Bombay Presidency."

The insect has certainly not been recorded from Bombay but it is possible it may exist somewhere at the top of the Ghats. If it does, it must be extremely local but it is a curious thing that a species of *Meliosma* is said to have been found by Dalzell in the "Konkan" of Bombay which has never since been again discovered. If the plant is really a Bombay plant, then *Rhopalocampta benjamini* may also turn out to be a Bombay butterfly.

(To be continued.)

BIRDS-NESTING WITH A CAMERA IN INDIA.

BY

CAPTAIN R. S. P. BATES.

Part III.

(*Continued from page* 105 *of this volume.*)

(*With* 6 *plates.*)

AN INDIAN HERONRY.

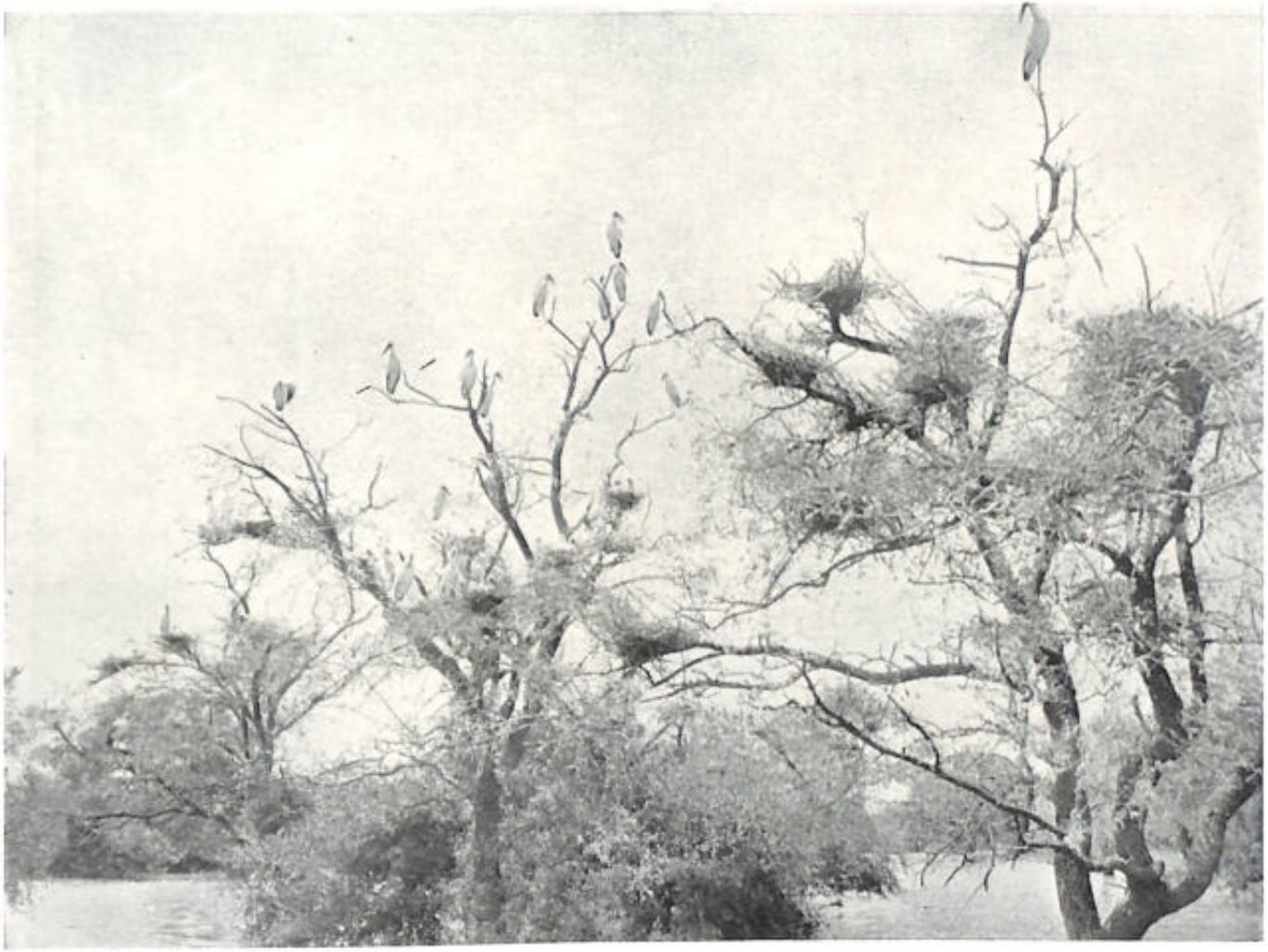
The Keoladeo Ghana in Bharatpur, whose denizens, other than the sporting birds, I am about to describe, is renowned throughout the length and breadth of India for its unrivalled duck-shooting. Few of the sportsmen, who visit it during the cold weather at the invitation of His Highness the Maharaja, are probably cognisant of the fact, that it is not a natural jhil, but a well-wooded depression, which is filled during the rains from the water collected behind a considerable dam known as the Ajan Band. In the spring and early summer its wide open spaces afford excellent pasturage for large numbers of cattle and buffaloes. There too herds of black buck are to be met with, and that strange horse like antelope, the Nilgai. Pig of course abound in hundreds, and as one would expect in such a well-populated preserve, panthers take their daily toll and have to be ruthlessly fought against that their numbers may be kept down to a minimum.

How different it is then from the reed-covered expanses of water on a certain day in the winter months, when the cries of hundreds of beaters and the shrill trumpeting of elephants mix with the whirr of startled wings and the cracks of the 50 odd guns, concealed in the scientifically scattered butts. However I am wandering away from my subject.

When rainfall has been scarce, the filling is deferred, and thus many of the early migratory water birds have already passed on and settled elsewhere. In the year 1919 however the filling was taken out of human hands, as very early in the monsoon exceptional floods burst the Ajan Band. On the afternoon of the 15th July I photographed a Bay-backed Shrike's nest in a small babool tree in an open grassy space near the centre of the Ghana. A few hours later nothing but a couple of feet of the top of the tree were to be seen. Many square miles of country had been inundated within a few hours, attended of course with much loss in crops and property entailing many hardships on the poor villagers. The water having poured in, the birds did likewise, and in an incredibly short space of time there was one area of perhaps half a square mile in extent, in which every tree and bush was thickly populated by colonies of Openbills, Herons and Egrets, White Ibis and Darters, all feverishly bent on building operations, accompanied by a perfectly deafening clamour of avian voice. Outlying hamlets there were too, but for the most part all were collected in this one area, which consisted of a half submerged wood about the centre of the Ghana.

Of these the Openbills (*Anastomus oscitans*) were probably the most numerous, and were well ahead of the others in settling down to domestic duties. The Openbill, an excellent name for it, can never be mistaken for anything else.

Jerdon's name for it was the Shell Ibis, but as it is in no way connected with the Ibises, and certainly does not resemble them in the least, it is a name to be avoided. It's main peculiarity, whence the appropriate name of Openbill is derived, is the distinct gap between the upper and lower mandibles. The bill cannot be completely closed, but only meets at the tip. At one time some



The Openbill (*Anastomus oscitans*).



The Painted Stork (*Pseudotantalus leucocephalus leucocephalus*).

writers had it, that this gap was due to attrition of the edges of the mandibles caused when breaking the hard shells of the *Ampullariæ* upon which the bird feeds. It will be noticed in the photograph that the young birds have no such space. However it now seems that it develops naturally with maturity.

The Openbill cannot be called a beautiful bird. In fact I consider it distinctly ugly and certainly most curious. It is about the size of a goose with fairly long legs. At the commencement of the breeding season the plumage is white with the exception of the primary and greater and secondary wing-coverts, which are black glossed with purple and green. The large bill is dull green and the legs and feet pale fleshy. In his second best towards the end of the season the white becomes a light smoky grey, giving him a decidedly unwashed appearance. The nest is a mere platform of sticks, and hundreds of them are to be found closely packed in a single colony, making use of trees both high and low. In this Bharatpur jhil I noticed nests both close to the water and others 30 feet or more up in the topmost branches of the trees. The eggs, from 3 to 5, were dull white, thick shelled and chalky, 2·25″ by 1·6.″

Not far behind the Openbills came the White Ibis (*Threskiornis melanocephalus melanocephalus*). These had appropriated some more or less flat-topped bushes, a few of which stood out but 2 or 3 feet from the water's surface. They had not spread themselves out so much as the former, and were all collected in perhaps a hundred yard square at one corner of the breeding ground. The photograph shows excellently how closely packed the nests were and how near to the water. It shows but a portion of the bush, on which I suppose there were at least twenty nests. I noticed that dwarf eggs were of extremely frequent occurrence, this bush producing three, all in separate nests, and one tiny little perfectly round one with a diameter of not more than three quarters of an inch.

I was at an enormous disadvantage at this time, being equipped with but an ordinary double extension quarter plate camera. I cannot but consider myself lucky that I was able to get the photos I have done, as my only method of getting those of the birds was first of all to focus the camera for a certain distance, say 12 or 18 feet, and then to get my companion to edge up the punt, from which I worked, very slowly towards the desired subject. More often than not the bird or birds would take fright when I was still about double the distance away, but after a time they certainly became more or less used to my antics and at times I was enabled to get closer even than 12 feet. The Painted Storks especially allowed of a very close approach, but of course the closer I was to my quarry, the more accurate had the focussing to be, with the result that with such a camera I had many a disappointment in the dark-room, when developing the day's work. A reflex would have been invaluable but I did not become possessed of one till the following year and unfortunately I left Bharatpur early in 1920 and have not since had an opportunity of revisiting it during the rains.

The Ibis never allowed me to get closer than 18 ft., and even then it will be noticed that many of them are on the wing. They too are not such very prepossessing looking birds, at any rate at close quarters, when the naked black face and neck devoid of feathers are to be seen. The plumage is pure white, the tertiaries slate grey, but the skin of the wing is blood red, and one gets an impression of this colour when the bird takes to flight. The bill is much curved, six and a half inches in length and black. The legs and feet are black, the latter edged with a membrane, which forms an incomplete web. During the breeding season a collar of longish white feathers grows round the base of the neck, and there are tufts on the breast. The tertiaries become elongate and loose textured, so that, when the wings are closed, it appears to have grey plumes on the lower back.

Oates in the Fauna states that the Ibises go about in colonies *except* in the breeding season. I cannot quite see what he means, as let alone the fact that they breed in colonies, I used to see large wedge-shaped flights of them passing to and fro from the feeding grounds back to the nesting sites and *vice versa*, and from the time they appeared in the district till the time they left it, wherever I met with them, they were almost always in flocks, though often small ones of but two or three pairs. A single pair was more the exception than the rule. The nest is not much of a structure, a few sticks sufficing for the 3 eggs, the number generally laid, though 2 to 5 seem to be the limits. The eggs are very chalky white, slightly greenish, in size about 2·5″ by 1·7″.

Although all the Ibis were together in one spot, yet I noticed that they appeared to be in separate communities, each one of which was at its own particular stage. For instance all the nests of one bush might contain eggs, whereas those on a bush hard by held newly hatched young ones. The members of one community appeared to have commenced operations at one and the same time. It gave one the impression that they were a sort of United States of America, each state a law unto itself. Immature birds by the way have the neck completely feathered, and the bill much shortened and not so curved as in the adults. I observed one flock of Glossy Ibis (*Plegadis falcinellus falcinellus*). On one occasion they alighted on a tree within their cousins boundary, but although I saw them feeding on many occasions within the confines of the Ghana, I was unable to trace their usual abode. There were no Black Ibis (*Inocotis papillosus papillosus*)—easily distinguishable by a large white patch in each wing,—although I noticed they were numerous in December at Kotah a few hours journey to the south.

The Herons, Egrets, Paddy Birds and Darters appeared to begin together and a few days after the Ibises. Of the *Ardeidae*, there was a most complete series—The Purple and Common Herons, the Large, Smaller and Little Egrets, the Cattle Egret, and also the Night Heron and the Pond Heron. I did not pay much attention to the last two, but noticed that there were fully fledged young about at the same time as those of the other Herons and Egrets, so concluded that they too must have begun about the same time.

Of all these the Darters alone made an attempt at forming separate communities, the others without exception having their nests indescribably jumbled together. The Common Grey Herons (*Ardea cinerea cinerea*) as a rule occupied the upper branches of the trees, the different species of Egret and the Eastern Purple Herons (*Ardea purpurea manillensis*) being somewhat lower down and more partial to the tangle of smaller branches, which occurred from about 10 ft. or so above the water. The Purple Heron was to be distinguished from the Common Heron by the red in his plumage and the slaty black lines down the sides of the neck; the different species of Egrets chiefly by their size, and the Cattle Egret in addition by the yellow beak and orange-buff head, neck and dorsal plumes; a relieving splash of colour, which appears in the breeding season. The true Egrets or White Herons are pure white birds of graceful build with very slender necks, black dagger-like bills and long blackish legs and feet. At this period too in the breeding season the "ospreys" or "aigrettes" appear, in the form of filamentous decomposed looking feathers growing from the lower back. A crest of two long and slender feathers grows downwards from the back of the head in the case of the Little Egret (*Egretta garzetta garzetta*) and both this species and the Smaller Egret (*Egretta intermedia intermedia*) have pectoral plumes also. Thus all three species are readily distinguishable apart from their size. The Large Egret (*Egretta alba alba*) has a dorsal train only; the Smaller Egret a dorsal train, and pectoral plumes; and the Little Egret, a dorsal train, pectoral plumes and a crest in addition. At the end of the breeding season these ornaments are entirely dropped.

The eggs of all the Herons and Egrets are pale blue-green ovals, there being little variation except in size. Those of the Cattle Egret average about 1·7″ by 1·3″ and are perhaps paler than those of the true Egrets. The eggs of the Large Egret measure about 2·1″ by 1·6″, of the Smaller Egret about 1·9″ by 1·4″, of the Little Egret about 1·7″ by 1·3″, of the Common Heron about 2·3″ by 1·7″, and of the Purple Heron about 2·2″ by 1·6″. The number of eggs laid by each is 3 to 5, 3 or 4, 4, 4 to 6, 3, and 4 or 5 respectively. They one and all construct mere platforms of sticks for their reception, though those of the Purple and Common Herons, especially the former, are often more substantial affairs. The newly hatched young of all these birds are covered with white down.

The Herons and Egrets were not really shy, but my efforts to get good photos of them were all brought to nought by an exasperating habit they had of walking calmly through the tangle of branches to the opposite side of the tree, whenever they saw the camera levelled in their direction.

The Indian Darters or Snakebirds (*Anhinga melanogaster*) were somewhat unpleasant customers, with which to deal. They were distinctly odiferous, and when the young birds had been hatched long enough to take an active interest in what was going on around and below them, to approach anywhere near needed considerable courage. The moment one got well beneath a tree full of them, a general panic appeared to set in. Before, I had only heard the expression "sick with fright," but these birds introduced me to the reality. One was greeted with a shower of disgorged sprats ranging from an inch to three inches in length, which pattered into the water and into the punt like hailstones. Occasionally, a large plop informed one that a youngster, anxious to efface itself completely, had dived overboard. I hardly ever saw these adventurous spirits come to the surface again, although even at this age, when they were still but black downy morsels, they were expert swimmers and divers. I was able to follow them under water occasionally, until they dived into the submerged branches of some bush, where I suppose they came up to look round, or, what is more likely, where they became entangled and were drowned. I fear they must all have met with a watery death, as they were still unable to stand upright, and I saw numbers floating dead on the surface. In fact after a time I avoided their vicinity altogether, as it was really cruel to disturb them.

Throughout the whole area Common Kites (*Milvus migrans govinda*), Brahminy Kites (*Haliastur indus indus*) and Tawny Eagles (*Aquila rapax vindhiana*) were continually on the look-out, so the moment the disgorging process commenced the air was filled with them swooping down to pick up the fish as they floated on the surface. I got quite a good snap of an immature Brahminy Kite and a Tawny Eagle flying down within a few yards of the boat. The young Brahminy Kite rather closely resembles the Common Kite, but may be easily distinguished by the rounded tail—the tails of *M. m. govinda* and *M. m. lineatus* being comparatively long and forked.

The rather fine-looking Pallas' Eagle (*Cuncuma leucorypha*) too was often to be seen, and more often to be heard, as he threw back his handsome head and laughed long and loud, a rather high pitched effort I admit, but undoubtedly a laugh. Pallas' Eagle is a great nuisance as far as the sportsman is concerned. Many a time have I seen a hard-earned teal carried away, before it could be gathered into the bag. A charge of shot may make him drop it, but not always by any means. I dropped a snipe one day and it fell certainly not more than 10 yards out from the edge of the jhil. I had stopped to reload when a swish made me look up just in time to see a Pallas' Eagle, neatly sweeping it up off the water. A round of No. 8's merely made him shake his tail and away he went with my snipe. He is a large bird with grey head and neck and is armed with a most powerful looking beak and talons. The general colour of the body and the wings is a rather dark brown, and there is a most conspicuous white bar about 4 inches

wide fairly near the end of the tail. They were much shyer than the Tawny Eagles, and never allowed me to get close enough for a photograph.

However I was talking about the Darters. Their nests were the usual platform of sticks and the number of eggs 3 or 4. These were pale bluish-green about 2·1″ by 1·4″. The Darter is a curious looking bird, but admirably fitted for its *modus operandi*. It is largely black. The tail is large and flat, the feet webbed. The neck, the upper parts of the sides of which are whitish, is exceedingly thin and flexible ; the bill, blackish on top, the lower mandible being yellowish, is as sharp as a dagger. It can swim under water with great speed and stay submerged for a considerable time, and even when swimming on the surface the top of the back alone is visible. They are often to be seen swimming this way and that with but the head and two or three inches of neck above water. In fact they are veritable avian submarines. Any thinking fish must live in mortal terror of them. For it is on fish that they live, and they catch them in two ways, either by seizing them in the bill or impalling them on its sharp point. For this latter purpose they are possessed of a most useful gadget—a permanent crick about the centre of the neck. This is really a pivot, as shown by Garrod, and by its means the bird can strike at it prey with increased force and rapidity. After fishing for some time they love to stand on a stump or on the bank with their backs to the sun, and the wings half opened. This, I presume is to thoroughly dry the feathers after prolonged submarine exploits.

I have now to describe the late arrivals. When the domestic duties of the Openbills were almost over, the Ibis were commencing to feed their new-born families, and the Egrets, Herons and Darters mostly had eggs. It was then that the Cormorants were just completing their nests, and the Painted Storks, the very latest arrivals, selecting their town-sites and still daily increasing in numbers. These two were on excellent terms with one another, and most of the Stork colonies had Cormorants living amongst them.

The Cormorants were of two species—the Indian Large Cormorant (*Phalacrocorax carbo sinensis*) and the Little Cormorant (*P. javanicus*). The former has a white patch across the throat from eye to eye. It is also considerably larger than the other species, so to separate them was not difficult. As a matter of fact there were not more than a dozen pairs of the Large Cormorant, and these had their nests all in the one tree, sharing it with a couple of pairs of Painted Storks. The Little Cormorants ran into the thousands, and were probably the most numerous inhabitants of the jhil.

The arrival of my punt was always a signal for a general hullaballoo, which fortunately subsided in a few minutes. Still during those minutes the noise of thousands of wings, and the hoarse cries of nearly every bird in the place, was almost deafening. The air used to be one mass of birds—slow flapping Herons and Egrets, languid Storks, ungainly Openbills and dark masses of scurrying Cormorants, the latter at times literally blotting out the sky.

The Cormorants eggs were inclined to be very long when compared with their width, and nests containing as many as six were quite common. They were exceedingly chalky, a layer of quite soft chalk more or less covering the blue-green of the actual shell. When the young appeared they were the quaintest objects, I have ever seen. The tops of their heads were bald, shiny and bright red, their necks very skiny, and their bodies covered with black down.

By the time the Painted Storks (*Pseudotantalus leucocephalus leucocephalus*) commenced to arrive, there was hardly a square foot of room on the trees of the main breeding place, with the result that they had to be content with outlying and somewhat scattered accommodation. This was decidedly limited, so much so that even naked and diminutive babool trees with their tops only a few feet above the surface often held as many as 7 or 8 nests. These nests were very flat and flimsy, and 2 or 2½ feet in diameter, but only the centre of the nest



The Indian Spoonbill (*Platalea leucorodia major*).



The Openbill (young) (*Anastomus oscitans*).



The Painted Stork
(*Pseudotantalus leucocephalus*[*leucocephalus*]).



The Black-necked Stork
(*Xenorhynchus asiaticus asiaticus*).



The Little Egret (*Egretta garzetta garzetta*).



The Indian Spoonbill (*Platalea leucorodia major*).



The Little Cormorant (*Phalacrocorax javanicus*).

was at all substantial, the outer 6 to 9 inches all round being but a single layer of inter-twined sticks. The eggs 3 to 5, though I seem to recollect seeing a few with 6 were pretty large white ovals, not very chalky, about 2·8″ by 1·9″. These birds were perhaps the most interesting denizens of the Ghana, and also afforded one considerable amusement. They have a curious habit of standing over the nest with wings half-opened, shading the eggs or young ones from the direct rays of the sun. A tree-full of them, all with their backs to the sun and consequently all facing in the same direction with their heads bowed down, reminded one very much indeed of a bored cricket crowd on a wet day. Another habit, the reason for which I was unable to find the solution, was that flocks of them were often to be seen at a high altitude, sailing round and round on fixed pinions in a small circle, apparently drifting aimlessly across the sky with the wind. These circling stunts were often kept up until the flock had drifted right out of one's sight.

On the whole the Painted Stork is quite a handsome bird, though the 10 inch long yellow bill, projecting from an entirely naked and yellow wrinkled face, could hardly fail to detract from any bird's appearance. The plumage is white, except for the tail and part of the wings, which are black glossed with green. The under-wing coverts and a band across the lower breast look just as if wavy irregular black lines had been painted across them. The legs and feet are brown. The young were born covered with a coarse white down, and I discovered that when deprived of the shelter of their parents' wings, even for a few moments, they very soon showed signs of great distress. The sun seemed to knock them out very easily. They appeared to be fed on fish, and I remember on one occasion, finding a youngster (in fact I have a very good photo of it), whose eyes were decidedly too big for its little mary. It was attempting unsuccessfully to swallow a half-pound lanchi, half of which was till protruding from its over-distended throat, and it appeared to be already far gone from the effects of suffocation.

The latest breeding members of all were a few pairs of Indian Spoonbills (*Platalea leucorodia major*). I only noticed three nests, but there may have been more, as they chose very leafy and flat-topped bushes or trees on which to build. Their nests were not unlike those of the Storks, thin and flat. It appeared that incubation had been commenced with the laying of the first egg, as the young were in very different stages of growth. This can be seen quite plainly in the photograph. One young one being so big and lustly that its two brothers or sisters were momentarily in danger of being crushed or suffocated.

The flat spoon-shaped bills of the adults render them absolutely unmistakable. It will be noticed that the bill of even the largest young one is neither flat nor spoon-shaped, but rather clumsy, bulbous towards the tip and distinctly bent downwards. The Spoonbills plumage is entirely white except for a patch of buff on the front of the lower neck. They have a considerable throat pouch, the skin of which is reddish-yellow. The bill except the tip which is yellowish, and the legs and feet are black. In the breeding season there is a long drooping crest of narrow pointed feathers. The Spoonbills were the sole members of the community with spotted eggs. They lay a white egg about 2·7″, by 1·8″, which is marked with ill-defined brown spots.

I have now described the breeding members of that vast community with the exception of the handsome Night Herons (*Nycticorax nycticorax nycticorax*) and the inconspicuous lazy Paddy Birds (*Ardeola grayii*). About the beginning of December a real falling off in numbers became evident, and by about half way through the month almost complete silence reigned. The place reminded one strongly of a ruined and deserted city, once thronged by a vast and cosmopolitan population. The trees were bare, many absolutely leafless and all lime-bespattered to a dirty grey.

In the course of my cruises I did of course find other nests, but as they were those of non-gregarious birds, whose nests were to be found dotted about throughout the confines of the jhil, they cannot be included in the same category, as those I have described. For instance in a small prickly bush, at the foot of a tree containing a party of Darters, was the nest of a Brown Munia containing five white eggs ; a loose domed structure, about 5 inches in diameter, of fresh grass and a few feathers with a back and front door. These little birds seem quite partial to water, and I have often found their nests in situations overhanging and quite close to its surface.

Another bird, of which I should like to say a good deal were it fitting here and whose nests were very numerous in the Ghana, was the Dabchick (*Podiceps ruficollis albipennis*). Under the Ibis colony's bushes I found two pairs nesting. What interested me about them was the lateness of their breeding, October and November. I used to amuse myself suddenly appearing close to a nest in attempts to make the owner leave the eggs uncovered. I was only once successful in this, observing that one or two hurried tugs at a pad of weeds, always kept handy, were quite sufficient to camouflage the eggs. In Kashmir I watched a bird putting the finishing touches to its nest in the Dal Lake half way through May, and at the beginning of June took many nests there containing eggs.

I have completely forgotten to make mention of a great visiting member of the community the Pelican. I made many attempts to get near these strange birds, but soon discovered that they were able to swim considerably faster than I could punt the boat through the maze of bushes and tree trunks.

There are still the hangers on too—the municipal sweepers, as it were, *i.e.*, the Kites (*Milvus migrans govinda and Haliastur indus indus*), the Tawny Eagle, (*Aquila rapax vindhiana*), and last but not least Pallas' Fishing Eagle (*Cuncuma leucorypha*). The Kites of course were not breeding at this time. The Tawny Eagle, which builds an inconspicuous nest in any fair sized tree, is rather a late breeder, and I first noticed one at work on its nest at the end of September. This was almost invisibly placed amongst the foliage at the top of a large pipal tree. I noted 3 nests of Pallas' Fishing Eagle—one was a converted Vultures' in an enormous banyan tree just outside the Ghana's official entrance, right on a main road, and practically on the outskirts of a village : a second was in the Ghana itself, a large affair high up in an enormous tree about three-quarters of a mile from the breeding ground : the third was a veritable landmark, being an enormous collection of sticks at the summit of a gaunt and absolutely leafless tree on the Ajan Band. On the 31st December No. 2 contained a pair of fairly hard-set eggs as on this day—one of the big duck-shoots—Captain Livesey, who was in the next butt to mine and had the nest almost over his head, succeeded in obtaining them. It was a difficult nest to reach and two or three volunteers or should I say aspirants for " bakshish ", failed to reach it.

I wonder if I ought to include the Dusky Horned Owl (*Bubo coromandus*) amongst the hangers-on, as they probably took a nightly toll. These fine birds invariably proclaimed their presence from sunset onwards. As a matter of fact during the rains and breeding season one often hears them calling in broad daylight. I actually investigated but one nest of this species in the Ghana, though I noticed others. It was in a very interesting situation, being in the main fork, and so only about 8 feet from the ground, of a very lonely tree at the extremity of a short band, projecting straight out into the water. It contained the usual two white eggs. I never once saw any of these birds of prey attack or attempt to steal from even the weakest members of the community, nor did I see them molested in their turn. In fact they all appeared to be tolerated, and I have a photograph of a Pallas' Eagle sitting quite unconcernedly surrounded by young Cormorants and young Painted Storks. I suppose



The Indian Snake Bird. (*Anhinga melanogaster*).



The White Ibis (*Threskiornis melanocephalus melanocephalus*).



The Sarus Crane (*Megalornis antigone antigone*).



The White Ibis (*Threskiornis melanocephalus melanocephalus*).

as long as they behaved themselves and removed the surplus food and deceased young ones, their presence was tolerated and even welcomed. Had they made nuisances of themselves, and so have become a danger to the community, they would soon have been ousted. An irate Painted Stork, let alone some hundreds of them, must be a most unpleasant opponent.

And now before I cease to tell of the Ghana, I would like to write of the Sarus Crane (*Megalornis antigone antigone*), and the Black-necked Stork (*Xenorhynchus asiticus asiaticus*), both of which bred there. Other breeding water-fowl there were in considerable number—Coots, Water-hens, Nuktas, and Spotted-billed Ducks, etc., but I never looked for nor stumbled across their nests. The Sarus I simply must mention, because every time I paid the jhil a visit, I came across them in considerable numbers, and on one occasion counted no less than 17 feeding together. The Sarus is supposed to breed during the rains. The majority may do so, but I am of the opinion, that so long as there is water about, they are not over particular about the time of the year. The nest shown in the illustration contained fresh eggs, and I took this photograph on the 7th of February. I also took another nest about quarter of a mile from the 'Heronry' in November. This was a real curiosity as no nest had been built, the eggs being laid on a layer of rushes placed on a tiny island about 4 yards in diameter—one of the island butts to be exact. After all what need was there of a nest. The usual structure is a bulky reed affair, because for protection's sake it is built up well out from the jhil's bank in the water, and to avoid the possibility of swamping in such a situation and to support so large a bird it must of necessity be big. On the 31st December one of the beaters brought in a long-legged ungainly little ball of reddy-buff down—a young Sarus hatched perhaps a week or ten days. It was just able to stand with difficulty, but could not walk. The down was creamy below, the bill pink with a yellowish tip. Here then were at least three nests in this one jhil (a very large jhil it is true), none of which were even started in the rains.

The Black-necked Stork in some ways can hardly be called a bird of the jhil. True, in a district where there is not much water, there will be no Black-necked Storks. They do not effect just one particular jhil or marsh, but each pair seems to appropriate a considerable extent of country to the exclusion of others of their species, and the nest is often some distance away from water. For instance there was a nest in a tall and half dead pipal quite close to my bungalow, and the nearest water was certainly a good mile away. Another, a landmark for miles around, being in a dead and leafless tree close to the main road to Dig. This was certainly over half a mile away from water. A third was beyond the railway station and also in a pipal, but this was in the centre of a small flooded area. These three nests formed a triangle with about a mile and a half side. I only noticed one nest of this species actually within the boundary of the Ghana. This was at the top of a perfectly enormous tree, but even so the huge proportions of the nest quite flattened its crest. Their nests are invariably colossal affairs, and must sometimes be large enough for a man to lie down on at full length quite comfortably, and, what is more, the depth of the nest is also very considerable and often not less than the breadth. However such a structure befits such a bird, the Black-necked Stork in my opinion being one of the finest and most handsome of Indian birds. The beautiful purple and green iridescent glosses of the black portions of the plumage are perfect, and both in flight and when stalking about on mother earth, the bird has a most dignified and well-groomed appearance.

(To be continued.)

NOTES AND DESCRIPTIONS OF INDIAN FISHES.

BY

HENRY W. FOWLER

OF

THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

PART II.

(*Continued from page* 41 *of this volume.*)

ARIIDÆ.

Arius malabaricus (Day). "Ettachulli."

Head 3½ to 3⅔; depth 4¾; D. i, 7; A. v to ix, 11 or 12.

Body well compressed, long and slender. Head flat below, convex above, width 1½ to 1¾ its length. Snout broadly obtuse, length ⅔ to ¾ its width or ⅞ to 2⅛ in head. *Eye*—large, hind edge of pupil midway in head, diameter 4 to 4⅔; eyelid free. Mouth broad, superiorly terminal, width 2⅔ to 2⅞ in head. Maxillary barbel reaches back far as depressed pectoral tip; outer mental barbel ⅓ to ½ in depressed pectoral; inner mental barbel reaches pectoral origin. Bands of fine teeth, moderately wide in each jaw; narrow band transversely across vomer; small patch of fine teeth on each palatine. Nostrils quite large; anterior close to front snout edge; posterior with broad fleshy flap, diameter but slightly less than pupil. Interorbital but broadly convex, 2¾ to 3 in head. Narrow fontanel extends to occipital plate. Casque and sides of head all covered with thin skin, all with more or less coarse venules, these also extend over humeral region. Occipital process and dorsal buckler form complete bony bridge. *Gill-rakers*—5×9, lanceolate, slightly less than gill-filaments or 2 in eye.

Fins—Dorsal inserted midway between snout tip and origin of adipose fin; spine compressed, front edge with 5 antrorse barbs terminally, hind edge with 6, also series of 6 smaller short close-set points on lower front edge, spine 1⅔ to 1¾ in head; first branched ray 1 to 1⅛. Adipose fin large, inserted trifle nearer base of last dorsal ray than caudal base, fin 1⅔ in head. Anal origin midway between dorsal origin and caudal base, first branched ray 1⅞ in head. Caudal well forked, long as head. Caudal peduncle well compressed, least depth 1⅝ to 1⅔ its length or 3 to 3⅓ in head. Pectoral about long as head; spine ¾ to ⅘ of fin, outer edge with 5 or 6 weak antrorse barbs terminally and 10 or 11 irregular obsolete denticles basally; inner edge of spine with 3 to 5 antrorse barbs terminally. Humeral process ⅔ length of spine. Ventral inserted little behind dorsal base, 2 in head. *Colour*—Neutral-gray above, becoming whitish below. Barbels dusky. All fins with more or less neutral dusky terminally. Four examples. 58 to 73 mm.

CYNOGLOSSIDÆ.

Cynoglossus cynoglossus (Buchanan—Hamilton). "Manthal."

Head ¾ to 4¼; depth 3⅔ to 4; D. 98 or 99; C. 10; A. 79 or 80; scales 81 to 85 in median lateral line, counted from opposite hind edge of gill-opening; 16 scales between median and upper lateral lines, 23 below at widest part of body to anal base.

Body elongately ovoid, widest at first ⅔ its length. Snout 3 to 3½ in head, measured from upper eye. Upper eye 8½ to 8¾ in head. Lips entire. Mouth cleft 3½ to 4 in head. Few small teeth developed on blind side of jaw only. Two nostrils, one between eyes at lower front eye edge, another before eye with

slight cutaneous rim. Interorbital very narrow concave groove. No gill-rakers. Scales of left side with 13 to 18 basal radiating striæ, edges narrowly scalloped; apical denticles 16 to 25, basal elements in 3 to 5 series. Scales of right side with 13 or 14 basal radiating striæ; apical denticles 19 to 22, with 3 or 4 series of basal elements. Scales 23 from rictus to hind edge of gill-opening. One lateral line on dextral side, 2 sinistral. *Fins*—Dorsal begins little before eye. Caudal $1\frac{7}{8}$ to 2 in head. Ventral largely detached from anal. *Colour*—Left side finely mottled drab-brown, showing now as obscure irregularly vertical pale streaks. Dorsal, anal, and caudal neutral-slaty, margined with pale or whitish. Inside gill-opening neutral-slaty. Eyes pale slaty-gray. Right side of body whitish, vertical fins showing dusky. Young with dorsal and anal but little darker, simply grayish. Three examples, 76 to 110 mm.

Achirus cynoglossus Buchanan-Hamilton appears to be the oldest name for this species. *Cynoglossus hamiltoni* Gunther was proposed to eliminate tautonomy.

Mugilidæ.

Mugil carinatus (Valenciennes). "Malam".

Head $3\frac{1}{3}$; depth $\frac{1}{4}$; D. IV—I, 8, i; A. III, 9; scales 37 or 38 in lateral line to caudal base or 5 more on latter; 11 or 12 scales transversely; 22 to 24 predorsal scales.

Body elongately fusiform, well compressed, edges rounded, deepest at spinous dorsal origin. Head moderate, width $1\frac{3}{4}$ its length. Snout broadly obtuse, length $\frac{2}{5}$ to $\frac{1}{2}$ its width or 4 to $4\frac{1}{2}$ in head. *Eye*—Moderate, hind edge slightly before middle in head length; $4\frac{1}{2}$ to $4\frac{3}{4}$ in head. Adipose-lid moderate, covers about $\frac{1}{2}$ to $\frac{1}{3}$ of eye. Mouth inferior, angle obtuse, width $3\frac{1}{2}$ to 4 in head; symphyseal knob single. Maxillary exposed, very narrow, reaches eye. No teeth. Transverse groove across vomer. Upper lip moderate, forms end of snout. Interorbital broadly convex, $2\frac{1}{4}$ to $2\frac{2}{3}$ in head. Preorbital narrow, edge very finely serrated, reaches slightly beyond front eye edge. *Gill-rakers*—26×40, finely lanceolate, $1\frac{2}{3}$ in eye, equal gill-filaments. Scales with 5 or 6 basal radiating striæ; 30 to 33 apical lobules, with as many radiating weak striæ; circuli fine; 6 scales between depressed spinous dorsal tip and soft dorsal origin; soft dorsal, anal and caudal finely scaled; axillary pectoral scale $\frac{1}{3}$ of fin; row of few small scales on preorbital.

Fins—Spinous dorsal origin little nearer snout tip than caudal base, first spine 2 in head. Soft dorsal origin little nearer spinous dorsal origin than caudal base, first branched ray 2 in head. Anal origin slightly before that of soft dorsal, third spine $3\frac{1}{2}$ to 4 in head, first branched ray 2. Caudal deeply emarginate, lobes pointed, equal head. Caudal peduncle compressed, least depth $1\frac{1}{2}$ to $1\frac{1}{3}$ in its length or $2\frac{1}{3}$ to $2\frac{1}{2}$ in head. Pectoral reaches slightly beyond spinous dorsal origin or about $\frac{4}{5}$ in ventral, fin $1\frac{1}{2}$ to $1\frac{1}{4}$ in head. Ventral origin about opposite tip of depressed pectoral, fin $1\frac{3}{4}$ to $1\frac{1}{2}$ to anal or $1\frac{3}{5}$ to $1\frac{3}{4}$ in head. *Colour*—Back brownish, pale to whitish below. Fins paler, narrow dusky edges on ends of dorsals and caudal behind. Slight slaty blotch at bases of uppermost pectoral rays, also inner axillary bases, at least of upper, dusky. Three examples, 126 to 134 mm.

Polynemidæ.

Polydactylus heptadactylus (Cuvier). "Neurakudigan."

Head 3; depth $3\frac{1}{3}$; D. VIII—I, 12; A. III, 11; tubular scales 45 in lateral line to caudal base and 16 or 18 more on latter; 6 scales above lateral line, 9 or 10 below; 24 to 28 predorsal scales.

Body elongately ovoid, well compressed, deepest about midway in spinous dorsal. Head width $2\frac{1}{4}$ to $2\frac{2}{3}$ in its length. Snout obtusely conic, length $\frac{2}{3}$ to $\frac{3}{4}$ its width or 5 to $5\frac{1}{2}$ in head. *Eye*—Center about first fourth in head,

length 4⅛ to 4⅓. Adipose eyelid entirely covers eye. Mouth large, inferior mandible tip opposite hind nostril. Maxillary, from snout tip, 1⅔ to 1¾ in head, expansion 1⅓ to 1¾ in eye. Teeth fine, uniform, uniserial in jaws; similar short transverse row across vomer; band of minute fine teeth on each pterygoid. Interorbital convexly elevated, with median depression, width 4 in head. Hind preopercle edge serrated, with spine below at angle. *Gill-rakers*—Finely lanceolate, 21 × 21, 1⅓ in eye. Gill-filaments ⅔ of gill-rakers. Scales with 6 or 7 basal radiating striæ; apical denticles 51 or 52, basal elements in 8 or 9 series; circuli fine. Strong spine at beginning of lateral line.

Fins—Third dorsal spine 1⅔ to 1½ in head; first branched dorsal ray 1⅔. Anal like soft dorsal; third spine longest, 3⅔ to 3½ in head; first branched ray 1⅔ to 1¾. Caudal long, deeply forked, with long slender pointed lobes 2⅓ to 2½ to caudal base. Caudal peduncle strongly compressed, least depth 1½ to 1⅔ in its length or 2 1/10 to 2⅛ in head. Pectoral reaches anal, 1 1/10 in head; filaments 7, reach soft anal origin. Ventral reaches ⅞ to 9/10 to 1 anal, length 1⅔ to 1¾ in head. *Colour*—Back olive-brown, sides and below pale to whitish. Pectoral neutral slaty-blue, filaments white. Fins all more or less dusky terminally. Iris silvery. Snout whitish. Inside gill-opening dusky. Three examples, 96 to 103 mm.

SCOMBRIDÆ.

Scomber microlepidotus Ruppell. "Ayila".

Head 3⅛; depth 4⅓; D. x—1, 10×5; A. 1, 10×5.

Body strongly compressed, fusiform. Head greatly compressed, deep, width 2½ its length, which 3⅓ in head measured from upper jaw tip. *Eye*—Large, hind edge midway in total head length. Adipose eyelid large, leaves only median third of eye exposed. Mouth inclined, moderate, lower jaw lightly protruding. Maxillary slips below broad preorbital its entire length, reaches opposite hind pupil edge, expansion 2⅓ in eye, length 2 1/10 in head measured from upper jaw tip. Single row of moderately fine short even teeth in each jaw, upper covered by tip, lower exposed. No teeth on mouth roof or tongue. Mandible 1 in head. Interorbital narrow, very slightly concave, 4⅔ in head measured from upper jaw tip. Broad preopercle flange and opercle with weak radiating striæ. *Gill-rakers*—16×34, strongly compressed, slender, ⅔ longer than gill-filaments or 3 1/10 in head measured from upper jaw tip and inner edge, of each with close-set fringe of fine setæ. Corselet distinct, rest of scales minute on trunk, mostly fallen.

Fins—Spinous dorsal inserted at first third of entire length, first dorsal spine 2⅛ in total head length. Soft dorsal inserted much nearer caudal base than eye, first branched ray 3⅔ in head. Anal like soft dorsal, opposite, first branched ray 4 in head. Caudal small, emarginate. Caudal peduncle slender, least depth about half its length or 2 in eye. Pectoral high, origin level with upper ⅔ of eye; fin 2⅓ in eye. Ventral inserted opposite spinous dorsal origin, 2⅛ in head; 2⅓ to anal. *Colour*—Back lilac brown, sides and below whitish. Iris slaty. Fins all pale brownish. One example, 117 mm.

CARANGIDÆ.

Caranx djeddaba (Forskal). "Para".

Head 3⅛; depth 3; D. VIII—1, 23; A. II—1, 20; scales 35×45, of which 7 on caudal base; 11 scales above lateral line, 19 below; 30 predorsal scales.

Body elongately fusiform, greatest depth midway in its length, strongly compressed. Head greatly compressed, width half its length, upper profile little more inclined than lower. Snout conic, long as wide or 3¾ in head, measured from upper jaw tip. *Eye*—Large, hind pupil edge about midway in total head length, diameter equals snout. Adipose-lid only covers hind third of eye. Mouth moderate, mandible protruding slightly. Maxillary inclined, end well exposed, reaches pupil, expansion 2 in eye, length 2⅓ in head measured from upper jaw tip. Teeth very small, even, uniserial, minute and in narrow band

on each palatine, none on vomer; tongue roughened with minute teeth. Interorbital convexly elevated, with median keel extending predorsally to spinous dorsal; width equals eye. Preorbital slightly wider than maxillary expansion. *Gill-rakers*—11×28, slender, lanceolate, little longer than gill-filaments or $1\frac{7}{8}$ in eye. Scales fine, well adherent, cover breast and chest; 12 to 16 series of vertical striæ each side of median axis, several innermost continuous above and below. Curved section of lateral line $2\frac{3}{4}$ in straight section; scuters of latter section enlarged, deepest 2 in orbit.

Fins—Spinous dorsal origin slightly nearer, soft dorsal origin than hind eye edge, third spine $2\frac{2}{3}$ in total head length. Soft dorsal inserted midway between mandible tip and caudal base, first branched ray half of head. Soft anal opposite soft dorsal, similar; first branched ray $2\frac{1}{3}$ in head. Caudal deeply forked, slender lobes pointed, equal head. Caudal peduncle slender, least depth 2 in its length or 2 in orbit. Pectoral long, falcate; $2\frac{1}{3}$ to caudal base, extends well beyond front of straight section of lateral line. Ventral origin opposite that of pectoral, reaches little beyond vent or $1\frac{1}{2}$ to soft anal origin, fin $2\frac{1}{10}$ in head. *Colour*—Back rather dark neutral, sides below and under surface silvery-white. Spinous dorsal tinged dusky; soft dorsal and caudal with grayish and other fins whitish. Large blackish neutral blotch on opercle above, little smaller than eye, but larger than pupil and not extending on upper portion of shoulder girdle. One example, 110 mm.

Caranx kalla Valenciennes. "Para."

Head 3 to $3\frac{1}{8}$; depth $2\frac{2}{3}$ to $2\frac{3}{4}$; D. VIII—I, 24; A. II—I, 21; scales 35 to 37×37, of which last 7 on caudal base; 11 scales above lateral line, 19 or 20 below; 20 to 22 predorsal scales.

Body elongately ovoid, greatest depth at soft dorsal origin, strongly compressed. Head greatly compressed, width $2\frac{1}{8}$ to $2\frac{1}{4}$ its length, upper profile little more inclined than lower. Snout conic, length equals width or $3\frac{2}{3}$ to 4 in head, measured from upper jaw tip. *Eye*—Large, hind pupil edge midway in total length of head; $2\frac{2}{3}$ to 3 in head measured from upper jaw tip. Adipose lid only covers hind third of eye. Mouth moderate, mandible slightly protruding; Maxillary inclined, end well exposed and reaches pupil, expansion $2\frac{1}{4}$ to 2 in eye, length $2\frac{2}{3}$ to 3 in head. Teeth in jaws very small, even, uniserial, broad areas of minute close-set ones on vomer, palatines and pterygoids; 5 parallel longitudinal broad bands of teeth on tongue. Interorbital moderately elevated convexly, with median keel extending predorsally to spinous dorsal; width $3\frac{1}{4}$ to $3\frac{1}{2}$ in head from upper jaw tip. Preorbital equally wide at maxillary expansion. *Gill-rakers*—10×27, slender, lanceolate, equal gill filaments or 2 in eye. Scales fine, closely adherent, cover chest and breast; 15 to 26 series of vertical striæ each side of median axis, several innermost continuous above and below. Curved section of lateral line $1\frac{1}{2}$ to $1\frac{2}{3}$ in straight section; scutes in straight section enlarged, deepest 2 in orbit.

Fins—Spinous dorsal origin slightly nearer soft dorsal origin than hind eye edge third spine $2\frac{3}{4}$ to 3 in total head length. Soft dorsal inserted midway between mandible and caudal base, first branched ray $1\frac{2}{3}$ to 2 in head. Soft anal opposite soft dorsal, similar, first branched ray $2\frac{1}{2}$ to $2\frac{1}{2}$ in head. Caudal deeply forked, upper lobe much longer; slender pointed lobes equal head. Caudal peduncle slender, least depth half its length or half of orbit. Pectoral reaches $2\frac{1}{4}$ to caudal base or fourth to sixth scute in straight section of lateral line. Ventral origin opposite that of pectoral, reaches slightly beyond vent or slightly less than half way to soft anal origin, fin $1\frac{1}{2}$ to $2\frac{2}{3}$ in head. *Colour*—Back rather dark neutral tint, sides below and lower surface silvery white. Dorsals and caudal tinged with grayish, other fins whitish. Large blackish blotch on opercle above, with good portion extending also over on shoulder-girdle above, whole but less than eye. Two examples, 97 to 101 mm.

Besides the character of the large dark opercular blotch this species differs from *Caranx djeddaba* in the slightly wider naked predorsal area and greater curvature of the lateral line. Except for the small ventral Day's figure agrees in most respects.

Caranx oblongus Valenciennes. "Valodu."

Head $2\frac{3}{5}$; depth 2; D. VIII—I, 22; A. II—I, 17; scales 57 × 37 in lateral line, of which last 7 on caudal base.

Body rather deeply ovoid, strongly compressed, predorsal and orbital keel strong. Head greatly compressed, deep, upper profile little more inclined, width $2\frac{3}{4}$ its length. Snout conic, width $1\frac{1}{4}$ its length, which 3 in head measured from upper jaw tip. *Eye*—Large, center very slightly advanced in total head length, $3\frac{1}{8}$ in head. Maxillary well inclined, rather large, reaches eye, expansion 2 in eye or $\frac{3}{4}$ of preorbital width, length 3 in head. Teeth fine, very small, in bands in jaws, on vomer palatines and tongue. Mandible protrudes, 2 in total head length. Interorbital, convexly elevated, with median keel rising up in front to spinous dorsal, width 4 in head measured from upper jaw tip. Cheek and opercle smooth. *Gill-rakers*—9×24, lanceolate, equal filaments or $2\frac{1}{4}$ in eye. Scales fine, closely adherent, none on breast or subpectoral region; cycloid, with 17 to 20 series of vertical striæ each side of median axis, several innermost may more or less converge and join. Scutes of lateral line not enlarged, straight section $\frac{3}{4}$ of curved.

Fins—Spinous dorsal inserted slightly nearer beginning of straight section of lateral line than mandible tip; third spine 3 in total head length. Soft dorsal origin midway between front eye edge and caudal base; first branched ray $1\frac{5}{8}$ in head. Caudal well forked, slender lobes even, $1\frac{1}{2}$ in head. Caudal peduncle small, slender, least depth half its length or $2\frac{1}{2}$ in eye. Pectoral equals head, reaches straight section of lateral line. Ventral inserted opposite pectoral origin, reaches $\frac{3}{4}$ to soft anal. Latter opposite soft dorsal, first branched ray 2 in head. *Colour*—Brown on back, silvery white below, opercle neutral above. Iris silvery white. Fins all pale. Dorsal and caudal little grayish. One example, 93 mm.

LACTARIIDÆ.

Lactarius lactarius (Schneider). "Adavu."

Head $2\frac{1}{2}$ to $2\frac{2}{3}$; depth $2\frac{2}{3}$ to 3; D. VIII—I, 21 or 22; A. III, 25 to 27; scales 70 (pockets) in lateral line to caudal base.

Body ovoid, well compressed. Head deep, strongly compressed, width $2\frac{7}{8}$ to 3 in its length. Snout conic, length $\frac{4}{5}$ to $\frac{5}{6}$ its width or 4 in head measured from upper jaw tip. *Eye*—Large, hind pupil edge slightly before middle in total head length, $3\frac{1}{3}$ to $3\frac{4}{5}$ in head measured from upper jaw tip. Mouth large, greatly inclined. Maxillary reaches opposite middle of eye, expansion $1\frac{2}{3}$ to 2 in eye, length 2 to $2\frac{1}{8}$ in head. Mandible well protruding, $1\frac{7}{8}$ to 2 in total head length. Teeth uniserial and uniform in jaws, also pair of wide-set canines above and small one symphyseal. Vomer with Λshaped row of small teeth. Interorbital convexly elevated, width $3\frac{2}{3}$ to 4 in head measured from upper jaw tip. Superciliary and frontal ridges parallel, latter higher. Preorbital less in width than maxillary expansion. *Gill-rakers*—3×12, lanceolate, little longer than gill-filaments or 2 in eye. Scales very caducous, all having fallen.

Fins—Spinous dorsal inserted much nearer mandible tip than caudal base, second spine $2\frac{5}{6}$ to $3\frac{1}{8}$ in total head length. Soft dorsal inserted midway between eye center and caudal base, first branched ray midway between hind eye edge and caudal base in younger, $2\frac{3}{8}$ to $2\frac{2}{3}$ in head. Anal origin midway between front eye edge and caudal base, slightly more advanced in younger, third spine $4\frac{2}{3}$ to 5 in head, first branched ray $2\frac{1}{2}$ to $2\frac{2}{3}$. Caudal strongly forked, slender lobes pointed, $1\frac{1}{4}$ to $1\frac{2}{3}$ in head. Caudal peduncle strongly compressed

least depth $1\frac{1}{5}$ to $1\frac{1}{4}$ in its length or $3\frac{4}{5}$ to $4\frac{1}{8}$ in head. *Colour*—Brown on back, sides and below silvery to whitish. Fins pale, dorsals and caudal tinged brownish. Deep brown blotch about size of pupil, on opercle above and another at upper end of opercular flap. Iris silvery-white, also sides of head and abdomen. Three examples, 84 to 113 mm.

LEIOGNATHIDÆ.

Secutor ruconius (Buchanan—Hamilton). "Chakkara mullan."

Head 3 to $3\frac{2}{3}$; depth $1\frac{2}{3}$ to $1\frac{3}{4}$; D. IX, 15, i; A. III, 14, i or iii. 15, i; scales 50 in median lateral series to caudal base and 4 more on latter; tubes in lateral line 18 to 20.

Body deeply ovoid, strongly compressed, edges trenchant. Head strongly compressed, width $2\frac{1}{3}$ to $2\frac{2}{3}$ in its total length. Snout obtuse, long as wide, length $3\frac{1}{4}$ to $3\frac{1}{2}$ in head measured from upper jaw tip. *Eye*—moderate, about midway in head length, $2\frac{2}{3}$ to $2\frac{1}{2}$ in head. Mouth superiorly terminal. Maxillary 2 to $2\frac{1}{3}$ in head. Teeth very minute, obsolete, in narrow band apparently only in upper jaw. Nostrils close together, above and level with front eye edge, posterior vertical slit, larger. Interorbital elevated, $3\frac{1}{4}$ to $3\frac{2}{3}$ in head. Lower preopercle edge finely serrated, serræ becoming obsolete behind. *Gill-rakers*—6×17, lanceolate, slightly less than gill-filaments or $\frac{1}{3}$ of eye. Scales very caducous, most all fallen.

Fins—Spinous dorsal inserted behind pectoral base, second spine $1\frac{2}{3}$ to $1\frac{4}{5}$ in total length. Second anal spine $2\frac{1}{3}$. Caudal well forked, lobes pointed, equal head Caudal peduncle compressed, least depth 1 to $1\frac{1}{5}$ in length or 1 to 2 in eye. Pectoral $1\frac{1}{3}$ to $1\frac{1}{4}$ in head. Ventral $2\frac{1}{3}$ to $2\frac{4}{5}$. *Colour*—Dull brownish generally sides of head and costal region silvery-white. About dozen vertical dark brown streaks on back, irregular or some broken into spots. Dusky streak from lower front eye edge to mandibular articulation. Fins all pale. Dark brown line along dorsal bases. Two examples, 51 to 73 mm.

POMADASIDÆ.

Pomadasis hasta (Bloch). "Kurukuruppan."

Head $2\frac{2}{5}$ to $2\frac{3}{5}$; depth $2\frac{1}{3}$ to $2\frac{4}{5}$; D. XII 13; A. III, 6 or 7; scales 43 to 45 in lateral line to caudal base and 6 to 8 more on latter; 4 scales above lateral line, 12 below; predorsal scales 23 or 24.

Body ovoid, back elevated, well compressed. Head width 2 to $2\frac{1}{5}$ in its length. Snout obtusely convex, length $\frac{2}{3}$ or $\frac{4}{5}$ its width or $3\frac{1}{2}$ to $4\frac{1}{3}$ in head measured from upper jaw tip. *Eye*—moderate, hind edge midway in head length, diameter $3\frac{2}{3}$ in head. Mouth superiorly terminal, upper jaw slightly protruding, moderate. Maxillary entirely ensheathed above by preorbital, reaches about opposite front pupil edge, $2\frac{4}{5}$ to $2\frac{7}{8}$ in head, expansion 2 to 3 in eye. Bands of fine uniform teeth in each jaw, none on mouth roof or tongue. Nostrils rather large, close together; front one circular and at last third in snout; hind one close before front eye edge. Interorbital broadly and slightly convex, 5 in head. Preopercle edge serrate, serræ coarser at angle. Suprascapula serrate. *Gill-rakers*—6×12, lanceolate, $1\frac{1}{3}$ in gill-filaments or $2\frac{1}{4}$ in eye. Scales with 8 or 9 basal radiating striæ; apical denticles 23 or 24, basal elements in 3 or 4 series; circuli fine.

Fins—Fourth dorsal spine $1\frac{1}{2}$ to $1\frac{2}{3}$ in total head length. Third dorsal ray $1\frac{7}{8}$. Second anal spine $1\frac{2}{3}$ to $1\frac{3}{4}$, second anal ray $1\frac{1}{4}$ to $1\frac{7}{8}$. Caudal truncate, $1\frac{1}{3}$ to $1\frac{1}{4}$ in head. Caudal peduncle well compressed, least depth $1\frac{1}{5}$ to $1\frac{1}{4}$ its length or $3\frac{2}{5}$ to $3\frac{4}{5}$ in head. Pectoral $1\frac{1}{10}$ to $1\frac{1}{5}$. Ventral $1\frac{2}{3}$ to $1\frac{3}{4}$, reaches 1 to $1\frac{1}{2}$ to anal, spine $1\frac{1}{3}$ to $1\frac{1}{2}$ in fin. *Colour*—Back pale brownish generally, with 7 obscure saddle-like blotches of about same tint. Most fins, except white ventrals, more or less dusky terminally. Round blackish blotch on opercle above, little less than eye. Dusky spot in pectoral axil. Three examples, 49 to 54 mm.

SCIAENIDÆ.

Johnius miles (Lacépède). "Korakulti."

Head 2⅔ to 3; depth 3⅓ to 3⅗; D. x, 1, 26, i or 27, i; A. II, 7, i; tubular scales in lateral line 46 to 49 to caudal base and 4 to 7 more on latter; 5 scales above lateral line, 7 or 8 below; 26 or 27 predorsal scales.

Body elongately ovoid, well compressed. Head width 1⅞ to 2⅛ in its length. Snout obtusely convex, length ⅔ to ⅘ its width or 3⅖ to 3¾ in head. *Eye*—moderate, superior, center at first third in head. Mouth inferiorly terminal, rather large. Maxillary entirely ensheathed above by preorbital, 2⅛ to 2⅖ in head, expansion 1⅔ in eye, reaches opposite ⅓ of eye. Bands of fine teeth in jaws, upper forward teeth little enlarged as single outer row, also lower inner row slightly enlarged. No teeth on tongue or mouth roof. On each side of mandibular symphysis below 2 pores, outer larger. No barbel. Nostrils close together before front of eye; front one pore; hind one short slit close on front eye edge. Interorbital broadly convex, 2⅞ to 3⅛ in head. Bones of head cavernous. Preopercle edge rather weakly serrate, with slightly larger spine at angle. *Gill-rakers*—6×15, lanceolate, ¾ of gill-filaments or half of eye. Scales with 9 or 10 basal radiating striæ; apical denticles 23 to 27, basal elements in 6 or 8 series; circuli fine. Tubes of lateral line posteriorly, with few slight branches.

Fins—Third dorsal spine 2⅔ to 2⅗ in head. Second dorsal ray 2⅛ to 2⅖, second anal spine 2¾ to 2⅘. Third anal ray 1⅞ to 1⅞. Caudal with median rays prolonged to point, 1 to 1⅛ in head. Caudal peduncle well compressed, least depth equals its length. Pectoral 1⅔ in head. Ventral ⅔ to ⅘ to anal, 1½ to 2 in head, spine 1⅔ to 1⅞ in fin. *Colour*—Brownish generally, sprinkled with minute dots over back and sides. Spinous dorsal dusky black and soft dorsal and caudal dull brown with gray tint. Other fins pale. Ventral with some dusky dots terminally. Inside gill-opening dusky. Two examples, 87 to 94 mm.

Sciaena macroptera (Bleeker). "Korakulti."

Head 3⅔; depth 3½; D. x, 1, 31 i; A. II, 7, i; tubular scales in lateral line 45 to caudal base and 6 more on latter; 4 scales above lateral line, 8 below; 26 predorsal scales.

Body elongately ovoid, strongly compressed, deepest about middle of spinous dorsal. Head width 1⅘ its length. Snout obtusely convex, length ⅖ its width or 3½ in head. Snout obtusely convex, length ⅖ its width or 3½ in head. *Eye*—small, center at first third in head length, diameter 4½. Mouth inferiorly terminal, rather large. Maxillary entirely ensheathed above by preorbital, 2⅛ in head, expansion 2 in eye and reaches opposite hind pupil edge. Broad bands of uniform fine teeth in jaws, outer upper and inner lower rows slightly enlarged. No teeth on tongue or mouth roof. Short fleshy barbel at symphysis, about ⅛ of eye, with 2 pores each side and one in front, outermost largest. Front nostril midway in snout length, hind one larger, vertical, close before front eye edge. Interorbital broadly convex, 3 in head. Bones of head cavernous. Preopercle flange and edge rather firmly membranous, edge with feeble serræ. *Gill-rakers*—5×7, lanceolate, half length of gill-filaments or ⅓ of eye. Scales with 10 or 11 basal radiating striæ; apical denticles 31 to 40, basal elements in 5 to 7 series; circuli fine. Tubes of lateral line with 3 or 4 short accessory branches.

Fins—Third dorsal spine 2⅔ in head. Third dorsal ray 2⅛. Second anal spine 2⅔. Second anal ray 1¾. Caudal with median rays prolonged to point, 3 in combined head and trunk. Caudal peduncle well compressed, least depth equals its length or 3⅔ in head. Pectoral 1⅔ in head. Ventral reaches half way to anal, 1⅔ in head, spine 1⅔ in fin. *Colour*—Rather warm brownish above, sprinkled with minute dark dots over back and side. Spinous dorsal dusky black

other vertical fins grayish, darker terminally. Pectoral pale. Ventral with dusky dots terminally. Inside of gill-opening tinged with dusky. Opercle olive-brown, darker than rest of head. One example, 89 mm.

DREPANIDÆ.

Drepane punctata (Gmelin). "Payindi".

Head $2\frac{1}{4}$; depth $1\frac{1}{8}$; D. VIII 21, i; A. III, 17, i; tubular scales 45 in lateral line to caudal base; 16 scales above lateral line, 26 below to soft anal origin.

Body greatly compressed. Head width $2\frac{1}{3}$ its length. Snout obtuse, width $1\frac{1}{2}$ in its length. *Eye*—elevated, hind edge slightly advanced from middle, diameter $3\frac{1}{3}$ in head. Mouth small, gape short. Maxillary well inclined, $3\frac{1}{3}$ in heads. Lower jaw little shorter than upper. Teeth fine, in narrow bands in jaws. Nostrils rather small, together, close before middle of front eye edge. Interorbital $3\frac{3}{4}$ in head, superciliary edge with 3 small denticles. Row of 6 median small occipital denticles. Lower preopercle edge with 8 denticles. *Gill-rakers*—2×6 short weak points, about $\frac{1}{6}$ of gill-filaments, which equal eye. Scales largely adherent cycloid, with 2 or 3 basal radiating striæ; concentric striæ complete, 22 or 23. Lateral line well arched, largely parallel with upper profile.

Fins—Third dorsal spine $1\frac{3}{4}$ in head. Eighth dorsa ray $1\frac{3}{5}$. Second anal spine $2\frac{2}{5}$. Sixth anal ray 2. Least depth of caudal peduncle $3\frac{1}{2}$. Caudal length $1\frac{1}{10}$. Pectoral $1\frac{1}{2}$. Ventral 1, spine slightly less than half of fin. *Colour*—General color pale brown, dusted with minute dark dots. Fins neutral-dusky, pectoral pale. One example, 46 mm.

SCORPÆNIDÆ.

Gymnapistes dracæna (Cuvier). "Thumba".

Head $2\frac{1}{3}$ to $2\frac{1}{5}$; depth $2\frac{2}{3}$ to $2\frac{1}{3}$; D. III, IX, 7 or 8; A. III, 6; tubes 22 or 23 in lateral line to caudal base and 1 more on latter.

Body ovoid, elongate, strongly compressed, deepest at ventral origin. Head width 2 to $2\frac{1}{10}$ in its total length. Snout obtuse, length $\frac{1}{2}$ to $\frac{2}{3}$ its width or $4\frac{3}{4}$ in head measured from upper jaw tip. *Eye*—elevated, hind edge midway in head length, $3\frac{3}{8}$ to $4\frac{1}{4}$ in head. Mouth moderate, mandible well protruded. Maxillary reaches $\frac{2}{3}$ in eye, expansion $1\frac{2}{3}$ to $1\frac{1}{2}$, length $2\frac{1}{3}$ to $2\frac{1}{2}$ in head. Bands of minute fine teeth in jaws, on vomer and palatines, none on tongue. Interorbital convex, equals snout. Front preorbital spine short, hind one long or $\frac{2}{3}$ to $\frac{3}{4}$ of eye. Opercular spine nearly long as orbit. *Gill-rakers*—5×13, short, clavate, about $\frac{1}{3}$ of gill-filaments, which half of eye. Scales very small, rather sparse on trunk, not extending on predorsal, chest or belly and few on head; each with 5 radiating basal striæ; circuli about 15.

Fins—Third dorsal spine $1\frac{3}{4}$ to 2 in head. Second dorsal ray $1\frac{2}{3}$ to 2. Third anal spine 2 to $2\frac{1}{3}$. Second anal ray $1\frac{2}{3}$ to 2. Caudal peduncle compressed, least depth equals its length or $3\frac{3}{4}$ to 4 in head. Caudal truncate, $1\frac{1}{2}$ to $1\frac{2}{3}$. Pectoral 1 to $1\frac{1}{10}$. Ventral $1\frac{1}{3}$ to $1\frac{1}{2}$, reaches soft anal origin, spine $\frac{3}{4}$ to $\frac{4}{5}$ fin length. *Colour*—Gray brown with irregular darker blotches on back and upper surfaces. Lower surfaces pale to whitish. Caudal whitish, with 3 gray submarginal transverse streaks. Other fins all more or less neutral black terminally, though basal half of ventral whitish. Black blotch on spinous dorsal from six to eighth spines. Soft dorsal nearly black. Iris slaty. Length, 41 or 42 mm.

(To be continued.)

THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By Colonel W. H. Evans, D.S.O., R.E., F.Z.S., F.E.S.

(*Continued from page 96 of this Volume.*)

Part VI.

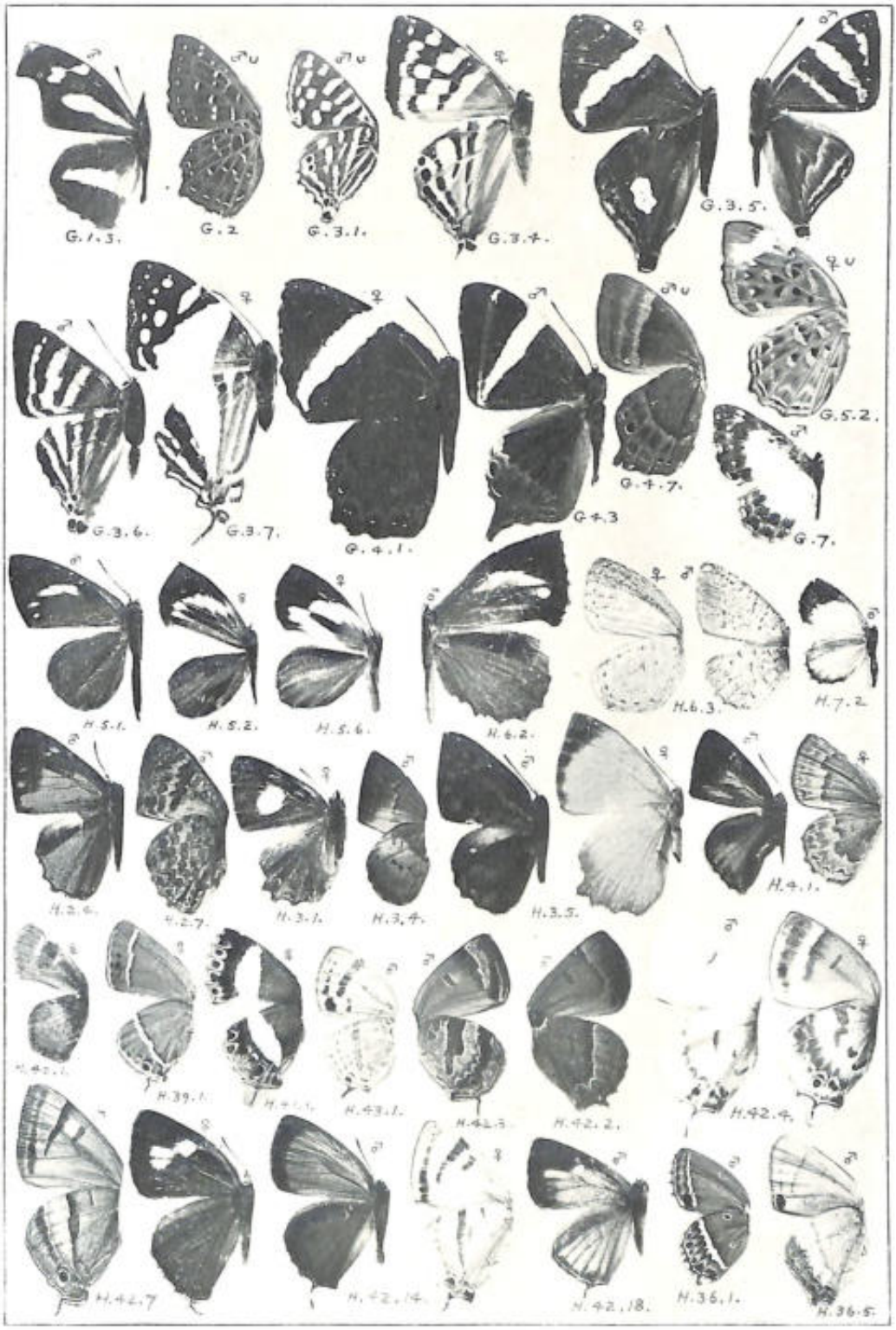
(*With 2 Plates*).

G. Erycinidæ.—The Erycinids. Key to Genera.

1 (2a). Palpi porrect and enormously long, like a beak or snout.
Libythæinæ. Single genus *Libythea, E.* The Beaks. (Plate 26).
2a (1). Palpi small, do not project beyond face.
Riodininæ.
2b (4a). H. precostal from origin of v8.
2 (3). H vs. 6 and 7 from upper end of cell ; 3 and 4 from lower end cell. F lower end dcv at origin v3. H not lobed. Eyes smooth.
Zemeros, Bdv. The Punchinello. (Plate 26).
3 (2). H vs 6 and 7 forked after end cell ; v3 from before end cell. F end dcv after origin v3. H produced and lobed. Eyes hairy.
Dodona, Hew. The Punches. (Plate 26).
4a (2b). H precostal from after origin v8 ; vs 6 and 7 forked after end cell. v3 from before end cell. F end dcv after origin v3.
4b (7). H v8 long, ends beyond origin v6 ; v7 to apex.
4c (6). No ♂ brand.
4 (5). H cell long and narrow at base ; scv and mv convergent at base. Eyes hairy.
Abisara, Fd. The Judies. (Plate 26).
5 (4). H cell short and broad at base ; scv and mv parallel ; scv parallel to v8, sharply angled opposite precostal. Eyes smooth.
Taxila, Db. The Harlequins. (Plate 26).
6 (4c). ♂ F dorsum much bowed, covering a brand uph on a nacreous area below costa. ♂ ♀ dcv H at right angles to vs 4 and 6, not inclined as usual.
Laxita, But. The Red Harlequin.
7 (4b). H v8 very short, ends before end cell ; v7 very short also and ends long before the apex. Base cell as in No. 5. Eyes hairy.
Stiboges, But. The Columbine. (Plate 26).

G.1. Libythea.—The Beaks. (Plate 26).

1a (4). Upf prominent ochreous streak in cell from base.
1 (2a). Upf ochreous spot in 1. All ochreous markings very broad. H costa concave before apex and termen concave below apex.
celtis, Fuess. (45-50). The European Beak. Chitral. NR.
2a (1). Upf no ochreous spot in 1. H costa and termen straight on either side of apex.
2 (3). Upf ochreous spot beyond cell streak quadrate, separate or only joined to cell streak by a narrow neck.
α. Upf cell divided in 2 before end cell ; all apical spots white. Uph white quadrate spot mid costa.
lepita lepitoides, M. (45-50). The Common Beak. Ceylon. S. India. NR.
β. Upf cell streak not divided ; lowest apical spot ochreous. Uph rarely with white quadrate spot mid costa.
lepita lepita, M. Kashmir—N Burma. C.
3 (2). Upf ochreous spot beyond cell oval, joined to spot end cell, making an even edged continuous club shaped streak.
α. Above ochreous markings F and H narrow ; upf apical spots white. Uph band not to dorsum.



G. **Erycinidae.** H. 1-3. *Poritiinae*: H. 4-6. *Gerydinae*.
H. **Lycaenidae**. H. 37-43. *Thecla Group*: H. 36. *Ilerda*.

G.1. Libythea—(*contd.*)

myrrha rama, M. (45-55). The Club Beak. Ceylon. C.

β. Above ochreous markings slightly wider. Upf usually 2 apical spots white and lower 2 ochreous.

myrrha carma, Fruh. S. India. C.

γ. Above ochreous markings wide. Upf all apical spots yellow. Uph band to dorsum.

**myrrha sanguinalis, Fruh.* Kulu—Burma. C.

4a (1a). Upf no ochreous streak from base cell.

4 (5). Upf dark brown, white spot end cell and mid 2 as well as the usual apical spots; uph narrow macular white band. In ♀ the markings above are tinged ochreous.

narina rohini, Mar. (50-55). The Whitespotted Beak. Assam—Burma. R.

5 (4). Above pale blue with fuscous margins, unspotted except at apex. In typical form the fuscous margins and apex upf are broad, with the apical spots sharply marked.

geoffroyi alompra, M. (50-60). The Blue Beak. S. Burma. R.

v. hauxwelli, DeN. Upf the fuscous margin and apex narrow; apical white spots obscure, but all markings showing through from below. R.

G.2. Zemeros.—The Punchinello. (Plate 26.)

Above purple brown with small white spots. In DSF the white apical spots are enlarged.

**flegyas indicus, Fruh.* (35-40). The Punchinello. Mussoorie—Burma. VC.

G.3. Dodona. The Punches. (Plate 26).

1a (6a). Unh 2 small black spots just before the apex.

1b (5). Upf spotted, not striped.

1 (2a). Upf an ochreous bar end cell, as well as a bar in cell and beyond. No tail. Above dark brown with prominent ochreous spots on upf.

**durga,* Koll. (30-40). The Common Punch. Kashmir—Nepal. VC.

2a (1). Upf no ochreous bar end cell.

2b (4). Above dark brown; uph markings obscure.

2 (3). H not tailed. Below markings narrow; unf costal spot and white bar end cell usually separate, if joined, costal spot shifted in. Unh pale bands narrow and of equal width.

α. Smaller and paler. Uph ♂ unmarked; unh markings very obscure. ♀ below markings yellow.

dipæa nostia, Fruh. (35-40). The Lesser Punch. Murree—Kumaon. R.

β. Larger, darker. Above markings ochreous. Below markings much more developed and white.

dipæa dipæa, Hew. (40-45). Sikkim—Assam. R.

γ. As last, markings very small. Below reddish ochreous, clear white narrow markings; unh lobe divided by an ochreous line.

dipæa dracon, DeN. N. Burma. VR.

3 (2). H tailed. Below markings broader; unf costal spot coalesced to bar end cell. Unh silver bar through mid cell and bar before apex wide, wider than the other markings.

α. Small. Upf in ♂ spots whitish.

eugenes eugenes, Bates. (35-40). The Tailed Punch. Murree—Kumaon. NR.

β. Larger and darker. ♂ upf spots ochreous and unf basal and central markings pale yellow.

eugenes venox, Fruh. (40-45). Sikkim—Assam. NR.

4 (2b.) Uph reddish ochreous in ♂, yellow in ♀, with dark bands. Upf black, bases dark ochreous brown, large reddish ochreous spots in ♂, yellow in ♀. Below ferruginous brown.

G. 3. Dodona—*(contd.)*

**egeon, Db.* (45-50). The Orange Punch. Nepal—Karens. R.

5 (1b). Upf striped, orange band in ♂, white in ♀ ; discal band from mid costa to tornus. Unf bands very obscure and highly irregular. No tail.

α Paler. ♂ upf orange discal band very wide, wider than the black bands on either side. ♀ white band even edged to the spot in 1, which is shifted out.

ouida phlegra, Fruh. (40-55). The Mixed Punch. Mussoorie—Nepal. NR.

β. Darker. ♂ discal band narrow ; ♀ irregular, spot in 1 small.

**ouida ouida, M.* Nepal—Karens. NR.

6a (1a). Unh no black spots just below apex.

6 (7). Above orange banded. Below pale yellow with narrow black bands. No tail.

α. Upf base dark ochreous brown.

* *adonira adonira, Hew.* (40-50). The Striped Punch. Nepal, Sikkim-Assam. R.

β. Upf base black. Below dark bands are brown and unh with prominent silver stripes.

adonira argentea, Fruh. N. Burma. (Fruh). VR.

7 (6). Above very dark brown, with a white band across both wings ; apex F white spotted. H with long tail.

α. Above white band narrow = ⅓th wing and upf spot beyond cell small and obscure ; marginal and submarginal spots diffused.

deodata, longicaudata, DeN. (40-50). The White Punch. Assam. VR.

β. WSF ♂ white band = ⅓rd wing and upf spot beyond cell and spot in 3 sharp and prominent, remaining apical spots obscure. WSF ♀ white band very broad and white spot beyond cell extending to costa ; uph base white striped. ♂ DSF bases F and H white striped. ♀ DSF almost entirely white.

* *deodata deodata, Hew.* Shan States—S. Burma. R.

G.4. Abisara.—The Judies. (Plate 26).

1a (4a). Upf prominent broad, pale band from mid costa across end cell, or just beyond, to tornus.

1 (2a). H slightly produced at v4. Above dark brown, ♂ with yellow band upf, which is white in ♀.

* *fylla, Db.* (50-60). The Dark Judy. Mussoorie—Burma. C.

2a (1). H with long tail at v4, tipped white. Above brown, band white.

2 (3). Upf no prominent white spot at upper end of postdiscal dusky pale line ; discal band always slightly sinuous.

α. Small. Upf discal band narrow and constricted at ends.

neophron neophronides, Fruh. The Tailed Judy. Sikkim—Nepal. NR.

β. As last, but larger.

neophron neophron, Hew. (50-55). Assam—N. Burma. NR.

γ. Upf band not constricted at upper end.

neophron gratius, Fruh. Karens—S. Burma. NR.

3 (2). Upf prominent white spot at upper end of postdiscal pale dusky band. Very like last.

α. Small and dark. Upf bands narrow and constricted at ends.

chela chela, DeN. (45-50). The Spot Judy. Sikkim—Assam. VR.

β. Larger and paler. Upf discal band absolutely straight, expanding to costa and spreading slightly along costa, edges pale yellow, especially at costa ; meets postdiscal band at v1. Uph marginal markings small and discal line evenly zig-zagged throughout.

**chela kalawna, Evans.* (50-55). Kalaw, S. Shan States. VR.

4a (1a). Upf pale band, if present, well beyond end cell.

4 (5a). H with a long tail at v4, tipped white.

α. Upf and Uph a narrow white discal band ; upf dusky pale postdiscal line meets discal band at v1. Above bright maroon.

savitri attenuata, Tyt. (50). The Malay Tailed Judy. Manipur. VR.

G. 4. Abisara.—(*contd.*)

β. Above dark ferruginous brown; upf 2 pale dusky parallel bands. Below bright ferruginous.

savitri savitri, Fd. (50-55). Mergui. VR.

5a (4). H may be angled or produced at v4, but never with a white tipped tail.

5b (8). Uph at most a single pale brown discal band. Above purple brown or maroon. Uph discal and postdiscal bands separate throughout.

5 (6a). Upf the discal and postdiscal band divergent to costa, never parallel.

a. Wsf ♂ very uniform above, dark and brilliantly purple shot; discal band upf nearly straight. DSF smaller and only slightly different. ♀ band pale brown throughout.

echerius prunosa, M. (42-50). The Plum Judy. Ceylon—Palnis. C.

β. Smaller and paler, less brilliantly shot. DSF sharply marked and ♂ above outwardly paler; discal band upf more angled. ♀ often with upper part of the discal band white upf.

echerius suffusa, M. (40-50). Kanara—Himalayas. C.

γ. Unf discal band always white at upper end and angled in middle. ♀ upf discal band always white at upper end in WSF. Very variable and seasonal forms sharply marked as in last.

echerius angulata, M. (40-45.) Assam—Karens. C.

δ. As last but discal band upf is usually white at the upper end. Darker.

echerius abnormis, M. (40-50.) Dawnas—S. Burma. C.

η. Much larger. ♂ upf and unf discal band never white, very broad unf. ♀ upf bands very broadly white at upper end and highly angled.

echerius bifasciata, M. (50-55). Andamans and Nicobars. NR.

6a (5). Upf discal and post discal bands parallel, never angled, though may be evenly curved. Unh discal band very even.

6 (7). ♂ above bands visible. ♀ unf bands separate throughout.

a. Larger. ♂ upf bands diffuse and not paler at upper end. ♀ upf bands broad, diffuse and white.

**kausambi paiones, Fruh.* (42-46). The Straight Plum Judy. Manipur—Tavoy. R.

β. Smaller. ♂ upf bands prominently paler and wider at upper end. ♀ bands whiter.

kausambi kausambi, Fd. (42-46). Mergui—S. Burma. R.

7 (6). ♂ above very dark rich purple brown, unmarked; Unf bands narrow, plumbeous. ♀ upf a sharply defined white pre-apical patch uniting the bands at their upper end.

kausambioides, DeN. (40-45). The Malayan Plum Judy. Mergui—S. Burma. R.

8 (5b). Above ochreous red; F. and H with inwardly black edged narrow, macular, discal bands and subterminal white line. Uph no black spots at apex as usual.

burnii, DeN. (40-45). Burns' Judy. N. Burma. VR.

G5. Taxila.—The Harlequins. (Plate 26).

1 (2). Unf discal band of inwardly black edged metallic blue spots in a regular line. Unh postdiscal band of similar spots regular and prominent. ♀ upf apical white patch crossed by ochreous veins.

thuisto sawaja, Fruh. (35-45). The Lesser Harlequin. Karens—S. Burma. NR.

2 (1). Unf spot in 3 of discal band pushed out. Unh postdiscal spots obscure. ♀ upf white apical patch diffuse and not crossed by ochreous veins.

**haquinus fasciata, M.* (45-55). The Harlequin. Assam—Burma. N & R

G.6. Laxita.—The Red Harlequin.

♂ above dark brown, outer ⅓ F and apex H red; upf large white patch mid dorsum. ♀ upf outer ½ rosy red. Below rosy red with irregular metallic blue and black markings; bases yellow; apex F yellowish in ♂, rosy in ♀.

telesia boulteri, Fruh. (45-48). The Red harlequin. Mergui. VR.

G.7. Stiboges.—The Columbine. (Plate 26).

Above transparent white, with white spotted dark brown border.

Apex F pointed in ♂, very rounded in ♀.

**nymphidia, But.* (35-45). The Columbine. Bhutan—Burma. VR.

H. Lycænidæ.—The Blues. Key to genera.

1a (5a). H v8 abnormallyshort—½ length of v1 F and only extends half way along v7 H; traces of pcv present. Antennæ club gradual, cylindrical. Eyes and Palpi smooth. F vs 5 and 6 close and 7 and 6 from a point. H tornus rounded, no lobe or tail; termen may be produced at v4.

Poritiinæ. The Gems.

1 (2a). F vs 8 and 9 absent; 11 and 12 touch. ♂ uph tuft over brand in cell against scv just before middle and a 2nd tuft near base.

Cyaniroides. DeN. The Emerald.

2a (1). F v8 or both 8 and 9 present; 11 and 12 anastomosed.

2b (4). F v9 absent.

2 (3). ♂ uph brand above v7 covered by an erectile tuft of yellow hairs also a recumbent tuft of black hairs along the dorsum from near the base.

Poritia, M. The Gems (Plate 26.)

3 (2). ♂ uph 1st brand and tuft as in last; a small obscure brand at end cell uph above origin v4, overlying which there is an insignificant tuft of recumbent dark hairs.

Simiskina, Dist. The Brilliants. (Plate 26).

4 (2b). F v9 present. No brand or tuft in the Indian form.

Deramas, Dist. The Bluejohn. (Plate 26).

5a (1a). H v8 normal, nearly or quite equal to v1 F; no signs of pcv.

5b (8a). Legs abnormal. Antennæ club gradual and cylindrical. Eyes smooth; palpi smooth and very long, 3rd joint as long as 2nd. F vs 11 and 12 separate; 7 and 6 forked; 5 mid 4-6; 9 present and 8 absent. H tornus rounded, no tail or lobe; termen may be produced at v4.

Gerydinæ. The Brownies.

5c (7). Legs very long, tarsi abnormal.

5 (6). Legs, 1st joint of tarsi elongated, compressed and flattened. ♂ upf v4 thickened at base (except one species); sub-anal abdominal tufts and clasps of ♂ very long and thin.

Gerydus, Bdv. The Brownies. (Plate 26).

6 (5). Legs, 1st joint of tarsi elongated, but cylindrical.

Allotinus, Fd. The Darkies. (Plate 26).

7 (5c). Legs short, tarsi normal, but tibiæ outwardly incrassate.

Logania, Dist. The Mottles. (Plate 26).

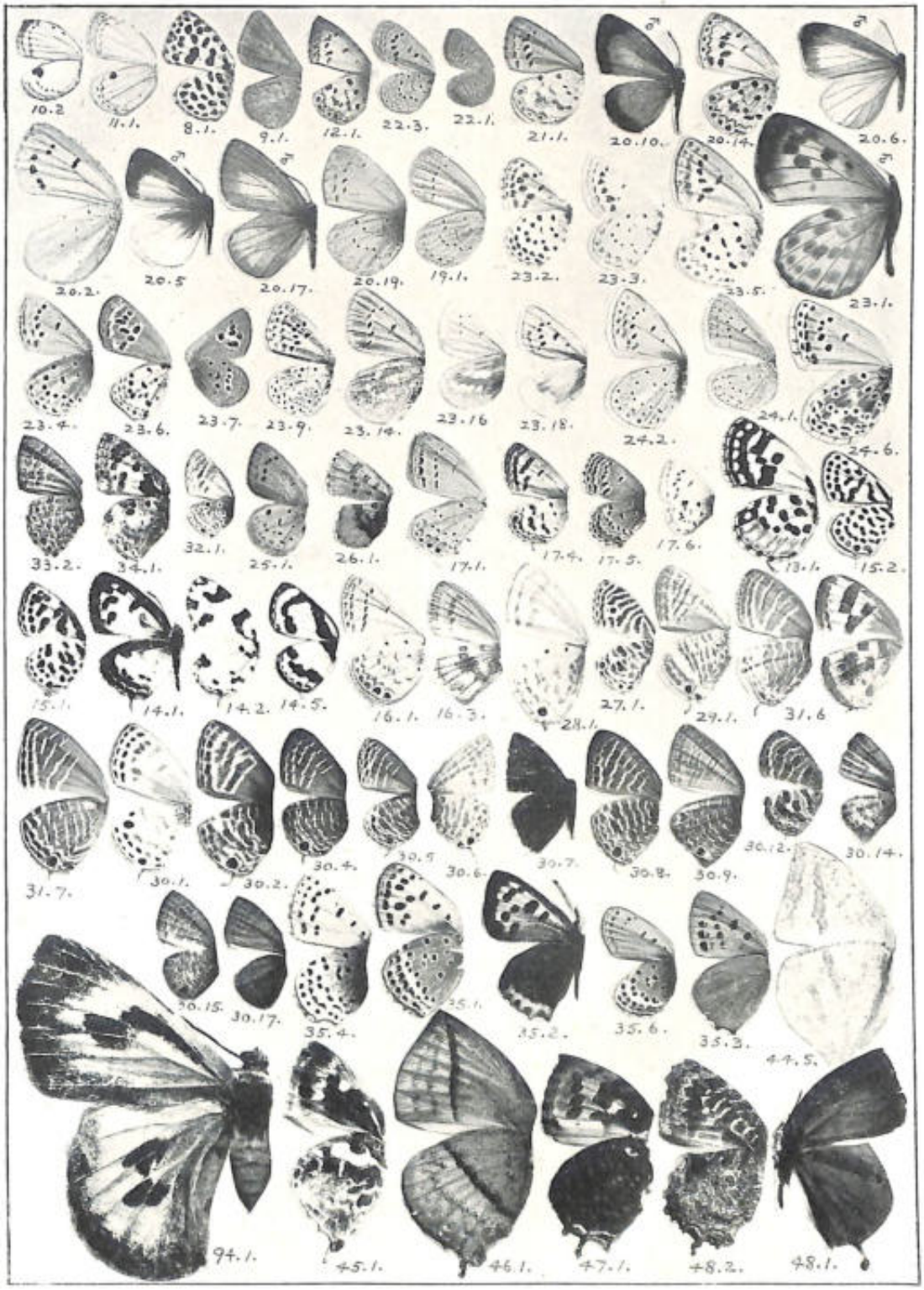
8a (5b). Legs normal (except No. 8).

8b (37a). Antennæ club flattened and spatulate or hollowed beneath (except Nos 8 and 9). F v5 mid 4-6; 8 absent, 9 present. H rounded or produced with or without a short filamentous tail at v2.

Notes.—The arrangement of the *Erycinidæ* is much as usual; many authors call them the *Nemeobidæ* or the *Riodinidæ*.

The only new name is *Abisara chela kalawna* (G. 4, 3) for a very distinct race that I found flying at Kalaw in February.

The following are new to the Indian Empire; *Abisara savitri* (G4.4) and *Laxita telesia boulteri* (G. 6), both caught by Mr. Cooper in the cold weather of 1921-22.



H. Lycaenidae. H. 8-35. *Lycaeninae*: H. 44. *Curetis*: H. 45-48. *Amblypodia Group*: H. 94. *Liphyra*.

H. Lycænidæ—(*contd.*)

Lycæninæ. The Weak Blues.

8c (10a). Antennæ club gradual, cylindrical and not hollowed beneath Eyes and palpi smooth. F vs 11 and 12 wide apart; 7 from well before 6. H rounded, tailless.

8 (9). Forelegs with tibiæ thickened. F v9 from mid 7.

Taraka, Doh. The Forest Pierrot. (Plate 27).

9 (8). Legs normal. F v9 from before mid 7. Apex F pointed in ♂.

Spalgis, M. The Apefly. (Plate 27).

10a (8c). Antennæ normal for group see 8b.

10b (35a). F origin v10 nearer origin v11 or mid 11-7.

10c (24a). Eyes smooth, tornus evenly rounded, never produced.

10d (18a). Palpi smooth (except one species of No 17).

10e (12a). F costa highly and evenly arched throughout; vs 6 and 7 separate. H tailless.

10 (11). F vs 11 and 12 anastomosed.

Pithecops, Hors. The Forest Quakers. (Plate 27).

11 (10). F vs 11 and 12 wide apart and parallel.

Neopithecops, Dist. The Quaker (Plate 27).

12a (10c). F costa straight or only slightly arched, more prominently so at the base than elsewhere.

12b (14a). f vs 6 and 7 approximate at their origins.

12 (13). F vs 11 and 12 free, though close. Tailed or tailless.

Megisba, M. The Malayan. (Plate 27).

13 (12). F vs 11 and 12 anastomosed. Tailed.

Talicada, M. The Red Pierrot. (Plate 27).

14a (12b). F vs 6 and 7 wide apart at their origins.

14b (17). F vs 11 and 12 free, though often close and even touching.

14c (16). Below with prominent basal markings.

14 (15). F end v11 well beyond end cell.

Castalius, Hub. The Pierrots. (Plate 27).

15 (14). F end v11 opposite end cell.

Tarucus, M. The Blue Pierrots. (Plate. 27).

16 (14c). Below markings normal, *Lycæna*-like, no basal markings.

Euchrysops, But. The Plains Cupids. (Plate 27).

17 (14b). F vs 11 and 12 anastomosed. Mostly tailed.

Everes, Hub. The Tailed Cupids. (Plate 27).

18a (10d). Palpi hairy (faintly so in some species of *Chilades* and *Zizera*, while individuals and those from certain localities have them quite smooth).

18b (20a). F vs 11 and 12 anastomosed. Tailless.

18 (19). Habitat palaearctic.

Cupido, Schrank. The Cupids.

19 (18). Habitat N. E. India.

Bothrinia, Chapman. The Hedge Cupid. (Plate. 27).

20a (18b). F vs 11 and 12 not anastomosed, but usually more or less bowed towards one another and frequently touching in No. 22. Tailless.

20 (21-23). Fly high along hedges and bushes. Habitat palaearctic and Indo-Malayan.

Lycænopsis, Fd. The Hedgeblues. (Plate 27).

21 (20, 22, 23). Fly high on lime bushes. Habitat Indo-Malayan.

Chilades, M. The Limeblue. (Plate 27).

22 (20, 21, 23). Fly slow and low on grass.

Zizera, M. The Grassblues. (Plate 27).

23 (20-22). Fly fast and low over meadows and in the open.

Lycæna, F. The Trueblues. (Plate. 27).

24a (10c). Eyes hairy.

24b (31b). Palpi hairy

H. Lycænidæ—(*contd.*)

24c (27a). Tailless (also some species of No. 30). F vs 6 and 7 separate.
24 (25a). F vs 11 and 12 well separated. Very like *Lycæna*.
Polyommatus, Lat. The Meadowblues. (Plate 27)
25a (24). F vs 11 and 12 anastomosed.
25 (26). H costa rounded.
Una, DeN. The Una. (Plate. 27).
26 (25). H costa straight and apex sharp pointed.
Orthomiella, DeN. The straightwing Blue. (Plate 27)
27 a (24c). Tailed (except some species of No. 30).
27b (30). F vs 11 and 12 free, though close.
27 (28a). H rounded. F vs 6 and 7 separate.
Syntarucus, But. The Zebra Blue. (Plate 27).
28a (27). H produced.
28 (29). F vs 6 and 7 separate.
Catachrysops, Bdv. The Forget-me-not. (Plate 27).
29 (28). F vs 6 and 7 close together at origins.
Lampides, Hub. The Peablue. (Plate 27).
30 (27b). F vs 11 and 12 anastomosed; 6 and 7 separate.
Nacaduba, M. The Lineblues. (Plate 27).
31a (24b). Palpi smooth. F vs 6 and 7 separate.
31 (32. 33a). F vs 11 & 12 well separated, but joined by a short spur. Tailed.
Jamides, M. The Ceruleans. (Plate 27).
32 (31. 33a). H vs 11 and 12 anastomosed. H produced; tailless.
Azanus, M. The Babul Blues. (Plate 27).
33a (31. 32). F vs 11 and 12 free and separate.
33 (34). H with cilia prolonged into short, very fine tails at vs 1, 2 and 3.
Lycaenesthes, M. The Ciliate Blues. (Plate 27).
34 (33). H produced, but tailless.
Niphanda, M. The Pointed Pierrot. (Plate 27).
35a (10b). F origin v10 much nearer 7 than 11; 7 and 6 from a point: 11 & 12 free. Eyes smooth. Palpi hairy. Tailed or tailless.
35 (36). F v12 ends before end cell.
Heodes, Dalman. The Coppers. (Plate 27).
36 (35). F v12 ends after end cell.
Heliophorus, Geyer. The Sapphires. (Plate. 26).
37a (8b). Antennæ club gradual and cylindric (except No. 81).
37b (94). Body normal, slender, comparatively robust. Usually tailed and lobed, the tail being wider than in the *Lycæninæ*. F v8 usually absent and v9 usually present.
Theclinæ. The Strong Blues.
37c (44a). Palpi hairy and H with a more or less well developed lobe at tornus and usually with a tail. F vs 11 and 12 free; 5 and 6 separate.
Thecla Group. The Hairstreaks.
37d (40a). F vs 8 and 9 absent.
37e (39). No tail.
37 (38). No lobe. No brand.
Neolycæna, DeN. The Persian Hairstreak.
38 (37). H lobed. ♂ upf an oval brand at upper end of cell, which distorts v7 at its base, causing it to rise well before the end of the cell; in ♀ vs. 6 and 7 from a point.
Callophrys, Billberg. The Tailless Hairstreaks.
39 (37e). Tailed. ♂ brand and venation as in last.
Strymon, Hub. The White-line Hairstreaks. (Plate 26).
40a (37d). F v9 present, v8 absent. Nearly always a tail at v2.
40b (43). F v7 ex 6.

H. Lycænidæ—(*contd.*)

40 (41a). H costa straight ; F termen angled in middle ; H lobed, tailless. ♂ uph brand base v7 and unf a tuft of hairs mid dorsum.

Listeria, DeN. Lister's Hairstreak. (Plate 26).

41a (40). H costa and F termen evenly convex. ♂ no brand.

41 (42). F v9 from half way along v7. H v3 from end cell. Tailed.

Euaspa, M. The Water Hairstreak. (Plate 26).

42 (41). F v9 from much nearer base v7 ; H v3 from before end cell. All except one species tailed.

Thecla, F. The Hairstreaks. (Plate 26).

43 (40b). F vs 7 and 6 from a point. Tailed.

43a (43b). H tailed at v2 and costa rounded.

Chætoprocta, DeN. The Walnut Blue. (Plate 26).

43b (43a). H not tailed, produced and lobed at v1, above which dorsum is concave. Costa straight, apex right angled and termen concave below apex.

Amblopala, Leech. The Chinese Hairstreak.

44a (37c). Palpi smooth (except No. 80).

44 (45a). F v7 ends on termen in ♂ and ♀ ; 5 and 6 wide apart ; 11 and 12 separate ; 7 and 6 separate ; H no lobe or tail, but wings may be highly angled. Eyes hairy.

Curetis Group. *Curetis, Hub.* The Sunbeams. (Plate 27).

45a (44). F v7 ends on termen in 1st 2 genera only, but 5 and 6 are in those cases approximate.

45b (81a). Eyes smooth.

45c (50a). F vs 5 and 6 approximate ; 11 and 12 separate ; 7 and 6 separate. Tail never very long.

Amblypodia Group. The Oakblues.

45d (48a) H with a lobe and a tail at v1.

45 (46a). ♂ ♀ F vs 5 and 6 from a point. ♂ F vs 8 and 9 present and v7 ends on termen. ♀ v8 absent and v 7 ends on costa.

Iraota, M. The Silverstreak Blues. (Plate 27).

46a (45). ♂ ♀ F vs 5 and 6 approximate, but not from a point.

46 (47). H tailed only at v1. ♂ F v8 present, absent in ♀ ; ♂ ♀ v7 ends on termen.

Horsfieldia, Riley. The Leafblues. (Plate 27).

47 (46). H tailed at vs 1, 2 and 3, tail at 2 longest. F vs normal, 8 absent and seven ends on costa.

Thaduka, M. The Many-tailed Oakblue. (Plate 27).

48a (45d). H no tail at v1 ; usually lobe at tornus and a tail at v2. F venation normal as in last.

48 (49). H costa concave, apex pointed and more or less hooked. Tail spatulate.

Mahathala, M. The Falcate Oakblues. (Plate 27).

49 (48). H costa usually arched ; tail, if present, not spatulate.

Amblypodia, Hors. The Oakblues. (Plate 28).

50a (45c). F vs 5 and 6 well separated (except some species of No. 59).

50b (56a). H no tail at v1 ; always lobed and with a tail or tooth almost invariably at v2, sometimes at v3 and even at v4.

50c (53a). H not produced at v2 or tornus ; tail comparatively short. F vs 7 and 6 separate, 8 absent and 9 present.

Surendra Group. The Acacia Blues.

50d (52). H no tail at v4.

50 (51). H costa convex ; tail at v2 comparatively short (may be absent) and at v3, if present, very short.

Surendra, M. The Acacia Blue. (Plate 29).

51 (50). H costa straight, apex pointed. H lobe very large, tail at v2 moderately long and tail at v3 nearly as long.

H. Lycænidæ.—(*contd.*)

Mota, DeN. The Saffron. (Plate 29).

52 (50d) H slender tails at vs 2, 3 and 4, tail at 2 longest.

Semanga, Dist. The Rededge. (Plate 29).

53a (50c). H produced at v2 and tail long, no tail at v3. F 7 and 6 close, 8 absent.

Loxura Group. The Yamflies.

53b (55). H dorsum excavated before lobe, which is pronounced. Tail very long.

53 (54). F v9 present. No ♂ brand.

Loxura, Hors. The Yamfly. (Plate 29).

54 (53). F v9 absent. ♂ uph a brand along v1.

Yasoda, Doh. The Branded Yamfly. (Plate 29).

55 (53b). H dorsum not excavated and lobe obsolete.

Drina, DeN. The Yams. (Plate 29).

56a (50b). H always tailed at v1 as well as at v2 and sometimes at v3 also.

56b (58a). F vs 6 and 7 forked or from a point.

Spindasis Group. The Silverlines.

56 (57). F v1 absent, 9 present. H 2 nearly equal tails at vs 1 and 2.

Spindasis, Wallen. The Silverlines. (Plate 29).

57 (56). F vs 8 and 9 present in ♂, v8 absent in ♀. H 2 equal tails at vs 1 and 2 in ♂, an additional short tail at v3 in ♀.

Zesius, Hub. The Redspot. (Plate 29).

58a (56b). F vs 7 and 6 separate at origins.

58b (64a. 79a). H nearly equal tails at vs 1 and 2, under $\frac{1}{2}$ inch.

Tajuria Group. The Royals.

58c (61a). ♂ uph always with a brand about base v7.

58 (59a). ♂ upf with a brand on v1 and an overlying tuft of white hairs. F v9 present and in one species v8 as well.

Dacalana, M. The Tufted Royal. (Plate 29).

59a (58). ♂ upf no brand or tuft. F v9 present, 8 absent.

59 (60). ♂ unf with a tuft mid dorsum.

Pratapa, M. The Tufted Royals. (Plate 29).

60 (59). ♂ unf no tuft mid dorsum.

Maneca, DeN. The Slate Royal.

61a (58c). ♂ uph no brand and unf no tuft.

61 (62a). ♂ F vs 8 and 9 absent. In one species ♂ has a brand upf about end cell, which disappears on the application of benzine.

Britomartis, DeN. The Baby Royals.

62a (61). F v8 absent, 9 present.

62 (63). ♂ upf a black brand in cell at end, which does not disappear on the application of benzine.

Creusa, DeN. The Black branded Royal.

63 (62). ♂ upf normally no brand, if so, of modified scales at end cell, which disappears on the application of benzine.

Tajuria, M. The Royals. (Plate 29).

64a (58b. 79a). H 2 unequal tails at vs 1 and 2, a tooth or very short tail at v3 and rarely a tooth at v4.

64b (71a). H tail at v1 longer than the tail at v2; F v9 present.

Jacoona Group. The Imperials.

64c (69a). F v9 long, its origin well before end v 10.

64d (66a). ♂ no secondary sexual characters.

64 (65). F vs 11 and 12 separate. H v7 from well before 6. Tail at v1 12 mm. at v2 6mm.

Charana, M. The Mandarin Blues. (Plate 29).

65 (64). F vs 11 and 12 anastomosed in ♂, well separated in ♀. Hv7 from just before 6. Tail at v1 17 mm. in ♂, 28 in ♀: at v2 2mm. in ♂ 9 in ♀.

H. Lycænidæ.—(*contd.*)

Jacoona, Dist. The Great Imperial.

66a (64d). ♂ with secondary sexual characters. F vs 11 and 12 well separated.

66b (68). ♂ ♀ F v8 absent. H vs 3 and 4 from a point; 7 from well before 6.

66 (67). F v9 from nearer 10 than end cell. ♂ uph large oval black brand about origin v7, covered by a thick tuft of black hairs; unf corresponding nacreous area above mid dorsum, which is bowed. Tail at v1 10mm. at v2 4mm.

Manto, Den. The Green Imperial.

67 (66). F v7 from just before end cell. ♂ uph small inconspicuous brand base 6 in the middle of a large nacreous area; unf a tuft of white tipped brown hairs mid dorsum over a nacreous area; dorsum F bowed. Tail at v1 8-10 mm. at v2 3-5 mm.

Mantoides, Druce. The Brush Imperial.

68 (66b). F v8 present in ♂, absent in ♀. H v3 from just before end cell and 7 from just before 6. ♂ uph prominent circular black brand base 7 in middle of a nacreous area; unf a tuft of white hairs mid dorsum over a nacreous area; dorsum bowed. Tail at v1 12mm. in ♂, 20mm. in ♀ : at v2 4-7mm.

Neocheritra, Dist. The Grand Imperials. (Plate 29).

69a (64c). F v9 short, its origin after end v10; 8 absent; 11 and 12 close. No secondary sexual characters. Tail at v2=4mm.

69 (70). Tail at v1=8mm.

Purlisa, Dist. The Giant Imperial.

70 (69). Tail at v1=12mm.

Suasa, DeN. The Red Imperial. (Plate 29).

71a (64b). H tail at v2 longer than tail at v1. F v8 absent.

Marmessus Group

71b (76a). F v9 present.

71c (74a). F v9 comparatively long, origin well before end v10. Tail at v2 very long.

71 (72a). F origin v9 nearer to base v7 than to its apex. F apex truncate and termen angled in middle. Tail at v1 4mm. at v2 13mm.

Cheritrella, DeN. The Truncate Imperial. (Plate 29).

72a (71). F origin v9 nearer to apex than to base v7.

72 (73). F origin 5 nearer to 6 than to 4. Tail at v1 6mm. at v2 25mm.

Neomyrina, Dist. The White Imperial. (Plate 29).

73 (72). F origin 5 mid 6-4. ♂ uph small pale brand base 7, covered by a thin tuft. Tail at v1 5mm. at v2 22mm.

Cheritra, M. The Common Imperial. (Plate 29).

74a (71c). F v9 short, origin after end v10.

74 (75). F v12 ends before end cell. Tail at v1 5mm. v2 18mm. ♀ v3 1½mm.

Ticherra, DeN. The Blue Imperial.

75 (74). F v12 ends after end cell. Tail at v2 under ½ inch. ♂ with brand in one species.

Biduanda, Dist. The Posies. (Plate 29).

76a (71b). F v9 absent (rarely present in ♀ of No. 76).

76b (78). H angled and tailed at v3.

76 (77). H not angled at v4. ♂ uph large oval speckled brand about origin v7 with a white area below and a nacreous area above; unf corresponding white patch and nacreous area, dorsum much bowed. Tail under ½ inch.

Marmessus, Hub. The Common Posy. (Plate 29).

77 (76). H angled at v4. ♂ upf a circular brand bases 2 and 3, which disappears with benzine. Tail over ½ inch.

Eoxylides, DeN. The Branded Imperial.

H. Lycænidæ.—(*contd.*)

78 (76b). H in ♂ not angled or tailed at v1 and tail at v2 short; in ♀ angled at v1, but not tailed, tail at v2 long, but under ½ inch.

Thamala, M. The Cardinal. (Plate 29).

79a (58b. 64a). H with 3 more or less equal slender tails at vs 1, 2 and 3. F vs 8 and 9 absent.

Horaga Group. The Onyxes.

79 (80). H sharply right angled and produced at v4.

Rathinda, M. The Monkeypuzzle. (Plate 29).

80 (79). H termen at most faintly angled at v4. ♂ unf a brand in two species.

Horaga, M. The Onyxes. (Plate 29).

81a (45b). Eyes hairy.

81 (82a). Palpi hairy. H with 3 slender tails at vs 1, 2 and 3, that at 2 longest. F vs 8 and 9 absent; 7 and 6 from a point; 11 and 12 separate; 5 and 6 separate.

Catapoecilma Group. *Catapoecilma, But.* The Tinsels. (Plate 29).

82a (81). Palpi smooth.

82b (85a). H with a tail at v1 as well as at v2, that at 1 longest, lobed. F vs 8 and 9 absent 7, and 6 separate, also 5 and 6.

Hypolycaena Group. The Tits.

82 (83a). Antennæ club flattened and somewhat spatulate. F vs 11 and 12 close.

Chliaria, M. The Blue Tits. (Plate 29).

83a (82). Antennæ cylindrical as usual.

83 (84). H apex evenly rounded, end v7 mid 8-6. ♂ one species with a brand on disc upf.

Hypolycaena, Fd. The Tits. (Plate 29).

84 (83). H apex sharp, v8 short and end v7 much nearer end v6, termen quite straight from apex to v3. Tails long and fluffy.

Zeltus, DeN. The Fluffy Tits. (Plate 29).

85a (82b). H no tail at v1, though lobe, which is more prominent than in the other groups as a rule, may be pendulous and look like a tail. F v8 absent.

Artipe Group. The Flashes.

85b (93). F v9 present.

85c (89a). F v9 comparatively long, about half as long as v7 and arises well before end v10 from about half way along v7.

85d (87a). No secondary sexual characters.

85 (86). ♂ with slender tail, ♀ with a very long fluffy white tail.

Artipe, Bdv. The Green Flash. (Plate 29).

86 (85). ♂ ♀ with slender tail at v2.

Deudoryx, Hew. The Cornelians. (Plate 29).

87a (85d). ♂ uph with a brand about base v7 and usually unf with a tuft mid dorsum.

87 (88). F vs 7 and 6 from a point, 5 nearer 6 and lower dcv concave; 11 and 12 parallel, separate. ♂ unf tuft always present.

Virachola, M. The Guava Blues. (Plate 29).

88 (87). F vs 6 and 7 separate, 5 mid 4-6, lower dcv straight; 11 and 12 close. ♂ tuft missing in two species and individuals of another.

Rapala, M. The Flashes. (Plate 29).

89a (85c). F v9 short, about ¼ length of v7 or less, arising beyond mid 7 and at or after end v10.

90 (91a). H lobe small. F vs 11 and 12 close, ♂ uph prominent brand about base v7 and unf either a tuft or a brand.

Sinthusa, M. The Sparks. (Plate 29).

91a (90) H lobe elongate and pendulous.

H. Lycænidæ.—(*contd.*)

91 (92). H produced and tail very long, over ½ inch. ♂ uph brand about base v7 and unf a tuft mid dorsum.

Bindahara, M. The Planes. (Plate 29).

92 (91). H tail well under ½ inch. ♂ no brand.

Araotes, Doh. The Witch. (Plate 29).

93 (85b). F v9 absent; 11 and 12 touch. ♂ uph a tuft of black hairs mid cell and an obscure brand about origin v7; unf tuft black hairs mid dorsum over a polished area. H tail under ½ inch, lobe elongated and pendulous.

Sithon, Hub. The Plush. (Plate 29).

94 (37b). Highly abnormal and more like a moth. Large, body very stout, as wide as cell. F vs 11 and 12 separate; 7 ends on termen. 7 and 6 forked, 8 and 9 present, 5 and 6 separate. H lobed, tailless. Eyes smooth. Palpi smooth and unusually small.

Liphyrinæ. Liphyra, Wd. The Moth Butterfly (Plate 27).

H. 1. Cyaniroides.—The Emerald.

Above ♂ shining emerald green, broad dark brown borders; ♀ pale greyish blue with very broad dark brown borders and base H. Below white with numerous fine zigzag lines.

libna andersoni, M. (28-32). The Emerald. Kisseraing Is, Mergui (Moore). VR.

H. 2 Poritia.—The Gems. (Plate 26).

♂ above brilliant blue or green with a broad black apex and costa F and H: the apex F is more or less blue spotted; there may or not be a more or less well developed black spot in the middle of 1 upf. Below with numerous catenulated bands. ♂ ♂ are very variable and it is difficult to distinguish between the species.

1a (3a). Below the catenulated bands are evenly distributed; unf across 2 and 3 there are 2 bands internal to the discal band.

1 (2). ♂ upf blue colour confined to 1 and 2, apex and cell unmarked black uph blue colour up to v5 and mid cell. ♀ extensively violet blue; upf with only a narrow black bar at end cell; more or less prominent submarginal blue spots, between which the veins are obscurely broad reddish. Below grey, bands cinnamon.

sumatrae, Fd. (26-38). The Sumatran Gem. Mergui. VR.

2 (1). ♂ upf blue colour to v4; marginal and apical spots large and prominent and with a basal blue streak along upper edge of cell; uph blue colour not above v4 or in cell. Below very dark plumbeous, much darker than any other species of the genus; bands close and very dark cinnamon. ♀ brown; upf an obscure orange discal spot; below paler.

philota, Hew. (29). The Malay Gem. Mergui. VR.

3a (1a). Below catenulated bands wider apart on disc, especially beyond the cell; unf only one band across 2 and 3 internal to the discal band; ground colour white or grey. ♂ upf blue colour nearly always reaches to v4.

NOTE.—The general arrangement is much as usual and is a mean more or less between the various authorities. I have put the *Poritiinæ* at the beginning as being nearest to the *Erycinidæ*. The genera *Lycæna, Lycænopsis* and *Zizera* have been split up into a number of genera based on the genitalia; I do not know whether such genera will stand, but I personally hope not. *Selira* is very closely allied to *nissa, Koll*, which is a true *Rapala* and I have therefore sunk the genus *Hysuara* to *Rapala* (H. 87). I have not seen a ♂ of *virgo, DeN*, the type of *Pseudochitaria, Tyt.*, and it may perhaps be worth retaining it as distinct from *Sinthusa* (H. 89). *Ops, DeN., Creon, DeN.*; and *Bullis, DeN.*, do not seem to be worth keeping separate from *Tajuria, Pratapa* and *Britomartis* respectively (H. 63, 59 and 61), nor does *Zinaspa* from *Surenda* (H. 50). *Dacalana* should probably be united to *Pratapa*.

H. 2. Poritia.—(*contd.*)

3b (6a). ♀ uph more or less violet blue no yellow.

3c (5). ♀ upf no yellow whatsoever, broadly violet blue.

3 (4). ♀ uph cell and basal half of 4 black; upf cell black with a blue spot in the middle, 2 apical and 1 or 2 submarginal spots. ♂ upf cell mostly blue, but there is a black streak above the mv nearly to the base; apex and margin usually not spotted, but there may be traces of spots; uph except near margin blue colour does not enter 4, nor into cell except more or less patchily. Below very white, much whiter than any other species except the ♀ of No. 7; catenulated bands pale, with only a faint cinnamon tinge.

dawna, Evans. (25-35). The Dawna Gem. Dawnas—S. Burma. VR.

4 (3). ♂ ♀ uph cell and to v4 black; upf cell blue. Below grey, bands very prominently cinnamon.

α. ♂ ♀ upf always with apical and 2 or 3 submarginal spots (may be absent in DSF).

**pleurata geta, Faw.* (30-40). The Green Gem. Manipur—Dawnas. NR.

β. ♂ apical and submarginal spots absent; ♀ submarginal spots present, but apical may be present or absent.

pleurata regia, Evans. (30-38). Tavoy—S. Burma. NR.

5 (3c). ♀ upf always a yellow discal patch in 4; cell black; uph black with a more less developed violet blue band on disc. ♂ upf cell usually all black, but there may be traces of blue scales at the base and in the middle.

α. ♂ ♀ apical and submarginal spots usually present. ♂ uph cell and all 4 black.

hewitsoni hewitsoni, M. (31-38). The Common Gem. Kumaon—Assam. NR.

β. ♂ ♀ upf apical and submarginal spots usually absent. ♂ uph cell and 4 may be blue with a narrow black bar end cell.

hewitsoni tavoyana, Doh. (30-36). Burma. NR.

6a (3b). ♀ uph more or less yellow.

6 (7). ♀ above entirely yellow except for a dark brown costa and termen upf and some diffuse marginal spots uph. ♂ upf cell black and the blue colour only just enters 3; submarginal spots obscure, apical absent; uph cell black and space 4 blue except at base. Below white with very prominent ferruginous bands and prominent ferruginous patches at apex F and H, making the underside very distinctive.

karennia, Evans. (34-36). The Karen Gem. Karens. R.

7 (6). ♀ above with yellow discal patches only, which are of variable extent, on H consisting of at most a narrow band. ♂ very variable, but always much bluer than any of the preceding species; upf basal half entirely blue, apical, and, submarginal spots usually well developed and the apical may be joined to the blue discal area; uph blue colour never enters cell nor into 4 except sometimes at the margin.

α. ♀ as ♀ of No. 5 but yellow spots uph.

erycincides elsiei, Evans (26-36). The Blue Gem. Assam—N. Shan States. NR.

β. ♀ above no violet.

**erycinoides phraatica, Hew.* (26-36). S. Shan States—S. Burma. NR.

H. 3. Simiskina.—The Brilliants. (Plate 26).

♂ above black with brilliant blue or green markings; upf a basal streak below the mv, costal spots beyond and a complete curved submarginal row, also conjoined spots mid dorsum; uph basal streak below mv, discal and marginal spots. Below no catenulated bands. Termen in ♀ sharply angled and produced at v4. ♂ ♂ very alike above, but ♀ ♀ very distinct.

1a (3a). Unf with a white central band. ♀ above dark brown.

1 (2). Unf the central white band broad and increasing to dorsum markedly, continued on H through end cell. ♀ upf a prominent circular white discal spot. Below dark ferruginous brown.

H. 3. Simiskina.—(*contd.*)

**phalena harterti, Doh.* (28-34). The Broad-banded Brilliant. Assam—S. Burma. VR.

2 (1). ♀ unf the central white band narrow, not increasing to dorsum and continued narrowly on H well beyond end cell. Below bright ferruginous, no dark bar end cell unf; a rather obscure whitish submarginal band, irregular on H. Above plain brown. (Hewitson's type is tinted dull blue above and on uph has a pale blue line from the dorsum to v4 along the margin; these are inconstant characters in other species). ♂ unknown.

pediada, Hew. (30). The narrow-banded Brilliant. Mergui. VR.

3a (1a). Below no white band.

3 (4a). Unh ♂ ♀ prominent sharply defined blue line along the termen from tornus to v4. ♀ above plain dark brown with traces uph of a blue marginal line. Below plain, rather pale brown, no ferruginous tinge, pale bordered dark line end cell, similar discal and submarginal lines, former being very irregular on H. ♀ only slightly angled at v4.

pharyge, Hew. (32-35). The Blueline Brilliant. Mergui. VR.

4a (3). Unh no blue submarginal line. Below always with more or less of a ferruginous tinge.

4 (5). ♀ above plain dark brown. ♂ below dark purple brown with a shining gloss, lines as in last; outer half H beyond cell prominently paler; unf submarginal line parallel to margin. ♀ below pale brown with a faint purple gloss. ♂ above markings greener than usual.

* *pasira dohertyi, Evans.* (28-35). The Green Brilliant. Tavoy—S. Burma. R.

5 (4). ♀ above orange yellow; upf apex and termen dark brown, sometimes with dark brown shading of varying width and intensity along dorsum and a thin line end cell; uph all orange yellow, sometimes more or less suffused dark brown scales and with diffuse submarginal spots. ♂ above bluer than the last. Below marked as the last; ♂ unf apex and upper part of termen prominently paler and the submarginal line curved in at the upper end. ♀ ochreous below with a strong purple wash.

**phalia, Hew.* (35-40). The Blue Brilliant. Dawnas—S. Burma. R.

H. 4. Deramas.—The Bluejohn. (Plate 26).

♂ above black, lower part F and H shining blue, divided on F by a black streak in 1 and uph bearing diffused dark submarginal spots. ♀ purple instead of blue, more extensive on F and not divided by a black streak. Below purple brown (to ochreous in ♀) with dark discal and submarginal line and some dark spots at tornus H. H margin even in ♂ slightly angled at v4 in ♀.

**livens jasoda, DeN.* (33-36). The Bluejohn. Karens—S. Burma. R.

H. 5. Gerydus.—The Brownies. (Plate 26).

Above dark brown with a more or less prominent curved white or pale yellow discal band upf from mid costa to tornus, portion in 1 and 2 consisting of more or less detached spots. Below brown with more or less obscure spots on H. Body in ♂ very long, projecting well beyond the wings.

1 (2a). ♂ v4 F thickened at base. Upf discal band very variable, straight or angled, spot in 1 may be absent and sometimes spot in 2 in ♂.

**croton, Doh.* (28-42). The Plain Brownie. Bhamo—S. Burma. NR.

2a (1). ♂ v4 F not thickened at base.

2b (5a). Upf the upper edge of the discal band even.

2c (4). Upf the lower edge of the discal band irregular; if extended to base, there is always a dark area about origins vs 2 and 3.

2 (3). Apex upf not conspicuously darker than the rest of the wing; discal band as in last, but in ♂ may be reduced to a small whitish patch base 4.

**boisduvali assamensis, Doh.* (32-38). The Common Brownie. Sikkim—Burma. C.

H. 5. Gerydus.—(*cont'd.*)

3 (2). Apex F conspicuously darker than the rest of the wing, which is much paler brown ; discal band more prominent and in DSF may extend to the base, the whole of the upperside being white except for the apex F, costa H and a discal brown patch F.

longeana, DeN. (30-38). Long's Brownie. Manipur—Burma. NR.

4 (2c). Upf discal band broad and white=at least ¼ wing and even edged on both sides.

biggsii, Dist. (32-38). Bigg's Brownie. Burma. R.

5a (2b). Upf discal band broad and upper edge sharply angled in at v3.

5 (6). Upf discal band not divided and often extended to base ; ♂ ♀ uph with a pale discal streak.

symethus diopeithes, Fruh. (40-50). The Great Brownie. Nagas—Burma. VR.

6 (5). Upf discal band completely divided by a broad brown streak from base 2. ♀ upf and all uph except costa very pale brown.

**ancon, Doh.* (36-48). The Divided Brownie. Burma. NR.

H. 6. Allotinus.—The Darkies. (Plate 26).

Above dark brown, sometimes with a pale area upf as in last. Below grey striated or spotted on H as in last. Body of ♂ very long, longer than the wings.

1a (3a). Below broad catenulated markings and small dots as in *Gerydus*. Above marked as *Gerydus*.

1 (2). F apex projected as a fine long tooth and termen crenulate. Below brown with an ante-terminal band. ♂ upf yellowish white curved discal fascia in 2-4. ♀ white except for apex F and costa H.

drumila, M. (48-54). The Crenulate Darkie. Sikkim—Assam. VR.

2 (1). F apex not projecting, termen straight in ♂, crenulate in ♀.

α. ♂ ♀ fascia as in ♂ of No. 1, becoming obscure in ♂.

**multistrigatus multistrigatus, DeN.* (48-54). The Great Darkie. Kumaon—Shan States. VR.

β. Below greyish yellow, no ante-terminal band. Smaller. ♂ as No. 1, but band upf slightly bent forward. ♀ between Nos. 1 and 3.

multistrigatus apthonius, Fruh. (48-54). Karens. VR.

3a (1a). Below striated.

3b (8) Upf pale discal marking, if present, never to base and never bluish.

3c (7). Unh dark brown spot mid costa not more prominent than any other spot.

3d (5a). ♂ upf prominent pale streak about basal half v4 ; ♀ pale discal area. Unf uniform.

3 (4). ♂ upf pale streak long and comparatively broad. Below much striped.

**horsfieldii continentalis, Fruh.* (38-44). The Common Darkie. Assam—Burma. C.

4 (3). ♂ streak short and comparatively narrow. Below less striped.

posidion atacinus, Fruh. (34-40). The Lesser Darkie. Burma R.

5a (3d). ♂ ♀ upf discal streak and pale area obsolete.

5 (6). Unf apex prominently light burnt sienna. ♂ F apex produced.

taras, Doh. (34-40). The Brown-tipped Darkie. Burma. R.

6 (5). Unf uniform. ♂ apex not produced. ♀ termen prominently-toothed at v4.

fabius panormis, Ell (34-40). The Angled Darkie. Nagas—Karens. VR.

7 (3c). Unh prominent dark brown spot mid costa. ♂ ♀ F and H termen crenulated.

nivalis substrigosa, Fruh. (20-30). The Small Darkie. Karens.—S. Burma. R.

8 (3b). Upf with a blue patch extending to base, narrow in ♂, broad in ♀.

subviolaceus manychus, Fruh. (30-38). The Blue Darkie. Manipur—Burma. R

H. 7. Logania.—The Mottles. (Plate 26).

Above dark brown with a whitish or pale bluish discal area, which may extend to base and all H. Below closely mottled.

1 (2a). Below dark mottled with on H a very prominent broad white streak from base to termen below apex. Above bluish white with a very broad black apex upf.

sriwa, Dist. (28-35). The Striped Mottle. Mergui. VR.

2a (1). Below uniformly mottled, no white streak H.

2b (4.5). Upf apex dark brown with broad bluish white discal area, extending to costa, dorsum and often to base, which may be suffused brown. Uph costa brown, rest blueish white, more or less suffused brown. Below prominently mottled.—2 (3) Unh white mottled dark brown.

**marmorata, M.* (20-22). The Pale Mottle. S. Burma. R.

3 (2). Unh ochreous. Termens crenulate.

luca, DeN. (23-30). The Yellow Mottle. Rangoon—S. Burma. R.

4 (2b.5). Upf apex brown, prominent bluish white discal patch, which does not extend to base, costa or dorsum, where the brown area is bluish. Uph costa brown, rest bluish, often with discal white patch. Unf broad discal white fascia, rest and unh prominently mottled.

watsoniana, DeN. (24-32). Watson's Mottle. Manipur—Burma. VR.

5 (2b.4). Upf brown with a rather small discal bluish white patch, remainder dark brown. Below rather obscurely mottled.

massalia, Doh. (20-30). The Dark Mottle. Assam—Burma. VR.

H. 8. Taraka.—The Forest Pierrot. (Plate 27.)

Above ♂ dark brown; upf with more or less of a black spotted white discal patch and uph the black spots from below showing through ♀ white with broad dark costa and termen upf and the dark spots from below showing through faintly.

Below white with numerous large black spots, including 4 along the costa F.

**hamada mendesia, Fruh.* (20-30). The Forest Pierrot. Sikkim—Burma. NR.

H. 9. Spalgis.—The Apefly. (Plate 27.)

Above brown with diffused or well defined white patch upf. Below covered with numerous very fine wavy brown lines.

α. Paler. Upf white discal area nearly always present.

**epius epius., Wd.* (20-30). The Apefly. Ceylon, S. India—Bengal. Kumaon—Burma. NR.

β. Darker. White area obsolete upf.

epius nubilus, M. Andamans, Nicobars.

H. 10. Pithecops.—The Forest Quaker. (Plate 27.)

Brown or blue above. Below white, with a large prominent black costal spot unh and no basal markings.

1 (2). Above dark shining blue with broad brown border in ♂; ♀ brown. Unh no postdiscal band.

fulgens, Doh. (22-28). The Blue Quaker. Assam. R.

2 (1). Above ♂ ♀ brown, paler on disc F. Unh usually with narrow postdiscal band. Unf 2 small prominent costal spots.

**hylax, F.* (21-26). The Forest Quaker. Sikkim—Burma. NR.

H. 11. Neopithecops.—The Quakers. (Plate 27.)

Above brown with more or less of a white discal patch F and H. ranging from almost entirely brown in WSF to almost entirely white in DSF. Below very like *P. hylax*; unh black costal spot is smaller and with a small spot on dorsum, also there may be 3 basal spots and a postdiscal band. Unf no prominent spots on the costa except as part of the postdiscal band.

**zalmora, But.* (20-30). The Quaker. Ceylon & ndia—Bengal. Kumaon—Burma. Andamans. C.

H. 12. Megisba.—The Malayan. (Plate 27.)

Above dark brown with a well defined whitish discal patch nearly always present upf. Below white with spots *Lycaena*-wise, that is with a discal series and on H basal spots; in addition in strongly marked specimens there are 4 small spots on the costa upf as well as a spot in the cell.

α. Tailless.

**malaya thwaitesi, M.* (20-30). The Malayan. Ceylon, S. India—Bengal. NR.

β. Tailed.

malaya sikkima, M. Kumaon—Burma. Andamans. NR.

H.13. Talicada.—The Red Pierrot. (Plate 27.)

Above black with a broad orange area H. Below white, large discal and marginal black markings F; H with broad orange marginal band bearing white spots. Cilia chequered.

α. Above orange area more extensive, width ¼ inch. Unh markings reduced, most of discal band H absent.

nyseus nyseus, Guer. (30-36). The Red Pierrot. Ceylon, S. India. NR.

β. Above orange area restricted, well under ¼ inch. Unh markings large and complete.

**nyseus khasiana, Swin.* (30-36). Assam—N. Burma. NR.

γ. Smaller and much darker. Unf outer black border nearly meets discal band; all markings very broad.

nyseus burmana, Evans. (28-34). Shan States. R.

H.14. Castalius.—The Pierrots. (Plate 27.)

Mostly white above or with a broad white discal band. Below white with very characteristic markings.

1 (2a). Above white with several black spots on the white areas F and H; bases metallic blue, suffused dark scales in ♀, costa H dark brown. Below with several irregularly arranged black spots. Unf basal markings consist of a long basal streak, spot end cell and a spot on 1, all well separated.

**rosimon rosimon F.* (24-32). The Common Pierrot. Ceylon. India. Burma. C.

β. Spots larger,

rosimon alarbus, Fr. Andamans and Nicobars. C.

2a (1). Above a broad white band across both wings, extending to costa on H except rarely in No. 2, the upper end on F angled outwards; costa F and margins dark brown; white band immaculate except on H in No. 5.a.

2b (5). Unf discal band in 3 portions, upper and lower consisting of large spots, central smaller and nearer margin. Unh discal band usually also in 3 parts.

2 (3.4). Unf basal markings consist of a short basal streak and a well detached broadly angled band from costa to dorsum. Unh at base a narrow elbowed band, often macular and not reaching costa. ♂ black above.

α. Above white band narrower in all seasonal forms.

caleta hamatus, M. (26-32). The Angled Pierrot. Ceylon. NR.

β. Above white band wider; markings below smaller and more macular.

**caleta decidia, Hew.* S. India. Sikkim—Burma. NR.

3 (2.4). Unf basal markings consist of 2 parallel and nearly equal inclined streaks. Unh 2 parallel basal streaks, not reaching costa, often coalesced. ♂ cobalt blue above; ♀ dark brown.

α. Above discal band broad. Below markings smaller and well separated.

ethion ethion, Db. (26-30). The Banded Blue Pierrot. Ceylon, S. India. Assam—Burma. Andamans. NR.

β. Above discal band narrower. Below markings large, discal spots on H coalesced.

H. 14. Castalius.—(*contd.*)

ethion airavati, Doh. Nicobars. R.

4 (2.3). Unf basal markings consist of a single broad, sharply angled band meeting a black area at base H. ♂ black above.

elna noliteia, Fruh. (30-34). The Elbowed Pierrot. Orissa. Sikkim—Burma. Andamans. NR.

5 (2b). Unf discal band either continuous or lower part only separate; basal markings consist of a single broad inclined straight streak from mid costa to dorsum near base, joining a black area at base H. ♂ above black. Unh the 3 parts of the discal band may be conjoined.

α. Above white areas more extensive; in DSF uph black discal spots show up as below owing to the black margin being narrower.

roxus roxana, DeN. (26-30). The Straight Pierrot. Assam—N. Burma. NR.

β. Above white areas narrower. Uph never with detached discal spots.

**roxus roxus, God.* S. Burma. Andamans. NR.

γ. Above white areas much restricted. Unh extreme base costa not white.

roxus manluena, Fd. Nicobars. R.

H. 15. Tarucus.—The Blue Pierrots. (Plate 27.)

Small; blue above. Below white with a prominent dark streak from the base in each wing. Close to *Castalius,* but without the large white areas above.

1 (2a). Unh at most a single obscure metallic spot at the tornus. ♂ above very dark purple blue, with rather narrow dark brown border; ♀ plain brown, rarely with the bases blue. Below markings as in next, but darker, broader and coalescent.

**ananda, DeN.* (22-28). The Dark Blue Pierrot. S. India. Sikkim—Burma. R.

2a (1). Unh with a prominent black spot above the tail, a prominent metallic spot at tornus and 2 or 3 along the termen.

2 (3) ♂ above rather pale violet blue with a narrow brown border; upf always a black spot end cell and sometimes a spot below it and 2 discal spots. ♀ brown with blue bases, discal spots fully developed and whitish patches beyond cell F and along margin H. Below plentifully marked with rusty brown to black streaks on a white ground, varying in size and intensity; unf a spot in the cell and another below it.

**theophrastus nara,* Koll. (22-30). The Rusty Pierrot. Ceylon. India. N. Burma. C.

3 (2) ♂ darker with broad fuscous borders. ♀ dark brown.

venosus, M. (22-33). The Kulu Pierrot. Abbotabad—Kumaon. R.

H. 16. Euchrysops.—The Plains Cupids. (Plate 27.)

Blue above with catenulated discal spots on a grey ground below; on unh spots at base, along costa and tornus are black, latter crowned metallic and orange; remaining spots very much paler brown. Unf no spot in cell.

1 (2a). Unh discal band very broken, spots in 1 and 1a completely separate; 2 nearly equal black spots at tornus; no spot in 1 below cell spot. ♂ above violet; uph 2 black spots at tornus and no spot in 1a.

**cnejus, F.* (25-33). The Gram Blue. Ceylon. India. Burma. Nicobars. C.

2a (1). Unh discal band more regular; spots in 1 and 1a with edges conjoined. WSF unh tornal spot in 1a.

2 (3). Unh no spot in 1 under cell spot; spots at tornus subequal, uph single spot at tornus above tail.

α. Much brighter blue and below markings more prominent.

contracta nila, Evans. (20-25). The Small Cupid. Ceylon. NR.

β. Duller above and below.

contracta contracta, But. S. India—Sind, Punjab, N.W.F. Province. NR.

H. 16. Euchrysops.—(*contd.*)

3 (2). WSF unh a spot in 1 under cell spot ; tornal spot in 2 far more prominent than the spot in 1.

α. WSF and DSF very alike. Larger and brighter blue. Uph marginal spot in 2 prominent, but there is a series of dusky spots on either side and a prominent white line beyond them.

pandava lanka, Evans. (30-35). The Plains Cupid. Ceylon. C.

β. WSF and DSF very different. Smaller. Uph only a marginal spot in 2, no marginal white line. DSF below has the discal band much widened and on H is conjoined to the spot end cell, forming a large central dark patch; tornal spots obsolete.

**pandava pandava, Hors.* (25-30). India, Burma, Nicobars. C.

H. 17. Everes.—The Tailed Cupids. (Plate 27.)

Small ; usually blue in the ♂. Below grey to white, spots as usual and with more or less prominent orange tornal spots unh.

1a (5a). Unh never a spot in 1 adjacent to the spot mid cell.

1b (4). Unf discal spots in a continuous line. ♂ blue above. Tailed.

1c (3). Below all spots black and equally prominent. Unh discal spot in 6 shifted in, not in line with the spots in 5 and 7. ♂ brown above.

1 (2). Unf discal spots all in line ; unh discal spot 2-5 on an even arc. ♂ upf dark border under 2 mm.

α. ♀ uph with orange spots at tornus. ♂ upf border under 1mm.

argiades diporides, Chap. (20-25). The Tailed Cupid. Chitral—N. Burma. C.

β. ♀ uph no orange spots at tornus. Very variable, but in WSF the spots are considerably larger below. ♂ upf border about 1½mm.

**argiades hellotia, Men.* (24-30). Sikkim, Bhutan. C.

2 (1). Unf discal spot in 2 shifted in ; unh discal spots in 3-5 in a straight line, spot in 2 shifted in. ♂ above border over 2mm. and often a very prominent spot end cell. ♀ uph no orange spots at tornus. Unh orange spots more extensive and not sharply defined.

dipora, M. (22-26). The Dusky Blue Cupid. Kashmir—N. Burma. NR.

3 (1c) Unh spot mid cell, the 2 costal spots in 7 and the spot in 1a on dorsum black, forming a contrast with the remaining spots, which are grey and hardly darker than the ground. Unf discal spots in line. Unh discal spot in 6 in line with the spots in 5 and 7 or very nearly so.

α. ♂ above border about 2mm. ♀ with discal areas pale dull blue.

parrhasius parrhasius. F. (22-28). The Indian Cupid. Ceylon, S. India. NR.

β. ♂ above variable, usually much darker, with prominent black veins and broader border. ♀ usually uniform black, but Burmese specimens often have the disc blue.

parrhasius assamica, Tyt. Assam.—Burma. NR.

γ. Above as α. ♀ with discal areas above paler, often nearly white. Below discal markings obsolete or nearly so, never so prominent as the marginal markings.

parrhasius pila, Evans. (22-26). Andamans and Nicobars. NR.

4 (1b). Below discal bands much broken, broad and very black ; unf a continuous upper band in 3-6 and a similar quite separate lower band in 1-2 ; unh discal band in 3 parts. Above ♂ ♀ uniform dark brown. Tailed.

**potanini, Alph.* (22-25). The Banded Cupid. N. Burma—Dawnas. R.

5a (1a). Unh with a spot in 1 adjoining the spot mid cell. Above ♂ ♀ dark brown. Below markings more or less normal.

5 (6). Tailed. Unh with prominent orange markings at tornus. Below leaden grey, markings small, prominent, and of uniform size.

**kala, DeN.* (22-25). The Black Cupid. Nagas—S. Shan States. R.

6 (5). Tailless. Unh no orange markings at tornus. Below nearly white, markings H irregular and of unequal size.

* *moorei, Leech.* (20-23). Moore's Cupid. Assam. VR.

H. 18. Cupido—The Cupids.

♂ above dull blue, shading to a broad fuscous border; an obscure dark spot end cell F. ♀ plain brown. Below grey, spots minute and marginal spots obsolete; unh discal spot in 6 between spots in 5 and 7, spots 2-5 on an arc, obscure black tornal spots crowned metallic and orange.

sebrus shandura, Evans. (21-25). The Shandur Cupid. Chitral. R.

H. 19. Bothrinia.—The Hedge Cupid. (Plate 27.)

Resembles *Lycaenopsis* very closely. ♂ above dull blue with a black bar end cell F, ♀ border rather narrow, dilated at apex F. Below grey; unf discal spots 1-5 in line, spot in 6 only slightly shifted in; unh spots small and regular, discal spot in 1 almost in line with spots in 1a and 2.

**chennellii, DeN.* (22-25). The Hedge Cupid. Assam—Karens. R.

H. 20. Lycænopsis.—The Hedge Blues. (Plate 27.)

♂ blue above, sometimes with white discal areas and a dark border of varying width. Below grey to white; spots as usual, but never any metallic or orange spots and no spot in cell F. Unf spot in 6 shifted in normally out of line with the rest of the discal spots and unh discal spot in 6 is shifted in out of line with the spots in 5 and 7.

1 (2a). Below white, no basal or cell spots, submarginal spots large and immediately preceded by the discal line. ♂ dark blue, border ½mm. widening at apex. ♀ dark brown with a well defined white band above.

haraldus ananga, Fruh. (40-42). Felder's Hedge Blue. Victoria Point. VR.

2a (1). Below with basal markings H and spot end cell F and H.

2 (3a). Below white, marginal markings absent; spots on H very minute: discal spots on F very large, spots in 2 and 3 shifted out near the margin, no spot in 6. Above ♂ dusky blue, border 4 mm; ♀ disc F white, H all dusky blue.

**vardhana, M.* (38-44). The Dusky Hedge Blue. Kashmir—Kumaon. NR.

3a (2). Below marginal markings present; unf discal spots in 2 and 3 not shifted out and markings on F and H of equal size.

3 (4a). Unf spot in 6 absent or, if present, in line with rest, spot in 1 shifted in; all markings very small. ♂ above violet blue, border 2mm. Below grey marginal markings complete.

binghami, Chapman. (30). Chapman's Hedge Blue. Assam—N. Burma. VR.

4a (3). Unf spot in 6 always present and much shifted in (except in DSF forms where all the spots tend to obsolescence).

4b (7a). Below submarginal lunules completely absent, marginal spots present. Unh no spot base 2.

4c (6). Unh discal spot in 4 not markedly different to the other spots. Unf discal spots 2-4 in line.

4 (5). Unf always discal spot in 1, which is shifted in. Below pale grey. Above dark blue, border a thread; ♀ violet blue with broad borders.

lanka, M. (27-32). The Ceylon Hedge Blue. Ceylon. R.

5 (4). Unf never a discal spot in 1. Below white, markings very small. Above white with broad dark costa and termen F; base and costa leaden blue in ♂ dark brown in ♀.

**akasa mavisa, Fruh.* (26-30). The White Hedge Blue. Ceylon, S. India. NR.

6 (4c). Unh discal spot in 4 oblique and elongated. Below white, usually a spot in 1 unf. ♂ above pale blue with a large white discal patch F and H. apex broadly dark brown, reducing to a thread at tornus F. ♀ dark brown with narrow white discal patch F and H.

**albocoerulea, M.* (26-34). The Albocoerulean. Simla—Karens. R.

H. 20. Lycænopsis.—(*contd.*)

7a (4b). Below always at least traces of the submarginal lunules as well as of the marginal spots.

7b (11a). Unh always a spot base 2 anterior to the spot mid cell (present sometimes in Nos. 14 and 15). Unf always a discal spot in 1 and spot in 4 F and H more or less oblique.

7c (10). Unh discal spot in 7 not conspicuously larger than the remaining spots.

7 (8a). Unh discal spot in 6 midway between the spot in 5 and the bar end cell. Below pale grey and markings grey, except for the basal and costal spots H, which are black. ♂ above blue, border 1mm.

musina musinoides, Swin. (26-30.) Swinhoe's Hedge Blue. Assam—Shan States. NR.

8a (7). Unh discal spot in 6 much nearer bar end cell.

8 (9). Below white and all markings dark brown; unh discal spot in 4 only slightly oblique and no longer than the spot in 2. ♂ above rather pale violet blue, border a thread.

singalensis, Fd. (34-39). The Singhalese Hedge Blue. Ceylon. R.

9 (8) Below pale grey; unh spot in 4 highly oblique, elongated and much longer than any other spot. ♂ above costa and termen broad dark brown, disc white and base dull blue; H dark brown with a narrow white discal patch and base dull leaden blue.

dohertyi, Tyt. (32). The Naga Hedge Blue. Nagas VR.

10 (7c). Unh discal spot in 7 round, large, far more prominent than any other spot. Below pale grey, markings prominent. ♂ above bright shining blue, border 2mm; in DSF a white patch on disc F; ♀ with a broad, well defined straight edged white band on F and most of H is white in the DSF.

**transpecta, M.* (28-36). The White-banded Hedge Blue. Sikkim—Burma. Nicobars. NR.

11a (7b). Unh no spot base 2 (except in individuals of Nos. 14 and 15).

11b (18a). Below markings never so regular as in 18a and almost invariably a discal spot in 1 unf.

11 (12a). Unf discal spot in 7 large, far larger than any other spot.

11a (11b) Unh discal spots in 4 and 5 midway between end cell and margin. Below white or very pale grey. ♂ above metallic blue, border 2mm. ♀ black with a narrow white discal patch upf, inwardly bordered with dull blue scales.

α. Larger and paler blue; uph border continuous dark brown. Below markings fainter and more linear.

melaena melaenoides, Tyt. (28). The Metallic Hedge Blue. Manipur. VR.

β. Smaller and darker; border uph may be broken into spots. Below markings larger and darker.

melaena melaena, Doh. (24-26). Tavoy—S. Burma. R.

11b (11a). Unh discal spots in 4 and 5 much nearer margin. Below chalky white, markings prominent. ♂ above metallic blue, border 4mm. at apex F, 1 mm. elsewhere: upper discal white patch H. ♀ above large white discal areas.

cossæa distanti, Fruh. (28) The Chalky Hedge Blue. Mergui. VR.

12a (11). Unh discal spot in 7 not markedly larger than any other spot. ♀ with prominent white discal areas usually.

12b (14a). Unf upper edge vertical spot in 3 joins or is directed to the outer edge of the oblique or horizontal spot in 4.

H. 20. Lycænopsis.—(*contd.*)

12 (13). Unh spot in 7 linear. Below pale grey, submarginal marking faint. ♂ above rather dark shining blue, border 1mm.: upf with 2 conjoined, sharply defined, white patches at bases 2 and 3 and a similar patch in 6 H.

albidisca, M. (32-38). The Whitedisc Hedge Blue. S. India. NR.

13 (12). Unh discal spot in 7 round. Below grey, markings large and coarse in DSF, narrow in WSF. ♂ above dark shining blue, border 2mm. and a large white discal patch F and H.

marginata, DeN. (30-36). The Margined Hedge Blue. Kumaon—Karens. NR.

14a (12b). Unf discal spots in 3 and 4 never arranged as in 12b.

14b (16a). Unf discal spot in 2 highly oblique, pointing to spot end cell; spot in 4 also oblique and pointing to spot end cell, spot in 3 vertical and pointing to the centre of spot in 4. Below markings very coarse in DSF, narrower in WSF. Unh discal spot in 4 oblique and elongated and often a spot base 2. Sometimes unf there is an additional costal spot over spot in 6 and unh a spot at extreme base 7, present in no other species.

14 (15). Unf inner edges discal spots 2-5 very irregular. ♂ above shining blue.

α. ♂ above as β, darker and more uniform lavender blue: upf borders narrower.

puspa lavendularis, M. (28-35). The Common Hedge Blue. Ceylon. C.

β. ♂ above with prominent white patches in DSF; border F 1½mm, dilated at apex.

**puspa gisca, Fruh.* (28-35). India, Burma. C.

γ. Intermediate between α and β.

puspa telis, Fr. Andamans.

δ. ♂ paler blue and no white patches. ♀ white areas very restricted and dusky.

puspa cyanescens, DeN. (27-32). Nicobars. NR.

15 (14). Unf inner edges of spots 2-5 on an even arc. ♂ shining blue, border 1-1½mm, dilated at apex, no white patches.

lilacea, Hamp. (29-32). Hampson's Hedge Blue. S. India. R.

16a (14b). Unf discal spot in 2 vertical or slightly oblique, pointing to spot in 6.

16 (17). Below grey; unf discal spot in 1 almost invariably present. ♂ above blue, border narrow.

α. Below spots irregular; unf spot in 4 very oblique. ♂ upf border very narrow and not or very faintly dilated at apex. ♀ border narrow and no white patches.

limbata amitra, Fruh. (28-32). The Plain Hedge Blue. Ceylon. NR.

β. Below spots much more regular. ♂ above as last. ♀ with much broader borders.

limbata limbata, M. (28-32). S. India—Bengal. NR.

γ. Below markings broader, regular or irregular. ♂ upf border broader and always prominently dilated at apex.

limbata placida, M. (28-34). Sikkim-Burma. C.

17 (16). Below white, markings small; unf spot in 1 present or absent. Unh spot in 4 usually oblique and elongate and spot in 3 minute or absent. ♂ above rather pale blue, border a thread, white discal patches present or absent.

* *cardia dilecta, M.* (28-32). The Pale Hedge Blue. Simla—Karens. NR.

18a (11b). Below pale grey, markings small and regular; unf never a discal

H. 20. Lycænopsis.—(*contd.*)

spot in 1 and unh spot in 4 never more than very slightly oblique; spots in 2-5 unh on an even flat arc.

18 (19). Larger. ♂ above border very narrow and regular on F and H not dilated at apex.

α. Paler. Below markings smaller.

huegelii huegelii, *M.* (34-40). The Large Hedge Blue. Kashmir—Kumaon. C.

β. Much darker blue. Below markings larger and clearer.

huegelii orcana, *Swin.* (38-40). Bhutan to Assam to 8,000 feet. NR.

γ. As last, but smaller. Below markings small and more or less obsolete.

huegelii oreoides, *Evans.* (32-35). Sikkim—Assam over 8,000 feet. R.

19 (18). ♂ above border dilated at apex. Smaller.

α. ♂ never with white patches above, border F 1mm. Below white and markings black.

argiolus coelestina, *Koll.* (25-32). The Hill Hedge Blue. Chitral—Kumaon. C.

β. ♂ above with prominent discal white patches in DSF; border very variable, but usually much wider, 2mm. Below white to grey and markings may be black or grey.

argiolus jynteana, DeN. (28-34). Sikkim—Burma. C.

H. 21. Chilades.—The Lime Blue. (Plate 27.)

Above blue. Below pale brown with large spots arranged as usual; unf with an additional costal spot in the angle formed by the junction of v9 with v7, always a spot in 1; unh always spot base 2 and the discal spot in 6 shifted in. In DSF unh there is a large clouded discal patch.

α. Smaller. ♂ above dark border linear. ♀ WSF dark brown, bases metallic blue; DSF rather pale blue with a broad border.

**laius laius*, *Cr.* (26-30). The Lime Blue. Ceylon, India, N. Burma—Moulmein. C.

β. Larger. ♂ above dark border diffused inwards and uph with prominent marginal black spots. ♀ paler blue with broad borders. Below markings much darker and more pronounced; seasonal difference not nearly so marked.

laius tavoyana, *Evans.* (30-35). Tavoy. R.

H. 22. Zizera.—The Grass Blues. (Plate 27.)

Small low flying insects. Below pale grey to brown; unh always a spot base 2 under spot mid cell.

1 (2a). ♂ ♀ above dark brown. Unh with a marginal row of jewelled metallic spots; basal and costal spots black, rest dark brown; unf no spot in cell or on costa internal to the discal band.

α. Uph dark marginal spots in ♂ faint and not orange crowned; below brown and jewelled spots not prominently orange crowned.

**trochilus putli*, *Koll.* (15-22). The Grass Jewel. Ceylon. S-NE. India. Burma. C.

β. H marginal spots prominently orange crowned above and below; paler below.

trochilus trochilus, *Frey.* (15-20). N.W. India. C.

2a (1). ♂ above blue. 2b (6) Unh no jewelled spots or orange markings.

2b (5). Unh discal spot in 6 midway between spots in 5 and 7, always a discal spot in 1.

2d (4). Unf with a spot in cell and a spot in 7 on costa between the discal spot in 6 and the spot end cell.

2 (3). Larger. ♂ above pale blue, border broad. ♀ dark brown with more or less basal blue suffusion. Unf often small spot base 1.

H. 22. Zizera.—The Grass Blues. (Plate 27.)—(*contd.*)

α. Below markings small and on H nearly obsolete. ♂ above very pale silvery blue.

maha ossa, Swin. (26-30). The Pale Grass Blue. S—Central India. VC.

β. Below markings always more prominent. ♂ above usually darker and very variable.

maha maha, Koll. Central—N. India. Burma. VC.

3 (2). Small. ♂ above dark blue with broad borders. ♀ normally plain brown, but may have some basal blue suffusion. Below grey with the spots all small, black and well defined.

**lysimon, Hub.* (18-24). The Dark Grass Blue. Ceylon, India, Burma, Andamans. C.

4 (2c). Unf no spot in cell; 2 small costal spots on either side of the spot end cell. Below white, markings all small, black and well defined; marginal markings unusually sharp. ♂ above dark blue with a broad border.; ♀ plain brown.

gaika, F. (16-24). The Tiny Grass Blue. Ceylon, India, Burma, Andamans. C.

5 (2b). Unh discal spot in 6 shifted in, not in line with spots in 5-7, no costalspots or spot in cell. ♂ above dark blue with broad borders; ♀ brown with more or less basal blue suffusion.

α. Below spots prominent; unf discal series very large.

otis decreta, But. (19-26). The Lesser Grass Blue. Ceylon. S-Central India. C.

β. Below spots small, often nearly obsolete; spots unf never more prominent than the spots unh.

otis otis, F. (19-26). N. India—Burma, Andamans, Nicobars. C.

6 (2 b). Unh 2 prominent jewelled black tornal spots also 2 prominent black costal spots and a spot in cell: remaining markings below grey, catenulated. ♂ above violet blue, very narrow, dusky border: ♀ brown.

galba phiala, GG. (20—24). The Persian Grass Blue. Idak, Waziristan. R.

H. 23. Lycæna.—The True Blues. (Plate 27).

Blue or dark brown above; below various patterns, general arrangement of the spots being the same; unh spot in 6 nearly always midway between 5-7 and usually a spot base 2.

1 (2a). Unh with a spot base 8. Below white with numerous very large black spots, which show through above; unf with spot in cell and discal row curved in so that spot in 2 comes under spot end cell. Above white with broad dark brown border; in ♂ the white area is suffused pale blue; in ♀ blue only at base.

**atroguttata, Doh.* (44-48). The Great Spotted Blue. Naga-Chin Hills. R.

2a (1). Unh never a spot base 8 and never white above.

2b (12a). Unh discal spots black, not white.

2c (10a). Unh no basal green scaling or, if so, very faint and not sufficient to obscure the basal spots.

2 (3a). Unf with spot in cell and the cilia prominently chequered. Unh marginal spots prominently orange crown. Above ♂ pale to rather dusky blue with a more or less broad border; prominent bars end cells. ♀ brown.

**baton cashmirensis, M.* (27-31). The Kashmir Blue. Chitral-Kashmir and Ladak. NR.

3a (2). Unf never a spot in cell and cilia unchequered.

3b (7a). Unf with metallic spots on margin.

3 (4a). Unh small metallic spots along entire margin and marginal spots F and H faintly orange crowned; unf discal spots large, unh small and regular.

H. 23. Lycæna.—(*contd.*)

Above ♂ dull violet blue, border narrow; ♀ brown with basal blue suffusion.

christophi samudra M. 30-34.) The Small Jewel Blue. Baluchistan, Chitral Kashmir. R.

4a (3). Unh metallic spots confined to tornus.

4 (5a). Below complete row large orange marginal spots, only faint traces of a metallic spot in 2 near tornus H; discal spots, very regular and nearer margin than usual; unh spot in 1 not shifted out of line as usual. Above ♂ violet blue, border linear, with orange spots at tornus H; ♀ brown with orange marginal spots at tornus F and H.

**pylaon indica, Evans.* (29-31). The Baluchi Jewel Blue. Baluchistan. R. (Compared with *pylaon, Fisch*, from S. E. Russia, the spots below are more regular and the tornal orange markings are reduced. This race also occurs in W. Thibet.)

5a (4). Below only orange at tornus H, crowning prominent metallic scales in 1 and 2; unf discal spot in 2 shifted in under spot end cell.

5(6). ♂ above blue with rather broad dark border; ♀ brown with prominent orange tornal spots H and often with a postdiscal row of white spots F and H. Below all spots large and prominent; unf discal spot in 2 elongated; submarginal lunules coalesced to a broad dusky band; tornal metallic and orange spots H large and prominent.

α. upf borders narrow.

loewii chamanica, M. (32-36). The large Jewel Blue. Baluchistan. NR.

β. upf dark borders broad.

**loewii sanoga*, Evans. Chitral-Ladak. NR.

6 (5). ♂ ♀ above very dark bronzy brown, prominent spot end cell F. Below discal markings prominent, marginal small and fainter.

**iris dshretha, Evdns.* (25-29). The Chitral Jewel Blue. Chitral. NR. (Darker than true *iris* from C. Asia).

7a (3b). Unh no metallic spots.

7b (9). Below no orange submarginal spots.

7 (8). Unf and unh discal spot in 3 markedly shifted out of line towards margin. Below discal markings prominent, marginal faint. Above ♂ rather pale blue, diffused, rather narrow border and upf discal spots showing as well as spot end cell; ♀ brown, upf discal spots show faintly.

**cytis, Lang.* (24-26). The Shandur Spotted Blue. Chitral. R.

8 (7). Unf and unh discal spots regular; marginal markings prominent. Unf coppery brown; unh white. Above ♂ ♀ dark brown with black spot end cell upf.

astorica, Tyt. (29-31). The Astor Argus. Astor. R.

9 (7b). Below complete prominent row submarginal orange spots, which appear above, complete in the ♀, more or less so in the ♂. Above ♂ ♀ dark brown with a black spot end cell upf. Unf discal spot in 2 shifted in under spot end cell; unh discal spot in 6 shifted in and adjoining spot in 7.

**astrarche, Berg.* (25-30). The orange bordered Argus. Chitral-Kumaon. C.

10a (2c). Unh with prominent basal green scaling, which obscures the basal spots.

10 (11). Unh marginal spots more or less orange crowned; marginal markings faint on F. Unf and unh discal spots very regular; unh discal spot in 2 in line with the rest. Unh bar end cell triangular and prominently white edged, often with a prominent white streak thence to mid termen. Very variable and in some specimens the discal spots below are completely absent. Above ♂ ♀ unmarked dark brown.

H. 23. Lycæna.—(*contd.*)

eumedon antiqua, *Stg.* (28-32). The Chitral Argus. Chitral-Gilgit. R.

11 (10). Unh marginal markings obsolete; all discal spots below small and regular, becoming obsolete towards tornus F and H. Above ♂ dull violet blue with very broad borders. Unh spot end cell nearly white.

semiargus annulata, *Elwes.* (28-32). The Dull Chumbi Blue. Chumbi. R.

12a (2b). Unh discal spots, if present, white: marginal markings absent.

12b (16a). Unh with metallic green scaling extending to termen or at least well beyond discal band. Unf discal spots nearly always black and all marginal markings F and H absent.

12 (13a). Above ♂ ♀ dark brown; unh no discal spots and with more or less metallic spots at tornus.

younghusbandi, *El.* (28-30). The Chumbi Green Underwing. Chumbi. R.

13a (12.) Above ♂ blue; unh with white discal spots as a rule.

13 (14-15). Above ♂ rather pale blue, with sharply defined dark border, 2mm; ♀ plain brown. Unf grey.

metallica, *Fd.* (26-30). The Small Green Underwing. Chitral-Ladak. R.

14 (13-15). ♂ above dusky violet blue shading to a broad dark border, 4mm; on H blue colour usually confined to the base. ♀ plain brown. Unf much darker, brown not grey.

**omphissa*, *M.* (30-32). The Dusky Green Underwing. Kashmir, Ladak-Lahoul. R.

15 (13-14). ♂ above violet blue, border not over 2mm. Larger.

α. ♂ above dark border 1mm. increasing to 2mm. at tornus F and on H; ♀ above sometimes plain brown. Unf diffused submarginal dark patches above tornus.

galathea chitralica, *Evans.* (34-39). The Large Green Underwing. Chitral. NR.

β. ♂ above dark border 1mm. even throughout. ♀ brown with large orange marginal spots above tornus F and H. Unf the discal spots are sometimes white.

galathea galathea, *Blanch.* (32-37.) Kashmir-Kumaon. NR.

16a (12b). Unh metallic green scaling basal or absent.

16b (18). Upf never a spot end cell. 16 (17); Above ♂ violet blue, ♀ brown with rarely any blue scaling at base. Below very variable, more so than any other Lycaena. Unf pale grey, a spot end cell and a regular discal row which are usually black but may be white, only rarely a spot in 1. Unh varying from entirely greenish white to entirely brown or may be centrally brown and rest greenish white, metallic green suffusion present or absent. Unh the spotting equally variable; usually spots large and white, but may rarely be small and black; typically with a straight discal row 2-5 pointing to apex, conjoined discal spot 6-7, basal spot in 7, spot end cell and mid cell usually conjoined; rarely the spot in 6 is central between spot in 5-7; sometimes spots very enlarged, sometimes entirely absent.

α Rather smaller and paler.

pheretes lehana, *M.* (24-28). The Mountain Blue. Chitral-Kumaon, over 12,000 feet. NR.

β. Rather larger and darker.

**pheretes pharis*, *Faw.* Sikkim. NR.

17 (16). Above shining sky-blue, with very rarely prominently chequered cilia.

asiatica, *Elwes.* The Sikkim Mountain Blue. Sikkim. NR.

18 (16b). Upf with a prominent spot end cell.

H. 23. Lycæna.—(*contd.*)

α. Above without any discal white spots (sometimes obscure in ♀). ♂ greenish blue with a broad border 2mm; ♀ plain brown. Unf grey with a prominent black spot in cell, discal row curved bringing spot in 2 under cell spot and always a spot in 1. Unh outer third white, central third brown, base more or less metallic green; large white spot end cell, conjoined spot 6-7(rarely with black centres), rarely small black spot base 1; rarely a discal row of conjoined white spots is perceptible as separate from the white margin.

**orbitulus walli, Evans.* (28-30). The Greenish Mountain Blue. Chitral. R.

β. Above with a more or less complete series of prominent white discal spots F and H and always a black centred white spot end cell F and usually H; dark brown, overlaid with greenish blue scales from the base outwards of varying extent, less extensive in ♀ or absent. Below as last, but unf spots more regular and often more or less obsolete; unh as last, but all spots entirely white and larger; discal spots in 6-7 usually united to the white border.

orbitulus jaloka, M. (25-29). Kashmir. R.

γ. As last, but upf with a white spot end cell.

orbitulus leela, DeN. Ladak, Pangi. R.

H. 24. Polyommatus.—The Meadow Blues. (Plate 127).

Close allies of *Lycaena.* ♂ above always blue. Below spots black and white ringed. Unh nearly always a spot base 2, discal spot in 1 in line with spots in 1a and 2 and discal spot in 6 central between spots in 5-7.

1a (3a). Unf with a spot in cell and another often below it in 1; may be absent in specimens with ill-developed spots. Usually with orange marginal spots below, never any metallic spots.

1 (2). ♂ above uniform lilac blue, border linear, blue colour never shades to border nor are veins darkened before reaching it; never a black spot end cell F. ♀ very variable, from plain brown to dusky blue with broad borders and marginal orange spots. Unf discal spots 4, 5 and 6 on a curve. Unh spot in 6 usually rather nearer to spot in 5.

α. Above bright lilac blue. Below spots very small and uniform, no white patches H.

* *icarus fugitiva* But. (30-32). The Violet Meadow Blue. Baluchistan. C.

β Above duller. Below more variable, marginal orange spots better developed and sometimes traces of white patches H.

icarus chitralensis, Swin. (30-36). Chitral. C.

2 (1). ♂ above very variable, border variable, often diffused and veins always slightly blackish just before the border. ♀ more constant, rarely any blue above and large orange submarginal spots usually well developed. Unf spots in 4, 5 and 6 in a straight line or nearly so. Unh spot in 6 usually nearer spot in 7.

α. ♂ above very pale silvery blue, border a thread. Below markings small, marginal orange spots nearly obsolete, no white patches H.

eros balucha, M. (28-34). The Common Meadow Blue. Baluchistan. R.

β. ♂ above as last, but border broader, 1mm. Below orange spots very large, but rather pale, no white patches H.

eros drunela, Swin. (28-34). Safed Koh. NR.

γ. ♂ above more lilac blue and dusky, borders more or less diffused, 1½-2mm; usually a spot end cell F and traces of marginal spots H. Below variable, marginal orange spots small, but dark, white patches usually prominent on H. Varies a good deal with the season and the elevation.

H. 24. Polyommatus.—(*contd.*)

eros droshana, Evans. (32-40). Chitral. NR.

δ. Small, ♂ above pale violet blue, border narrow, 1mm., slightly diffused. Below markings small and tending to obsolescence, white patches H prominent.

eros stoliczana, Fd. (30-34). Ladak. NR.

. ♂ spring form brilliant violet blue, summer form pale shining blue, border 1mm.; very much as β but larger. Below as γ.

**eros pseuderos, M.* (32-35). Kashmir, Murree. NR.

ξ ♂ above bright metallic blue, border F 1½ mm. Below grey, marginal orange markings nearly or quite obsolete and white markings prominent, especially the white transverse streak from base to mid termen H.

eros ariana, M (38). Kangra, Kulu, Spiti to Kumaon. NR.

η. ♂ varying from pale lilac blue with narrow margins and obsolescent markings below to a rather deep brilliant blue with black marginal spots uph and below chalky white with prominent large submarginal orange spots. ♀ variable.

eros arene, Fawcett. (30-35). Chumbi Valley, Bhutan NR.

3a (1a). Unf no spot in cell or in 1 below cell.

3b (5a). Unh basal spots absent except for that in 7 and the spot mid cell may be traceable. Above unmarked and border a thread.

3 (4). Below marginal markings prominent and on H crowned orange; unf submarginal spots conjoined to a broad dusky band, marginal spots absent, discal spots curved round so that spot in 2 comes under spot end cell, spot in 6 shifted in and no spot in 1. Unh spot in 6 central between spots in 5-7, spots 2-5 on an arc, spot on 1 shifted out and spot in 1a absent. Above ♂ pale silvery blue, border a thread. Apex F pointed.

poseidon poseidonides, Stg. (40). The Silvery Meadow Blue. Baroghil Pass, Chitral. R.

4 (3). Below marginal markings entirely absent; uniform very pale grey brown. Unf discal spots in a nearly straight line, getting nearer margin at lower end, spot in 1 present, double. Unh spot in 6 slightly shifted in and nearer spot in 7, spots 2-5 on an arc, double spot in 1 and spot in 1a shifted out, close together. Above ♂ shining lilac blue, border a thread. Wings broad.

iolas, Ochs. (38). The Gilgit Meadow Blue. Gilgit. VR.

5a (3b). Unh the row of 4 basal spots prominent. Below all spots large, never any orange submarginal spots F, usually present on H and often metallic spots at tornus.

5 (6). Unh discal spot in 6 much nearer spot in 7 than spot in 5; basal row 4 spots not quite in line, that in 1 slightly shifted in; marginal orange spots obsolete. Unf discal spot in 1 present or absent. Upf prominent spot end cell.

a. Above ♂ rather dull blue, border 1-2mm, on H broken into large marginal spots.

devanica gracilis, Evans. (24-30). The Dusky Meadow Blue. N. Chitral R.

β. Above ♂ bases only dusky blue, border 4mm. or more, the blue colour often extending through cell and along costa to apex.

devanica devanica, M. (30-34). Chitral, Kashmir, Ladak. R.

6 (5). Unh discal spot in 6 central between spots in 5-7; basal 4 spots in line, marginal orange spots more or less well developed.

a. ♂ above bright blue, border very narrow, marginal spots H. Upf no spot end cell and unf no spot in 1. ♀ above with very large submarginal orange

H. 24. Polyommatus.—(*contd.*)

spots F and H and black marginal spots H ; on F the orange colouring sometimes spreads to the disc.

**sarta sartoides, Swin.* (35-38). The Brilliant Meadow Blue. Chitral. R.

β. ♂ above dull dusky blue evenly extended to the dark brown border. Upf with spot end cell ; unf with discal spot in 1. ♀ varying from plain brown to an approach to last with submarginal orange spots appearing above.

sarta rupala, Tyt. (32-36). Astor. R.

H. 25. Una.—The Una. (Plate 27).

Above ♂ dark purple brown, border narrow ; ♀ sky blue upf with broad borders and uph pale brown with blue scales at the base. Below pale ochreous brown of a peculiar shade, bearing small black spots arranged as usual, marginal markings obsolete ; small double spot in cell F, no spot in cell H ; the 2 costal spots H more prominent than the rest ; all spots tend to obsolescence.

**usta, Dist.* (24-27). The Una. Assam—S. Shan States. R.

H. 26. Orthomiella.—The Straightwing Blue. (Plate 27).

Above ♂ dark shining purple, border a thread, cilia chequered and elongated at tornus H ; ♀ shining blue, border broad. Below brown with dark catenulated spots arranged as usual ; marginal markings nearly obsolete ; unf a spot in cell and in 1 below it; unh dorsal half from base to discal band darkened, covering all the markings.

**pontis pontis, Elwes.* (28-32). The Straightwing Blue. Sikkim-Assam. R.

β. Smaller. Wings more pointed. Browner above and yellower below.

pontis rovorea, Fr. N. Burma. VR. (Fr.).

H. 27. Syntarucus.—The Zebra Blue. (Plate 27).

Above ♂ violet blue ; ♀ base blue with a white discal area F bearing black spots. Below with alternate broad and narrow bands at right angles to the costa, broken into spots on H. Markings variable and irregular, but quite different to any other species. Unh metallic spots at tornus.

**plinius, F.* (22-30). The Zebra Blue. Ceylon, India, Burma. C.

H. 28. Catachrysops.—The Forgetmenot. (Plate 27).

Above pale blue, border narrow. Below pale grey with catenulated bands; unf the discal band broken into 2 portions and at the upper end there is a small spot on the costa internal to the band. Unh a single very large orange crowned spot at tornus.

1 (2). Unf spot on costa midway between spot end cell and the discal band. Above ♂ violet blue. Below bands narrow and more catenulated.

**strabo, F.* (25-35). The Forgetmenot. Ceylon, India, Burma, Andamans, Nicobars. C.

2 (1). Unf spot on costa adjoins upper end of discal band. Above ♂ pale silvery blue. Below markings paler, broader, straighter and more confluent.

lithargyria, M. (25-35). The Silver Forgetmenot. Ceylon, Assam-Burma, Andamans. NR.

H. 29. Lampides.—The Peablue. (Plate 27).

Above ♂ violet blue, frosted over. Below pale brown, marked with fasciæ, no spots, except for 2 black ones crowned orange and metallic at tornus H ; marginal lunules F and H ; unf with a short fascia in cell, end cell and a discal

H. 29. Lampides.—(*contd.*)

band ; unh basal band, fascia end cell, discal band and a white band beyond.

* *boeticus, Ramb.* (24-36). The Peablue. Ceylon, India, Burma, Andamans, Nicobars. VC.

v. obsoleta, Evans. Except for the tornal spots H all the marginal markings F and H are absent. Andamans. NR.

The following are new names :

Poritia erycinoides elsiei. Simiskina pasira dohertyi. Talicada nyseus hurmana. Euchrysops contracta nila and *pandava lanka. Everes parrhasius pila, Lycaenopsis huegelii orevides. Chilades laius tavoyana. Lycaena pylaon indica, loewii sanogha, iris ashretha, galathea chitralica. Polyommatus eros droshana. Lampidesboeticus var obsoleta.* To be described by Gen. Tytler :— *Lycaena astorica* and *Polyommatus sarta rupala.*

(*To be continued.*)

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS,

By

Herbert Stevens, M.B.O.U.

Part V.

(*With a plate.*)

(*Continued from page* 71 *of this Volume.*)

239. Buturlin's Red-spotted Blue-Throat. Cyanosylvia suecica robusta (But.). ?

Obtained on one occasion only ♂ 13-2-19, at 3,500′, and observed ♀ 2-12-21* on both occasions in the bottom of the Rungbong Valley at Gopaldhara. The great majority of these Blue-Throats must clear the outer hills on their descent to the plains, and it is only stragglers, finding a congenial haunt, that remain. I noted it on a few occasions in grass-land near the Sankos River in the plains in January 1922. On comparing this single ♂ with my Assam skins I find six specimens to measure as follows: Sikkim, ♂ wing 70; Assam, 3 ♂ ♂ §, 73·5-75 av. 74·3; 2 ♀ ♀, 69·5-72·5, av. 71.

Dr. Hartert's measurement for *Luscinia s. pallidogularis*, 71-75.

Type locality Orenburg and probably the Turan.

L. s. discessa 69-74

„ „ Transcaspia.

L. s. robusta 75-80

„ „ Kolyma's Delta.

As this latter bird is generally considered to be the form found in the plains of Upper Assam during the winter and can hardly be the first two mentioned. I would draw attention to the short wing measurements of my specimens.

§ ♂, 1-5-03, has assumed the full blue throat; wing, only 73·5. All these specimens have a dark crown, similar to "robusta."

240. The Common Ruby-Throat. Calliope calliope (Pall.)

Blanford states this species was seen occasionally in the latter part of September, and more frequently in October, apparently coming from the north and migrating southward; one shot at Momay Samdong at 15,000′ on the 19th September. It occurs in limited numbers throughout "the cold weather" in suitable haunts on the Outer Ranges; these Ruby-Throats are most likely merely a sprinkling of the numbers which perform the downward journey without a break to their more distant quarters. Gopaldhara, 3,500′, ♂ 30-1-19*. 4,700′, ♀ 5-2-18*. Thurbo, 4,250′, ♂ 25-3-11, one of a pair. Turzum, ♂ 11-1-21, (O. Lindgren). Mangpu, 3,700′, ♀ 3-3-20. 3,800′, ♂ 5-11-20, (G. E. Shaw). Sukna, 550′, ♂ 30-11-19, (C. M. Inglis). Two specimens examined: ♀ Wing 75·5-79, av. 77·3, compared with Assam skins, 3 ♂ ♂ wing 73-75·5, av. 74·5.

241. The Eastern Ruby-Throat. Calliope pectoralis confusa (Hart).

Recorded for Sikkim, "breeds 10,000′ upwards". It may extend into the plains or even reach the base of the hills during "the cold weather," but I have no information as to this conjecture. It is sparingly distributed at this period of the year at moderate elevations in the Outer Hills, and its numbers are not so limited as seems apparent, as all Ruby-Throats are adept skulkers. Observed on a few occasions during November and December, one noted ♂ 9-11-21*, and one obtained at Gopaldhara, 3,500′, ♂ 18-3-21. A pair observed at 4,300′,

22-4-23* were probably this species. Blanford records it as common on the Cho La Range, less abundant in northern Sikkim, August to September a 12,000′, usually above the limit of the forest.

242. The Tibet Ruby-Throat. Calliope pectoralis tschebaiewi Prezew.

Recorded for Sikkim in its distribution. I am not aware of the reasons for regarding this bird as a sub-species of "*pectoralis*". Mandelli obtained it in March 1878 from Native Sikkim and both these Ruby-throats may well breed at high limits in Sikkim. It has recently been recorded from the Bhotan Dooars where, Mandelli also obtained specimens in "the cold weather." These birds may arrive in the plains by a more easterly route, as they were common in Upper Assam at this period of the year, being more numerous than *C. calliope*. As might be expected from my experience with its near ally, I have failed to discriminate the differences by observation, though I was well acquainted with it in former years. Sikkim appears to be the extent of its western distribution limits and probably *C. p. confusa* is the predominant bird in these hills.

243. The Golden Bush-Robin. Tarsiger chrysæus Hodgs.

Recorded as a constant resident at moderate heights on the Himalayas which is strictly not correct. Odd birds do rarely occur on the high ridges of the Outer Ranges in winter; these may be regarded as stragglers driven down from the extreme upper limit of their breeding range as this Bush-Robin is recorded as having bred at 12,500′ in Sikkim (Hartert), whilst *the majority move into the valleys* to again *ascend at the nesting season*. I have noted it on three or four occasions at Gopaldhara at elevations of from 4,000′-4,500′ during "the cold weather," the last instance being at 4,400′, ♂ 28-12-21*. In the Mai Valley, East Nepal, 7,000′–8,000′, 1 ♂ and 3 ♀ ♀ were obtained, 2—8-4-12. Darjeeling, south side of the station, at 7,500′, ♂ 14-2-20, flitting about the road-side, remarkably tame, as it was in no way concerned with the passers-by; particularly raw weather at this time and hunger no doubt accounted for its unusual fearlessness. At most times, it is dislodged with difficulty from the dense growth it frequents on the valley-slopes; its golden-yellow plumage is seen only for an instant as it makes a hurried movement across an open space into an equally dense retreat. Obtained below Mangpu at elevations of from 2,400′, 10-1-21, up to 3,800′, (G. E. Shaw).

244. The Red-flanked Bush-Robin. Ianthia rufilata (Hodgs.).

Widely distributed *during the winter at varying altitudes*; odd birds occurring at *10,000′* on the Outer Ranges simultaneously with the appearance of others at *3,500′* and a few on rare occasions may move down to the foot of the hills. I have no record to support this anticipation but was actually the case in Upper Assam when, it was obtained on a few occasions, on the North Frontier. I did not meet, however, with any birds in the Raidak Gorge in the Bhotan Dooars, in January 1922. The majority remain at elevations of from 7,000′-5,000′, at this period of the year, and the following summary of records throughout these months is given, yet this Bush-Robin being by far the commonest in comparison with the other two species; this list by no means exhausts the innumerable times it has come under my observation. Gopaldhara, 4,720′. During December and January, an odd bird or two always frequent the compound. I noticed one secluded corner was a favourite abode, to be occupied regularly each successive year by evidently the same bird; as I remarked on its appearance on a subsequent visit that it had assumed the full adult garb. Others, invariably immature birds are to be seen on the outskirts of the forest. Obtained above the Tista Valley at 3,650′, at Mangpu and upwards to Senchal

(G. E. Shaw). Semana basti, 6,000′, adult ♂ 20-1-12*. Mirik, 5,200′, December and January, 1911-12, adult males somewhat rare. Ghoom to Sookia Pokhari, 7,200′, adult ♂ 19-1-12, noted as numerous hereabouts, 13-12-13* when several adult males were seen. Ghoom to Sonada, 7,300′, adult ♂ 8-2-17. 7,200′, adult ♂ 9-2-17.

Above Turzum, 6,000′, adult ♂ 20-2-19.* Sonada to Senchal, 8,000′, 24-3-15.* Lachung, 8,800,′ adult ♂ 1-3-20. Karponang, 9,500′, ♀ 19-3-17. Tonglo, 10,000′, ♂ 22-1-12, observed a female or immature male also in company with a male *Phœnicurus frontalis*; another specimen secured but subsequently lost (January). Kalo Pokhari, East Nepal, 10,160′, ♀ 20-3-12, ♂ 1-4-12 ♂ 6-4-12; ♀ 8-4-12, numbers seen on other occasions. The male evidently takes more than one year to acquire the blue plumage of the adult; some males in female dress are breeding birds: a parallel case to *Heteroxenicus cruralis* and *H. nipalensis*. The bluish-grey supercilium seems to be confined to the female yet present to a less extent in the male when in the female phase of plumage. All such examples require care in preparation and carefully sexing. Eleven specimens examined:

♂ Wing 79-86·5, av. 81·3; ♀ wing 78-81, av. 79·5; whereas immature (?) males average 80, adult males run somewhat larger: the wing of a Lachung (interior of Sikkim) specimen measures 86·5.

Oates remarks that "males from Sikkim are very bright; those from other parts have the upper plumage a greenish-blue."

My four males are equally divided as regards this depth of coloration and the deep coloured birds are matched by a specimen from the Miri Hills, Assam. It is significant that *all these examples have a longer wing measurement than the greenish-blue birds* and is possibly a matter of age co-related with vigour: *the bases of the eyebrow feathers are white* giving the latter birds a distinguishing supercilium. Blanford records it from the Cho La Range at 12,000′ (August).

245. The White-browed Bush-Robin. Ianthia indica indica (Vieill.).

The least common of the three species of Ianthia. Observed and obtained on the following occasions. Sookia Pokhari, *6,800′*, 13-2-20*, two or three at scattered intervals along the road-side; this *elevation is the lowest* at which it has been met with. Senchal, 7,750′, ♀ 7-2-17, secured in dense undergrowth in forest. Mai "Khola", East Nepal, 8,000′-9,000′, ♀ ♀ 23-3-12. Tonglo, 10,000′, Sikkim side of the Frontier, ♀ 30-1-12, procured in a similar habitat and adjacent to where a ♂ I. rufilata was obtained. ♂ 5-2-12, a female seen on the 9-2-12*, in company with the male, but the growth was too dense to allow of my seeing the latter. Karponang, 10,500′, in evidence towards the end of March, 1917.

Five specimens examined: ♂ Wing 83-84·5, av. 83·8; 2 ♀ ♀ wing 77-79.

246. The Rufous-bellied Bush-Robin. Ianthia hyperythra Blyth.

This handsome Bush-Robin has been observed and obtained on the following occasions. Nurbong, 1,085′, ♂ 21-2-14*, observed at close quarters, having come out into the open after a heavy shower. Toong (interior of Sikkim), 4,300′, ♂ 24-2-20. Gopaldhara, 5,000′, ♂ 5-5-17*.

Sookia Pokhari, below, at 6,800′, ♂ 20-2-19*, another ♂ and possibly two ♀ ♀ in the same locality. Ghoom, near the Pussimbing turning, at 7,300′, ♂ 17-1-17, this bird was very tame and was observed later on during the first week in March, in the same identical place.

Karponang, 9,800,′ ♂ 17-3-17, and seen ♂ 24-3-17*. Sandakphu, 11,800′, Nepal side of the mountain, ♂ 2-3-12, single bird only, secured amongst some dwarf rhododendron in a rocky gully on the bare slopes, no females obtained.



H. S. Photo.

DIKCHU DAK BW.

2,150'. Tista Valley. 23rd February, 1920. Tropical vegetation.
Haunts of *Melanochlora sultanea sultanea*, *Yuhina nigrimentum nigrimentum*, *Pericrocotus solaris*, &c., &c.



H. S. Photo.

LACHUNG DAK BW.

8,800'. 8th March, 1920.
Surroundings, the haunts of *Fulvetta vinipecta vinipecta*, *Troglodytes troglodytes nipalensis*, *Perissopiza carnipes carnipes*, *Carpodacus edwarsii saturatus*, &c., &c.

Five specimens examined:
♂ Wing 78-83·5, av. 80·3, for comparison (Assam) skins. ♂ wing 76·2; ♀ ♀ wing, 75-77·5.

247. The Blue-headed Robin. Adelura cæruleocephala (Vig.).

Its generally accepted place is now in the genus *Phœnicurus*; the reasons for treating this species as a Redstart are not quite obvious.

Recorded "Himalayas 10,000′ upwards in summer, much lower levels in winter." Obtained on one occasion only at a high altitude in winter. *Apparently not previously recorded for Sikkim.*

Saburkum, Nepal-Sikkim Frontier, at *11,500′*, ♂ 19-2-12. At first sight I mistook this bird for a Chat, notwithstanding, the lonely recesses of the pine forest, with the ground in places heavily covered with snow seemed a most unlikely place to meet with any *Saxicolas*; secured in lonely company with a Wren (*Troglodytes nipalensis*).

248. Hodgson's Grandala. Grandala cœlicolor Hodgs.

Recorded for extreme elevations of not below 15,000′, Sikkim. "Observed 17,000′" (Blanford). Occurs in the Lachung Valley above the village at *10,000′, and upwards in winter*, when they congregate in huge parties moving about the rocky slopes of the valley, and observed to come down to about *9,000′* under stress of severe weather, at early morn, after a heavy fall of snow. Near Phalut summit, 11,700′, 16-2-12*, an immense flock of these birds presumably, heavy mist at the time coming on, and I was making every effort to reach shelter before darkness set in, having been out in the snow the whole previous night.

In their "habits" they distinctly have close relationship with the Starling.

The young male is identical in plumage with the adult female; the upper tail-coverts first showing signs of acquiring what will later be cobalt-blue when the complete change has been effected.

Oates makes no mention of the gloss in the plumage of the adult male; the only Indian bird I know of which is similarly favoured, is the male of *Oriolus traillii*.

Eight specimens examined: ♂ Wing 140 in first stage,—148 in adults, av. 144·2; ♀ Wing 135.

Soft parts; Iris hazel; bill black; gape yellow; tarsus black.

249. The White-tailed Blue Robin. Notodela leucura (Hodgs.).

Occurs sparingly around Gopaldhara from 4,700′, ♂ 5-11-18, up to 5,000′ during "the cold weather"; these being probably birds which have moved down from higher extremes; its numbers being augmented during the nesting season by birds which have ascended in the summer. A juvenile in spotted plumage obtained at 5,000′, 25-6-23. Observed at 6,500′, ♀ 6-5-23.* Three secured 12—14-4-21 4,750′-5,000′. Mai "Khola East" Nepal, 8-4-12*, observed in dense forest in the upper reaches of the valley at *8,000′*, approx. elevation. Obtained in the hills above Mangpu at an elevation of 6,200′. (G. E. Shaw). Recorded breeding at Rishap, 4,000′. (Gammie). Lebong, 5,500′. (Mandelli).

250 The Blue-fronted Callene. Callene frontalis (Blyth).

Recorded only for Sikkim. Apparently rare with a restricted distribution. Represented by 13 ♂ ♂, January—May and 2 ♀ ♀, August and December. 1873-78. (B. M. Coll.). Inglis obtained it at Jore Pokhari, ♂ 7-7-04.

This species bears a strong superficial resemblance to *Notodela leucura*, and might easily be mistaken for it by the field-naturalist: the prominent white

markings on the tail of the latter species when expanded, could be the only reliable distinguishing clue to make note of, to settle the difficulty.

251. The Indian Magpie-Robin. Copsychus saularis saularis (L).

This songster is a summer visitor only to the hills on the western side of the district, and penetrates the deep valleys of the interior to a corresponding elevation. I have never obtained their eggs from *an elevation of above 5,500'*, which appears to be *the limit reached* by a few birds. Odd birds may be seen in and about the compound of many of the tea-planters' bungalows, which are separated widely apart on the hill-sides of the Rungbong Valley.

Nurbong 2,000', ♀ 3-3-14*. ♂ 6-3-14*. Gopaldhara, 3,440', ♂ ♀ 30-3-18*. 4,720', 18-5-18, a single bird. 19-6-23*, a male in evidence. 29-6-15*, a male singly lustily at 6. a. m. in the bungalow compound; heavy rain last two days, having previously been seen on the first occasion, ♂ 12-4-15*, noted again 25-4-15*, and possibly 1-5-15*. Seeyok, 5,200', ♂ 22-3-16.* Observed below Gangtok at 5,000', 20-2-20.*

252. The Indian Shama. Kittacincla macroura tricolor (Vieill.).

Evidently *confined to the base of the Lower Foot-hills*, and has some status in the Tista Valley. Obtained up to an elevation of *3,800'*, below Mangpu (G.E. Shaw). Commonly occurs in the densely wooded country at the base of the hills in the Eastern Dooars, and almost equally as plentiful in the spare growth in the vicinity of habitations in the more open, cultivated country, where it is more accustomed to the presence of the villagers and in consequence less shy. Females are rarely seen strangely enough; they appear to be still more shy than the males.

Bhotan Ghat, Raidak River ♂ 20-1-22, this specimen has the tail 198 in length, whereas a Gauhati, Assam, ♂ also adult, measures only 142 and none of the seven Assam skins with which it has been compared approach in tail measurement anything like this Dooars example.

253. The Himalayan Blue Chat. Larvivora brunnea Hodgs.

Breeds sparingly around Gopaldhara at all elevations *from 5,000' upwards*. The nest is a shallow cup containing a few feathers; in the vicinity of Gopaldhara, the feathers of the Kalij Pheasant and the Red-throated Partridge are used: eggs, pale blue unspotted and usually four. Only once have I seen the male and female together during "the cold weather". 4,600', 10-1-19.* Three ♀ ♀ were secured in the Mai Valley in Nepal, 30th April to 22nd May, where also I obtained eggs. ♀ Wing 71-71·5, av., 71·3.

254. Gould's Shortwing. Heteroxenicus stellatus. (Gould).

Decidedly rare. Blanford is recorded as having obtained one specimen at an elevation of 12,000'-13,000' (Yumthang), and there are two or three specimens in the Tring Museum from somewhat higher limits. I have only managed to secure a solitary specimen, but this record is interesting as it proves this Shortwing does occur at much lower elevations. Notwithstanding, its breeding habitat is undoubtedly at extreme heights; some birds may breed at much lower levels, as is the case with the other Shortwings which have a breeding zonal distribution covering a difference in altitude of 5,000 feet on the Outer Ranges. Mai ("Khola") Valley, East Nepal, 7,000' approx. elevation, ♂ 8-4-12 For some unknown reason this specimen is minus many of its wing feathers, which are in course of being replaced: Right wing, first four primaries not quite half grown, 5th-9th, intact, secondaries half grown. Left wing, 1st-4th primaries intact, 5th-9th, not quite half grown, six secondaries intact, remainder missing, showing

no sign of fresh growth. This bird, so seriously handicapped must have been almost incapable of flight; although there is every likelihood of this species making as much use of its legs, if we are to judge from the habits of the other species of this genus as they are skulkers with a partiality for keeping to the ground and could work their way up the mountain-slopes without any great effort from their wings.

255. The Rusty-bellied Shortwing. Heteroxenicus hyperythrus. (Jerd. & Blyth).

I have little information respecting this rare Shortwing which occurred in the Plains of Upper Assam "during the cold season." Observed at Tonglo, 9,700′, ♂ 27-1-12,* in dense "maling" bamboo-growth. No specimens secured, however, as it was with difficulty I could force my way through the thickets and impossible to use a gun unless at close quarters, when the effect would certainly have been to the detriment of the specimen. Mr. G. E. Shaw has secured it at Mangpu at 3,800′ in "the cold weather."

256. The Nepal Shortwing. Heteroxenicus nipalensis (Hodgs.).

Occurs around Gopaldhara sparingly at the nesting season at *4,700 'and upwards.* I have noted one specimen, ♂ 20-7-16*, singing lustily a few feet above the ground and judged to be a male. I obtained two males in the Mai Valley in Nepal at about 7,000′ approx. elevation, 3—8-4-12. These birds are both in the normal dark slaty-blue plumage. My experience thus agrees with others in Sikkim where the blue phase of coloration is more generally met with; whereas it was the reverse in Assam, all the males obtained being in the typical female phase. ♂ Wing 60-61, av. 60·5. Assam skins for comparison. 4 ♂ ♂ wing 59-62·5, av. 61·9. 6 ♀ ♀ wing 55-59, av. 57·8.

257. The White-browed Shortwing. Heteroxenicus cruralis (Blyth).

Comparatively numerous yet far from common on the Outer Ranges and is migratory to some extent according to season. Obtained above Mangpu at 5,000′-5,300′ in elevation. (G. E. Shaw).

There is some confusion in respect to the coloration of the adults.

The males of this Shortwing in many cases breed at the extreme upper limit of its distribution in the female phase of coloration. The white supercilium is present in the male only and not as stated by Oates "Common to both sexes, although absent in the young."

The following specimens have been examined:

Gopaldhara, Rungbong Valley, 4,700′, ♂ 26-12-11, wing 68, in similar plumage to the female, supercilium present, others seen in the dense brushwood about this time. 5,000′, ♂ 15-4-21. wing, 71-5. in slaty-blue plumage, testes enlarged, breeding. 26-6-17*, observed in the forest, uttering a single loud note. All eggs taken at Gopaldhara have been pure white.

Mai Valley, East Nepal, 9,500′, ♂ 8-4-12. wing 68. ♀ wing 64·5, both in similar plumage, female without the supercilium.

Kalo Pokhari, 10,150′, ♂ 12-5-12, wing 68·5, in female phase of plumage 10,160′, ♂ 16-5-12, in slaty-blue plumage; female seen but not secured, being too near to shoot. Others seen on various occasions; males mostly in female garb. All these breeding males April to May, also have the supercilium as defined as in the slaty-blue specimens. On comparing skins from N. E. Assam, I find these are typical "cruralis"; 2 ♀ ♀ in my collection are more rufous than olive in comparison with skins from Sikkim and Nepal; the average wing measurement is larger 68-68·5, though neither of these measurements reach the measurement of the largest Sikkim male, the wings of which are 65·5-71·5., av. 68·3.

258. Hodgson's Shortwing. Hodgsonius phœnicuroides (Gray).

My observations are extremely meagre in respect to this Shortwing. Obtained on one occasion only at Gopaldhara at 4,600′, ♂ 5-12-18, wing 72, in a female phase ? of plumage, and on the few occasions I have observed this bird, all have been similarly coloured, so it may be a parallel case to some of the members of the near genus *Heteroxenicus*. This specimen was shot in rank growth near the ground; at times, it appeared on the top of the vegetation and uttered a single "tsip" when its tail was raised almost perpendicularly; the eye was very prominent. Another seen, 10-3-19*, at a slightly lower altitude. 3,500′, 7-11-21*. 3,450′, 15-10-14.* 3,500′, 24-9-20.* Nurbong, 2,000′, 3-2-14*. These latter three records are not substantiated but most likely refer to this species as I only got a hurried glimpse, yet sufficient to make a mental note of the main characters. Obtained at Mangpu, 3,800′, ♀ 19-2-20 (G. E. Shaw). Obtained by O'Donel in the Bhotan Dooars, 500′, ♂ 15-2 23, ♀ 8-2-23.*

Soft parts: Iris brown; bill plumbeous-olive, upper mandible darker than lower; tarsus plumbeous-olive; soles paler.

259. The White-collared Ouzel. Planesticus albocinctus (Royle).

"*Charchar*," Paharia, applied to all Blackbirds, Rock Thrushes, etc.

Recorded for the Himalayas, "in summer found up to 13,000′, Cho La Range, August, (Blandford), in winter down to 7,000′." Observed and obtained at elevations of from around 5,000′ up to 10,000′ I have no record for a lower limit in these hills. On the North frontier of Assam it was secured on a single occasion at the base of the Dafla Hills.

Mirik, 5,200′, 14-1-16 *, one female observed, and large parties of other species of Ouzles, amongst which was *P. atrogularis* identified with certainty. Chungathang, 5,350′, 24—26-2-20, several in evidence, scattered about the maidan. Gangtok, 5,800′, early March 1917, numbers observed.

In the beautiful grounds of the Residency, their presence was an additional charm to the velvety lawns. Lachung, 8,800′, a single pair noted during the first weeks in March, 1920. Karponang, 9,500′, ♂ 21-3-17, this bird being the fore-runner of the numbers which would arrive before many days elapsed. Blandford records it from Lachung at 8,000′ in September. Seven specimens examined; ♂ Wing 140-141, av. 140-5. ♀ wing 132-139, av. 136.

Soft parts; Iris brown (of a definite colour, not hazel); bill ochreous-yellow dusky at tip; orbits ochreous-yellow; tarsus dark ochreous-yellow.

260. The Grey-headed Ouzel. Planesticus castaneus castaneus (Gould).

Evidently one of the least plentiful of the members of this genus. Obtained on one occasion only at Kalo Pokhari, Singile la Ridge, 10,000′, ♀ 3-5-12, wing, 133. This female is in slightly abraded plumage. Its condition, taken in connection with the circumstances under which it was obtained, indicated breeding hereabouts in the dense vegetation below the Ridge, on the Sikkim side of the Frontier. The following day there was an appreciable increase in the number of birds to arrive from below: *Ianthocincla ocellata*, *Tesia castaneo-coronata*, *Petrophila erythrogaster*, *Urocissa flavirostris*, which last had been absent for some time. Adversely to these additions, and contrary to my accustomed meeting with the party of *Chelidorhynx hypoxanthum*, which had haunted the ridge until this morning, it was apparent, they had ascended to even higher limits. In my "Notes on the Birds of Upper Assam", I recorded a ♂ wing, 142, obtained on the 4-3-05 at Dejoo, N. Lakhimpur, under the typical form. This record refers to a cold-weather migrant of the eastern race.

This is probably the first occasion *Planesticus castaneus gouldi* (Verr.) has been obtained within strict Indian limits. Lord Rothschild showed me specimens of a light and dark-backed form amongst a collection from N.W. Yunnan; which may eventually require separation, the bulk of the breeding birds being the dark-backed form, while some are the light-backed form; these last agree with Chinese (Chihli) birds to which my single bird is referable. For this information consult Novitates Zoologicæ, Vol. XXX, 1923, No. 1, pp. 42, 43.

261. The Dusky Ouzel. Planesticus eunomus (Temm.). (**P. fuscatus** (Pallas) auct.).

Recorded as obtained in Nepal by Hodgson. Likely to occur as a rare migrant; though I have no knowledge of any record for the Sikkim Himalaya and it is not represented from this portion of the Himalayas in the B. M. Collection.

262. The Red-throated Ouzel. Planesticus ruficollis (Pall.).

Observed and obtained at elevations of from about 3,000′ upto 10,000′. Cedars Balasan Valley, 3,200′, ♂ ♀ 5-4-17,* beautiful adult birds. Gopaldhara, Rungbong Valley, 4,720′, ♂ ♀ 7-4-15*. Above Mangpu at 5,000′ (G. E. Shaw). Chungthang, 5,350,′ 24—26-2-20, plentiful on the maidan; on the 11-3-20 had diminished in numbers. Semana basti, 6,000′, 8-2-17*, many in evidence. Kalo Pokhari, 10,160′, 1-4-12, several seen amongst the snow. Six specimens examined: ♂ Wing, 140-144, av., 142. ♀ wing, 130-136·5, av., 133·6.

263. The Black-throated Ouzel. Planesticus atrogularis (Temm.).

Undoubtedly the most plentiful and widely spread of all the Ouzels. In common with several of the other species, delights in open, bare tracts in winter where they have the necessary scope, and being at this time generally shy can more easily avoid one's approach. Gopaldhara and Mirik, late December 1911 and early January 1912, specimens obtained 1—12-1-12. Gopaldhara, 4,720′, ♀ 8-4-18. Temi, 5,000′, 16-3-20,* numbers of Blackbirds sp? sp? but this bird identified, distributed over the bare surrounding waste. Seeyok, 5,200′, 22-3-16,* two birds noted. Kalo Pokhari, 10,000′, ♀ 18-4-12, numbers seen on various occasions previously to this date, adult males being rarely represented. Obtained at Mangpu from 3,860′-5,000′. (G. E. Shaw).

Ten specimens examined from various parts of N. E. India:

♂ Wing 131-139, av. 134·5. ♀ wing 127-134, av. 130·8.

These five females are quite distinct in coloration from the females of *P. ruficollis*. There are no rufous marks on the tail and throat; in one specimen only is there a rufous tinge on the flanks, which is not to be found in any of my specimens of *P. ruficollis*: the red coloration on the throat in these skins being distinctly terminated on the upper breast in a defined band.

I have not followed the generally accepted treatment of regarding *atrogularis* a form of *P. ruficollis* as I consider both to be well-marked species.

264. The Grey-winged Ouzel. Planesticus boulboul (Lath.).

This Ouzel exerts its vocal powers at the breeding season, when it deservedly takes a leading place amongst a none too plentiful company of competitors. Recorded upto 8,000′ from the base of the hills. During the cold-season stragglers descend to the Terai, whilst *not extending over the plains* as several of the other Ouzels do, being much more sedentary in their habits, notwithstanding there is a change in its distribution according to season, as there is a marked increase in its numbers around Gopaldhara, where it commonly breeds at elevations of from 4,500′-6,500′, and it is equally numerous in the Mai Valley

in Nepal at elevations up to 9,000′ in March and April. Gopaldhara, 5,000′ 8-3-16.* A large congregation of thirty to forty birds, both sexes in about equal numbers, preparatory to nesting. Ten specimens examined: ♂ Wing 140-151, av. 144·8. ♀ wing 131-141, av. 135·8.

265. Tickell's Ouzel. Planesticus unicolor (Tick.).

Recorded for the Himalayas to Sikkim, "in summer up to about 7,000′". My impression is this Ouzel breeds in the regions far beyond or at extreme high elevations only, whatever its breeding habitat is in the N. W. Himalayas. It is decidedly uncommon, and I have only met with it on the Semana Mirik Ridge above Gopaldhara at 6,000′, when females were obtained; two on the 4-11-19 and two on the 9-11-19. Obtained as low as 600′ at the base of the hills. (G. E. Shaw).

Four specimens examined: ♀ Wing 116-123, av. 119·8.

Soft parts: Iris brown; bill olivacous-horny, culmen and edges lighter lower mandible lighter than the upper mandible; tarsus ochreous-horny, darker at the front.

266. The Dark Ouzel. Planesticus obscurus obscurus (Gmel.).

Recorded for Sikkim. So far not obtained by either Mr. G. E. Shaw or myself. Not represented in the National collection from the Sikkim Himalayas which appear to be west of its main southerly migration route, though there is a single specimen, reputed locality Nepal, without further data, *ex* Hodgson Coll.

267. The Pied Ground-Thrush. Geocichla wardi (Jerd.).

Recorded as "summers in the Himalayas (Sikkim) up to 6,000′ or 7,000′".

The only occurrence of this rare Thrush which has come to my notice is that of an adult ♀ 24-4-20, obtained above Mangpu at 3,800′. (G. E. Shaw).

Represented in the Tring Museum, ♂ 17-6-75, *ex.* Elwes Coll. and in the B.M. Coll., ♂ March, 1879, ♀ April 1876.

268. The Orange-headed Ground-Thrush. Geocichla citrina citrina (Lath.).

Recorded as found in summer throughout the Himalayas up to 5,000′ or 6,000′. This Thrush comes up the Rungbong Valley to breed and is sparingly distributed in the interior of Sikkim. The *majority* no doubt *nesting* in the densely forested tracts at the *base of the hills*. Obtained at elevations of 3,400′-3,900′ around Mangpu. (G. E. Shaw).

Gopaldhara, 3,800′, 25-4-16*, a pair of this Thrush foraging amongst dead leaves and decaying vegetation, somewhat shy, yet they allowed me to obtain a satisfactory observation. ♂ 4-7-16,* seen on this occasion, a short distance below, on the path. 4,720′, 21-7-23,* warm with drizzling rain, a male in evidence this morning, its vocal efforts by no means to be despised, but the occasional sustained production more often than not gives way to a medley of notes with no apparent connection to its main effort.

Between Pakyong and Rungpo at 3,200′, approx. elevation, ♂ 27-3-17, procured in a narrow fissure of a coppice on the hill-side.

I have two males only for comparison (Sikkim) ♂ Wing 123. (Assam) ♂ wing 113. ♀ wing 114, all adults. A series from these two areas is desirable for further information.

269. The Blue-headed Rock-Thrush. Petrophila erythrogaster. (Vig.).

During the *breeding season* occurs commonly in the Bungbong Valley from 5,000′ upwards, and at this time is *plentiful at 10,000′* on the Singile La Ridge (April-May). Stragglers descend to the *base of the hills* in the *cold-weather.*

Observed at the bottom of the Rungbong Valley at 3,500′ in January, and obtained as low as 2,200′ in the Tista Valley. (G. E. Shaw). Bhotan Ghat, Raidak River, 30-1-22, when I observed a male taking toll of an odd white butterfly *Appais* sp. ? on the outskirts of the forest. Lepcha Jagat, near Ghoom, 7,200′, 28-5-16*, a female at work, building her nest near the road-side. Semana basti—Mirik ridge, 6,500′, 24-5-23,* a female complacently sitting on her eggs ; nest in bank at road-side ; standing a poor chance of survival, as events later proved. The majority of the birds breed at 7,000′ upwards in the Mai "Khola" in East Nepal. Eight specimens examined : ♂ Wing 122-127, av. 124·2. ♀ wing 118-122, av. 119·7.

270. The Blue-headed Rock-Thrush. Petrophila cinclorhyncha Vig.

This Rock-Thrush arrives at Gopaldhara in late March or early April, and nests sparingly in the Rungbong Valley. It has a *similar breeding distribution to P. erythrogaster on the Outer Ranges* generally. Its occurrences are always worthy of note and its vivid colours lend itself to easy observation ; the female is not so easily located, but the birds are at this time invariably in pairs.

Obtained below Mangpu, 3,000′ (G. E. Shaw). Gopaldhara, 4,720′, ♂ early April 1914 ; ♂ 1-4-17 ; 4,500′, 2♂♂ 1♀ 8-4-17 ; ♂ 8-4-18 ; ♂ 19-4-19 ; 4,650′, 13-8-21*, a juvenile female, observed at close quarters, evidently had recently left the nest. Avongrove, Balasan Valley, 3,500′ ♂ ♀, 24-3-15.*

Kalo Pokhari, 9,000′, approx. elevation, ♀ 5-4-12, ♂ 10-4-12, 10,160′, 15-4-12,* a pair in evidence.

I have never seen it in "the cold weather" when it appears to be entirely absent from the hills.

Three examined : ♂ ♂ Wing 103-104 ; ♀ wing 100.

271. The Eastern Blue Rock-Thrush. Petrophila solitaria pandoo (Sykes).

Occurs in the Tista Valley during the *cold-season*, where I have seen it above Tista Bridge at 750′ and it has been obtained at elevations of from 1,100′-3,500′ in this valley. (G.E. Shaw). It appears to be *only found at low elevations* at this period of the year and I have no information respecting its distribution in the summer, if it is then to be found in these hills. This Rock-Thrush was obtained by the first Mount Everest Expedition at 12,500′ and occurs up to 13,500′ in Garwhal (Kinnear, Ibis, July 1922, pp. 507-8).

272. The Small-billed Mountain-Thrush. Oreocincla dauma dauma (Lath.).

Apparently *breeds* around an elevation of *8,000′ and upwards*, descending to lower elevations after the nesting season and occurs at this time in the bottoms of the valleys in the interior. Observed and obtained on the following occasions ; Gopaldhara, 4,720′, 27-4-16*. single, 19—20-4-18.* Single, 18-4-23*, ♂ 12-4-17; ♀ 7-4-19, killed by dashing up against the glass-panes of the verandah ; not the first occasion I have known of this accident happening to this species. Sungma, 4,500′, ♂ 18-4-17. (C.E. Brown). Gopaldhara, 4,700′, 26-9-20*, single, first arrival. 5,500′, ♂ 21-12-11 ; 5,800′, ♀ 23-11-20 ; 5,500′, ♂ 21-12-11 ; 4,720′, ♂ 7-2-18 ; 5,700′, 9-2-19 ; 5,500′, ♀ 11-2-19 ; 5,800′, ♀ 27-2-19.

Penlong La, 6,300′ to Dikchu, 2,150′, 22-2-20*, single birds about the rocks on the road-side and very tame. Chungthang, 5,350′, 24—25-2-20, numerous and loath to leave their feeding grounds. Obtained from an elevation of 1,000′ upwards in the Tista Valley to Mangpu, 3,850′, ♀ 26-3-15, (G.E. Shaw). Kalo Pokhari, 10,000′, ♀ 9-4-12.

Seven specimens examined: Wing, 142-146, av., 143·9. These measurements overlap in each sex, males being slightly larger.

273. The Plain-backed Mountain Thrush. Oreocincla mollissima mollissima (Blyth).

This Thrush is a cold-weather visitor to Gopaldhara, and as it arrives later than *O. dauma*; it is to be presumed its *upper breeding limits* somewhat *exceed* those of *O. dauma* and this conjecture has been substantiated by observation, when I found *O. mollissima* in the interior of Sikkim at Karponang ascending with the imminent hot weather, 9,600′, 25-3-17,* a single bird; obtained previously, on a raw, wet afternoon at 8,000′, ♂ 16-3-17. The majority of the birds spend the winter at 5,000′ and upwards. Tonglo, near the summit on the Nepal side of the Frontier at 10,050′. In early February 1912, for two or three days only during a "brief" mild spell of weather, odd birds were in evidence. Mai "Khola", East Nepal, 7,000′-8,000′ ♀ 28-3-12; ♂ 9-4-12. Ghoom to Sookia, Pokhari, 7,200′, ♂ 19-1-12, numbers of others observed. 7,000′ ♂ 9-12-17. Semana Basti, 6,500′, ♂ 7-2-18.

Gopaldhara, 5,000′-6,000′, ♀ 4-1-12, others seen. 4,500′, 13-10-21, first arrival, dirty weather for the three previous days. 4,720′, ♂ 13-4-17, a pair observed the previous day.

Eight specimens examined: ♂ Wing 139-146, av. 143·7. ♀ wing 140-141, av. 140·5.

One other specimen of the suppressed "dixoni" obtained at 6,000′, 4-1-12; wing, 133, is evidently an immature bird. I can detect no difference in the tail measurement. I regard the fulvous tips to the median and greater wing-coverts as a sign of immaturity; a more definite character for differentiation is the absence of the bars on the breast; it thus exhibits a larger patch of white, and in this respect on the underside resembles *O. dauma*.

274. The Himalayan Whistling Thrush. Myiophoneus horsfieldi temminckii Vig. "Kholchara", Paharia.

This handsome and sprightly Thrush is undoubtedly one of our finest songsters. It is a gratifying experience to have this bird take up its quarters adjacent to one's home, as it is then its rich notes can be heard to advantage, as it pours out at sunrise its pleasing trill. One welcomed bird took possession of the precincts of the Gopaldhara Bw. During each successive cold-weather, daily, we were duly warned of its arrival, as the various stages it took in its hops to gain a commanding point of vantage on the corrugated-iron roof were quite audible, when we had not long to wait for the forthcoming melody. In January 1921, it became very tame and would make an early visit to the plant-pots on the verandah; as the warm weather appeared we lost its company, its visits becoming of less frequency until its disappearance. In another instance the fates were not so kind, as it was with regret we found our friendly visitor one morning helpless, evidently having dashed in its flight when disturbed, against one of the side walls, from the effects of this injury it never recovered. A few remain at extreme limits in winter up to 9,000′, Tonglo, Mechi Valley in Nepal, 5-2-12. Lachung, 8,800′, a pair or so about 27-2—10-3-20, and this no doubt is the case for lower limits, stragglers being found at the foot of the hills in winter. The *majority*, however, *breed at moderate elevations*, as low as 3,440′ and upwards in the Rungbong Valley. They cling in true conservative custom to a favourite haunt at the nesting period, occupying the same secluded rock, overgrown with vegetation, for preference, which unfortunately, they readily betray to the astute paharia urchin.

275. The Large Brown Thrush. Zoothera monticola Vig.

Generally distributed on the Outer Ranges. Obtained at Gopaldhara, 5,000′, ♂ 26-3-15, wing, 135, and on Tonglo at *9,700′*, ♂ 15-2-12, wing, 145, one of a pair, secured in swampy ground in dense forest-undergrowth. During the early part of the South-west monsoon in June, I have observed scattered birds feeding on the side of the Sookia Pokhari to Ghoom road at an elevation of 7,200′. Obtained in the Tista Valley at *2,500′* in October 1912. (G.E. Shaw). It escapes observation due to its partiality for dense matted undergrowth in heavy forest. Blanford obtained one specimen at 10,000′ in the Lachung Valley (September).

276. The Lesser Brown Thrush. Zoothera marginata Blyth.

Apparently comes up to breed around Gopaldhara when it is found up to an altitude of *5,000′* or thereabouts. Recorded as a permanent resident throughout its range. This statement does not hold good for this part of the district as it is *absent during "the cold weather"*. Gopaldhara, 4,700′, 19-7-21*, a pair observed at close quarters 5,000′, ♀ 5-6-21, caught on nest, containing three eggs.

Soft parts: Iris hazel; tarsus olivaceous-plumbeous.

277. The Purple Thrush. Cochoa purpurea Hodgs.

Recorded without doubt as a permanent resident up to 8,000′ at least. I have no hesitation in stating this information to be misleading as apart from its rarity; there is little likelihood of meeting with it in "the cold weather" when collecting is not as restricted as it is in "the rains", and though odd birds might remain in the bottoms of the deep valleys, only systematic searching during April to May onwards will reveal its status, when it is certain to visit its breeding grounds in common with numerous other species of Ground-Thrushes. Once obtained above Mangpu at an elevation of 5,000′, ♂ 13-5-20. (G.E. Shaw). Blanford obtained one specimen on the Cho La Range, Kaphu ? (Kapup) at 10,000′, 28-8-70. Represented in the Tring Museum, ♂ ♀ June, *ex* Elwes Coll.

In the B.M. series there are seven adults, April-August, three juveniles, August and September and a single immature male, January 1876.

278. The Green Thrush. Cochoa viridis Hodgs.

This brilliant Thrush is represented in the Tring Museum from Yunnan, (Forrest) and Amoy, December 1867, (Swinhoe) though only recorded for the Himalayas, Kumaun to Sikkim up to 11,000′. I have no first-hand information respecting this rare species. Its correct status, which will only be defined by a laborious search over a wide extent of country, at present remains somewhat a mystery. It is represented from the Sikkim Himalaya by two specimens from Gokh, Rammam Valley, 2,500′-3,000′, 24-7-70, Tring and British Museums, and five others, of which one is a juvenile, same locality and date, April, June, July, B.M. Coll.

279. The White-breasted Asiatic Dipper. Cinclus cinclus cashmeriensis Gould.

Recorded for Sikkim from 9,000′-14,000′, and under *C. sordidus* at 15,000′ at which elevation Blanford appears to have met with this Dipper in Sikkim. These two birds are now generally recognized to be one and the same species. Mr. N. B. Kinnear in his article "On the Birds of the First Mt. Everest Expedition", Ibis., 1922, page 507, supports Dr. Hartert in his treatment in sinking "*sordidus*" which is merely a dark phase. It was obtained at elevations of from 12,000′-17,000′. (A.F.R. Wollaston.)

280. The Brown Dipper. Cinclus pallasii tenuirostris Bonap.

This Dipper frequents every river of importance, where it can procure sufficient sustenance, and only on occasions forsakes its accustomed haunts for the minor streams which add their quota with varying speed and volume from every conceivable gully in the vast conglomeration of mountain ranges. It plays only a secondary part, however, to the Forktails, which regard these retreats as their own preserves. There is no more fascinating bird to watch in spite of its shyness, as it dips under the water to return shaking itself free from moisture and curtesying from its point of vantage.

Mai "Khola", East Nepal, 7,500′, approx. elevation, ♂ 14-5-12, adult, wing 101, testes minute, plumage showing little sign of wear, partial moult on back, evidently nesting season completed. ♂ ♂ 21-5-12, youngsters ready to leave the nest in the first stage of plumage. It breeds at a much later period in its higher limits than it does in the gorges of the rivers on the North Frontier of Assam, where it accommodates itself to local conditions as previously recorded in my "Notes on the Birds of Upper Assam." In comparing immature birds in various stages of plumage and dates on which eggs have been taken in Assam, there is a *difference of five months apparent between the nesting period at these levels.* I have no information as to whether it is double-brooded or not in the hills; in the latter event there must be a heavy percentage of deaths through some unknown cause, as they breed in secluded and generally inaccessible places, and it is remarkable that it is not more in evidence, instead of the few scattered birds that invariably attract notice.

281. The Eastern Alpine Hedge-Sparrow. Laiscopus collaris nipalensis (Blyth).

The winter distribution of this Accentor is especially interesting. It *never descends below 9,000′ on the Singile La Ridge* and at about 9,500′ in the mountains to the north-east of Gangtok. In the *Lachung Valley* it occurs at *8,500′ and on occasions 2,000′ lower.* When one considers to what extreme heights it attains in the summer; the extraordinary low limit reached in this valley is remarkable, but as an elevation of *6,500′* hereabouts sharply defines the delineation between the two zoological regions, both in respect to animal-life and the vegetation; it is appropriate that this typical high-elevation species should share, with other strictly sedentary Palæarctic species, the distinction in descending to this low limit, notwithstanding the fact that its breeding habitat is likely to be only at high altitudes. A summary of my observations and records during the winter is as follows: Sandakphu to Phalut, 11,600′, ♀ 16-2-12; one of a pair. Sandakphu, 11,800′, ♂ 7-3-12; 9,000′, ♂ 14-3-12. Observed on a few other occasions, invariably in pairs amongst the huge boulders on the exposed southern face of the mountain. In this locality they seek shelter and obtain the necessary protection under stress of severe weather. At times seen on the bare open patches of ground on the "dharas" or ridges and found foraging when the ground was heavily covered with snow. Very wild and generaly difficult of approach unless taken by surprise. Karponang, 10,000′, ♂ ♂ ♀ ♀, 17—22-3-17; all obtained when frequenting rocky, boulder-studded ground. A single bird to be seen every morning during our stay, in and about the drains of the detached cook house at Karponang Dak Bw. at 9,500′; unobtrusively attending to its wants with the confidence of a town-sparrow. Lachung, 8,500′, ♂ 5-3-20. A few birds at scattered intervals along the pleasant, wooded path which followed the gentle undulations of the open valley; they had got accustomed to the daily passing to and fro of the few villagers, being in no way perturbed at my presence. Near Kedom at 7,500′, 11-3-20, a single bird seen, and between Kedom and Chungthang at 6,500′ on the same day, another

bird; both of which, were to all appearance, lethargic with the heat in this, the narrow portion of the valley. The almost sudden change from the rigorous cold which I had recently experienced to the delightful warmth which became more marked with the rapid descent was just to my liking. Blanford never met with this bird below 14,000′ in the Lachung Valley but not in the Lachen Valley (September).

I have an aversion to calling this bird a Hedge-Sparrow. It somehow seems inappropriate to link it with the little, sombre bird of rural England. Similarity in form, movement, and not least the ability to withstand a rigorous climate are traits in common; yet its chosen home is the inhospitable, vast mountain-tracts of the Himalayas, whose rocks and boulders do not coincide with English hedgerows. We are apt to overlook the significance of our trivial and common-place names. Changes in the scientific names of some of our familiar birds have taken place in recent years rendering the employment of the trivial name almost a necessity, and the importance of these names may come more into prominence until we have obtained uniformity!! This bird has been singularly unfortunate with its share of generic changes. Five specimens examined: ♂ Wing 98-102, av. 101. ♀ wing 92-96, av. 94. Soft parts: Iris bright brown,—" a defined brown, not hazel"; bill black, excepting base of lower mandible to the extent of two-thirds ending in a point at edge of bill deep yellow; tarsus cinnamon-ochreous; claws black; soles greenish-ochreous.

The following records have no direct connection with this paper but being of remarkable interest are thus inserted. A pair observed at 21,000′ and the Mount Everest Expedition obtained it along with the Redstart (*Phœnicurus ochrurus rufiventris*) at 18,500′, on the 20th July and 20th September 1921 respectively, the greatest elevation from which specimens were brought back. Kinnear, N. B., Ibis. July 1922, pp. 508-510.

282. The Altai Hedge-Sparrow. Laiscopus himalayanus (Blyth).

The only locality where I have obtained this bird is above Karponang at an elevation of *9,800′-10,000′ during March* and although I only secured one ♀, 17-3-17; numbers were to be seen in their accustomed haunts, dodging in and about the crevices under rocks, occasionally a bunch of them would rise up for a brief interval and just as quickly settle a short distance away.

283. The Maroon-backed Hedge-Sparrow. Prunella immaculatus (Hodgs.).

Sparingly distributed and of irregular occurrence at elevations of from *7,000′—8,000′ during the winter.* Ghoom to Sookia Pokhari, 7,200′, ♂ ♀ 19-1-12, secured out of a party, located on the trees adjacent to the road-side, when the road was clear they would recommence feeding on the ground. Senchal, 8,000′, ♂ ♀ 6—7-2-17.

Four specimens examined: ♂ ♂ Wing 85-87. ♀ ♀ wing, 74-78.

284. The Robin Hedge-Sparrow. Prunella rubeculoides (Hodgs.).

Obtained by the Mount Everest Expedition at 17,000′.

Recorded for Sikkim above 14,000′, (Blanford) and June and October specimens from Sikkim examined by Oates. There is little doubt that this Accentor occurs only at *extreme high limits.* I have no information respecting its status in the winter with the exception of a doubtful observation of a single bird on Sandakphu summit at 11,800′ on the 15-2-12.* My inability to secure it, was due to a series of misfortunes: a heavy mist, snow-covered ground, and biting cold impeding my movements and sight. I was yet to undergo further trials:

a night by the road-side, two days without food at Phalut, an additional day to reach the Sandakphu rest-house, which we had overshot in the darkness, having covered 39 miles and more on foot since the last square meal in the meantime, as the pack-pony drivers with my camp kit and provisions lost heart at the snow-drifts on the track, choosing to leave my trusty servant and myself to our own resources. Blanford speaks of this bird replacing *Laiscopus nipalensis* in the Lachen Valley where he found it above 14,000′ together with *Fringillauda brandti hæmatopyga, Otocorys alpestris elwesi* and other birds belonging evidently to the Tibetan fauna.

285. The Brown Hedge-Sparrow. Prunella fulvescens fulvescens (Severtz.).

Obtained by the Mount Everest Expedition at 13,500′.

Recorded for Sikkim in winter only ; Mandelli having procured this species in the country north of Sikkim ; so it is safe to presume this Accentor is also confined to *extreme high limits.*

286. The Rufous-breasted Hedge-Sparrow. Prunella strophiatus strophiatus (Hodgs.).

Blanford records it from Yumthang 12,000′ (September) and it was obtained by the Mount Everest Expedition at 15,500′.

Sparingly distributed *during the winter* at elevations of from *7,500′-9,000′*, Outer Ranges, Jalapahar, 7,500′, ♀, 13-2-20, several about amongst the rocks, when it was observed to be an adept skulker and to remain very silent, Interior, Lachung, 8,800′, ♂ 28-2-20, ♀ 1-3-20, where it was apparently far from numerous.

Five specimens examined : ♂ Wing 68-71, av. 69·5. ♀ wing 65-67, av. 66·5. Soft parts : Iris bright brown ; bill horny-black, base of upper mandible, ochreous ; tarsus ochreous-pinkish ; claws dusky-horny.

287. The Fairy Blue-bird. Irena puella puella (Lath.).

Probably not found far above the base of the hills. Obtained at *plains-levels* in the Darjeeling District. (G. E. Shaw).

Recorded up to 4,000′ which may be safely regarded as too great an extreme for the Sikkim Himalaya.

288. Hodgson's Munia. Uroloncha acuticauda acuticauda (Hodgs.).

Occurs in the Rungbong Valley up to about 6,000′, and around Mangpu at 3,850′ above the Tista Valley (G. E. Shaw). In this last locality Gammie remarks on it breeding during a period from the middle of June to the middle of August at 2,000′-4,000′.

289. The Spotted Munia. Uroloncha punctulata punctulata (L.).

Breeds plentifully at Gopaldhara up to 5,000′, and at a similar elevation, 4,800′ around Mangpu. (G. E. Shaw).

290. The Allied Grosbeak. Perissospiza icteroides affinis (Blyth).

This fine Grosbeak occurs sparingly on the Singile La Ridge *during the winter* and evidently does not descend to a lower limit than about *9,000′* on either side of the Nepal-Sikkim Frontier.

Tonglo, (Nepal) 9,500′, ♂ 30-1-12, bill 24, wing 126, one of a small party, an adult bird : some of the primaries not fully grown. Tonglo, (Sikkim) 9,900′, ♀ 12-2-12, bill 23, wing 132, one of six birds or thereabouts, frequenting the tops of the high trees.

Soft parts in the female: Iris brown; bill greenish-blue (sea green); tarsus fleshy; claws horny.

291. The White-winged Grosbeak. Perissospiza carnipes carnipes (Hodgs.).

Apparently *replaces P. icteroides affinis in the Interior* of Sikkim. Fairly numerous around Lachung at elevations of 8,500′ to 9,000′ during February and March 1920, mostly in scattered pairs. 8,500′, ♀ 9-3-20; 8,800′, ♂ 9-3-20, in the female phase of plumage, one of a pair of similarly coloured birds; the female being in distress and averse to leave its companion, giving every indication this male was paired for nesting. 9,000′, ♂ ♂ 1—6-3-20. Karponang, 9,600′, ♂ ♀ 23-3-17. 10,500′, ♂ ♀ ♀ 19-3-17, obtained near the snow-line.

There is little likelihood of this Grosbeak being found at the recorded low elevations "occasionally descends to 5,000′," "generally above 8,000′" as it has a *definite Palæarctic status*; so far *not obtained below 8,500′ in the interior.* Nine specimens examined: In seven out of this series the bills are smeared with a black, resinous matter—the viscous juice of some favourite berry. ♂ ♀ Bill from feathers at base 20-22, av. 21 Wing 113-120, av. 115·5.

Soft parts: ♂ Iris brown; tarsus plumbeous-brown.

292. The Spotted-winged Grosbeak. Mycerobas melanoxanthus (Hodgs.).

Reported to me by the late Mr. W. K. Webb as having occurred at Pobong at 5,500′ below the Ghoom to Sookia Pokhari Ridge, and obtained above Mangpu at *4,400′*, ♂ ♀ 12-3-21. (G. E. Shaw). There is little doubt that this Grosbeak covers a wider extent of country during the winter. Its *breeding habitat* must however be at *extreme high altitudes.* As it is decidedly rare, information respecting its appearances is most desirable. Elwes obtained a specimen at (Yumthang) Yeomatong at 11,000′ in the upper limits of the Lachung Valley as recorded by Blanford.

293. The Red-headed Bullfinch. Pyrrhula erythrocephala Vig. "Kobyu," Lepoha.

During the winter and early summer this Bullfinch is found at considerably *lower limits in the Interior* of Sikkim *than on the Outer Ranges* at a similar period of the year. Dikchu-Singhik, at 3,650′, 22-2-20*, observed hereabouts. Singhik at 5,200′ ♂ 12-3-20, several scattered birds composing a party in which the sexes were equally divided. Gangtok, below the Durbar Hall and close to the Bazar at 5,700′, 15-3-20*, a small party entirely composed of six males, remarkably confiding, feeding on the nettles at the side of the path. Temi (south of) to Namchi, at 6,650′, 15-3-20*, three parties observed hereabouts, feeding on the seeds of the rank nettles which grew in profusion on the hillside. Lachung, 9,500′, ♀ 2-3-20, one of a pair, and likely to be an early nesting couple, as the majority of the birds were at much lower limits at later dates. Tonglo, Sikkim side of the frontier, ♀ ♀ 21-1-12, ♀ 26-1-12, occurred on both occasions, in small parties entirely composed of females; on no single occasion did I ever come across a male. Obtained on Sandakphu at 11,900′, ♂ 14-8-05. (C. M. Inglis). Blanford obtained it on the Cho La Range at 11,000′ and also in the Lachen Valley and states not common in North Sikkim. Six specimens examined: ♂ Wing, 77-78, av., 77-5. ♀ wing, 76-78·5, av., 77·7.

294. Beavan's Bullfinch. Pyrrhula erythaca erythaca Blyth.

Recorded for Sikkim. Evidently very rare and confined to *extreme high altitudes.* Neither Blanford nor Elwes met with it in the far interior. Represented in the National Collection by 7 ♂ ♂, collected in April 1874 from Sikkim.

295. The Brown Bullfinch. Pyrrhula nipalensis nipalensis Hodgs.

I have failed to locate this Bullfinch in the Interior of Sikkim.

It occurs *more frequently on the Outer Ranges.* Obtained near Sonada at 6,500′, ♂ ♀ 9-9-19. (G.E. Shaw). Kalo Pokhari, Nepal-Sikkim Frontier, 10,160′, a small party observed adjacent to my camp in early May 1912. They were entirely absent along the Ridge during the winter months when there is little doubt they had descended to lower limits. It has been obtained in summer on Tonglo at 10,000′, ♂ 30-6-04. (C. M. Inglis). Blanford obtained it in the Lachen Valley at about 10,000′, but states not of frequent occurrence which remark also applies to *P. erythrocephala.*

296 The Gold-headed Bullfinch. Pyrrhoplectes epauletta (Hodgs.).

Descends to *the valleys in the winter,* and is attracted to patches of ground overgrown with nettles, the seeds of which are a favourite food of all the Bullfinches. Hooker mentions two species of nettles, both of which virulently sting (*Urtica crenulata*) occurring in the valleys of the interior and (*Urtica heterophylla*) as being found in the valleys of the outer ranges.

During one cold-weather obtained at elevations of from 4,650′-4,720′ around Gopaldhara, ♂ 26-3-11, ♀ 30-3-11. Temi (south of) at 6,700′, 15-3-20*, a pair at the road-side . Mai "Khola," East Nepal, 6,000′ approx. elevation, ♂ ♀ ♀ 24-4-12. Observed in "maling" bamboo thickets at about 7,000′, 28-3-12*, when it was certainly ascending with the warm weather. Obtained at Kalo Pokhari at 10,000′ ♂ 1-5-12, ♀ 7-5-12. Sookia Pokhari, 7,200′, ♂ 18-4-17*, an extremely late date to be at this elevation, notwithstanding they arrive comparatively late at their breeding haunts. Blanford obtained it on the Cho La Range at 11,000′ in August.

Four specimens examined: ♂ ♀ Wing 77-78, av. 77·5.

297. The Himalayas Crossbill. Loxis curvirostra himalayana Blyth.

A rare vagrant on the *Outer Ranges during the winter.* Sandakphu, below the summit on the Nepal side of the mountain at 11,500′, ♂ 7-3-12, secured whilst hanging on to the face of a boulder, ♀ lost owing to its falling into an inaccesible place. This single pair was located amongst huge boulders on the southern precipitous face of the mountain,and this was the only occasion I met with the Crossbill. All efforts to find it in the pine forests being fruitless. The male had the testes developed and they were evidently an early breeding pair. The stomach contained only minute pieces of white quartz or felspar which had been nibbled from off the rocks, when at this occupation I had shot them. This male is more orange than rose coloured on the parts which are at times rosy-red; the female was observed to be in a pale phase of coloration. Turzum, *5,200′,* ♂ ♂, 28-12-16, ♂ ♀ ♀, 12-2-17, for which specimens I am indebted to Mr. O. Lindgren. One male only, in the deep phase, rosy-red; one ♀ sexed without error, similarly coloured to the male, only these parts are orange-yellow; another female evidently typical, the only bright portion is the greenish-yellow of the upper tail-coverts. Any abrasion that takes place in these males during the breeding period decreases the brilliancy of the plumage, as these specimens, February—March, had completed their moult. Wing, 82-85, av., 83-3. Well represented in the B.M. Coll. by Mandelli's skins from the interior of Sikkim.

Soft parts: Iris hazel-brown; bill, upper mandible dark horny, lower mandible tinged greenish, under portion dark horny; tarsus brownish-horny; claws darker.

298. The Scarlet Finch. Hæmatospiza sipahi (Hodgs.).

This brilliant Finch is a *widely spread* vagrant and occurs *at various elevations* in forest *during "the cold weather."* The following records and observations give some indication of its wanderings :—Namsoo, 2,200′, 7-2-14,* a small party observed on the east side of the Balasan River. Gangtok-Dikchu at 4,500′, 22-2-20,* a large party in the valley of the Dikchu. Gopaldhara, 4,550′, ♀ 31-3-11, ovaries normal ; ♀ 26-3-11 ; 4,700′, ♂ ♂ 8-1-12 ; ♂ ♀ 11-1-12; 5,800′, 10-2-19,* three or four pairs observed. 6,000′, ♂ ♀ 10-3-18 ; ♂ 17-2-18, in small parties of six or thereabouts. ♂ ♂, ♀ ♀ 10-2-18. Ridge above Temi at 6,800′, 15-3-20′,* a large party on the slopes of the ridge. Obtained at elevations of from 1,900′-5,800′ in the Tista Valley below and above Mangpu. 1,900′, ♂ 23-2-19, 4,100′, ♂ juv., ♀ juv., 20-5-20 ; 5,000′, ♀ ♀ 16-12-12 ; 5,800′, ♀ ♀ 30-11-20 (G. E. Shaw).

Eight specimens examined: four ♂ ♂ wing 94-102, av. 99; four ♀ ♀ wing 100 and this measurment in this sex is constant in these specimens. The difference in length of the wing in both extreme measurements of the males representing equally adult birds is just as marked in the total length measurement taken in the flesh 6·2″-7·5″. In one male 8-1-12, the first three primaries are in process of being replaced, and in one female 11-1-12, the 1st primary is not fully grown. The Iris in the adult male is stone-brown.

299. The Red-headed Rose-Finch. Propyrrhula subhimachalus (Hodgs.).

Oates quotes Jerdon, who states he found this Finch near Darjiling. This record is vague if we understand the term to include the district. Observed on the Singile La Ridge on two occasions only. Tonglo, 10,000′, ♀ 23-1-12, wing, 93. 1st primary, growth not completed. Kalo Pokhari, 10,000′, ♀ 28-4-12, wing, 93. Both birds were secured in the foliage of some dwarf trees at no great height from the ground, difficult to locate owing to their greenish plumage and silence ; no males seen.

Soft parts : Iris hazel-brown ; bill, upper mandible blackish-horny, lower mandible pale horny, dark at the tip ; tarsus brownish-horny.

300. The Red-breasted Rose-Finch. Pyrrhospiza punicea punicea Hodgs.

Obtained by the Mount Everest Expedition at 17,500′, "never below 16,000." Recorded for Sikkim at elevations of from 10,000′-17,000′.

Evidently it only occurs at *extreme heights*. Blanford records it from the Cho La Range at 14,000′, 27th August 1870.

301. The White-browed Rose-Finch. Carpodacus thura thura. (Bp. & Schleg.).

This Rose-Finch *occurs more plentifully in the Interior* of Sikkim than it does on the Outer Ranges at similar altitudes during the winter. Numerous above Karponang around 10,000′-11,000′ from the 17th to the 23rd of March 1917. Lachung, 8,800,′ ♀ 28-2-20; 9000′-9500′, ♂ ♂ 4—5-3-20. Sandakphu, 10,500′, ♂ 15-2-12, one of a pair ; this bird is in the female phase of plumage, obtained whilst feeding on the barren mountain-track in a dense overhanging mist and on a piercing, cold evening. There are few more delightful sights than to watch a party of these Rose-Finches flitting about the Rhododendron trees when the vegetation and ground is coated with a mantle of snow. Recorded Cho La Range 12,000′ August. (Blanford). There is little doubt that some males breed in the female phase of plumage. Twelve specimens examined : ♂ adult, Wing 83-85 av. 84 ; ♂ in female phase, wing 81-82, av. 81·5. ♀ wing 80-83 ; av. 81·3.

302. The Beautiful Rose-Finch. Carpodacus pulcherrimus pulcherrimus (Moore).

Evidently confined to the higher reaches of the *valleys in the interior during the winter*, probably ascending to extreme limits to breed. Lachung, 8,800′, ♀ 22-2-20, wing 75. Secured out of the naked branches of a stunted tree. I suspected others to be in the vicinity which were overlooked.

Obtained by the Mount Everest Expedition at 14,800′.

303. The Pink-browed Rose-Finch. Carpodacus rhodochroa (Vig.)

The distribution of this Rose-Finch as given by Oates is from Dharmsala to Nepal. *The following records extend its range to the frontiers of Western Sikkim.* Tonglo, 10,000′, Sikkim side of the Frontier, ♂ 22-1-12 ; ♂ ♂ 8-2-12. These males were secured out of small parties of mixed sexes. ♂ wing, av., 71. Neither of the next two Rose-Finches have so far been obtained within the actual borders of Sikkim, but as it is interesting to know the nearest locality to the frontier where they have been obtained; I quote from Mr. N. B. Kinnear's article in the Ibis which has supplied me with the Mount Everest records. *Carpodacus severtzovi* Sharpe., breeds commonly in southern Tibet and Colonels Bailey and Steen found nests at 14,000′ near Gyantse. *Carpodacus rubecilloides* Przew. Specimens of this Rose-Finch were obtained by Colonel Walton up to 15,200′ in southern Tibet during December, April and May, and he states that its distribution coincides with that of *C. severtzovi* which is Kinnear's reason for keeping them separate as good species.

304. The Spotted-winged Rose-Finch. Carpodacus rhodopeplus rhodopeplus (Vig.).

Recorded for the Himalayas, Garwhal to Sikkim. The National Collection is only represented by specimens from Nepal.

305. Edwards's Eastern Rose-Finch. Carpodacus edwarsii saturatus. (Blanf.)

Occurs at *elevations of from about 8,000′ to 10,000′ on the Outer Ranges and also in the Interior* of Sikkim. Kalo Pokhari, 10,000′, ♀ 23-4-12 ; ♀ 15-5-12 ; ♂ 19-5-12. Mai "Khola", East Nepal, 8,000′, ♀ 28-3-12. Found frequenting the dense "maling" bamboo growth on the precipitous mountain-slopes, when disturbed, occasionally rising into the bare branches of any near-at-hand tree. Lachung, 9,000′, ♂ 1-4-3-20, several observed on the ground hereabouts. Karponang, 9,600′, ♀ 18-3-17, procured on snow-covered ground in a thicket of heavy "maling" bamboo. Five specimens examined : ♂ Wing 81-85; av. 83-7. ♀ Wing 80-82 ; av. 81.

306. Hodgson's Rose-Finch. Carpodacus erythrina roseata (Hodgs.).

Obtained by Colonel Walton at 15,000′, October, in Tibet.

It occurs on the *upward migration at moderate elevations.* Observed and obtained on the following occasions at that period, with the exception of one cold-weather record. Rungbong Valley, Gopaldhara, 4,720′, ♂ ♀ 21-3-16, an adult male in deep phase of coloration seen at the same time. Thurbo, 4,250′-4,300′, ♀, 23-3-11 ; ♂ 25-3-11, one of a party of a dozen or thereabouts frequenting some peach trees in cleared ground. Gopaldhara, 4,720′, 5-4-14*, About sixty to eighty birds, adult rose coloured males much in the minority. 11-4-15,* a small party containing eight to ten birds, of which two were richly coloured males, females and immature males predominating. 4,800′, ♀ 3-11-20, "in fat condition", obtained out of a small party of six birds, all females or juvenile males. When the latter are in this phase of plumage it is impossible to discriminate between the sexes. These birds were feeding on the millet seed which

is grown by the paharias for brewing into "murwa" liquor. Cedars, Balasan Valley at 3,200′, ♂ 5-4-17, in female phase of coloration, frequenting the gaudy flowers of some "falada" trees. Obtained at 3,000′, ♂ 6-5-21, and at 3,800′: ♂ 21-4-20, around Mangpu (G. E. Shaw). Ten specimens examined. ♂ Wing 82-87, av. 84·1. ♀ Wing 78-82; av. 79·7. Dr. Hartert's measurements ♂ ♀ wing 85-90.

307. The Dark Rose-Finch. Procarduelis nipalensis (Hodgs.)

Blanford obtained this Rose-Finch on the Cho La Range at 13,000-14,000′ (27th August 1870). During the *winter* this Rose-Finch comes down to *an elevation not much below 7,000′*. Once actually *obtained at 4,500′* on the Pashok Spur *on the Outer Ranges*; whereas in the Interior it occurs at an elevation of under 6,000′. Ghoom to Sookia Pokhari, 7,200′, ♂ 19-1-12, secured out of a party of which there were several such, seen feeding on the road, and below Sookia Pokhari the previous day at 6,800′. Mai "Khola" East Nepal, 8,000′, ♂ 16-4-12; 9,000′, ♂ 25-5-12. Kalo Pokhari, 9,000′, ♀ 30-4-12; 10,000′, ♂ 18-4-12. Senchal, 8,000′, a large party numbering about fifty birds foraging on the road after a fall of snow on the 6-2-17. Below Lopchu at about 4,500′, ♂ 12-3-17, a remarkable low limit where *P. rubescens* was also obtained. Gangtok, 5,800′, 21—22-2-20, observed on the more *secluded* station-paths. Sandakphu and Phalut, 11,811′, ♂ *11-8-05. (C. M. Inglis).* Four specimens examined: ♂ Wing 88-91; av. 89·7. ♀ Wing 81. *Dr. Hartert's* measurements: ♂ ♀ wing 90-93.

308. Blanford's Rose-Finch. Procarduelis rubescens *Blanf.*

Recorded for Sikkim and the Eastern portion of Nepal, "probably at high elevations". I have located it on *several occasions during the winter below* 6,000′, and on *one occasion actually at* 4,500′, a remarkable low altitude. Observed in Gangtok in small parties at 5,800′, 15-3-17.* Rungmook. Observed in parties on the ground at 5, 600′, 31-3-17, specimens secured above this place at an elevation of 5,900′ on the 5-4-17, in a small cryptomeria plantation; when they showed every sign of being in readiness to migrate to higher limits, as they were very restless and in the upper outskirts of the wood in a party of twenty to thirty birds. Fortunately, I anticipated this event, as I was by no means sure of meeting with them again, some time having elapsed, and an abortive attempt by my shikari had not helped matters. Obtained below Lopchu on the Pashok Spur at 4,500′, ♂ 12-3-17. Four specimens examined: ♂ Wing 80-83, av. 81·7. ♀ Wing 80.

309. The Red-browed Finch.. Callacanthis burtoni (Gould).

Obtained on the *Singile La Ridge in winter, but found below 9,900′*. Tonglo at 10,000′, on the Sikkim side of the Frontier, ♂ ♂ ♀ 23-1-12; ♂ ♀ ♀ 12-2-12. Secured in the foliage of the trees which were in leaf at the time in a more sheltered quarter. No others seen on the second occasion with the exception of the three specimens obtained. There was no evidence to prove that these birds belonged to a combined party, but rather that they were scattered individuals. Dr. Hartert has mentioned this extension of its previously known range in his exhaustive work on the Palaearctic birds which Oates only recorded as far east as Kumaun.

Soft parts: Iris hazel; bill in male horny, base of the upper mandible and the whole of the lower mandible dull yellow, excepting the tip which is dark; bill in female similar, but without the yellow tinge.

310. The Tibetan Twite. Acanthis flavirostris rufostrigata (Walton).

Possibly may occur on the high eastern borders, as it is recorded from the Chumbi Valley at Gyantse in Tibet; where it has been obtained up to 15,200′. (Walton).

311. The Himalayan Greenfinch. Hypacanthis spinoides (Vig.).

Obtained by the Mount Everest Expedition at 12,500′.

This Finch commonly occurs around Gopaldhara at 4,720′, and is only absent for a few months, noticeable in August during the breeding season. In "the cold weather", small parties descend to the bottom of the valley at 3,440′. *Arbor vitæ* (Thuya) trees when seeding being the attraction; these have been planted at more or less regular intervals to demarcate the main paths through the estate. 29-3-18, observed in scrub-growth gradually receding from the vicinity of the bungalow. Mirik, 5,400′; 29-3-20, exceptionally large flights. Gopaldhara Bw., parties about in June 1914. 7-4-16, still in parties. 22-5-23*, in evidence at evening by their call. 15-6-15, much in evidence with their twitterings. 7-7-21, this morning a few birds observed to be feeding on the *Calliopsis* in the compound, the harmonizing tone of the yellow and green tints of the birds with the rich yellow flowers producing a pleasing effect. 12-7 23*, a pair at all events amongst the Calliopsis. They are very partial to the seeds of the Sunflower, which has spread to the surrounding country-side, and wherever various Coniferæ have been planted for utility or picturesqueness; it is obvious this bird has *extended its range to much lower limits* since these favourable conditions have developed. Obtained above Mangpu at elevations of 4,700′-6,500′. (G. E. Shaw).

Gopaldhara to Seyok, a series of ten specimens obtained at elevations of from 4,700′-5,000′ from the 19-12-11—7-1-12. Males in adult stage of plumage uncommon; immature birds of both sexes, impossible to separate by colour. Some time evidently has to elapse before the rich yellow tints of the mature bird are assumed and as Oates remarks summer birds sometimes fail to show the yellow tint of the forehead; it is fair to presume more than one year is required before it reaches maturity in this respect. One ♂ obtained 25-7-20 at 4,720′, when a few more wont to come into the compound to their favourite flowers has the deep, rich yellow tints well marked. Blanford records it as common in small flocks to about 9,000′ locally in the Lachung Valley and early in September in flocks as low as 7,000′ at Kedom. Not noticed on the Cho La Range or at high elevations in Northern Sikkim.

312. The Sikkim Siskin. Chrysomitris tibetana tibetana Hume.

Recorded for the interior of Sikkim at *high elevations* bordering on Tibet.

313. The Indian House-Sparrow. Passer domesticus indicus Jard. and Selby.

Occurs up to an elevation of 4,500′ at all events in the Rungbong Valley, though it is capricious in its distribution and takes second place to its ally in the hills. I have not noticed any mutual understanding between these two Sparrows as sometimes happened in the Plains, when both more or less equally shared what accommodation was available for nesting.

314. The Indian Tree-Sparrow. Passer montanus saturatus Stejn.

Resident and numerous in the station of Darjeeling and similarly firmly established in the interior of Sikkim at Gangtok. The elevation of the former town at Observatory Hill is 7,163′, and as it is found at Jalapahar around 7,000′; this elevation is a slight increase on its recorded distribution upto 7,000′. In summer, however, I have never observed any tendency to increase its limits as this Sparrow is sedentary and occasionally gets an acquaintance with light falls of snow hereabouts, in exceptional winters. Gopaldhara 4,720′

This bungalow evidently is not suited on to its requirements as at Turbo, 4,500′ where it breeds in fair numbers. A single bird was intent on finding quarters at Gopaldhara on the 24-4-18, but contented itself with a cursory look around and then left. A form of the Tree-Sparrow was obtained at 14,000′ during the Mount Everest Expedition.

315. The Cinnamon Tree-Sparrow. Passer rutilans cinnamomeus (Gould).

This Sparrow appears to pass over the hills at moderate elevations when on migration. Recorded up to 7,000′ for the Himalayas. I have strangely enough failed to meet with it in Sikkim. Bailey found this Sparrow breeding at 13,000′ in Tibet. Well represented in the B. M. Coll. by Sikkim, Tibet and Bhotan Dooars specimens. (Mandelli).

I have since observed a small party above Sungma at 5,000′, 1-9-23* which I have little doubt was composed of this sparrow.

316. Blanford's Mountain-Finch. Chionospina blanfordi (Hume).

Included on the record of four specimens in the Hume collection which were procured near Darjeeling! Obtained by the Mount Everest Expedition at 15,200′.

317. The Red-necked Mountain-Finch. Chionospina ruficollis (Blanf).

Recorded by Blanford for Sikkim at 15,000′-16,000′ on the Kangra Lama Pass and at Phàlung. (September).

318. Adams's Mountain-Finch. Chionospina nivalis adamsi (Adams).

Obtained by the Mount Everest Expedition at elevation of from 14,000′-16,000′.

Recorded according to Hume as far east as Sikkim and appears to be found at 11,000′-14,000′ in summer.

Sandakphu to Phalut at an elevation of over 11,000′ one or two specimens of a Snow-Finch or typical *Montifringilla* sp? very "white" birds were seen on the mountain-track, 19-2-12,* but unfortunately, none were secured. I had no time to waste on the road as this was my fourth day without food, with every chance of darkness coming on before I reached my destination, and the track was in places deep in snow. "This remedy is not to be recommended in its entirety as a certain cure for malaria."

319. Mandelli's Mountain-Finch. Chionospina mandelli (Hume).

Recorded for the Tibet-Sikkim borders as procured by Mandelli.

320. Hodgson's Mountain-Finch. Fringillauda nemoricola nemoricola Hodgs.

During the winter occurs on the Outer Ranges at all elevations from 6,500′ and "*on one occasion seen 1,300′ lower*" *up to 12,000′*. At this period of the year, it appears to be met with less frequently in the interior. Tonglo, Singile La Ridge, 10,000′, six ♂♂, one ♀, 22-1-12. Sandakphu, 11,900′, ♂ 2-3-12. ♂♀ 7-3-12, ♂ 13-3-12. Large parties were observed in January on Tonglo, feeding on the barren mountain-summit, and often seen at rest on the naked branches of the trees on the north side of the frontier. The sexes apparently keep in separate parties this month as the first batch of six specimens were

secured out of one party and were all males, which might have been a coincidence yet at Sandakphu in March the intermingling of the sexes had undoubtedly begun. Observed at Phalut on the summit at 11,800′, 16—19-2-12, in small parties ; the mountain was at this time covered in snow with heavy drifts on the ridge.

Seeyok, 5,200′, December 1917, a party of approximately two hundred birds observed flying overhead. Semana basti, 7-3-15, in cleared ground on the south side of the village, a party of from thirty to forty birds at 6,500′. Jalapahar, 7,500′, ♂ 13-2-20, several about on the rocky ground and using the telegraph wire to settle on.

Senchal 8,500′, 7-2-17, a few noted. Karponang, 10,500′ ♂ ♀ 22-3-17. Okayti, 5,500′, 26-12-12,* a large party, presumably this Finch.

Nine specimens examined. ♂ Wing 97-5-105, av. 100·6. ♀ wing 95-96. av. 95·5. All these are typical, inclusive of one ♂ only, 22-1-12, which has the streaks faintly indicated in the "rufous" of the crown, this coloration evidently is rarely present ; one exception is a ♂ secured along with others out of the same party of males with the axillaries ashy-white and tips to the median and greater wing-coverts tinged with rufous, is without the yellow at the base of the bill and shows no indication of the ashy-white supercilium. This specimen agrees in all respects with *F. n. altaica* (Eversm.). If the locality and circumstances were not known it would be impossible to identify correctly. Obtained by the Mount Everest Expedition up to 17,000′.

Soft parts : Iris sienna-brown; bill light horny-brown shading darker towards the tip, base of upper and lower mandibe dull yellow ; tarsus horny-brown ; soles dull yellow.

321. Brandt's Mountain-Finch. Fringillauda brandti hæmatopyga (Bonap).

Recorded for Sikkim at *high elevations* of from 12,000′-19,000′.

Blanford met with this bird on the Kangra Lama Pass at elevations exceeding 15,000′ in flocks of fifteen to twenty (September). Obtained by the Mount Everest Expedition up to 17,500′.

322. The Indian Grey-headed Bunting. Emberiza fucata arcuata Sharpe.

Recorded as resident in the whole of the Himalayas ; "breeds from 6,000′-8,000′". This statement is certainly misleading if Sikkim is included in this category. Buntings are conspicuous by their absence. Not represented in the B.M. Coll. from Sikkim. Mandelli obtained one from the Bhotan Dooars, February 1874.

323. The Little Bunting. Emberiza pusilla Pall.

The Little Bunting occurs irregularly in limited numbers at *varying altitudes* for brief periods on its *downward and upward migration* to and from the Plains.

Gopaldhara, 3,800′, 9-4-19, an odd ♂ ♀ pair or so on the flat in "the tea." Nigali near Mirik, 5,500′, ♀ 23-3-11. Kalo Pokhari, 10,000′, ♀, 23-4-12. A small party observed in the Botanical Gardens in Darjeeling on its ascent, date overlooked. Obtained at Gopaldhara, 4,500′, ♀ 23-12-11. Seen at Turzum, 4,500′, 18-1-12.* Obtained at Mangpu, ♂ ♀ 8-12-12 (G.E. Shaw). Okayti, 5,500′, 26-12-21,* a small party below the ridge.

Gopaldhara, 4,600′, 10-1-19, ♀ secured out of a party of a few birds.

324. The Yellow-breasted Bunting. Emberiza aureola Pall.

Represented in the B.M. Coll. by one specimen, October 1872, (Mandelli) and a few from Nepal (Scully and Hodgson).

Recorded as a common winter visitor to the Himalayas, Nepal to Assam, etc. This Bunting may pass high over on passage, yet I suspect the birds found during the winter in the Plains have arrived by a more easterly ? route. This remark also refers to the Moupin Black-faced Bunting which is similarly recorded in its distribution.

325. The Moupin Black-faced Bunting. Emberiza spodocephala melanops Blyth.

This bird was the common Bunting during " the cold weather " in the Plains of Upper Assam. I have totally failed to note one single occurrence in these hills. Evidently not represented in the B.M. Coll. from Sikkim, but there are 3 skins marked Nepal ! ! (Hodgson).

326. The Chestnut Bunting. Emberiza rutila Pall.

Recorded for Sikkim ; on whose specimens I am not cognizant, but probably Mandelli's. Evidence as to the supposed status of these species of *Emberiza* is most desirable. Represented from Sikkim, 3 specimens, March-April, 1871. One specimen, Bhotan Doars, January 1876 (Mandelli), B.M. Collection.

327. The Crested Bunting. Melophus melanicterus (Gmel.).

Recorded in its distribution as " everywhere apparently a resident species." This is not correct for the *Outer Ranges* in Sikkim where this Bunting is *absent in the cold-weather months*, but occurs as a *breeding species up to 6,000′* and somewhat higher. The dates of its arrival have been noted at these elevations. Nurbong, 2,000′ ♂ 22-2-14* and daily afterwards. Namsoo to Kurseong, 2,500′, 4-4-11,* a pair observed near Ambootia. Gopaldhara, 4,720′ and below, 4-4-18*; 11-4-15,* an odd pair or two about " the tea". Noted as plentiful at Cedars, 3,200′. Thurbo, 4,500′, and Gopaldhara 4,700′, early April 1917.

Obtained around Mangpu at 3,500′, ♂ 1-6-18. 3,600′, ♂ 3-3-19; 3,860′, ♀ 31-5-20; ♀ 22-5-15, parent bird with three eggs. (G.E. Shaw). I have observed it above Ambootia at 4,500, 29-8-21.* Gammie remarks on it breeding in May from 2,000′-4,000′ in the Tista Valley. Inglis obtained it breeding at Dentam, ♂ 7-8-05.

328. The Kashmir Martin. Delichon urbica cashmeriensis (Gould).

Recorded for the Himalayas up to 12,000′ or 13,000′. Included on the strength of " three adult specimens obtained in April in Sikkim " and evidently refers to birds obtained about the upper limits of the forest on the Cho La Range by Blanford.

329. Hodgson's Martin. Delichon nipalensis Moore.

Recorded. " Appears to ascend the Himalayas up to at least 8,000′."

Oates states he has seen specimens procured in Sikkim in every month from June to January.

Mai " Khola ", East Nepal, 28-4-12, a series of four ♂ ♂ and eight ♀ ♀ collected around 8,000′.

Singhik in the interior of Sikkim at 4,600′, numbers observed on the 12-13-3-20. Dentam, 4,500′, ♂ 6-8-05. (C.M. Inglis).

Nine specimens examined : ♂ Wing 91-97, av. 94-2 ; ♀ wing 90-97; av. 93-3.

330. The Indian Sand-Martin. Riparia brevicaudata McClell.

In all probability occurs in the Foot-hills. Specimens obtained out of a large party, hawking over the river-bed at evening below the Gorge of the Raidak River in the Eastern Dooars, 26-1-22 ; ♂ Wing, 93 ; ♀ Wing, 86.

331. The Crag-Martin. Ptyonoprogne rupestris (Scop).

Recorded for the whole Himalayas as far east as Bhotan, etc. Not represented from Sikkim in the National Collection. Nearest localities: Tibet, Khambajong, 4-10-03, Gyantse, 9-7-04. (Walton).

332. The Eastern Swallow. Hirundo rustica gutteralis. Scop.

The typical form is recorded for the Himalayas; "breeds 4,000'-7,000." Sikkim birds are *gutteralis*. Numbers breed under the eaves of the coolie houses at Gopaldhara, and it is widely distributed on the Outer Ranges at moderate elevations. Observed up to 7,600', but absent during the winter months, notwithstanding scattered birds certainly occupy the warmer portions of the valleys at this time; they are liable to fluctuation through various changes in the weather, and only ardent prolonged observations could check these movements. Apparently they arrive around Gopaldhara early in February. First appearances noted at 4,720', 5-2-16* and 16-2-15*. 3,440', 4-7-21,* Numbers of juvenile Swallows on the wing, evidently having recently left the nest, and resting in batches. 4,650', 28-5-23*, young birds on the wing, being fed by the parents.

333. Hodgson's Striated Swallow. Hirundo daurica nipalensis Hodgs.

This confiding Swallow must be almost entirely dependent on man's domicile to give it the desired nook where it can build its retort-shaped, substantial mud structure. There can be few houses without at least a pair of these charming birds unless conditions are not in their favour. Happily, it is rarely not assured the solicited protection when, they amply repay for the little untidiness which takes place, before they can be certain their abode is secure. One nest has to my knowledge stood the test for ten years though the rightful occupants have long since had to make way for a less industrious, but stronger tenants in a pair of Swifts (*Micropus affinis*). When such an event takes place, they make every endeavour to seek a more secluded site where they will be free from further molestation, even gaining access to the rooms, with their gapes full of mud, should the windows be thrown open for any length of time. They willingly accept the inconvenience of a closed-in verandah, taking their chance when the door is opened to allow of their ingress and egress. One pair of birds which had suffered ejection, eventually selected a corner of the masonry of one of the outer windows where they have endured no visible inconvenience with the exception of the drawing of a blind, and this operation is taken as a token of friendliness; as it is certain to elicit a quick response in a cheery "tweet" from the little inmates as a notification that all is well. What becomes of the numerous families which have been safely brought up remains a problem; I suspect that more often than not, fruitless attempts to bind up their dwelling under a smooth corrugated-iron roof which is liable to expansion and contraction under a varying temperature, is the work of younger birds. These almost pathetic attempts at the impossible does not discourage, judging by the renewed efforts, when the heat of the sun brings it tumbling down to be finally abandoned.

It breeds commonly in all stone habitations and even wooden buildings, and may utilise rocks and cliffs for this purpose, which I have so far not been able to substantiate, at all elevations from 2,822', at all events, Tindharia station on the D.H.Ry. up to the town of Darjeeling. At Gopaldhara Bw, 4,720', they are absent for a few months only, and not always that length of time, which depends on the prevailing conditions; as when a tolerable mild spell of weather intervenes they readily avail themselves of their own snug quarters, which are

then occupied almost year in and year out. Observed 9-1-17.* Most birds, however, come up to breed in early February; noted on the 16-2-15*, a few days earlier, reported to have arrived at Nagri by Mr. F. S. Boileau in the following year, when I noted their arrival at Gopaldhara on the 12-2-16.* Observed to have been absent for a brief period possibly occupied in getting the young brood safely launched on the wing, 14-9-17.*

334. The Indian White Wagtail. Motacilla alba dukhunensis Sykes.

Merely occurs as a *passing migrant at moderate elevations* on its descent to the plains, when it has been noted on the following occasions; all of which records apparently refer to this Wagtail. Gopaldhara, 3,500′, 19-9-21,* a single bird in company with a single M. cinerea melanope. 4,720′, 27-9-19,* single bird, stayed one day only. 3,500′, 28-9-21,* one adult and two immature birds in company with a Hoopoe. 4,720′, 4-10-20,* single bird only. 3,500′, 21-7-16.* Had I not made absolutely certain of my identification, I would not have inserted this remarkable occurrence, which remains a mystery, as to why a Wagtail other than *maderaspatensis* should appear in July; this bird had a "grey" back, as regards the colour of the ear-coverts, and whether an eye streak was present or not, I cannot speak with certainty; so far I have not observed either *M. alba personata* or *M. alba ocularis* on migration, and it must be left at that. The first and the last species of the next-mentioned were obtained by the Mount Everest Expedition upto 17,500′ and from 14,000′-15,000′ respectively.

Motacilla alba leucopsis Gould.
Motacilla alba ocularis Swinh.
Motacilla alba personata Gould.
Motacilla alba alboideis Hodgs.

Any of these Wagtails are likely to be discovered up at low elevations, at all events during "the cold weather." Blanford refers all his specimens of the Pied Wagtail obtained in the Lachung Valley above 12,000′ to the last species. It was not met with before the 11th of September.

335. The Large Pied Wagtail. Motacilla maderaspatensis Gmel.

Recorded "Breeds in the Plains, also in the Himalayas up to 3,000′." Partial to the stony banks of the large rivers when it is found during the winter at the foot of the hills. Obtained on the Raidak River above Bhotan Ghat in the Eastern Dooars, ♀ 23-1-22, ovaries fairly active; one of a small party of three or more. Also obtained on several occasions in the Tista River at low elevations by Mr. G. E. Shaw.

336. The Grey Wagtail. Motacilla cinerea melanope Pall.

Recorded for the Himalayas, "summer above 6,000′, where a few birds may also be found in winter." A cold-weather migrant arriving in the Rungbong Valley during September, leaving for higher elevations towards the end of April. Sparingly distributed adjacent to running water throughout "the cold weather"; as it is partial to the stony beds of all hill streams, there is every likelihood of it occurring in the upper reaches of the valleys as stated at 6,000′.

Gopaldhara, earliest arrivals.—4,500′, 10-9-17,* 4,720′, 21-9-20*, 3,550′, 22-9-19*, 19-9-21*, all of which records refer to single birds. Latest departures. 23-4-18,* a pair at 4,700′; a single at 4,720′, 22-4-23; 21-4-18,a single at 3,400′, 31-3-20*; a single at 4,750′, in company with Pipits (*Anthus hodgsoni*). All the Wagtails with this exception must be fleeting passage migrants, breaking their journey for brief intervals at moderate elevations on their descent to the plains.

Motacilla flava thunbergi Billberg.
Motacilla flava beema Sykes.
Motacilla citreola citreola Pall.
Motacilla citreola calcarata (Hodgs).

All of these Wagtails are likely to occur at plains-levels in "the cold weather." Unfortunately I have neglected these birds in late years, and at the moment I have not Mr. G. E. Shaw's records at hand. The two last-mentioned are recorded from Nepal where Hodgson obtained a large series of both species. Blanford speaks of procuring a young bird of Budytes viridis (*M. f. thunbergi*) at Yumthang, 12,000′, 13th September, when on migration.

Obtained by the Mount Everest Expedition (M. c. citreola, breeding at 14,000′).

337. The Forest Wagtail. Dendronothus indicus (Gm.)

Occurs *on migration*, both *on the downward and upward journey*, though of somewhat rare and irregular occurrence. Gopaldhara, 4,650′, 9-9-20,* heavy rain this morning ; a single bird, very restless, flitting about amongst some small "siris" trees on the "dhara" below the bungalow. 4,720′, 27-9-21,* a single bird came into the compound towards evening; somewhat shy, evidently a new arrival ; misty and drizzling rain prevalent. Obtained above Mangpu at 4,000′, ♂ 21-9-20. (G. E. Shaw). Observed on the upward migration at 5,500′ on a forest road above Pokharibong, date unfortunately not fixed.

338. The Indian Tree Pipit. Anthus hodgsoni Richmond.

Recorded "breeds 7,000′-12,000′, Himalayas." A cold-season migrant to the Rungbong Valley arriving at the latter end of September and departing before the close of April. Small parties are apparently resident on the Outer Ranges throughout the winter at much higher altitudes. Tonglo, 9,500′, ♀ 23-1-12, heavily streaked on both upper and underside ; secured out of a small party.

Bhotan Ghat, Eastern Dooars, January, 1922 ; commonly occurred in light growth in open forest at the base of the hills.

Gopaldhara, earliest arrivals.—4,700′, 13-9-20,* a single pair ; 4,720′, 22-9-20,* several, and many were in and about the compound on the 26-9-20* ; 19-9-16,* numbers located in "the tea" ; 4,500′, 19-9-17,* a single bird only ; 3,600′, 22-9-21,* a few about.

Latest départures.—4,720′ and below, 22-4-23, a few still about; 21-4-18*, numbers about ; 20-4-17,* numerous around the bungalow ; 20-4-21,* ♀ secured, one of half-a-dozen or so, very restless, preparatory to moving up ; ovaries showing signs of development ; 9-4-19,* much in evidence ; 4,750′, 31-3-20,* several in freshly dug ground. Jalapahar, 7,500′, ♂ 14-2-20, heavily streaked above and below ; several seen amongst the rocks. Gopaldhara, 4,500′, 18-1-20, albino ? ♀. This bird looked more like a mule-canary amongst the party of thirty to forty normally coloured individuals. Blanford has an interesting remark in reference to this species. No Tree Pipits were seen in Eastern or Northern Sikkim until about the 20th September, then they appeared in considerable numbers. ♂ Wing 84-87, av. 85 ; ♀ wing 80-86, av. 83. Assam skins from the hills and plains average somewhat similar measurements : ♂ 87. ♀ 82-2.

339. The Brown Rock Pipit. Anthus leucophrys jerdoni (Finsch.)

Recorded for Sikkim "breeds up to about 6,000′". I have no information respecting this Pipit.

340. Blyth's Pipit. Anthus richardi striolatus Blyth.

Occurs in the Rungbong Valley on its downward migration to the plains, staying for a brief period only. Obtained at Gopaldhara at 5,460′, ♂ 7-10-21,

wing 91. Turzum, 5,200′, ♀ 29-9-19. wing 90. (O. Lindgren). Mangpu, 6,200′, ♂ 15-9-19. 3,800′, ♂ 1-10-21. (G. E. Shaw).

Blanford found it common in clearings a little below 7,000′ in early September and at Phalung above 15,000′ in the beginning of October in the northern parts of Sikkim. Several seen by the Mount Everest Expedition at 20,000′.

Gopaldhara, 5,000′, 17-9-21, a party of about nine of these Pipits observed in the roughly cultivated ground on the steep hill-side; all had disappeared by the 24-10-21.

341. The Indian Pipit. Anthus richardi rufulus Vieill.

Recorded as ascending the Himalayas to about 6,000′. Its exact status is obscure.

342. Hodgson's Rosy Pipit. Anthus roseatus Blyth.

This Pipit is recorded for the Himalayas summer 12,000′-15,000′. It is a winter migrant to the plains, and so far has only been secured at high altitude on its upward migration. Karponang, 9,700′, ♂ 18-3-17, secured on an open patch of ground during a hot afternoon; evidently had recently arrived. Tonglo, 9,000′, ♀ 19-4-18. (G. E. Shaw).

Blanford records it as common on the Cho La Range in August and in the valleys of Northern Sikkim from 12,000′-15,000′ regarding it as a "constant resident, rarely or never descending to the plains." It was plentiful in the plains of Upper Assam in the cold weather. Obtained by the Mount Everest Expedition at 15,000′.

343. The Japanese Water Pipit. Anthus spinoletta japonicus Temm. & Schleg.

Recorded as follows: "Undoubted specimens from Darjiling are in the British Museum, collected in the winter months."

There is a possibility of *Anthus spinoletta blackistoni* Swinh. occurring on migration. *Oreocorys sylvanus* (Hodgs.) is also recorded as a permanent resident as far east as Nepal. Neither of these species is known to me.

(*To be continued.*)

A SPORTING TRIP TO THE PINDARI GLACIER.

By

W. H. O. Shortt.

Part II.

(*Continued from page 47 of this volume.*)

(*With 3 plates.*)

I arrived at Kathgodam by the mail in the early morning and found my coolies waiting. As I had packed most of my stores, etc., in bags for easy handling, and had previously arranged the weight of each package, there was no difficulty in dividing it out, and we marched off at about 7 A.M. We followed the Motor Road as far as a place called Ranecbagh and then descended by a bridle path, which in places was little better than a bog on account of recent rains, to a most picturesque suspension bridge over the Baghul River, where the scenery is magnificent. Then commenced a real nightmare of a hill. Although I met worse hills later, I was more seasoned to them then. I had spent the last twelve years among the lowlands, and especially coming, as it did, immediately after the rains, the eight miles to Bhimtal seemed as if it would never end. From Ranecbagh to within a mile of the dak bungalow, it is a steady and fairly steep ascent. After about three miles of this I sat down for a rest. When I got up something seemed to have gone wrong with my thighs, which had developed pains all over. I struggled on for another mile and then decided it was time for lunch. After lunch my pains and aches were worse and the sight of Bhim Tal itself was a very welcome one, for the road from there on to the bungalow, about a mile away was level. At the south end of the lake from which the settlement derives its name, is a large masonry dam, which allows surplus water collected during the rains to be utilized for irrigation and at the same time keeps the level of the lake up and conserves a large volume of water for emergency irrigation. The dak bungalow is situated just behind this at an elevation of 4,500 feet. Besides the dak bungalow there are two hotels on each side of the lake. There is not much in the way of shooting to be had here, except on private estates belonging to the hotel proprietors. You have to go a good distance for shikar.

The main attraction at Bhim Tal is the fishing. The lake is full of Mahseer and some quite respectable fish are to be had. As I am not a fisherman myself I won't attempt to say anything about it. Boats may be had on hire, either for sailing or fishing. In the evening I exerted all my will power and struggled out along the road I had come by in the morning for perhaps a mile and a half and then went down the khud a little way. My cocker spaniel, who glories in the name of Dick Twankey, put up a covey of Kalij pheasants which I missed badly. The country looks as if it should abound with pheasants, but the annoying part of it is that it doesn't. This covey was all I saw. There are several lakes round about within a radius of 8 miles, but these are all fishing lakes, although ducks are occasionally to be had on them. I did not visit any of the others. The next morning I felt a little a better, but still very stiff. At about 7 A.M. I set out to march to Bhowali Forest Bungalow, about five miles distant and at an elevation of 6,000 feet. This is rather an uninteresting march. Although I had less than half the climbing to do that I did the previous day, I felt it nearly as much as the first instalment. Bhowali itself is a very pretty little place and boasts two hotels and a sanatorium. The Ramgarh river flows through the village on the banks of which there used to be a Turpentine factory. It is now dismantled and you only see a weird assortment of flywheels and such like contrivances. The Motor road from Naini Tal to Ranikhet passes through Bhowali. About a mile along this road towards Naini Tal you come to a pass with a fine but contracted view. The King Edward VII Sanato-

rium is situated just above the pass from which there is a short cut to Naini Tal which is only about 5 miles away by this route. Next morning I went out on the hill to the west of the village to see what I could shoot. I was informed there were plenty of Kalij pheasants there and an occasional goral or barking deer (*Kakar*). I did about 4 hours hard work climbing up and down the hills, the sides of which are extremely steep, but without result. Dick flushed some pheasants but I was unable to get a shot. These Kalij pheasants have a diabolical habit of dodging round a tree as soon as they rise and you haven't time to get a shot. Besides these I saw nothing except a young Kakar. By the time I got home I was tired but not stiff or sore and I thought my muscles had now been slackened and that I would have no further trouble. The next march was to Khairna Dak Bungalow, which is twelve miles away and at an elevation of 3,350 feet. The road is the motor road all the way, but you can save bits here and there by taking short cuts. The scenery is very fine indeed. The Ramgarh river flows below the road all the way and is usually far below in a gorge occasionally coming into view as the road winds in and out among the hills. The steepness of the fall in the river varies greatly. In one place it is nothing better than a rapid, and a little lower down it shows down into an ordinary stream. At about 8 miles you come to a place called Rattighat, where another stream joins the Ramgarh. This is one of the prettiest spots on the route and anybody who is out for scenery alone should arrange to stay here for a day. There is a P. W. D. inspection house here which is delightfully situated, and judging by appearances, there should be plenty of game around. Even if you do not stay here, you should pay the suspension bridge a visit.

This is thrown across the Ramgarh about a furlong away from the inspection house, and is well worth a photograph. This should be taken from the bed river upstream of the bridge. There is a short cut by the bridle of the path from this bridge to Naini Tal, which is about 8 miles by this route.

Although the road is downhill all the way I found this nearly as painful as going uphill, the explanation being that one set of muscles was exercised going uphill, and another going downhill. However, all things come to an end and I arrived at Khairna early in the afternoon. I found the Maharajah of Jhind had a shooting party there, but managed to get a room in the inspection house. As the Maharaja's party had been there for a couple of days already I did not expect to get much and I wasn't disappointed. He, too, had had a very disappointing shoot and when I left next morning had only bagged a goral and a pig, exclusive of birds. Khairna bungalow is situated high above the road, and looks out over a valley which is broad in comparison to what I had been passing through recently. The cart road from Naini Tal to Almora is met just beyond Khairna. Next morning I set out for the worst march of the whole trip, the march to Ranikhet which is 15 miles distant and at an elevation of 5,983 feet. Immediately after leaving the bungalow you cross the Kosi river by a fine girder bridge. There used to be a suspension bridge here, but it was washed away in a recent flood. Just below the bridge the Kosi is joined by the Ramgarh, which does not appear to make much difference to the former, which is quite a considerable stream. I believe there is excellent fishing to be had in this stream. The view from the bridge looking up the valley of the Kosi is magnificent.

The perspective view of one range behind another, each one getting fainter and bluer with the sky for a background is indeed lovely. Just above the bridge is a large deep pool, which looks most enticing for a bath. It was being used for that purpose by some of the Maharaja's guests when I passed.

Not long after leaving the bridge behind you get into open country and from here on it is a steady uphill grind all the way, with barely a tree to break the monotony of the landscape. At about mile 5½ you come to a Military post which is merely a halting place for troops marching along this road. Near

here is the P. W. D. inspection house of Bamshaon. About a mile out of Ranikhet, you again meet the pine woods, and a very welcome change it is indeed. The dak bungalow is on the left of the road as you enter Ranikhet and the inspection house on the right, just above it. Ranikhet itself is a lovely little place, with very fine view of the snows, the first you have had by this route. It is quite an up to date little place and has a skating rink and Cinema combined. There is a Military Station here also. It is not actually in Ranikhet itself, but is about 3 miles away at Chaubattia. I should not think there would be much shooting around such a large place, but I was informed that goral were obtainable on the hills. Shooting within cantonment limits is not allowed. I didn't spend any time here, but pushed on the following morning to Majkali a distance of 9 miles, the elevation being 6,000 feet. The khansama has contrived to obtain a license for selling liquor. I believe he also keeps a few tinned stores for stray visitors who may happen to stop here. About five miles out of Ranikhet I bagged a Kalij Pheasant. I left the road and walked along the hill side above it, among a fairly dense growth of young pines and oaks, out of which Dick flushed the birds. The last two miles were through bare hill sides and cultivated land. Just before coming to Majkali you leave the motor road and take a short cut through the village of Reuni. This brings you out at the bungalow itself. A very fine view of the snows can be obtained from here.

I went out with my gun in the evening but got nothing more. I saw a Kalij, but was unable to get a shot. They are terrible skulkers and if they can possibly run they will, rather than take to their wings.

I noticed nearly all the pine trees of any size had a deep groove cut down the bark with a small earthenware pot attached to the bottom, and a drip iron placed above to collect the resin and guide it into the pot. One wonders where all the resin goes to. I started off early next morning for Someswar, 13½ miles distant. The elevation of this Dak bungalow is 4,572, but that is rather misleading as an index to the nature of the march, as is the case with a good many marches. You start off by going down hill for 4 miles to Golchina, about 5,100 feet elevation, where resin is collected in a specially prepared storehouse which is mostly underground. Then you start a very steep and long climb up to Aridco Pass, about 6,900 feet elevation, where there is said to be a forest bungalow. I looked for it but didn't see it, it was probably a little way off the road.

On this march I noticed a peculiarity about the pine trees for which I should like an explanation. About 50 per cent. of the pine trees here had, for some unknown reason, started twisting in early life and had continued doing so. The whole fibre of the wood twisted round and round like a corkscrew, some more and some less. Some took a complete twist round within a few inches. This, of course, renders the wood quite useless for timber and it is only used for extracting resin or for firewood. This twisting seems to have the effect in some cases of distorting the tree badly.

To get back to the route—by the time you reach the top you are glad to sit down. If you are going on to Someswar, this is a good place to have your lunch. From there on the road was all downhill and a new trouble came to afflict me. As the road was fairly steep each step I took jammed my toes into the toes of my boots, and the continual friction rubbed the skin right off the tops of some of them. Everybody has suffered from blistered toes at one time or another, so I need not describe the torture I suffered. I set my brain to work on a method to circumvent this and finally evolved the following method :—If I expected to have a good deal of steep downhill work, such as khud climbing on a shooting expedition or a long downhill march, before I set out I wrapped a short strip of thin cotton material round each toe, except the big one which seemed hardier than the others. I allowed each toe about three turns of the cotton. This had the effect of taking up nearly all the fric-

tion. I fancy well fitting boots with the high American toes ought to be useful for this sort of work. The only other alternative is to have your toes amputated before you start. I was very thankful to reach the dak bungalow and get my boots off.

On the way up to Arideo peak my dog disturbed some animal, but I could not say what it was. I believe there is good goral shooting to be had on Arideo, but my time was limited and I had to get on. I saw pig tracks on the way down to Someswar.

I decided here to go off the direct route to the glacier and to visit Kausanie, where there was a Tea garden which I wished to see in order to compare it with other gardens in Assam. I had also read that the view from Kausani was very beautiful. The direct route is from Someswar to Bageswar, but I decided to go to Kausanie, and from there to Baijnath, and thence to Bageswar, and I had no reason to regret my choice. It is a very short march to Kausanie, only 6½ miles. At Kausanie there is a P. W. D. inspection house at about 6,000 feet elevation. The view of the snows from here was glorious, and the foreground of deodars and pines made a lovely picture. I have made a diagram from the photographic illustration, showing all or nearly all the principal peaks.* I noticed all along the route and even in the Pindari Glacier log book, that information about the correct names of the peaks was most vague, and the names were repeatedly misquoted. It is not a very difficult matter to fix the names from a map if you have a compass and take a few cross bearings. The peaks of Nanda Devi and Nanda Kot are the oftenest misquoted. Beyond Kausanie you cannot see Nanda Devi, and Nanda Kot is continually being confused with Bankattia. With the help of the small scale snow view and the larger and nearer views in conjunction with the diagram, there should be no difficulty in being able to name the peaks. The peak of Bankattia, 22,530 feet high is unmistakable. It has a sharp chisel edged top, and lies east of, but connected with, Nanda Kot, which is one of the left bank of the glacier. "The peak" and Nandi Khat are on the right bank.

At Kausanie I found the tea garden was no longer being worked, but had been taken over along with some others, by Government, and was being used for making grants of land to soldiers. I called on Mr. Bellairs the officer in charge of the scheme and we went out together to see if we could pick up a bird or two. We saw nothing. He informed me that there was very little shooting in the neighbourhood. An occasional tiger or leopard came along, or a few pigs but that was all. At present there was a man eating tiger in the district who had already accounted for over a dozen people, but as he wandered over a district between points about 60 miles apart, there was no immediate prospect of bringing him to book. He is still at large. I was disappointed as regards the tea garden, as it had shut down all manufacture and cultivation after being taken over by Government. The only class of tea grown was China. A few experimental bushes of what looked like Lushai indigenous had been planted but had not proved a success, though they appeared to compare very favourably with the neighbouring bushes. The crop on these gardens is very small and is counted in pounds. I believe the estimated crop for Kausanie used to be 100,000 pounds, or 1,250 maunds.

Next morning I took a short cut through the estate and picked up the cart-road for Baijnath. This was a most uninteresting March.

Just before reaching the village of Baijnath you cross a tributary of the Gomati by the most ramshackle suspension bridge I have ever seen. The supporting wires are suspended from wooden supports and are themselves only 2 or 3 ordinary thick galvanized wires roughly twisted together. They also act as a hand rail, though at each end you cannot reach it and in the middle it is below your knees. The whole bridge is so wobbly that a barrier has

*This diagram was published with Part I of this article, *vide* p. 42 of this volume.

been put across each approach to prevent cattle essaying the feat of crossing.

A little further on you cross the Gomati by a fine suspension bridge and then begin a climb to the bungalow. The march is a short one of about 8 miles. I do not remember the elevation of Baijnath inspection house. You can go to Mussoorie *via* Baijnath and Gwaldam, but the inspection houses have, like those on the Pindari route, only a chowkidar in charge. There is no shooting to be had here close at hand, though the neighbouring hills look as if they would harbour Gural and Kakar.

From Baijnath, which is a little out of the road to Bageshwar, there is a short but rather miry path that brings you back to the road and saves you a mile. The total distance to Bageswar is about 12 miles by this short cut. During October, and even later, especially if rain has recently fallen, you occasionally get ducks on the rivers, but I saw none on this march. As a matter of fact I only saw ducks once and that was on the return trip.

The first four miles are rather uninteresting as the road lies along the Gomati which here flows through a broad valley but at about 4 miles narrows down, and thence forward the scenery is very fine indeed, the river flowing through a narrow valley with the hills rising straight from its bed and the road winding along above it. The village of Bageswar is very prettily situated just above the junction of the Gomati with the Surjoo river. The streets are all paved with flat stones and wind about all over the place. The bungalow here stands hard up against the village, which is rather unpleasant, but otherwise it is beautifully situated. The elevation is only 3,200 feet.

There is a very fine pool in front of the bungalow which is full of fish, but as the priests of a temple close by are in the habit of feeding the fish, the Hindoo inhabitants dislike anybody fishing in it. The Surjoo is a fair sized river and like all hill streams, abounds in deep pools. If you notice the volume of water flowing over some of the shallower reaches, you will have an idea of the depth of some of the narrows through which the river passes. You are inclined to wonder how that volume of water could pass certain points. This is particularly noticeable at the gorge just past the 30th mile stone. I believe the fish to be had here are very large. I will deal with the shooting on the return trip, as going upwards I didn't stop here.

The next march was to Kapkot, distant 14 miles, the elevation of which is 3,750 feet. At the third or 30th milestone you cross the Lahor stream and turn to the right, following the right bank of the Surjoo. About here there is a good road to the left leading to a forest bungalow.

The river here enters a deep gorge where the scenery is magnificent. The left bank is almost a sheer precipice and has every little break in the face of the rock crammed with ferns. Here and there a date palm is clinging to the face of the cliff in a wonderful manner. Later on the left bank is less precipitous and the right bank becomes a precipice, with the road cut out along the face probably a couple of hundred feet above the river, which is not visible. Here, too, a few date palms have got a footing, but the cliff is very much more broken here and its face is covered by a mass of trees of varying size, though there are no really large ones. This is rather a long march, 14 miles, and you might arrange to have lunch at Hatsila, a village just half way between Bageshwar and Kapkot. Personally I like to do at least two-thirds of the march before halting for lunch. As you approach Kapkot the valley widens out into a fertile plain, in the middle of which the village is situated on the bank of the Surjoo. This is the last place at which you will find a butcher and even his supply is somewhat problematic. I went on again next morning and the scenery was just a shade less beautiful than it had been on the previous march. About a mile from the bungalow you cross to the left bank of the Surjoo by a suspension bridge, over a fine pool and then proceed along as before. The milestones here are somewhat confused, as I believe some refer to the Milam

route and some to the Pindari glacier route. However, about 4 miles from Kaphot the Rapti stream joins the Surjoo and at this point you leave it, and crossing the Rapti by a wooden bridge, follow the right bank of that stream as far as the village of Kharlbagar. The road to Milam follows the left bank of the Rapti. There used to be a bridge here across the stream but it is now abandoned and the present bridge is just above its confluence with the Surjoo. At Kharlbagar the road turns sharply to the left and you are faced with a horrible looking hill up which the road zigzags. Fortunately it is not very long, about half a mile, and then you commence a long gradual descent back to the Surjoo valley. You cross the Surjoo at about 6½ miles and climb up a steep hill on the other side just for the pleasure, apparently, of climbing down again on the other, at least it feels like that. Just in front of you you see a very good example of a landslip. It occurred quite recently, I am informed. It has caused a pool to be formed in the bed of the Surjoo at this place. After passing this you come to a school which is roughly, the foot of the big climb to Dhakuri Pass. However, about a mile of very steep climbing brings you to Loharkhet bungalow. This is 9½ miles from Kaphot, and has an elevation of 5,600 feet. The bungalow is situated right on the bank of a small hill stream. This is, I might remind you, the last place where stores of any kind are obtainable. You will probably have to engage an extra coolie here to carry the rations of your party for the period you will be north of this bungalow. There is a coolie contractor here who will arrange for any coolies you require. The charge is Re. 1 a day to the coolie and an anna a day per head to himself as commission, the amount to be paid on your return to Loharkhet.

I was informed that you could get chukar and black partridge here, and the country certainly looks like it, but if you wish to shoot, it is better to do so from the next bungalow, as there you will get a much bigger variety of game.

At this bungalow you ought to occupy the evening in memorizing the whole of "Excelsior" for you will certainly need it next morning. Quoting verses from this poem is a great solace as you go toiling on and on and never seem to be coming any nearer the top. You will probably have gone through the whole of "Excelsior" several times before you at least reach the pass, the elevation of which is 9,500 feet odd. As you reach the top on your left is Dhakuri Peak, 10,540 from which a magnificent view may be obtained. However, you are not likely to hanker to reach the top on this occasion, so we will leave it for the time being. The bungalow of Dhakuri is about half a mile or less further on. About two-thirds of the way up I heard a barking deer quoting "Excelsior," at least I expect it was equivalent to that. In any case, I chained Dick up and proceeded to stalk it. It was rather a coincidence that it happened to be the 15th of October, the first day that shooting for barking deer opens. I was lucky in the selection of a stalking ground, as there was a small but very turbulent stream running down the hill side here, and the very considerable noise I made in great hobnailed boots as I slipped among loose stones or trod on dry twigs was almost entirely drowned by the noise of the water. Fortunately I saw the deer before it saw me and put a lethal ball into it, dropping it dead. This cheered me up greatly and I had no further need of quoting "Excelsior".

This whole march is only about six miles, so I decided to do a double march, as the next march was only five miles. I stopped at Dhakuri bungalow, the elevation of which is 8,725 feet, until my coolies came up, and employed myself in the meantime with some fruit and nuts, which always composed a considerable portion of my lunch. After they had rested a bit we all pushed on. The jungle on the northern side was much more open and consisted chiefly of large trees with bracken and a species of small bamboo called, I believe "Ringalls" as undergrowth. After about a mile you come to a junction of two roads, the one on the left going to Gwaldam and the other to the

Glacier. The Gwaldam road is also the one you take if going to the lower slopes of Nandi Khat, which I was informed, was a wonderful place for "Tahr." The jungle you leave behind you here is commonly frequented by tiger and leopard, for which it should prove an ideal hunting ground on the lower slopes. You then cross a bare piece of hillside, which appears to have been cultivated at sometime or other, and then enter the jungle again for a short time, crossing a small hill stream in a veritable fairy's dell. The hill side on either bank is smothered in ringalls, and provides a sight to which no photograph could do justice. It is, besides, a difficult place to get a good photograph of I tried to myself and eventually went away without getting one. The large trees all round are mostly wild chestnut trees, and in October the nuts are ripe and are falling all the time. After leaving this spot you again come into cultivation. I put up a Kalij cock and a hill partridge or "Peura" from among some ringalls. I missed the former, the latter didn't give me the chance to miss it. A very striking feature of the cultivation round here is that it is mostly canary yellow or a deep red for the correct shade of which I do not know the exact name. This crop is a cereal and is called *Chuwa* in the vernacular. They are sometimes sown mixed, and sometimes apart. A field of red *Chuwa* looks very striking indeed.

Khati is reached shortly after, at an elevation of 7,650 feet, and you are glad to sit down. You have now come into the valley of the Pindar River, and looking up the valley through the trees you see what is, I believe Nanda Kot. I didn't look carefully and so I cannot say definitely that it is Nanda Kot. This view also, though making a beautiful picture to the eye, makes a poor photograph, as the foreground comes out hopelessly under-exposed.

The inspection house here is situated rather too close to the village of Khati but overlooks it. In winter the village is frequently snow bound and is entirely cut off from the outer world for a short period, according to the local Chowkidar. From the same source I learned that there was no shooting to be had in the vicinity as cattle even grazed there, but that an occasional bear were seen. There must, however, be kakar and goral a little further in, as the jungle is dense. Milk is usually obtainable here, but I wouldn't guarantee the quality, as hill men are notorious for adulterating milk. You will probably have to patch up some of the panes of glass here, as there are usually some broken ones and a bitterly cold wind blows in. Next morning I set out for Diwali bungalow which is about 6½ miles distant and 7,967 feet high. The road lies all the way through dense jungle and you gradually descend to the bed of the Pindar. At mile 3¾ you cross to the right bank and then back again to the left just at Diwali bungalow. In this march you reach the habitat of the gorgeous Monaul pheasant. As we were leaving the jungle at one point and coming on to the bed of the Pindar itself, a couple of pine martens dashed out of the wood. They both turned back on seeing us, but one of them for some unaccountable reason suddenly turned back and made for a large boulder near the edge of the water. I bagged this one. There are some magnificent water falls on this and the next march. They were very fine now, but after a heavy shower of rain, they must make a wonderful sight. They are too close to make good photographs. Diwali is the starting point if you wish to visit the Kuphini glacier, about three miles distant, I was told. I did'nt go, so can say nothing about the route. The Kuphini river joins the Pindar at Diwali Bungalow, which is beautifully situated right in the fork.

There is quite good bear and thar shooting to be had from here, but you have to go about four miles, and the going is all over very steep hills. Unless you are out for shooting only, and have ample time it is not advisable to try. I just waited till my coolies arrived and had a rest, and then pushed on to the last bungalow, Phurkia, about 3½ miles away at an elevation of 9,900 feet. It is always advisable, after leaving Loharkhet, to carry a Cardigan or Sweater

in your haversack, as while you are waiting for your kit to arrive, you will find a shirt and vest even woollen ones, insufficient to protect you from the cold.

About half roads to Phurkia you pass some salt spring falls on the right bank of the Pindar. This is a favourite place for thar. If you see any here don't shoot them. The river, though it looks insignificant, cannot be forded and to recover the animal you will have to go back to Diwali, cross the river, and come up over the mountains and then down to the Pindar bed. I did not know this, and on my return journey saw some thar here and wounded one, without killing it. I was unable to follow it up and had to leave it. When firing over a valley like this, it is extraordinarily hard to guess the range. I think at this site the range is about 200 yards, though it looks about 50.

About this point you get out of the heavy jungle into scrub which looks like birch. In October this is a beautiful site, being a mixture of greens, yellows, reds and browns. The colouring here reminded me strongly of the colouring in the Pass of Killiecrankie in Scotland about the latter end of September. This scrub is frequented by Monaul pheasants. I bagged the first one I saw with quite a good shot and shortly after missed another with both barrels. These birds are a little deceptive to shoot. They are so large that they appear nearer than they are. I read a description of a Monaul which I thought was very good. It was described as being like a gigantic humming-bird. These birds also frequent open, grassy hillsides, especially where there are low scrub covered cliffs. The way to get them is to send a man above you to where they are expected to be, and for you to go ahead, but some fifty yards lower down. The birds almost invariably fly down and along the hill side in a sweeping curve and they fly fast and well and carry a fair quantity of shot. On the whole, however, they are fairly easy to shoot. The hen is about the same size as the cock or perhaps a trifle smaller, and looks like a huge partridge when flying.

On arriving at Phurkia I found only one-half of the bungalow habitable. The porch of the other half had given away during the last rains and gave the whole of that side an unsafe appearance. There was no crockery here, nor were there, as far as I remember, any cooking utensils. A roaring fire and a cup of coffee did a good deal towards cheering me up.

Next morning I left the bungalow at about 6 a.m. on the final stage of my journey. On arrival at the snout, or rather above it, as I had ascended the eastern moraine I spotted a couple of Burhel (*P. nahura*) on the dirty lower portion of the glacier itself. Unfortunately they spotted me too and cleared off. A little later one of my men spotted another group of burhel on the far bank. Those of my readers who wish for a description of the scenery and the glacier must forgive me. I was out for shikar first and scenery afterwards. I only had my gun, and some ball cartridge, but I took a long last look at the glacier, and said "Good Byee" and went after the burrel. It was a forlorn hope, but still !!! . . . . . .

The bungalow chowkidar, who acts as a guide on the glacier is a very keen shikari, and much prefers shikar to conducting people over the glacier. He, naturally, was delighted. We crossed the Glacier as soon as the burhel got out of sight on the far side of the west moraine and hoped to cut them off near the snout. They moved, however, too fast for us and before we were in position crossed the place we had hoped to intercept them at. Then followed a most arduous time. I managed eventually to get within two hundred yards of them, and it was impossible to get nearer. I tried one or two shots at that range, but with the gun it was quite hopeless. However, I had had my fun all the same. I then took one or two photographs of the snout and snows, which I hope will go towards satisfying those who are more interested in the glacier than in shikar.

At Phurkia is kept a "Log Book," which was meant originally to record scientific observations regarding the glacier, but has gradually developed into a record of each party's visit. It is quite interesting reading.

I shall now try and describe the glacier as I saw it, very superficially. As a glacier it is very disappointing, at all events, your first acquaintance with it. The lower end or snout is unrecognisable from above as a glacier, as it is covered with stones and debris embedded in the ice. Here and there a crevasse has formed, but elsewhere the ice is usually invisible, except at the snout itself. At present the main opening in the snout only discharges a small trickle of water, the main flow going on under the ice for several feet and coming out of an insignificant crack lower down. These are shown clearly in the illustration.

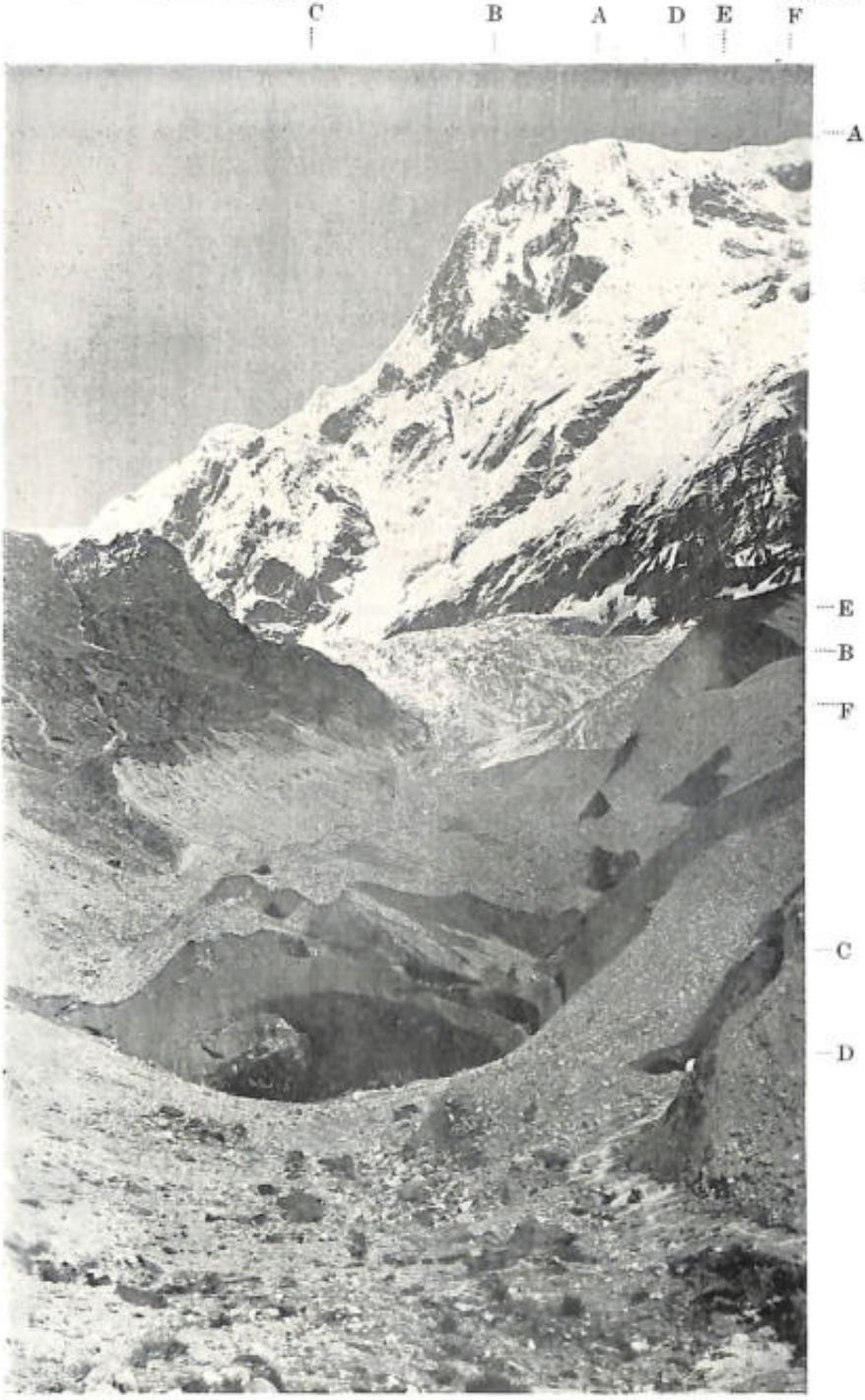
If you refer to the illustration (Plate II) you will see that the glacier is joined by another smaller one some distance above the snout on the right. A little above this junction the ice becomes clear and forms an ice cascade formed by the glacier coming down a steep declivity. From a distance it gives one the impression of a frozzen rapid. Above this is another stretch of ice, and above it again, a second cascade. The mountain on the right of the glacier is Nanda Kot which is connected to Bankattia, a little further to the right. Bankattia is not shown in this illustration, but can be recognised from any point of the route by its chisel-edge-like peak.

The peaks on the left of the glacier from right to left are "The peak and Nandi Kkat." The latter also has a razor back peak, but from further south this is not so much in evidence, whereas the peak of Bankattia retains its chisel like appearance.

On my way home, just below the snout, I put up a couple of snipe, but they were fearfully wild and I could not get a shot. I bagged a pair of snow pigeons and a monaul a little lower down, after which I was very thankful to meet my lunch bearer. I was due back at Diwali next morning, on the return journey, and as it was only a short march, I decided to devote the morning to thar. I accordingly accompanied the chowkidar back towards the glacier for about a mile and then tackled a very nearly perpendicular hill on the right. There was some rhododendron scrub on it and I bagged a hen monaul going up. After an hour's most strenuous work I reached the thar ground, but there was no sign of thar. I sent the chowkidar off to see if he could find any trace of them, and amused myself by munching gingernuts and looking about the various slopes with my glasses, in the hopes of seeing something moving. I eventually did spot some moving objects a good thousand or more yards away. It was a herd of thar. I counted 44 with my glasses. Unfortunately there was an impassable ravine between us, and I would have had to go about 3 miles round and well over the snow line to reach them. I had not the time to do this unfortunately. I had to content myself with another monaul on the way back.

Between Phurkia and Diwali I had the bad luck to wound a thar, as I have already mentioned. While I was firing at them I was joined by the District Engineer of Almora who was on his way to Purkhia with his wife. It was he who told me of the difficulty in retrieving an animal from that spot. He also informed me I was firing at female animals. This, however, was quite excusable as there is very little difference between the sexes. I was informed by him that the males are darker in colour. About this time it started raining and I was glad to reach Diwali bungalow.

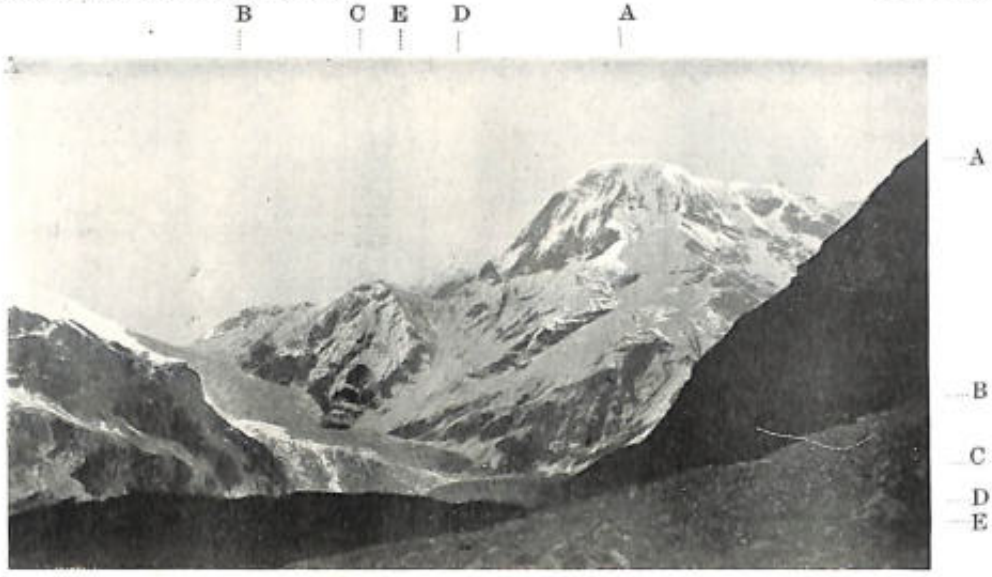
I set out next morning for Dhakuri. Between Diwali and Khoti my dog put up several covies of "*Peura*" or wood partridges and some deer or gural. I didn't see what they were. I knocked over a partridge but failed to recover it as Dick was off after something else and couldn't or wouldn't hear me calling. He is rather deaf and I am never very sure whether he cannot or will not hear on these occasions. I fear it is the latter. As I left Khati behind me I saw it was raining at Diwali and further north, and it wasn't long before it was raining



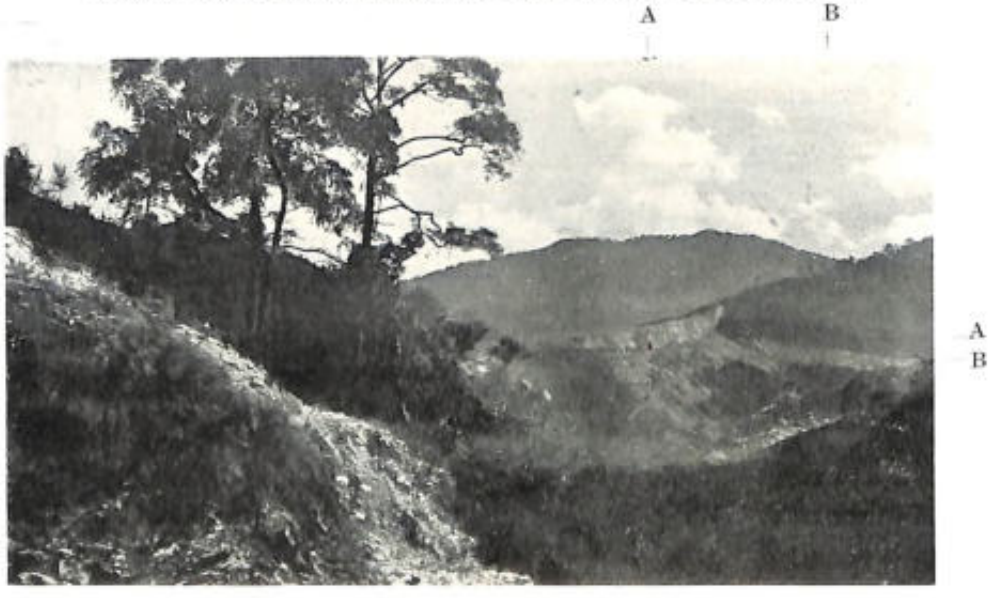
PINDARI GLACIER.

References.

A—A Nanda Kot.
B—B Lower Ice Cascade.
C—C Snout.
D—D Minor Outlet.
E—E End of Medial Moraine.
F—F Subsidiary Glacier from right.



NANDA KOT, SHOWING UPPER AND LOWER ICE CASCADE.



A LANDSLIP NEAR LOHARKHET.

References.

Upper :—A—A Nanda Kot.
B—B Upper Ice Cascade.
C—C Lower Ice Cascade.
D—D Medial Moraine.
E—E Eastern Moraine.

Lower :—A—A Landslip.
B—B Do.

where I was. About half roads between Khati and Dhakuri Dick put up a cock Kalij and I noted that it settled in some low scrub. I followed up and actually saw it sitting less than 6 feet from me in a thick bush. I made a noise but it wouldn't get up, so I called Dick up. This was too much for its nerves and it got up with a tremendous noise. It was rather too close for a shot when I fired and I blew its wing off. I decided to make an early start next morning as besides looking round for game, I wished to climb to the peak and take some photographs and magnetic bearings. What had been rain at the bungalow had been hail on the peak, but I expected this would have melted, and the ground been frozen, so put on rubber soled boots for stalking. I found the hail had not melted, but the sun had started thawing it, and my boots were frightfully slippery in consequence. When I reached the top of the hill I found there were too many clouds about to take any views, so I gave up that idea. I found several fresh tracks of goral, evidently the evening before or that morning. I also saw equally fresh bear tracks. I followed these up till they went to a very precipitous part of the hill, where I couldn't follow in my rubber soles. Dick put up several monaul. I might have got some of these but I was hoping for bigger game and did not fire at them. When I gave up hopes of big game I did not get an opportunity at the smaller game. It is always the way things happen. It came on raining again and in hurrying home my treacherous rubber soles let me down with a terrific bump. I dented my left barrel and the middle of my back at the same time. Next morning I got up earlier and went up to the peak again. I took some views but they did not turn out well. I had decided on a double march to-day, so had arranged to have my breakfast at the top of the pass, and I was ready for it, too, by the time I got back there. This is rather a painful march as you have such a steep descent that unless you have made good arrangements your toes get jammed into the toes of your boots, and you lose all the skin off them, a most painful and protracted process. At Loharkhet I paid off my extra ration coolie, who was almost totally deaf and nearly dumb, but otherwise a fairly tough specimen.

I have already mentioned a school house near Loharkhet. Well, near this school is a cliff, and it is usually frequented by snow pigeons, so you should be prepared. I wasn't as I had packed up my gun in view of the double march.

On arriving at Kapkot I enquired for a shikari, and was brought a lanky individual who addressed me familiarly as "Tum," whether from insolence or ignorance I have not yet made up my mind. However, as I required his services, I did not protest. Next morning he conducted me to a hill about opposite a milestone marked 45, about three miles along the road from Kapkot to Loharkhet. We climbed up here through a gully that should have been stiff with pheasants, but was not and then started a scramble up on almost perpendicular khud, holding on by grasses, ferns, &c. By the time my breathing apparatus had started sending out urgent S.O.S. signals, we reached a crest of the hill and the shikari looked over and then beckoned to me. There were a couple of goral standing about 100 yards away. The shikari took no pains to hide himself, and the goral suddenly remembered an important engagement on the next hill. We went on after them and eventually the same result was achieved, only this time the pair, or another pair, turned into four or five. This time we followed more cautiously, and at last my shikari spotted a couple about 250 yards away. I crawled to within about 200 yards of them, but could not get a clear sight as they were standing in long grass. I was just going to risk a shot when another one came into view about 100 yards off. I took aim at this one and fired with the only result that the animal careered off at full gallop. I sent the shikari to look for the bullet hole. He didn't find it, but found some fur instead. This raised our hopes and we set Dick on the job. After a while we heard a wild yelping and the goral dashed past, apparently unhurt, with a hairy black object pelting along after it, getting badly left behind. We followed up and traced it to a dry water course where Dick lost the scent. The shikari, however, found a pool of

blood, and a little lower down just below a small fall in the gully, found the goral dead under a bush. The bullet had taken it low down nearly disembowelling it and yet it had carried on for some considerable time as though unhurt. I anticipated great difficulty in getting the animal out of this place, as it was extremely precipitous, but one of my coolies tied its feet together and took it out on his back in the usual way hill people carry loads. I handed my rifle to the shikari to carry although he already had my gun. These hill men with their bare feet can cling to anything. The shikari said that presumably we would come to a "maidan." When we arrived at it, the "maidan", turned out to be a hillside, so steep, that I found the best way of getting down was to sit on one leg, stick the other straight out and slide down. The hobnailed surface of the boot I was sitting on, aided occasionally by the other boot and my hands, acted as a brake, and prevented my descent being too rapid. This method is apt to cause frequent punctuation by strong language caused by the unseen stones being forcibly driven into your nether regions by the velocity of your progress. You are also liable to leave sundry pieces of your pants behind if you are not careful, and you occasionally come to a 2 or 3 foot drop which you could not see for the long grass, which is two or three feet high at this time of the year. I do not know what happened to the flesh of that goral, but the piece I had was full of grit as though it had been dropped on sand and cooked without being washed. This suggestion of course was stoutly denied and the cook said that he too had found the flesh gritty. In the evening I went up the hill at the back of Kaphot village. Dick put up a Black partridge which I missed shockingly. That was all I saw.

I made an early start next morning and shortly after getting out of the village bagged a Black Partridge. A little way on you come to a hillside with thick scrub along the base which looks ideal for partridge or pheasant, but I tried it both coming and going without result. The valley of the Surjoo is fairly broad up to here, but now narrows down and begins to descend faster forming frequent pools. On one of these I saw a flock of teal and bagged one. They were probably migrating south and resting here. I dropped a second, but the river was very narrow and it dropped on the other side in dense jungle. I arrived at Bageshwar about 11-30 and spent the rest of the day sleeping and reading. I sent for the local shikari who told me where the game was to be had, and also about a problematical panther. I do not think he was favourably impressed with me as a potential source of much wealth because after promising to call for me at 6 a.m. he failed to turn up altogether himself. Beware of similar treatment. He has several decent chits, and I heard from an unbiassed source that he knew where the game was to be found, but that is how he treated me, although I was most polite to him from policy. I was late getting away in the morning as my cook slept in, and I didn't get started till nearly seven. I had three miles to go to the shooting ground, which I should have reached by 7 a.m. Just as I arrived and was enquiring for a guide from a village the local forest ranger turned up and very obligingly offered to show me the best place himself. This place may be found as follows:—Retrace your steps along the road to Kapkot, till you reach mile 30, where the Surjoo turns to the right and enters a gorge. A few yards beyond the milestone is a forest road on your left going up the hill. Follow this path and it will take you to the shooting ground, which is near the top of the hill. The best place is the east face, overlooking the road to Kapkot, though the road is quite invisible. At the 30th milestone is a tributary of the Surjoo called the Lahor. The hill I have just described is on its left bank, but the hill on the right is almost as good, the ranger told me. I did not try it. On arrival near the top we looked about and after a little while the ranger spotted a couple of goral. He pointed them out to me, but they were too far for a shot, so I proceeded to stalk them. About this time I got rather annoyed with the ranger who did not exercise the least caution. He wore heavy hob-nailed boots

like myself, and as he walked carelessly, made a terrific clatter. When we approached the spot we had first observed them at, I went on alone, but they had disappeared. I hunted about for a while and suddenly heard a peculiar noise, something like a sneeze, repeated once or twice. I suspected this was the alarm signal of gorals and I think I was right. Suddenly there was a slight clatter and one appeared on a rock for a moment and then disappeared. The other one then came bounding up from below, saw me as soon as it came in sight and galloped off. As it was turning a corner, past which I could not see, I fired at it and hit it. He went on for a bit till he came opposite my men, but a good deal below, when he was seen to be limping. He stopped in full view and after a little lay down. He got up again a moment later, but did not appear able to get away, although we were not far off and it saw us moving about. The ranger advised me to put another bullet into it, but I neglected the advice, thinking the animal was quite done. I told the man to unchain Dick, as going down a steep khud holding a dog on a chain is a big handicap. Dick got on the scent and went after the goral, yelling blue murder. The goral waited till Dick was practically on him and then bolted on three legs and got into dense scrub. For some reason or other Dick lost the scent and though we hunted for long we did not find it. It is just possible Dick did find it, and that it was dead, as he does not take the least interest in a dead animal and in that case we should not have known if he found it. Eventually we gave it up and climbed down a very steep hillside on to the road and so back to Bageshwar. Next time I wound an animal I shall put two bullets into him to make sure. As I do not eat anything before I get out in the morning, I usually take a few biscuits with me on these trips, but although I had done this as usual it did not take the edge off my appetite when I sat down to breakfast and lunch combined at about one o'clock, or when I had a good substantial tea a couple of hours later. It is wonderful what an appetite hill climbing gives you. There is no shooting close to Bageshwar, so I did not go out again in the evening.

Next morning I started off for Takula Dak bungalow, elevation 5,335. This is an eleven mile March, and a rather tiring one, as it ends with a long steep climb. Just outside Bageshwar you cross the Gomati River, immediately above its junction with the Surjoo. You follow the right bank for about two miles, passing some pools which are often frequented by duck, and are, I believe, excellent fishing pools. Then you finally leave the Surjoo and again have recourse to "Excelsior". You have a 4 mile hill to breast, most of it fairly steep. About ¾ of the way up you come to the Dewaldhar Tea and Fruit Gardens. These are worth a visit. If, however, you arrive at the latter end of October, there will be very little to see, as the fruit will be finished. You will, however, be able to obtain excellent walnuts. There is a small cottage on the estate, which can be rented on application, by anybody desirous of making a short stay there. I presume a small rent is charged, but I did not enquire. Any enquiries should be addressed to the Manager of the Estate. Tea garden work, too, is at a complete standstill, as by now the bushes have ceased to put out new leaves.

About a mile further on you come to the top of what is known as Parli Ridge, elevation 5,700' from where a magnificent view of the snows can be had.

I was informed by the manager of the estate that excellent shooting was to be had on it, and around it, but I was not very favourably impressed with the appearance of the country.

Immediately after crossing the ridge you descend very steeply for about a mile, then go along an undulating road for some distance and finally have a long stiff pull up to another ridge, which is about half a mile from Takula bungalow. This long hill coming at the end of a march makes it rather trying and you are glad of a rest at Takula. I had a good tea and a rest and then set out to try a neighbouring hill for pheasant. I was told that every morning a number of

birds could be heard calling, if this was true it was hard to understand where they had all gone to. I saw none of them but a good distance further on Dick put up a female Koklas pheasant. It was too far for a shot. I went out again in the same direction next morning but saw nothing, although my cook declared he heard them calling. I think he must have heard some ordinary barndoor cocks crowing.

From Takula, the direct road to Almora is 15 miles, but I proposed going to Binsar first. There are two roads you can take, one goes along the Almora Road to Kaffa Khan and then turns back, making a total march of 13 miles. The other route is only 6 miles. You retrace your steps towards Bageshwar for about half a mile and then take a bridle path to the right. This goes along a narrow hill crest and you have a beautiful view on both sides, the hillsides here being grassy and forest clad, but very steep. The road is an easy one most of the way, with a short steep pull up to the bungalow. There are several other bungalows at Binsar, but they are all private property. From the top of what is called Flagstaff Hill, about 1½ miles from the bungalow, you get a fine all round view. The elevation of the bungalow is 7,500' and this hill is 7,900 odd.

I walked out to this hill in the evening and took my gun with me but saw nothing. I arranged to go out next morning, the chowkidar's son offering to act as shikari. In the morning we set out as arranged, and before very long Dick put up a covey of Koklass. I had a shot but missed. They do not usually give you over much time before they are out of range. The shot, however, disturbed a muntjac (*kakar*) and as it did not go very far I decided to try for it, as it was quite a nice stag. I spent the next half hour going over some very narrow but nevertheless slippery and difficult watercourses, dry at this time, and eventually came within about 130 yards of the animal. I took a very careful aim and fired, the kakar gave a tremendous jump and that was about all. I did not understand this and had another shot, with a similar result. I could not see where my shots were going. When a third attempt had a similar result I looked at my sight and found some interfering blighter had been playing about with them and had set them to 300 yards. I should, of course, have examined my sights first, but as I had set them at 200 or point blank range before handing the rifle to my man to carry, I did not look to see whether they had been altered or not. The *kakar* seemed to realize this and decided to go while the going was good. I followed him up with great energy for a while, but did not see him again. I saw a goral making off in the distance. I had evidently disturbed it while following up the kakar.

I collected my men and went on to another spot which was said to be a usual resort of goral. Just as we reached the site I heard something clearing off, but did not see it. One of my men saw it, however and said it had gone right round a shoulder of the hill. I followed it up and entered on a very tiring and entirely fruitless stalk. The khud side here was extremely steep and there was not much cover. What there was was mostly composed of oak trees and these had shed most of their leaves, which made a loud crackling noise when trod on. I gave it up eventually and was informed by my men that the goral had joined two others and gone further on. I then sat down for lunch. I had just made a start on this important function when a covey of about 5 Kalij pheasants got up within a few yards of me. A pear was the only ammunition I had handy and I declined to risk a shot with that.

I did not see anything more till I was near home when about 4 Kalij cocks got up out of a thicket and made off. I winged one of these, but could not find it. Dick had gone off after the others. When I got him back I put him on the scent and saw him career of after it. He evidently got close to it, as I heard him yelping. I did not wish him to go too far as the jungle was dense, and there was a leopard knocking about. I whistled and called and the coolies called but all in vain. I began to get quite anxious when at last he turned up.

I do not know what it was, but something made me suspicious and I called him up and opened his mouth. There was a cock Kalij Pheasant's feather stuck on his palate. I thereupon cut a stick and made things very uncomfortable for him. I shall never be able to trust him again. He had evidently caught and eaten the pheasant, or at all events ruined it. In the evening I again set out and in much the same place as I had put up the pheasants I put up and bagged a wood partridge, called locally a '*Peura*.' I do not know whether it was an accident on the cook's part or some particular quality about the bird, but I ate it for dinner that night, along with some nicely fried Oxford sausages, and I do not remember ever enjoying a bird so much.

I put up a kakar a little later but didn't see it. Just as it was getting dark I saw a pheasant cross the path I was on and disappear down the khud, so went after it. I had hardly proceeded any distance when a kakar suddenly bounded off from quite close to me. I fired two barrels of No. 4 shot at it at about 15 or 20 yards and hit it badly, but did not stop it. Then as I turned and started going after it a cock pheasant got up from just over my head. I whirled round to fire at it with disastrous results. I had, apparently, been standing on a stone or something. Any way, whatever it was I, had trod on, it resented the action and removed itself suddenly. My legs shot out from under me and my back hit the khud violently. My gun muzzle got rammed into a bank of earth with such force that they were choked with mud to the depth of an inch. How in the world the gun did not go off and explode I shall never understand, as I had taken it off "safe" in turning round and found my finger on the trigger after I fell. We followed the kakar till it became too dark and then had to leave it. I had to leave next day, as my time was running short, but I should have liked at least one more day here.

The march next day was rather uninteresting. The coolies did the march in record time, as I had expected, all of them being residents of Almora. Almora is a fair sized and much talked of place. I had always had a great fancy to see it and pictured it as a sort of Garden of Eden. I was greatly disappointed. Most of the near hills are quite bare, with a large amount of cultivation. The town, itself, has a fair number of trees in and around it, especially towards the sanitarium, which is situated in dense pinewoods. When I was there the chestnuts, of which there are innumerable trees, were constantly dropping, and I was continually expecting one to fall on me. It wouldn't have hurt me if it had happened, but the continual suspense, if I might call it so, annoyed me. The bazaar in Almora is principally one long street, where you are in a mixture of all sorts of people, ranging from the pure low-country Indian to the pure Nepalee. I did not see any Bhotias. The white population of Almora was only a fraction of what I had expected, and very few of these were left, nearly all having moved down to warmer climes for the winter. The roads too were disappointing, being very rough and uneven. The dak bungalow gives the elevation as 5,500 feet. It is thirteen miles from Binsar and a very easy march, being mostly down hill. It is hardly worth while taking a gun with you on the march. You might see a goral or kakar or pheasant in the first three miles out of Binsar, but after that there is nothing. I saw nothing at all on the way. The next march to Peora is the same, and you will be well advised to leave your gun to follow you.

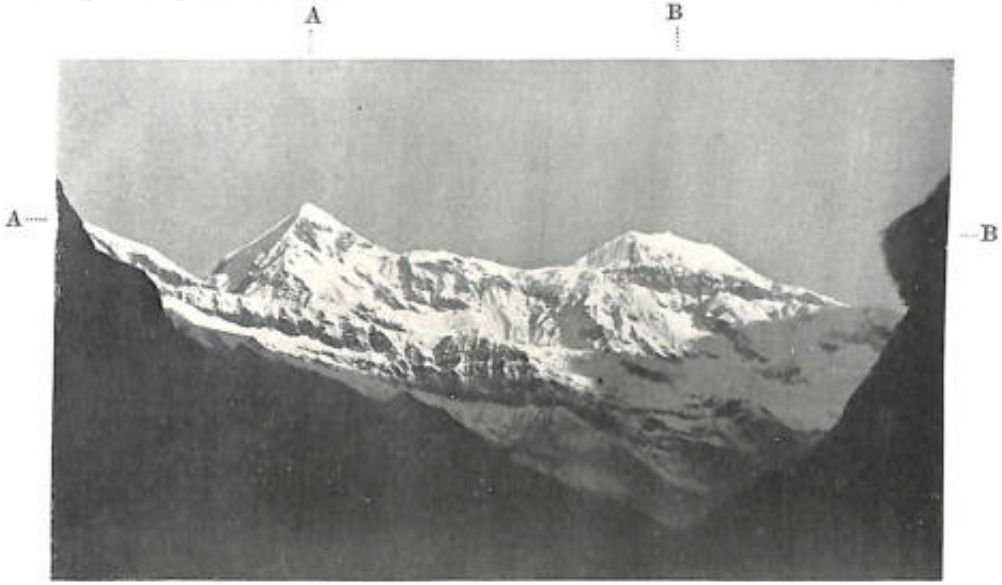
Peora is situated near a pass in the hills at an elevation of 5,700 feet, and is 9½ miles from Almora. It seems a very long 9½ miles. The first half is all down hill to the bed of the Sual, which is crossed by a suspension bridge. Immediately above the bridge the Kumnya river joins the Sual. This is an extremely pretty spot and well worth a photograph but I imagine a good one would be rather difficult to obtain. Directly you cross the bridge you start climbing and go on climbing till you reach the end of your journey, about 2,000 feet above you. This is another so called "*Maidan rasta*". The first half of this march is along bare hillsides and the latter half is through mixed pine wood, oak, and bare slopes.

About two miles before you reach the bungalow you pass a road going to the left, this leads to Muktesar, 3 miles away, from where one of the finest views in Kumaon is said to be obtainable. I did not have time to visit it myself. Just below the bungalow is a patch of jungle, with some abandoned terraces above it and in the middle of it. There are two gullies which meet some distance below the bungalow, and the patch of jungle already referred to lies between the two gullies and on each side of them. This place held a good many pheasants, but although I tried twice, I did not get one out of it. The jungle is either very dense, or, where the abandoned terraces are, very patchy.

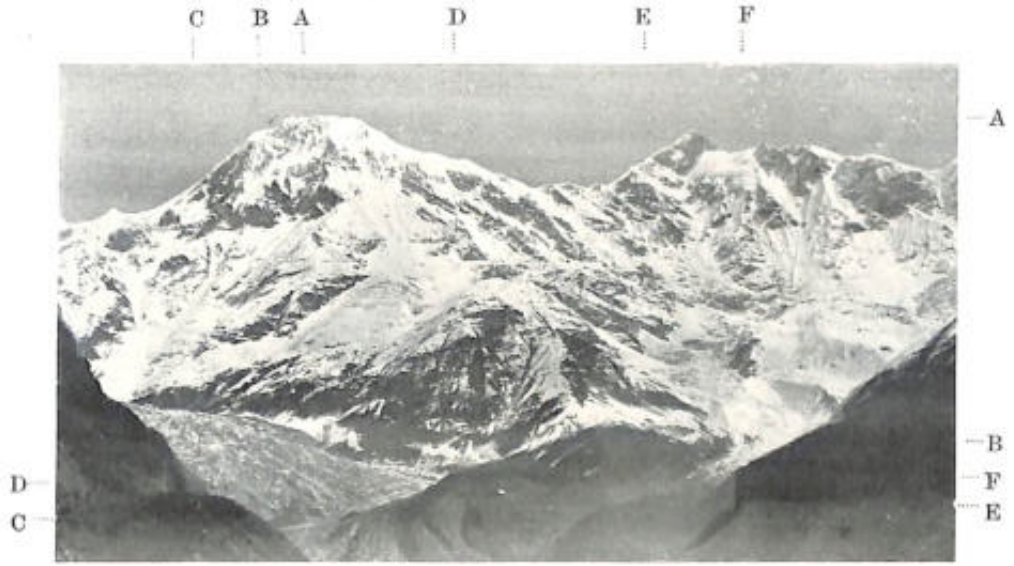
This makes the shooting very difficult as Kalij Pheasants are past masters in the art of dodging out of sight behind a tree, and where the trees are only a few yards apart they can usually afford to laugh at you. They sit close and get up with a tremendous flutter and just slip behind the nearest tree. That is all you usually see. Even if you are quick enough to hit him in this patch I am speaking of, you would probably blow a hole right through him he would be so close. There is some very good looking jungle on the hill on which the bungalow is situated, but on the reverse side. I did not try it myself, as I intended staying a day at Ramgarh and had not the time. There is a magnificent view of the snows from the bungalow. I set off next morning with the knowledge that I had a typical specimen of a hill road in front of me. I had first to descend a thousand feet and then climb the same, then descend another thousand and then climb up again. There is one compensation to this and that is that the whole route is through very fine scenery. Shortly after leaving the bungalow you come to a pass and begin a long easy descent to the valley of the Deodar river. From here there is a very stiff ascent through dense jungle to Nathukhan, from where you get your last view of Almora, if you want one. Now you again start descending a long easy slope to the Ramgarh river. The scenery along this route, known as the " Gallery ", is magnificent, the road being cut out of an almost perpendicular hillside, and winding in and out as it follows the contour of the hill. At mile 7½ you pass the village of Naikhana, which looks like a Noah's ark village from a distance. Shortly after you pass the ruins of an old iron smelting factory, which you can easily imagine to be a ruined castle. You cross the Ramgarh river by a suspension bridge and pass the village of Barakot at 8½ miles. Here a road leads off to the left. If you are doing the trip in the rains or there has been heavy local rain, you should take this road, which is about half a mile longer, but has a bridge. If you take the lower road you have to ford a stream, which can be done in the dry season, without wetting your feet. Immediately after crossing the river you start a steep ascent to Ramgarh dak bungalow, 6,000 feet high and 10 miles from Peora. You will be glad of a rest by the time you get to the top.

I sent for a shikari and in the evening we descended the hill to what is locally called a *Ghagar*, which means a ravine or gully, particularly a well wooded one. This one was situated directly below the bungalow. Dick put up a kakar, but I was unable to get a shot. I saw a few pheasants but these too, did not give me a chance.

I arranged to have a long day next day, as it would be my last shoot. We started off early in the morning and climbed to the Ghagar pass, a climb of 1,000 feet. From here I took the hill on the right and changed my hob-nailed boots for rubber soled ones. After proceeding for a while we came to a sort of pass between two portions of a hill, and I looked over the top. Right in front of me, about 20 yards away, I saw a number of pigs, which merely looked up when they saw me. I took them for tame pigs at first, and then suddenly turned to the shikari and asked him if they were wild ones. He then approached and said they were wild ones. His appearance on top of mine, was too much for the porkers. I had merely surprised them, and just as they recovered their wits the shikari appeared and sent them off as hard as they could go. Had I known what they really were I could have dropped one without trouble.



NANDI KHAT AND "THE PEAK"



NANDA KOT SHOWING LOWER ICE CASCADE, SUBSIDIARY GLACIER FROM THE RIGHT, AND ALL MORAINES

References.

Upper :—A—A Nandi Khat.
B—B The Peak.

Lower :—A—A Nanda Kot.
B—B Lower Ice Cascade.
C—C West Moraine.
D—D Medial Moraine.
E—E Subsidiary Glacier from right.
F—F East Moraine.

For sometime after we saw nothing, and then spotted a solitary goral. As the place promised good cover for stalking I set off for a stalk, but might have saved myself the trouble. When I reached the spot I had been making for the goral had disappeared. I thought it might have gone round a shoulder of the hill and went round to see, disturbing a kakar in doing so. The goral had disappeared. A little later I missed an easy shot at a Koklass pheasant. By this time the cravings of the inner man had become so insistent that I had my lunch, having come away in the morning without breakfast. Having completed this business I again set off and again just failed to get a shot at about the biggest kakar I have ever seen. I followed him up hoping against hope, but it was no use. We came to another spot which the shikari said was a favourite one for *kakar* so I loaded up with ball and L.G. I looked over a ridge into this particular place and three Koklass pheasants got up from within a few yards of me, giving me an easy shot, and I had ball and L.G. in my gun. Some people have luck but mine was dead out to-day. I went on and put up a cock a few yards further on, but I still had ball in my gun. He did not give a chance, however, even if I had had shot. A little further on I saw something, a good distance ahead, disappear over a ridge. It did not appear to have seen me. I took my rifle and doubled ahead and saw a bear moving quietly off. I got on my knee and was just getting a bead on it when it got behind some trees. It had not seen me so I did another double, but did not see it again. I heard it moving about down below, but it was in dense scrub and I could not see it. Then I heard another bear "wowfing" on my right and went after it, with a similar result. I hunted about for a good hour, but it was quite hopeless. I gave it up eventually and started homewards, picking up a couple of Kalij pheasants en route. Although I saw numerous signs of sambhar, some quite fresh, I did not see any of the animals themselves. We put up a pig on the way home but I did not see it. In the evening I again went out to see if I could get a few birds to take back with me, as I intended doing a double march next day and going straight into Kathgodam. I left my rifle behind, as my unlucky star was still in the ascendant, and contented myself with a few ball cartridge for my gun. We had not gone far when we put up a *kakar*, which, however, gave us no chance. Some time later one of my men noticed a stag kakar sitting down. I got to within about 150 yards and fired at it. My ball fell about 6 inches short. My only consolation was to bag a Kalij a little later. I think you ought to spend three days at Ramgarh, as there is plenty of ground to go over. If you propose to take the shooting seriously I would advise you to stay at an hotel which is about half way between the dak bungalow and the pass, from where the shooting ground commences. You have to be astir early for shooting, and this saves you about a mile and 500 feet climb at least. My shikari said that Chukor were also to be had at some distance away.

Ramgarh promises to develop into a fruit centre. There are already some fruit gardens there, and more are being opened up.

Next morning being the last day of my tour in Kumaon, I set out early. Just over the Gagar pass is the road from Ramgarh to Naini Tal, which is only 12½ miles from Ramgarh. I, however, was going *via* Bhim Tal to Kathgodam. About a mile along this road Dick put up either a kakar or a goral. I did not see it, nor a second animal a little later. I did not stick to the road where there were any bypaths, and on one of these, close to a village about 4 miles out of Ramgarh I put up a covey of Kalij pheasant and bagged a brace.

Shortly after this the nature of the country changed. So far it had been wooded with mixed pine and oak, but now the pine became scarce and we came to a piece of open undulating country with a large fruit orchard. Beyond this was a collection of houses and shops and a series of settling tanks, one of which I noticed, had finally settled a large rat. These tanks led to a set of huge circular iron cisterns. I was informed that this was part of a plant for supplying

water to a wealthy Indian's house on a neighbouring hill. I think it was also used for irrigation purposes, and the engine house looked more like a barn. I believe it did serve, both as a store house for fruit and manure, and as an engine house. Shortly after leaving this behind we left the wooded country behind us altogether and came out on to bare hillsides. Bhim Tal was now visible in the distance. On reaching Bhim Tal I marched along its northern shore, as I had come along the southern shore on the outward trip. As I was going along I saw a shoal of Mahseer swimming about near the surface. One came fairly near the top so I fired a No. 4 cartridge at him without result. Then a poor unfortunate coot caught the eye of my attendant and he begged me to shoot it. I obliged him and Dick went out for it. Coming back with it he swam into a willow branch which held him up. He paddled away gamely but could not make any headway and had not the sense to try another route. Eventually he managed to get one paw over it and then scrambled across it and got to shore. A little further on I saw another shoal of Mahseer. My man said a fish would float if I shot it. I waited till one started to rise. Just as he reached the surface I fired and laid it out. It certainly did float for a short while and Dick went after it, but before he reached it it sank. I had understood that the fish would go on floating for some time. It appeared to be about a pound in weight. I hope it was not an illegal action on my part. I have not found any rule forbidding it, so I shall rely on the first offender's act if anybody who reads this goes after my blood. The road from Bhim Tal to Raneebagh was in very bad condition. There were innumerable ponies either coming up or going down, and these had played havoc with the road as soon as the rainy weather moisture had evaporated. I was glad to get into Kathgodam which I reached about 2 p.m.

Thus ended one of the pleasantest months, if not the pleasantest, I have ever spent, and my one and only regret was that I had not had a suitable companion with me. I am not of a particularly gregarious nature, but often in the evenings or on the march I wished I had some one to talk to. A companion with me would have shortened the marches vastly, mentally and physically, if not actually. I can confidently recommend this trip to any one who likes walking and has an eye to admire and appreciate beautiful scenery. If your bones ache for the first few days, and they certainly will, you forget all about it later on, and can do without effort, what you would have endured agonies in accomplishing when you first started.

As a holiday, at the present rate of living, it is not expensive, especially if two or more join together, and unlike most holidays one spends in India, you acquire a certain amount of new knowledge and a vast amount of memories which you will never be tired of recalling or discussing. You feel a new man at the end of a month spent in this way. The trip cost me about 550 rupees, but had two of us been sharing expenses it would have come to not more than 350 or 400 rupees each at the most.

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

PART XX.

(*With* 1 *Plate and* 2 *text-figures.*)

(*Continued from page 117 of this Volume.*)

Genus—STYLOGOMPHUS Fras.

Memoirs of Pusa, pp. 69, 70 (1922).

Venation belonging to "Gomphus series." All trigones, hypertrigones and subtrigones entire; incomplete basal antenodal nervure absent; pterostigma short, less than one-fourth the length of distance between node and distal end of pterostigma; sectors of arc continually diverging from their origin; *Mis* and *Cui* parallel for the greater part of their length; only a single nervure between *Mi-iii* and *Miv* in the hindwing, 2 in the fore; 1 cubital nervure in all wings; 1 row of cells between *Mi* and *Mia* at distal end of pterostigma, the latter braced; 2 rows of cells between *Mi* and *Mii* beginning much nearer the pterostigma than node; only 3 rows of postanal cells in hindwing, only 1 in fore; forking of *Mi-ii* and *Miii* symmetrical in both fore and hindwings.

Legs moderately long, robust, femora minutely spined.

Abdomen slightly tumid at base, cylindrical there-after, segments diminishing progressively in length from 7 to 10.

Anal appendages rather longer than segment 10, superior tapering, at first divaricate and then curling in towards each other, the apices meeting or actually overlapping; inferior broad and oval, its apex cleft for about half its length into two parallel stout branches. Genotype—*Stylogomphus inglisi* Fras.

This genus is remarkable for a combination of characters possessed by other allied genera, thus the superior anal appendages are a cast between those of *Onychogomphus* and *Heliogomphus*, the inferior appendage is rather typical of that of *Leptogomphus*. The position of the first postanal cell and its undivided condition resembles *Gomphus sens strict*, but the shape of the appendages rule it out of this genus. Lastly the narrow bases of fore and hind-wings recall the condition found in *Onychogomphus modestus* and *diminutivus*.

Stylogomphus inglisi Fras. Memoirs of Pusa. l. c. pp. 70 and 71 (1922).

Male. (Female unknown) Abdomen 25·5 mm. Hindwing 21 mm.

Head. Labium yellowish; labrum black marked laterally with an oval yellow spot; bases of mandibles yellow; anteclypeus black, yellow medially, postclypeus black; frons black, its crest traversed with yellow. Occiput black, simple.

Prothorax black, posterior lobe margined with yellow.

Thorax black on dorsum marked with bright yellow as follows:—a complete mesothoracic collar, antehumeral oblique oval spots well separated from the alar sinus above and mesothoracic collar below. Laterally yellow, the sutures mapped out in black, the two fine lines connected by a short stripe at their middles. Tergum spotted with yellow.

Legs black, coxae and trochanters yellow.

Wings hyaline, palely saffronated at the base; pterostigma and costa black; nodal index:— $\frac{9\text{-}12}{9\text{-}9}\Big|\frac{11\text{-}9}{7\text{-}9}$

Abdomen black marked with yellow as follows—segment 1 with the sides broadly and a broad dorsal spot, 2 with the sides broadly, including the oreillets

and a middorsal fusiform stripe, 3 with its base laterally and a middorsal oval basal spot, segments 4 to 6 with narrow basal annules slightly interrupted on the dorsum, the remaining segments black.

Anal appendages highly specialized, the superiors pale yellow, long thin, broad at base, tapering to apex, curling first outwards and then semicircularly inwards until the apices actually overlap. In profile, sloped strongly downward, the extreme apices sweeping upwards again in a fine curve, two blunt tubercles not amounting to spines on the sides, one subbasal, the other closely following it, situated at the middle of appendage, thus giving a crenate border to appendages when viewed from above; inferior appendage black, very broad at base, roughly subtriangular or oval, bifid for about half its length, the branches parallel, blunt, curling gently up as seen in profile, shorter than superiors.

Genitalia. The examination of this was overlooked in making the primary examination.

Hab.—A single male from the Tista River, Darjeeling District, 1,500 ft., 8, VI, 20, coll. C. M. Inglis. Type in Pusa collection.

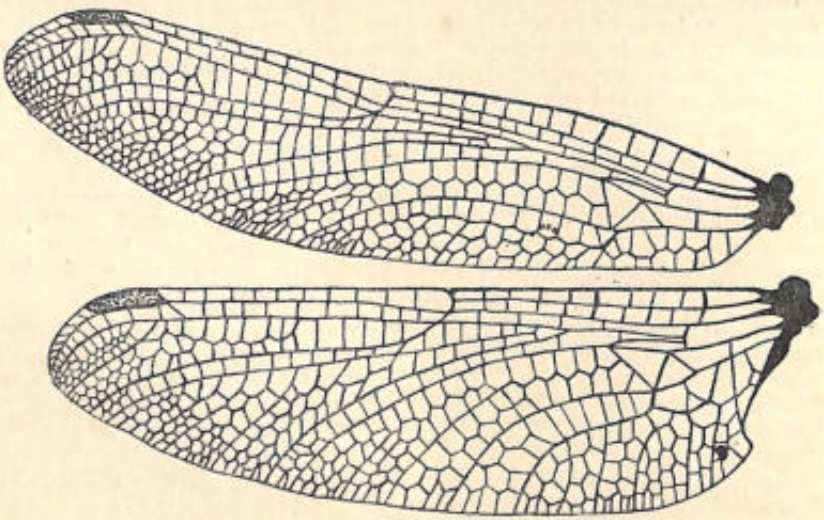


Fig. 1. Wings of *Ophiogomphus reductus* Calv. ♂

Genus—OPHIOGOMPHUS Selys.

Ophiogomphus, Selys. Bull. Acad. Belg. XXXI (2), p. 39 (1854); id. Mon. Gomph. p. 76 (1857); Kennedy, Proc. U.S. Nat. Mus. Vol. 52, pp. 529, 530, May 1917; Laid., l.c. p. 414 (1922); *Diastatomma*, Kirby, Cat. Odon. p. 61 (1890).

Characters of genus, based on an examination of *O. reductus* Calv., *O. severus* Hagen, *O. morrisoni* Selys, *O. occidentis* Hagen, *O. severus montanus* Selys.

Reticulation close, anal angle of hindwing prominent, base of same wing excavate in male, rounded in female, arc usually between antenodal nervures 1 and 2, opposite or occasionally distad to 2, sectors of arc continuously divaricate from origin, no basal incomplete antenodal nervure, all trigones, hypertrigones and subtrigones entire, trigones subequilateral, short, that of hindwing longer than in forewing, discoidal field with two rows of cells nearly as

far as or as far as level of node, node of forewing slightly distal to middle of wing, only 1 cubital nervure in all wings, 2 rows of postanal cells in forewing, 5 to 6 in hind, a vestigial loop present of 2 to 3 cells area, anal triangle of 4 cells, *Cui* and *Cuii* in hindwing divergent, about 5 cells between termenal ends, sectors uniformly curved but *Miii* and *Miv* slightly undulated in forewing, pterostigma small, braced, over 3 to 4 cells, 2 rows of cells between *Mi* and *Mii* beginning nearer stigma than node, 2 nervures between *Mi-iii* and *Miv* in forewing, only 1 in the hind.

Insects of moderately large and robust build, holarctic in distribution. Distributed throughout Europe, Central and Northern Asia and North America. Only one species occurring within Indian limits, *O. reductus* Calv. (Kashmir). I am indebted to Mr. T. Bainbrigge Fletcher for specimens of the latter beautiful species and to Mr. E. B. Williamson for specimens of the North American species quoted above.

To the characters of the genus, in addition to those purely relating to venation, given above, may be added.

Head moderately large, forehead prominent, upper surface very broad and deep, occiput simple in the male, furnished with two or more robust spines in the female. Abdomen dilated at base, narrow and cylindrical as far as apical half of 7, which with 8 and 9 is slightly dilated, oreillets small, anal appendages :—superiors simple, curved and tapering, inferior deeply cleft into two nearly straight branches, variable in shape.

Legs moderately long, extending to apical border of segment 1, femora armed with tiny, closely-set, numerous spines.

GENOTYPE—*O. cecilia* (Forst.)=*O. serpentinus* Charp.

Ophiogomphus reductus Calv., Proc. Acad. Nat. Phil. pp. 160-151 (1898), Laid., l. c. p. 414 (1922).

Male. Abdomen 37-38 mm. Hindwing 33-34 mm.

Head. Labium and labrum yellowish green; face and frons grass green, the latter narrowly black at its base; vertex black with an oval yellow spot just posterior to the ocelli; occiput pale green, separated from the previous spot by a narrow streak of black, fringed with black hairs, simple.

Prothorax yellow marked with black as follows :—a transverse stripe just behind its anterior border, a small spot at either end of the posterior lobe and a larger spot on the sides.

Thorax grass green marked sparingly with black as follows :—the alar sinus and upper part of middorsal carina finely, a narrow linear humeral spot shaped like an exclamation note without the dot, and situated in the length of, and about the middle of the humeral region, the humeral and postero-lateral sutures finely black.

Legs yellow marked with black, tarsi black spotted with yellow on the extensor surface, tibiæ with a longitudinal stripe of black on either side, femora with an outer distal stripe, tapering and fading away about the middle of the femora. Hind and mid femora furnished with a field of very short minute black spines.

Wings hyaline, costa greenish yellow as far out as pterostigma, which is green framed in black nervures, over 3 cells, braced; loop of 2 to 3 cells, wide but shallow; anal triangle of 4 cells; 5 rows of postanal cells in hindwing, 2 in the fore; 2 rows of cells in discoidal field as far as level of node; nodal index $\frac{10\text{-}12 \mid 13\text{-}10}{9\text{-}9 \mid 9\text{-}10}$; 2 to 3 rows of cells between *Mi* and *Mia* at distal end of stigma.

Abdomen yellow marked with black as follows :—segment 1 with a subdorsal

subbasal streak and two small spots near the apical margin, from the upper one of which springs a peculiar tuft of long hairs,segment 2 has the apical border ringed withblack but this nearly incomplete over the dorsum, a large spot on the sides runningfrom the jugal suture backwards but not reaching the apical border, and sending a prolongation upwards which does not quite meet its fellow from the other side, segments 3 to 6 each with a thick apical ring and an irregular black stripe on the sides which send up prolongations dorsalwards at the jugal suture and subapically, and on 5 and 6 fuse at the apex of segments with the apical black rings (the extent of these stripes is very variable and the prolongations may meet over the dorsum cutting up the ground colour into yellow dorsal oval spots), segment 7 has the lateral stripe much thicker and the apical ring very fine and followed by a ring of yellow, on 8 the lateral stripe extends the whole length of segment, fusing broadly with the apical ring and not deficient at the base as in the other segments, 9 similar to 6 but the ends of the lateral stripe curl up and meet over the dorsum so as to enclose an oval spot of the ground colour, 10 has a broad lateral spot on the basal two-thirds of the segment, meeting its fellow only at a point on the dorsum and tapered posteriorly, its apical border finely black.

Anal appendages yellow, the superiors tipped with black and the inferior brown at the sides. Superior 2·5 mm. in length, rather longer than segment 9, divergent in their basal half, convergent in the apical, in a regular curve, curved also down in the apical half, stout and robust. Inferior about one-third shorter, deeply cleft for about half its length into two closely-contiguous short stout branches. Viewed in profile the basal third looks thin and curves strongly down from origin and then straight back. At this point it thickens greatly and the upper border shows two curved emarginations, finally it thins again at the apex, which is sharply turned up.

Genitalia. Lamina short and narrow, arched, folded laterally on itself and deeply notched, inner hamules black, the apex deeply bifid, chelate, long, narrow and projecting objects, outer hamules greenish, digitate as seen in profile, the apex bevelled and pointed, lobe tumid at base and then constricted like the neck of a bottle, the apex expanded in two leaflike processes, yellow margined with black. Oreillets moderately large, greenish yellow.

Female. Abdomen 37-39 mm. Hindwing 35-37 mm.

Almost exactly similar to the male, the markings somewhat more restricted. The humeral linear spot almost obsolete or entirely so in some of Mr. Bainbrigge Fletcher's specimens.

The loop is larger, of 3 cells, as deep as wide; discoidal field with 2 rows of cells to well short of level of node.

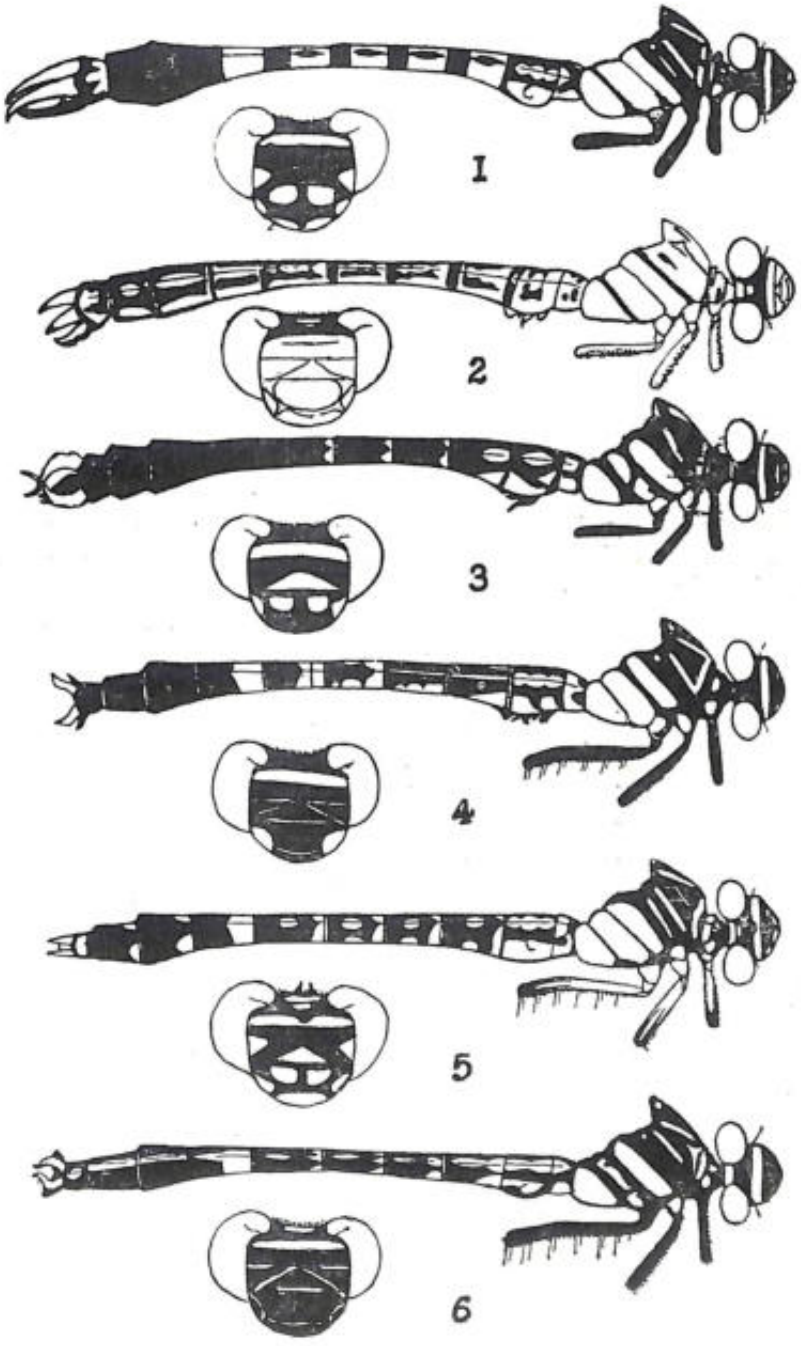
Armature of hind femora very specialized, after a short field of small spines, a row of moderately widely spaced, robust and rather long spines; armature of mid femora similar to that of male.

Anal appendages short, yellow, conical and tapering, separated by a large yellow conical process.

Vulvar scale very short, deeply bifid into two small triangular processes which are markedly divergent.

Hab. Kashmir only. The above descriptions were made from a series of specimens collected by Mr. T. Bainbrigge Fletcher in Kashmir, Gulmarg, 8,500 ft, 23. VIII. 23, and Yusimarg 7,500 ft, 15. VIII. 23.

The delicate grass green colour of head and thorax will distinguish this species from all other Indian Gomphines. The anal loop is not unlike that seen in *Mesogomphus* and represents the first postanal cell divided up by secondary nervures.



INDIAN DRAGONFLIES.

(*For explanation, see reverse.*)

INDIAN DRAGONFLIES.

Explanation of Plate I.

The size shown is purely hypothetical, each insect has been shown the same size for the sake of contrast—correct measurements are given in the text.

Figures 2, 3, 4 and 6 are drawn from life, 1 and 5 have been constructed from the author's descriptions.

1. *Onychogomphus aureus.* ♂
2. *Ophiogomphus reductus.* ♂
3. *Stylogomphus inglisi.* ♂
4. *Indogomphus duarensis.* ♂
5. *Indogomphus cerastes.* ♀
6. *Indogomphus longistigma.* ♂

Type unknown, paratypes in Indian Museum, Pusa and Fraser collections. (Type probably in U. S. Nat. Mus.).

Genus—INDOGOMPHUS Fras.

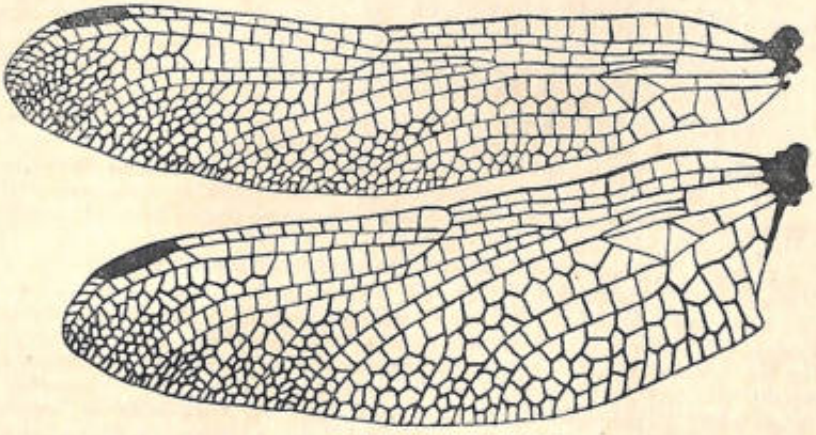


Fig. 2. Wings of *Indogomphus longistigma* Fras. ♂

Genus—*Indogomphus* Fras., Rec. Ind. Mus., Vol. XXIV, p. 422 (1922).

Since I defined this genus, further material has come to hand necessitating some changes and some amplification of the original description. Mr. H. V. O'Donel has sent me some more examples of *Burmagomphus duarensis* Fras., an examination of which clearly proves it to be a true *Indogomphus*. Furthermore a careful reading and interpretation of the Selysian description of *Onychogomphus cerastes*, originally described by him as an *Ophiogomphus*, convinces me that this species also must be transferred to *Indogomphus* and I have set down the reasons for this below. Both *I. longistigma* and *I. duarensis* show a great deal of variation in the presence or absence of an incomplete basal antenodal nervure; the anal appendages of *longistigma* and *duarensis* differ widely whilst those of *cerastes* are unknown, but there are a number of other salient and good generic characters which are common to all, such as the length of the hind femora, the peculiarly specialized armature of these limbs and the relative lengths of the last four abdominal segments, which resemble somewhat those of *Macrogomphus*. These in themselves are of sufficient importance to constitute a well-defined genus.

Characters of the genus :—

Venation : reticulation rather close ; all trigones, subtrigones and hypertrigones entire ; 3 transverse nervures between *Mi-iii* and *Miv* in the forewing, 1 or 2 in the hind ; incomplete basal antenodal nervure present or absent, sometimes present in all wings, more often only present in one or more wings ; forking of *Mi-ii* and *Miii* symmetrical in both wings ; sectors of arc approximating immediately after origin ; discoidal field variable, 2 to 4 rows of cells at level of node ; 1 to 3 rows of cells between *Mi* and *Mia* at outer end of stigma ; 2 rows of postanal cells in forewing, 4 in the hind, first postanal cell undivided, not extending inward nearly as far as inner angle of subtrigone ; anal triangle

3 celled; base of wing oblique, sinuous, very slightly indented, tornus obtuse. Stigma small, braced.

Head comparatively small, wide but narrow from before back, occiput of male simple, of female, armed with two medial spines, in at least two species of the genus, *duarensis* and *cerastes*.

Abdomen with the terminal segments prolonged, 8 and 9 of about equal length, 10 very short; hind femora of great length, extending to apical end of segment 2 and furnished with two rows of very long, very widely spaced robust spines. Anal appendages variable, lyrate or of simple *Gomphus sens strict* design. Genotype—*I. longistigma* Fras.

Indogomphus longistigma Fras. Rec. Ind. Mus., l. c. pp. 422-424 (1922).

Male. Abdomen 44 mm. Hindwing 35 mm.

Head. Eyes bottle green, labium, labrum and face glossy black, frons black with a broad greenish yellow stripe above and overlapping on to front. Above frons a fine black line at its base. Occiput simple, fringed with long black hairs, greenish yellow, black at either end.

Prothorax black, posterior lobe yellow, as is also a small oval spot just in front of it and a transverse anterior band.

Thorax black marked with bright yellow as follows:—a complete mesothoracic collar which sends a prolongation up along the middorsal carina as far as the alar sinus, a narrow dorsal stripe running alongside and parallel with the middorsal carina, reaching the alar sinus above but not the mesothoracic collar below, a vestigial humeral stripe represented by an upper spot and a more or less evident fine line below (sometimes quite obsolete). Laterally greenish yellow traversed by two closely parallel medial black stripes. Beneath black marked by a fine V-shaped spot.

Legs long and slim, armature as for genus. Anterior femora greenish yellow on flexor surface, otherwise all entirely black.

Wings hyaline, long and narrow; stigma pale brownish yellow, that of hindwing considerably larger than fore, 3·5 mm. to 5 mm; nodal index $\frac{11\text{-}16}{12\text{-}11}\left|\frac{15\text{-}12}{10\text{-}12'}\right.\ \frac{13\text{-}17}{12\text{-}14}\left|\frac{17\text{-}12}{11\text{-}12}\right.$; incomplete basal antenodal usually present in one or all wings, rarely absent in all wings.

Abdomen black marked with bright yellow as follows:—segment 1 with a broad stripe on dorsum and a large quadrate spot on each side, 2 with an L-shaped spot on each side, the under side of the oreillets, a short stripe on their upper surface and a trilobed middorsal band, 3 with a baso-lateral triangular spot, a latero-ventral stripe tapering from the basal end and a narrow middorsal stripe which may be cut in two by the finely black middorsal carina (the jugal suture is also occasionally finely black, cutting this stripe transversely), 4 to 6 with similar markings but the lateral stripe absent and the middorsal stripe well separated from the basal yellow, 7 with its basal half or rather less, broadly yellow, this sending a prolongation apicalward along the dorsal carina, 8 to 10 with only the middorsal carina finely yellow.

Anal appendages. Superior yellow, lyrate, broad at base, tapering to a fine point which is turned up slightly, at first divergent but then curling in regularly until the apices meet and enclose a circular foramen. A blunt spine on the outer side. Inferior appendage with widely divergent branches, projecting laterally from below the superior, so that the tips are visible from above, black, rather shorter than superiors. (The superiors remind one of the curled horns of a bullock.)

From the close resemblance of the superior appendages to those of *Heliogomphus*, I fell into the serious error of stating that the present genus was closely allied to it. This is a case of resemblance by convergence and the two genera are not nearly allied.

Genitalia. Lamina rather depressed, only slightly visible in profile, rather broadly arched, black; inner hamules aborted, outer very robust, with a prominent midrib, which is continued on as a robust forwardly curled spine, black; lobe prominent, deeply cleft, its mouth expansive, lips markedly overted.

Female. Abdomen 44 to 46 mm. Hindwing 37 mm.

Very similar to the male, differing as follows:—occiput simple, similar to the male but with short hair fringing it, no medial spines as in the two other members of the genus (these are probably absent on account of the highly specialized appendages of the male), bases of mandibles yellow, abdomen with 9th segment about the same length as 8 which is slightly dilated, as is also the apical half of segment 7, 9 dilated but tapering rapidly to segment 10 which is very short and narrow. The long spines on hind femora more numerous than in male.

Anal appendages small, conical, pale yellow, as is also a conical protuberance between them.

Wings slightly enfumed, stigma light brown, the difference in size more marked than in male, nodal index : $\frac{12\text{-}17}{11\text{-}10} \mid \frac{17\text{-}12}{11\text{-}11}$.

One female has two incomplete basal antenodals in one forewing.

Hab. Nilgiri Wynaad, Coorg, and probably widely distributed throughout the Western Ghats. Not reported from the Palni Hills. The type and other specimens are from Gudalur, Nilgiri Wynaad, taken in August 1921. An uncommon insect, found sparingly in different parts of Coorg at altitudes of about 3,000 ft., haunting the neighbourhood of rivers, especially scrub jungle bordering mountain streams. Occasionally males are seen patrolling streams, over shallows where the water is broken into glittering ripples as it flows over a pebbly beach. In such broken light the insect is almost invisible as it dashes backwards and forwards. The larva burrows in mud or sand and exuviae are not uncommonly found clinging to rocks in mid-stream.

Type ♂ and cotype ♀ in B.M., paratypes in Pusa and Fraser collections.

Indogomphus martin (Fras.) (*Burmagomphus*) l. c. pp. 421 and 422 (1922); *Platygomphus martini* Fras., Mem. Pusa, June 1922.

Male. Abdomen 34 mm. Hindwing 26 mm.

Head entirely black save for the bases of mandibles and a broad, bright yellow stripe on upper surface of frons; occiput straight, simple, fringed with black hairs.

Prothorax black with a large citron yellow spot on each side.

Thorax black on dorsum marked with yellow as follows:—an oblique ante humeral stripe confluent below with a slightly interrupted mesothoracic collar. humeral stripe vestigial, represented only by a small upper spot. Laterally greenish yellow marked by two fine black lines which map out the sutures.

Wings hyaline, slightly saffronated at the extreme base; pterostigma pale brown, braced, short; incomplete basal antenodal nervure entirely absent or irregularly present in one or more wings; nodal index :—
$\frac{11\text{-}15}{11\text{-}10} \mid \frac{16\text{-}11}{10\text{-}11}$, $\frac{12\text{-}17}{11\text{-}12} \mid \frac{15\text{-}11}{12\text{-}11}$.

Legs entirely black save the anterior femora which are pale whitish green inwardly, armature of hind femora as for genus. Hind legs of great length.

Abdomen tumid at base, very narrow and cylindrical from segments 3 to 6, 7 dilating apically, 8 and 9 dilated, 10 very narrow and short, black marked with citron yellow as follows:—segment 1 entirely yellow save for two black dorsal spots, 2 with a trilobed middorsal stripe, the oreillets and a lateral spot in continuation of the last, 3 and 4 with the dorsal carina finely yellow and a lateral stripe, broad at base of segments, tapering thence nearly as far as the apical border, 5 to 7 with the baso-lateral spots meeting over the dorsum, the ring thus formed much deeper on 6 and occupying the basal half of 7. Remaining segments entirely black. The markings on segments 5 and 6 are subject to some varia-

tion, thus in some specimens, received lately from Shillong, the basal ring on 6 is almost as broad as that on segment 7.

Anal appendages. Superior pale yellow, subconical, pointed at apex, short and widely divaricate. Inferior appendage deeply cleft into two equally widely divaricate branches, as long as the superiors, black.

Genitalia. Lamina arched, border emarginate, distinctly seen from the side, inner hamules narrow, long, projecting, ending in a sharply turned-back point, external hamules much stouter, projecting beyond apices of former, bevelled near the apex which ends in a blunt forwardly directed point, lobe cupped, projecting nearly as far as external hamules.

Female. Abdomen 35 mm. Hindwing 29 mm.

Very similar to male. Occiput slightly concave, armed in some specimens with medial spines similar in character to those of *cerastes*,—in one female, a long robust spine slightly to left of the middle line, in a second female, there is a spine on both sides of the middle line, but one is longer than the other.

Prothorax finely bordered with yellow along posterior border of posterior lobe, in addition to the lateral spot.

Wings saffronated palely at base ; stigma pale brown ; nodal index :— $\frac{10\text{-}17}{10\text{-}11} \left| \frac{16\text{-}11}{11\text{-}13}, \frac{10\text{-}18}{10\text{-}13} \right| \frac{17\text{-}12}{13\text{-}12}$, 2 rows of cells between *Mi* and *Mia*.

Legs.—Armature similar to that of male but spines more robust.

Abdomen. Segment 1 entirely yellow, 2 has the whole of the sides yellow as well as the dorsal trilobed stripe. The basal rings on 4 to 6 very narrow and not extended at all along the sides.

Anal appendages pale yellow, conical, pointed, short.

Vulvar scale rather hidden by the overlapping of dilated sides, rather long, triangular, very slightly bifid at apex.

Hab.—Type and paratypes from Hasimara Tea Estate, Duars, Bengal, collected by Mr. H. V. O'Donel, Sept. 1921, and 20 V, 23. Mr. T. Bainbrigge Fletcher has lately found it moderately common in Shillong, Assam, and I have been able to examine two males and three females of these, which differ only from type in the markings of segment 6 of the males as mentioned above. The basal incomplete antenodal nervure, as demonstrated in these specimens, seems far more common to the forewings than to the hind, it is present in none of the hind wings of the females, is absent altogether in one male and one female.

Type in Pusa, paratypes in B. M. and Fraser collections.

Indogomphus cerastes (Selys). (*Onychogomphus*) Mon. Gomph. pp. 63, 398 (1854) ; id. Bull. Acad. Belg. (2) XXVIII, p. 173 (1869) ; Will. l. c. p. 309, 311 (1908) ; Laid l. c. pp. 371, 411 (1922) ; *Ophiogomphus cerastes* Selys, Bull Acad. Belg. XXI (2), p. 41 (1854) ; *Lindenia cerastes* Kirby, Cat. Odon. p. 60 (1890).

Male. Abdomen 40 mm. Hindwing 32-34 mm.

Head. Labium dull reddish yellow, labrum yellow bordered with black along both anterior border and base, a tongue of black projecting from the base and cutting the yellow into two spots; anteclypeus yellow, postclypeus black with a large yellow spot on each side against the eyes, also a small medium yellow spot which is confluent with the yellow on anteclypeus ; frons broadly yellow, its anterior surface and base narrowly black; vertex black with a small point of yellow just posterior to the ocelli; occiput yellow bordered finely with black, fringed with long brown hairs, slightly notched at its centre.

Prothorax black, with two small points at its middle, the posterior lobe and the sides broadly yellow.

Thorax black on dorsum, yellow at sides. The following yellow marks on dorsum :—the middorsal carina finely yellow, oblique antehumeral stripes slightly separated from an uninterrupted mesothoracic collar, narrow humeral

stripes, the tergum spotted with yellow. Laterally the sutures finely mapped out in black, that on the last expanding into a black spot behind the hind leg and beneath the thorax.

Legs black, femora yellow externally, their apical ends showing the beginnings of two brown lines, hind femora long but not overlapping third segment, furnished with 5 or 6 very long robust spines. Tibiæ black, flexor surfaces finely yellow.

Wings hyaline, slightly tinted with yellow at the bases, costa finely yellow; as also are many of the transverse nervures, especially at base and near costa, nodal index $\frac{12\text{-}14}{11\text{-}12} \Big| \frac{16\text{-}12}{12\text{-}11}$; pterostigma reddish brown bordered with black nervures, 3.5 mm. in length, over 5 cells ; membrane pale, short and narrow. (The condition and colour of the wings points to the specimen being somewhat teneral.)

Abdomen (Incomplete, the last seven segments missing.) Segment 1 yellow, its base above and a medio-lateral spot black, segment 2 yellow laterally including the oreillets, black above with a trilobed stripe of yellow on the dorsal carina tapering apicad as far as apical border, 3 with a subbasal ring nearly divided by the black dorsal carina, a large yellow spot on middorsum and a lateral spot at the same level.

Genitalia and anal appendages unknown.

Female very similar to the male. Abdomen 43-45 mm. Hindwing 35-37 mm. Differs as follows:—The yellow stripe on frons nearly divided in two by a tongue of black running from the base.

Occiput armed with two closely apposed medial spines which converge towards one another.

Abdomen compressed, the last segments slightly dilated, proportionate length of segments 8 and 9 similar to *longistigma* and *duarensis*, the first three segments marked as in the male, 4 to 6 similar to 3, 7 with its basal half yellow, 8 and 9 black with a triangular yellow spot on the sides, 10 yellow, its base and apical border narrowly black.

Anal appendages yellow, slightly longer than segment 10, slender, pointed.

Hab. Nepal and North India. Type a female in the Selysian collection, cotype male and two paratype females in the British Museum.

This species was primarily classed as an *Ophiogomphus* by De Selys mainly on account of the occipital spines present in the female ; subsequently he altered this classification to *Onychogomphus*, Dr. Hagen having pointed out that the legs were too short for an *Ophiogomphus*. His reason for this is not at all clear as in the former genus, the legs only extend as far as the hinder border of the thorax, whereas, in the description of *cerastes*, Selys distinctly states that the legs " do not overlap the 3rd segment". Presumably from this the legs extended well on to the 2nd segment, as in *Indogomphus*. The occipital spines correspond to *duarensis*, whilst the proportionate length of segments 8 and 9, and the long spines on the hind femora correspond to *longistigma* and *duarensis*. Such a combination of characters, corresponding to those in other species of the genus *Indogomphus*, seem of sufficient importance to justify the transference of the species to that genus. *I. duarensis* and *cerastes* are probably closely related. If a specimen of *longistigma* and one of *duarensis* are laid side by side, the latter appears to be a miniature specimen of the former.

I. longistigma is at once determined by its peculiar specialized appendages and is easily distinguished from *cerastes* by its peculiar thoracic markings. *I. duarensis* is easily distinguished from both by its much smaller size.

(*To be continued.*)

A NOTE ON THE WEAVERS AND FINCHES OF THE PUNJAB.

BY

HUGH WHISTLER, F.Z.S., M.R.O.U., C.F.A.O.U.

PART II

(*Continued from page* 188 *of this volume*).

The Pink-browed Finch—*Callacanthis burtoni* (Gould).

Our information about this fine finch is very incomplete.

The ranges north of Simla appear to be its main habitat as far as the Punjab Province is concerned, though I believe I saw a female at Triun 9,700′ behind Dharmsala on 2nd April 1923.

Jerdon says (B. I., ii, 407): "This remarkable finch has hitherto only been found in the North-West Himalayas, chiefly in the mountains beyond Simla." This is amplified by Stoliczka who says (J. A. S. B., xxxvii.) "This rare species is found occasionally in winter on the lesser ranges about Koteghar and Simla between 4,000′ and 7,000′. In summer it lives in the highest cedar forests in the central range of the N.W. Himalayas."

Then we have Jones' statement (J.B.N.H.S., xxvi, 610) that "Dodsworth procured this species in March 1911 and January 1912. He notes that it goes about in small flocks and is remarkably fearless." Since that was written one of Mr. Jones' correspondents has secured him several specimens from a flock at Simla on 15th February 1921. A pair, dated March 1867, Simla are in the Tweeddale Collection.

These records imply that the species is only a winter visitor to Simla but at Fagoo, 12 miles north on the Hindustan-Tibet road, Tytler procured specimens on 13th June (Ibis, 1868).

M. Babault secured two males at the end of May in Kulu at Tchari Djony in the Parbatti Valley and he is my authority for stating that, the species has been recorded from Murree, though I cannot trace the original records to which he refers. (Mission Babault. Rés. Scient., 191).

It has been recorded from Chamba (Marshall, Ibis, 1884), where a few come down in winter.

The Himalayan Goldfinch—*Carduelis caniceps caniceps* Vigors.

A few pairs of the Himalayan Goldfinch perhaps breed in the north-western corner of our area, as Rattray found 4 fresh eggs on the 10th June at 5,000′ at Dunga Gali just a mile or two from the Murree border and Magrath has noted that it probably breeds at Thandiani beyond Dunga Gali.

It also breeds in the north-eastern corner, as I found a nest with a single fresh egg at Kailang 10,000′ Lahul on 11th June 1922. At this time the species was very abundant in the neighbourhood of Kailang but many of the birds may have been merely migrants moving further on to the innermost Himalayas as when I passed along the same way about the beginning of July the next year there were but a few pairs about. During the summer months a few pairs may be met with throughout the Chandra and Bhaga valleys of Lahul from Koksar to Jispar. In July in Spiti I observed also a few pairs along the Upper Spiti river about 13,000′ and these were doubtless on their breeding ground.

Two young birds in juvenile dress seen in the apple orchard at Bajaura (3,600′) on 22nd. June 1921 indicate that the Goldfinch breeds in Kulu. In all probability it breeds over a large area and in greater numbers in the north-eastern Punjab hills than there is at present evidence to prove.

As a winter visitor the Goldfinch is better known. At the end of December 1922 Mr. A. E. Jones saw it at Taxila and I found it common at Rawalpindi in February and the beginning of March 1911.

Stoliczka recorded long ago (J.A.S.B., xxvi, 610) that "During the cold weather it is very plentifully met with at Koteghar, near Simla, and all along the hill stations of the lower ranges." At Simla, according to Jones (J.B.N.H.S., xxvi, 610)" it is a more or less resident species. Small flocks wander from one locality to another, until they separate for the breeding season, about the middle of June."

In December 1922, I found flocks in the Alders of the Upper Beas Valley about Katrain and Sultanpur (4,000′—5,000′ in Kulu.)

At Dharmsala, it is distinctly rare and is not shown in Hingston's list. A few birds came to my garden at 4,000′ in the Lower Station in the first week of January 1921, and a single individual was seen in the same place on 19th December 1922. It occurs in Chamba (Ibis, 1884, 420).

A solitary bird was seen by Mr. A. E. Jones in a compound in Ambala Cantonment on February 6th., 1916 (J.B.N.H.S., xxvi, 676).

The Himalayan Greenfinch—*Hypacanthis spinoides* (Vigors).

The Himalayan Greenfinch is a bird of wide distribution along almost the whole length of the Himalayas but its movements do not appear to be thoroughly understood as yet.

The most westerly point from which it has been recorded is the Samana where according to Whitehead (Ibis, 1909, 231) a few individuals are to be found in December and January with the flocks of Goldfinches about Fort Lockhart. It is not improbable that these birds breed in the Kurram Valley. In parts of the Peshawar Valley, it is a common winter migrant, (Magrath, J.B.N.H.S., xxi, 1329).

In Murree and the Galis, Rattray says that it is fairly common arriving suddenly about the middle of June and at once commencing nesting operations. At Kotli below Murree, I observed a flock on 26th. May but in error recorded them as young birds (J.B.N.H.S., xxi, 1074). At Thandiani, it appears to be rare. In Kashmir it is a common bird as far north as the Liddar and Sindh Valleys where it breeds from 7,000′ to 9,000′ (Magrath, J.B.N.H.S., xxi, 1329). It is not found in Ladakh. Some of these western birds must move down to the high plateau of the Rawalpindi Division in winter as Mr. Jones inform me that he met the species at Taxila at Christmas 1922 and I saw a single individual at Jhelum on January 9th, 1914.

As regards Chamba, I have no information but it doubtless occurs there as a summer visitor, for at Dalhousie, I found it most abundant at 7,000′—7,500′ in September, whereas it had not been seen at all in the same area in June.

Along the outer slopes of the Duala Dhar or First Snowy range from Dharmsala to the Kulu boundary the greenfinch is a common bird but somewhat erratic in its movements. I have detailed records for this area and the bird has been met with in every month except August and September. In June and July my records are scanty and it is clear that the birds which I see so commonly during the rest of the year in the lower zone from 3,000′ to 5,000′ and in the foot hills of the Kangra Valley down to 1,200′, either move for the monsoon months to a higher zone or cross the range and become the summer visitors of the Inner Himalayas. I incline to the latter theory as the Oak jungles of the higher zone do not appear suitable to the breeding of this species which I have practically never met in them. Dodsworth's note (J.B.N.H.S. xxi, 1078) shows that the great majority of nests are built in Blue Pines and Cedars and these are very scarce on the Outer Duala Dhar.

From May to August on different occasions I have found it common in Kulu and Saraj from about 6,000′ to 9,000′, a few birds being observed lower down in the valley to 3,600′. In December I did not observe it.

According to Stoliczka it is found in Lahul and Spiti, but although I met with it near Kyelang at 10,000′ in June in the former province I did not find it in Spiti.

In the Simla hills it is a well known and abundant species but even so the records do not throw very satisfactory light on its status. In his very interesting and detailed note (J.B.N.H.S., xxi; 1075) Dodsworth says, that about Simla, the Greenfinch becomes tolerably common about June, (earliest date 4th. June), till the end of October and then disappears, while it breeds in July and August and a few in September, August being the most usual month for nests. The breeding zone is clearly defined at 6,000′ to 7,000′. Jones' account (J.B.N.H.S., xxv, 611) does not quite agree with this; according to him it is "Resident though the flocks wander away from their breeding haunts in the cold season and spring. Birds shot in April are moulting. Commences breeding operations in June which continue till September or rarely till October, for in 1916 I saw a brood of young ones which had not left the nest for more than a day. This was on the 29th of that month." Hume (N. & E., 2nd ed., ii, 156) gives the laying season at Simla as July and August but he does not comment on the status of the bird. The only nest that I have taken personally at Simla contained a single egg on 29th June.

I have information which shews that these Greenfinches breed very abundantly about Kufri, Fagoo, Baghi, and Narkundah in August. These birds however vanish by the end of October. Yet at Sabathoo at 4,500′ in Beavan's day (Ibis, 1867, 138) he heard that numbers of Greenfinches were caught by soldiers in winter and Captain Skinner records (J.B.N.H.S., xxi, 26) that flocks are common round Dagshai from November to March.

Some birds from this area also move right down to the plains as Mr. A. E. Jones met a small party at Jagadri, Ambala District, on 17th February 1918 (J.B.N.H.S., xxvi, 676).

Further east according to B. B. Osmaston, "these birds are common round the hill stations of Chakrata, Nainital, and Darjheeling from April to October where they breed between 7,000′ and 8,000′ and probably at similar elevations throughout the Outer Himalayan ranges. They nest chiefly in the months of July and August. In November they begin to move down the hills and in January and February they may frequently be seen in fairly large flocks of from 10 to 20 or more birds in the plains at the foot of the Himalayas. This is especially the case in Dera Dun and eastwards through Bijnor as far as Pilibhit. I have no personal knowledge of the plains below Darjheeling but it is very probable that the Darjheeling birds winter down below like their N.W. brethren" (J.B.N.H.S., xx, 853).

Stuart Baker confirms that it breeds at Darjheeling between 8,000′ and10,000′ and perhaps as low as 7,000′ and adds that while the bird moves up and down according to season it could hardly be called migratory. (J.B.N.H.S., xxi, 1074). At Kurseong 6,000′ below Darjheeling Mr. D. Abreu says that he saw it from early in October to late in December" (J.B.N.H.S., xx, 1152).

Scully says (S.F., viii, 336) that it is "found in great numbers in the valley of Nepal and although it moves about a great deal I think it must be a permanent resident there. It was obtained from early in February to July. [Hodgson stated that it breeds in the Central Hilly region of Nepal from April to July]. It frequents the central woods in flocks and may often be seen in the Residency grounds about sunset flying into the tops of the pine trees and moving about the upper branches very actively."

There appears to be no record of the species in Assam, Sylhet, Cachar, or British Burmah, but Godwin Auston recorded it from Khajinghon, Manipur, and Hume thought he saw it in the Limatol range of the western hills of Manipur (S.F., xi, 28).

I have given the above notes in detail as in spite of the fact that we have more printed records of this beautiful little bird than of most species it does not appear quite safe to generalise from them and lay down a summer and winter range for the species. Its distribution appears more strictly zonal than in most species and until the available records have been largely multiplied it is better not to draw deductions which may prove erroneous. As indicated above it may be considered in any case one of the more abundant finches of the Punjab though fairly strictly confined to the Himalayan ranges.

The Eastern Linnet—*Linota cannabina fringillirostris* Bp. & Sch.

Writing as I am far from libraries and museums it is useless attempting an accurate indication of the respective limits on our frontiers of the Eastern Linnet and the Eastern Twite as the problem has been complicated by the separation by various writers of races which at the best are obscure and probably are not separable. There is however no difficulty as far as the Punjab area is concerned.

The Eastern Linnet is a common winter visitor to the submontane tract of the North-Western Punjab.

Mr. A. E. Jones says of Campbellpore-Attock (J.B.N.H.S., xxvii, 798):—"First noted 20th December 1918 when a flock of 7 was seen. They were so wild that I had difficulty in securing one with the 12-bore gun. Subsequently found to be fairly common about the waste stony ground at the foot of the hills." At Christmas 1922 Mr. Jones informs me that he met with the species about Taxila.

In the Salt Range, the late Captain C. H. T. Whitehead secured a specimen on 13th December from a flock on the plateau to the north of Sardi. This was originally recorded as belonging to the typical form of Europe, but the identification was subsequently corrected (Bull., B.O.C., xix, 7 and xxi, 101).

It is probably a common winter visitor throughout much of the Salt Range as in the beginning of March 1914 I met with Linnets in some numbers about Dumman and Chakwal. Here as I have recorded (Ibis, 1916, 66) they were common enough in small flocks or in parties of 2 or 3 individuals. These would often be noted flying overhead, attention being called by their twittering note, or settling at the tops of Shisham and Kikur trees. In the early mornings the males were singing freely at the tops of trees round the Dumman Rest House.

Currie writes (J.B.N.H.S., xxiv, 566) "At Lahore, last September, (1914) I saw several small parties of Linnets feeding in the grass rukh and passing overhead in a south-easterly direction, which I fancy must have belonged to this species. I did not however shoot one." I feel however quite sure that these birds were not correctly identified as Linnets could hardly reach Lahore in September under any circumstances from what we know of their distribution in Asia.

The Eastern Twite—*Linota flavirostris montanella* Hume.

Stoliczka observes (J.A.S.B., xxxvii, 62) that this species visits Kulu and the Sutlej Valley in winter and is also in winter caught near Chini and some times caged. As his collections apparently contained no specimens from the localities and the record has not since been confirmed by other observers the species can only doubtfully be included in the Punjab list.

The Golden-fronted Serin—*Serinus pusillus* (Pall.)

The Golden-fronted Serin has as yet been reported only in the mountain area of the north-east corner of our Province.

Lieutenant Speke of the 46th B.N.I. long ago informed Blyth (J.A.S.B., xxiv; 257) that it was found in Spiti from 10,000′ to 13,000′ in summer and this was

confirmed by Stoliczka (J.A.S.B., xxvii, 1868) who says "Comes only in winter to the lesser ranges of the N. W. Himalayas ; it breeds east of Chini on elevations of 10,000′ and above, as likewise in Spiti, Lahul, and Ladakh."

In July 1922 I found this lovely little finch fairly common in pairs along the Spiti Valley from the Kunzum Pass to Kibar at 13,000′—14,500′. Nests with one and five fresh eggs respectively were found near Kibar on the 21st July.

In Lahul, it is one of the commonest birds in June and July along the valleys from the Rhotang Pass to Zingzingbar at heights from 10,000′ to 13,000′. Its main stronghold is the Juniper Forest which stretches from Keylang nearly to Patseo : here I found many nests built in the Juniper trees, with eggs in June and July.

Marshall says, that it appears in Chamba in flocks in March for a short time (Ibis, 1884, 42). In Kulu it apparently does not breed.

The species is most abundant as a winter visitor to the Lower ranges about Simla. Hume says (Lahore to Yarkand, 260) "Later in the autumn [after October] retreats further South [than Ladakh] and enormous numbers swarm over the lower ranges nearer the plains, at heights from 4,000′ to 7,000′. I have known of 30 being killed at one shot, near Koteghar, in the valley of the Sutlej." At Simla according to Jones (J. B.N.H.S., xxvi, 610) it is "abundant in the cold weather. Roams about the hill sides in vast flocks which retreat to their breeding quarters generally in April." Mr. Jones informs me that he has met with the species as low as 3,500′ at Koti in Baghat state towards the end of February 1923.

I met with some flocks at 6,000′—6,500′ near Katrain in the first week of December 1922 but have no other information regarding this bird in Kulu.

It is curious considering the abundance of the Serin in the Simla hills in winter that it apparently does not spread further west along the southern slopes of the Duala Dar or first Snowy range. During three winters at Dharmsala I have met with the species only twice, namely, a single flock seen on 3rd March 1921 above the tea garden 5,000′ which lies between Dharmsala and Kanhyara, and a party of 3 birds by Triune Rest House (9,600′) on 30th March 1923.

The Brambling—*Fringilla montifringilla* L.

The Brambling is recorded by both Delmé-Redcliffe (J.B.N.H.S., xxiii, 753) and Meinertzhagen (Ibis, 1920, 140) as an abundant winter visitor in flocks about Quetta from early November till March (latest date 2nd. April). These birds doubtless arrive by some westerly route but they appear to depart northwards through a line just west of our area and passing up through Kohat towards Gilgit and Chitral. At Kohat, Whitehead (Ibis, 1909, 231) states that it passes through the District in small numbers early in March, associating with big flocks of buntings : it was not noted on the autumn passage but he afterwards met it on the Kohat grass farm in December 1911. Of Chitral, Perreau says (J.B.N.H.S., xix, 913) that it was only observed in April when large flocks passed through Drosh on their way north. Biddulph and Scully agree (S.F., ix, 353 and x, 133) that it occurs in Gilgit in small numbers on passage in March and April. The bird passes through Kashmir though I can find no details of this and there is a specimen (undated) from Abbottabad in the Hume Collection. The name also occurs in the list of local birds in the Hazara Gazetteer.

In view of this very clearly defined distribution and movement it is not strange that Hume discredited (S.F., vii, 465) Jerdon's statement that the bird had been found at Simla and Mussorrie (B.I. ii. 412), a statement which is inherently improbable and has not since been corroborated.

The Brambling depends for its inclusion in the Punjab list on a female which was shot by me on 7th January 1911 in the compound of the Commissioners' house in the Civil Lines at Rawalpindi. It was solitary and was found perching on the top of a high thorn hedge.

The Yellow-throated Sparrow—*Gymnorhis xanthosterna* (Bonap.).

This is another of our common species on which our information is as yet very incomplete. The Yellow-throated Sparrow is divided into two races, the typical form from the Indian Peninsula and *G. x. transfuga* from Afghanistan, Baluchistan and Sindh. The meeting ground of the two races appears to be in the Punjab and the majority of Punjab birds are clearly intermediate between the two races, but it is probable that both races in their purity are to be found at the extreme ends of the Province and possibly with this is correlated the different status of the species in the north-west and south-east. Full observation and materials are required to clear up these points. In the meantime I have treated the bird binomially and must be satisfied with indicating the available records. It appears to be abundant wherever it occurs.

At Rawalpindi, it is a summer visitor and extends into the Foot-hills of Murree, probably up to about 4,500′. I found that it was already generally distributed by the 15th April. Presumably it occurs at Peshawar but I can find no record on the point.

At Jhelum, including the Salt Range, it arrives about the beginning of April and is one of the first of the summer visitors to depart; all have gone before the middle of August (Ibis, 1916, 67). Similarly in a line further west but outside of our area at Kohat (Ibis, 1909, 232) it arrives about 1st April.

At Gujranwala, I found that they had already arrived by the beginning of April and all had gone again by the end of July. For Amritsar I have a record as early as 24th March for the first arrival.

At Jhang, (Ibis, 1922, 272) I have recorded how it is an abundant summer visitor, arriving at the latter end of March and becoming common by the beginning of April: towards Shorkot however it appears to arrive a few days earlier. The birds flock in August and have gone by the middle of September. Yet it is curious that I observed them at Multan in the second half of October.

At Lahore, according to both Dewar and Currie, it is only a summer visitor; the latter states (J. B. N. H. S., xxiv, 566) that it arrives towards the end of March and leaves again in October, which it will be observed is intermediate between the early departures of the north and west and the winter status of Ambala birds.

It occurs in Chamba (Ibis, 1884, 419).

Along the Kangra Valley, as far at least as Mandi, it is common and reaches about to 4,500′ along the base of the ranges; at Dharmsala the first arrivals appear in the last week of March but after breeding it leaves again very early about July; even by the end of June the species has gathered into flocks preparatory to the migration. In the Simla hills, it similarly occurs up to 4,000′ (Jones, J.B.N.H.S., xxvi, 611).

At Ferozepore it is common by the end of March. At Ludhiana, the exodus seems to begin about August but a few were observed at Khanna in September.

At Ambala, the status of the species is distinctly different: in summer it is as elsewhere in the Punjab a generally dispersed breeding species. But in the winter, from December to February, I observed large flocks and it would be interesting to know whether these were composed of the local breeding birds or whether as is more probable the breeding birds winter elsewhere and these flocks were immigrants. A series of summer and winter birds is clearly needed from Ambala for careful racial examination.

For Hissar, my notes show that the bird was already common on my arrival on 27th April; it began to flock about July and a certain number were about till the end of October after which it was not seen.

At Delhi, it breeds in June (Bingham, N. & E., ii, 158) but I have no other information for the south-eastern Punjab.

The Cashmere Sparrow—*Passer domesticus parkini* Whistler.

There is considerable difficulty over the question of the Sparrows of the north-western corner of our Indian Empire owing to the overlooking for many years of the fact that, in the higher hill areas, the breeding bird is larger and with a stronger beak and therefore different from the small *P. d. indicus* of the plains. This larger bird I named as *P. d. parkini* with type locality of Cashmere (Bull., B.O.C., cclii, 13, 1920) but it is not yet possible for want of a sufficient series of Sparrows from different localities properly to work out its distribution and movements. Observers cannot be too strongly urged to collect a series of the breeding sparrows of their localities or of birds which are known to be on passage, as *parkini*, in portions at least of its range, is highly migratory. Until such series are available for identification one cannot satisfactorily deal with the status of this race. I have however the following data as a rough guide to it.

The breeding sparrow of Spiti is beyond all doubt *P. d. parkini* as I secured a series of 6 males there in July 1922 ; they were common about villages at 13,000′ and were nesting in the faggots which top the roofs of all houses in Spiti and eggs were taken. These six males show wing measurements of 79·5, 82·5, 82, 81·5, 81·5 and 81mm. A House Sparrow occurs in summer in Lahul at 10,000′ to 12,000′ but is rather scarcer than in Spiti and I have only been able to obtain 4 males (wings 79·5, 79, 78, 77·5). These birds are probably also *parkini*.

So far as I have been able to trace them, the Sparrows of the Outer Himalayan ranges appear to be intermediate between *parkini* and *indicus* : and in this area the birds are non-migratory. From Saraj (June), I have 3 males with wings of 78. 78·5 and 77·5mm. From Kulu, a series of 8 males (June and November) have the wings 75·5, 78, 77·5, 77·5, 76·5, 77·5, 78·5, 77 mm. Four males from Dharmsala (April, May, November) have the wings 78, 77·5, 75·5, 75mm. For the rest of the Punjab Himalayas, I have no material available. These measurements form a connecting link between true *parkini*, as exemplified in the above large Spiti birds and the small weak billed *indicus* of which 4 birds before me from Darbhanga Bengal show wings of 74, 73·5, 72 and 77mm.

Ticehurst has traced *parkini* through Bampur, Karman, Sheraj, Bushire and Afghanistan (J.B.N.H.S., xxviii, 218). It is probably the sparrow which is a summer visitor to Quetta and northern Baluchistan. My only 2 males from Quetta have wings 79 and 79·5.

At Chitral, Perreau records the Sparrow as a very common summer visitor about 4,500′ and higher to 7,800′ from the end of April till early in October (J.B.N.H.S., xix 913). At Gilgit also the sparrow is a summer visitor arriving about March and leaving in November and breeding in the lower valleys ; while some birds remain during mild winters. A series of males are said to have wings of from 3″ to 3·2″=76·5—81·5mm. (Biddulph, S.F., ix, 343. Scully. S.F., x, 128).

At Kohat, Whitehead records the passage of vast hordes of migrating sparrows in April and May in company with the Spanish Sparrow and the Rosy Pastor (Ibis, 1909, 232).

These Gilgit, Chitral and Kohat birds may well all be *parkini* but material is wanted for examination.

The type locality for this race is Srinagar, Cashmere where it breeds in abundance ; my series of males thence have the wings 80·5, 80, 79·5, 78·5, 77·5mm. Osmaston found it breeding throughout Ladakh.

Parkini is known to appear in the plains of the Punjab as a migrant. I first observed the new race through the flocks of migrant sparrows which passed through Jhang district in September and October with *Gymnorhis* and *Emberiza luteola* and there were signs of a return migration in March and April. Four males were obtained with wings 80,81, 80·5 and 77mm. (moult incomplete). Some of these birds were on their way to Sindh as Ticehurst obtained a male (wing 83) from a flock at the head of the Jamrao Canal on 8th December 1918 (Ibis, 1922, 650).

This migration apparently passes through the whole Punjab as I have a pair shot from a flock at Ferozepore on 18th September 1911 (Wing ♂ 79) and Mr. A. E. Jones obtained a male from a flock at Jagadri, Ambala District, in 12th March 1922 (wing 84).

The attention of all observers is directed to this interesting problem.

The Indian House Sparrow—*Passer domesticus indicus* Jard. and Selby.

A House Sparrow which is commonly attributed to this race is found as an abundant resident throughout the Punjab plains ; I have not however been able to examine sufficient material from the Indian Peninsula to feel certain whether one name will cover all the birds of the plains of India or whether in reality there is another race which has been overlooked.

The Sindh Sparrow—*Passer pyrrhonotus* Blyth.

This Sparrow was originally named by Blyth in 1844 from a single specimen obtained in Bhawalpur by Sir Alexander Burnes and then was entirely lost sight of for nearly 40 years until it was rediscovered by Doig in the Eastern Narra. It is only within the last 10 years however that its distribution has become fairly well known, though both Hartert and Stuart Baker have made the mistake of placing it as a race of *Passer domesticus*. This is quite incorrect as apart from the fact that the two birds are very distinct, *Passer domesticus* breeds freely through the whole range of *Passer pyrrhonotus*.

The Sindh Sparrow is essentially a riverain sparrow and its range is therefore largely dependant on the course of the river system of the extreme north-west : it is however inevitable that small colonies wander away from the rivers and establish themselves where a combination of Kikur trees, Sarpat grass, and water furnish the necessary conditions for their breeding and odd parties may of course be met anywhere in the area between the rivers. It is however only along the course of the rivers that the bird may be looked for with a certain expectation of its discovery.

I have traced the Sindh Sparrow as follows throughout the whole of its range :—

On the Indus, it is recorded from Dera Ismail Khan by Currie (J.B.N.H.S., xxiv, 566). There is then a gap in its known distribution down to the jungles north of Sukkur from whence it is fairly common down to the Sadhani forest in the Karachi collectorate and occasionally as far as the jungles in the Hyderabad district. It occurs at the Machar Lake and Jamrao Head (Ticehurst, Ibis, 1922, 652), and on the Eastern Narra (Doig, S. F., ix, 280).

There is no record for the Jhelum river.

On the Chenab it is found as far north as Wazirabad (Currie, *loc. cit.*) but it appears to be scarce along this river until about the Rivaz bridge at Chund Jhang District (Ibis, 1922, 274) : from there it is common down to Multan south of which there is no record.

On the Ravi, it is common about Lahore (Currie, J.B.N.H.S., xix, 259 ; xxiv, 566 ; Jones, xxi, 1073). Currie has recorded it from Gurdaspur but not made it clear where the species was actually found.

For the Beas, there is no definite record.

On the Sutlej, I have found it at Phillaur (J.B.N.H.S., xx, 1151) and again it is common at the Ferozepore bridge (J.B.N.H.S., xxii, 392). Still further south we have Bhawalpur the type locality.

Throughout its range the bird is a resident species.

The breeding season is extended and probably more than one brood is raised in the year. Nests have been recorded in April at Wazirabad Eastern Narra and Sadhni Forest, in May and June at Lahore, in August at Lahore and Jhang and in September at Jhang.

The Spanish Sparrow—*Passer hispaniolensis transcaspicus* Tschusi.

This race of Spanish Sparrow is said by Hartert to breed from the Transcau-

casus through Trancaspia to Turkestan, Kashmere, Afghanistan, Persia and Palestine.

If it breeds at all in Cashmere it must be very rarely as I can trace no actual records on the point though, Ward says, that he met with it in July in the Nowboog Valley (J.B.N.H.S., xvii, 485).

The winter distribution for India is given (F.B.I., ii., 239) as Sind, the Punjab, the northern part of Rajputana down to Sambhar, the N.W. Provinces and Oudh as far east as Mirzapore.

Some birds apparently arrive in India by a line somewhat similar to that followed by many species and passing down just along the west of the Punjab border; for while at Gilgit it is so scarce that Biddulph and Scully (S. F., ix, 393; x, 128) only obtained 2 or 3 specimens in winter, in Chitral it is a very common passage migrant in large flocks in October and November and at the end of April and beginning of May (Perreau, J.B.N.H.S., xix, 913). Immense flocks are reported from Kohat and the Kurram Valley where the passage dates are given as second week of March till middle of May and early August to October, but as it is scarce at Quetta in winter (3 specimens in the local Museum obtained on 18th November being the only record known to me) these flocks perhaps represent a second line of entry from the west. That this is probable is also suggested by the fact, that it is only a winter visitor to Upper Sindh in quite small numbers and a mere straggler to Lower Sindh (Ticehurst, Ibis, 1922, 651) as contrasted with the vast numbers which appear in the Punjab and pass through as far as the Sambhar Lake (Adam, S.F., i, 387). Had the Kohat birds been part of the north to south movement represented in Chitral the Spanish Sparrow could hardly fail to be a more abundant bird at Quetta and in Sindh.

Published records for the Punjab do not at all accurately represent the movements of the species: my own records are also very unsatisfactory as far many years I certainly overlooked the presence of the bird.

Hume says (S.F., i, 209), "During the cold season invades nearly the whole Punjab in such vast flocks that a single shot would often enable one to secure materials for a dozen pies." Again in the Ibis (1868, 233) he says "found throughout the Sirsa and Hansi districts.....about Sirsa it is found associated in immense flocks with the common sparrow". His collection contains specimens from Rhotak and Sirsa. It occurs in Hissar. In Ambala district according to Jones (J.B.N.H.S., xxvi, 676) it is a common winter visitor. At Jhang I found it a winter visitor in flocks but somewhat variable in numbers from year to year. My records were incomplete but the bird was certainly observed from December till the end of March (Ibis, 1922, 272). During a railway journey from Lala-Musa to Sargodha on 25th April 1918, I almost certainly identified this bird amongst very many flocks of Sparrows seen along the line.

The Cinnamon Sparrow—*Passer rutilans debilis* Hartert.

The Cinnamon Sparrow is a purely Himalayan species but while strictly speaking a resident in the hills and non-migratory it changes its altitude according to season, in winter appearing near the outer fringe of the foothills. The limits of this race do not yet appear to have been defined closely either on the west or east. Hartert's statement (Vog. P.F., 162) that it extends to Sindh is not correct and there is no record for the plains of the Punjab.

Within our area it is found very commonly in summer from about 5,500′ to 7,000′ as a breeding bird all along the outer ranges of the Himalayas and in small numbers down to 4,000′ and up to about 9,000′. At Murree it is common in summer but less numerous towards the Galis. There is no information available as to whether the birds of this area winter in the Rawalpindi foothills or whether they move further east. I did not however observe the species at Rawalpindi in winter.

It does not occur in Spiti or Lahul but breeds commonly along the Beas and its side nullahs in Kulu and in Saraj from about 4,000′ to 8,000′. I met with some at the end of November in Kulu but possibly the majority leave Kulu during the winter months.

From the Chamba border to the border of the Province beyond Simla it is very common south of the first snowy range about Dalhousie, Dharmsala, Kasauli and Simla breeding in May and June. It apparently occurs at Koteghar in winter and like the Himalayan Greenfinch is very irregular in its altitudinal movements; after the breeding season the birds gather in flocks and these gradually desert the higher levels and move about appearing in January and February as low as Kalka and the southern borders of the Kangra District about Jawalamukhi and Hamirpur (2,000′). Mr. A. E. Jones informs me that he met a flock at Ghaggar, Ambala District, on 29th February 1920. The return to higher levels takes place about March.

The Tree Sparrow—*Passer montana dilutus* Richm.

Stoliczka states (J.A.S.B., xxxvii) that the Tree-Sparrow is "only rarely seen in the eastern parts of the Sutlej Valley near Chini" which implies that it has been met with in the Punjab Province. In view however of the indefinite nature of this record, the want of further corroboration, and the general distribution of this race which renders its occurrence within our boundaries unlikely. I am not yet prepared to admit the Tree Sparrow to the Punjab list, though Marshall certainly includes it in his list of Chamba birds (Ibis, 1884, 419).

Adam's Snow Finch—*Montifringilla nivalis adamsi* Adams.

This race of Snow Finch was originally discovered by Adams in 1852 in Ladakh, near Lama Yaru, and appropriately enough this type locality falls within the area where we know most about the bird.

The traveller in Ladakh first meets with the species about the Namika-Lá. Here on the 21st August, Stoliczka says, that it was the only bird, in flocks at 12,000′ feeding and running on the ground like Larks, rising somewhat similarly with a loud chirp. He first saw it a little east of Shargol. (Diary: Second Yarkand Mission, 31; S.F., ii, 462). The Abbott collection contains an immature male taken at 11,000′ on 26th June. Ludlow found a nest with young at the foot of the Pass on 24th June (J. B.N.H.S., xxvii, 144). Mrs. Wathen informs me that she saw some on the summit of the Pass on 18th July.

Then at Karbu it is common: Henderson met it there in June and again found it in large flocks in October (Lahore to Yarkand, 262). Stoliczka's collection contains 4 specimens shot here on the 21st August.

On the Fotu-Lá it is one of the characteristic birds. Henderson found it there at 13,000′. Abbott obtained specimens about 12,000′ on 27th June. Ward obtained newly fledged young at 14,000′.

Then comes the type locality Lama Yaru; here Ludlow found a nest with young on 23rd June. The Stoliczka collection contains two specimens shot on 23rd August.

In the Indus Valley, it is apparently less often seen. Ludlow found a nest with 4 much incubated eggs on the 9th June near Mashool. Mrs. Wathen saw a single individual below Rasgo at 10,500′ on 4th August. The Abbott collection contains specimens from Upshi 11,000′ and Phyang 11,000′. The Stoliczka collection contains one specimen from Leh.

North-east of the Indus the Khardong ridge is a well known locality for the Snow Finch. Stoliczka found numbers there after a heavy fall of snow in early September (S.F., ii, 462). Mrs. Wathen found it abundant on the Pass up to about 15,000′ on 31st July and saw many fledged young.

Further north our information is very vague but the range appears to be

extensive. In Stoliczka's last paper (S. F., iii, 220) it is given in the very scanty list of birds which winter in the hills about Kashgar. Scully found it in flocks on 16th August on the Chuchu Pass at 11,700′ and two days later met it again at Kichik Yarlak (S.F. iv. 172). Biddulph says that on the return journey from Wakhan a few individuals were noticed on the passes between Sarikol and Turkestan.

I cannot find the authority for the statement that the Snow Finch occurs in Gilgit.

M. Babault obtained specimens on 27th July at Puga with the organs in breeding condition, and also at the Tso-Morari Lake (20th. July) and Zaruru (15th. 16th. July), (Mission Babault Résultats Sc., p. 194).

To the south-east it occurs in Rupshu as Stoliczka sent specimens from Marselang and Tajlang to Von Pelzeln (Ibis, 1868). From there the bird apparently extends right across Southern Tibet to the neighbourhood of Mt. Everest.

As might be expected from a perusal of the above records Adam's Snow Finch only occurs with in the Punjab boundaries in the extreme north-eastern corner.

In July 1922 I found that it was a common bird and nests with young were found about the villages of the Spiti Valley at 13,000′ from Losar to Kibar, extending in smaller numbers up to an altitude of about 15,000′. (Curiously enough in no part of its range does it appear to occupy quite so high a altitudinal zone as *M. b. haematopygia*). It was not observed on the western or Chandra Valley watershed of the Kunzum range on the Lingti Plain or in Lahul proper.

According to Stoliczka (J.A.S.B., xxxvii) his shikaris obtained the species in the Sutlej Valley and Kulu in winter while M. Babault (Résultats Scient., 194) on evidence unknown to me includes Lahul in its range.

Brandt's Mountain Finch—*Montifringilla brandti haematopygia* Gould.

This species which is very common throughout Eastern Turkestan and Ladakh beyond the Indus river only occurs within the north-eastern corner of our area; it is a bird of very high elevations keeping for the most part about 12,000′ and being at home as high as 19,000′.

Within our area I have met it in July from about 14,000′ above Zingzinbar, on the Baralacha Pass up to the summit at 16,000′; from there it is common in Lahul along the valley of the Chandra River to the Kunzum Pass, and along the Yunnan River and Lingti Plain to the Tsarab River at altitudes of not less than 13,000′. According to the Thakur of Lahul it appears in the Bhaga Valley in winter and he procured me a specimen in February. In Spiti I found it somewhat scarce along the valley of the Spiti River, but above Kybar it was common on the uplands from 15,000′ to 17,000′ where I was shooting Burhel.

Stoliczka states (J.A.S.B., xxxvii) that he obtained it in winter through his shikaris in the Sutlej Valley (rather too wide a term to be of value) as well as in Kulu.

The Mission Babault (Résultats Scien., 195) obtained specimens between the Baralacha Pass and the Ladakh boundary on the 11th—15th July 1914.

There appears to be no other record for our area.

So far as I could judge from the dissection of the specimens obtained in Spiti and Lahul the breeding season must be in July and August, but I could find no nests.

Stoliczka's Mountain Finch—*Montifringilla nemoricola altaica* (Eversm.)

This, the commonest of the Mountain Finches, appears to be widely spread through the whole of Chitral, Gilgit, Baltistan, Ladakh, Eastern Turkestan, Spiti and Eastern Tibet. To the west it extends into Afghanistan occurring even on the Samana about Fort Lockhart irregularly (Ibis, 1909, 224). Within this area it moves up and down at different levels according to season being found as low as 4,000′ winter and up to 14,000′ in summer.

In Chamba according to Marshall (Ibis, 1884, 421) it is very common all through the winter in large flocks.

In the north-west of our area it has not actually been recorded but it can hardly fail to occur on the hillsides about Murree in winter.

In the north-eastern corner of the area it is a familiar species. It breeds very commonly in the Upper Spiti Valley from 13,000 upwards. It is found in summer less abundantly but still commonly enough along the Valley of the Upper Chandra from the Baralacha Pass to the Kunzum Pass from 13,000′ upwards. It certainly breeds also from 12,000′ upwards in Lahul north of the Bhaga river along the Baralacha range. In central and southern Lahul it may be observed as low as 10,000′ in summer but erratically and often in large flocks, so it is probably scarce as a breeding species in these parts.

As regards the innumerable high ranges of Chamba Kulu and Bara Bhangal, I have no information as to whether the bird breeds on them or not, but a few appear to remain and breed on the Duala Dar range behind Dharmsala at 11,000′ and upwards.

In winter, this mountain-finch appears throughout the whole of the area south of the central Himalaya or Rhotang range reaching as low as 3,500′ in the Kangra Valley about Palampur on the one side and the lower ranges about Simla on the other; as Hume says (Lahore to Yarkand, p. 264) "Innumerable flocks swarm on the lower ranges of the Himalayas in winter from 4,000′ to 7,000′; no one would believe what countless multitudes throng at times every hillside in the Sutlej Valley near Koteghar in winter. They came and go in a most capricious manner". On the outer edge of their winter range they of course are less abundant than he has described above, but taking all in all one can hardly doubt that this bird is one of the most numerically abundant species of the Western Himalaya.

The movements of this Finch are so erratic and vary so according to locality that it is not easy to date their altitudinal migrations. But in the Kangra Valley they appear to reach their lowest haunts, the rice fields about 3,500′—4,000′ only in January and February, and they probably move off from the lower ranges below 9,000′ about March: otherwise their movements are doubtless regulated only by the conditions of the snow line in the various ranges.

In spite of the numerical abundance of this well known species very little is known accurately about its breeding. It is probably a late breeder in August and September for the flocks are often still unpaired well on in June and July and birds shot in those months frequently have the organs quite undeveloped. Even when the flocks have dispersed it is difficult to say from their behaviour whether the multitude of individuals feeding, courting, quarrelling on the hillsides are actually nesting, and it is almost impossible to find nests by accident or casual searching, so concealed are their sites under stones on the steep hillsides.

A JOURNEY TO SIAM AND BACK.

By

Major C. H. Stockley, D.S.O., O.B.E., M.C.

(*Continued from page* 981 *of Vol. XXIX*)

(*With* 2 *plates.*)

It was now time to leave the Mewong, as we were down to four days food, also the heat was great and Kunjanaw was decidedly ill from it.

Accordingly we started off early on the morning of April 12th 1920 and after crossing the ridge to the west of camp, we forded the Mewong and entered very dense evergreen forest. This continued for about 2½ miles, in the course of which we again forded the Mewong and for the last time . This ford was above its junction with the Hue Pa Suk and the Klong Sa Klo, which go to form the main stream, and consequently was quite shallow. Emerging from the evergreen, we forded the Hue Pa Suk and entered a tract of bamboo and grass where we put up several sambhar; then half a mile over low ridges with a jungle fire burning a little below the path, but not close enough to annoy us seriously, and we turned up a long ridge which grew steadily steeper.

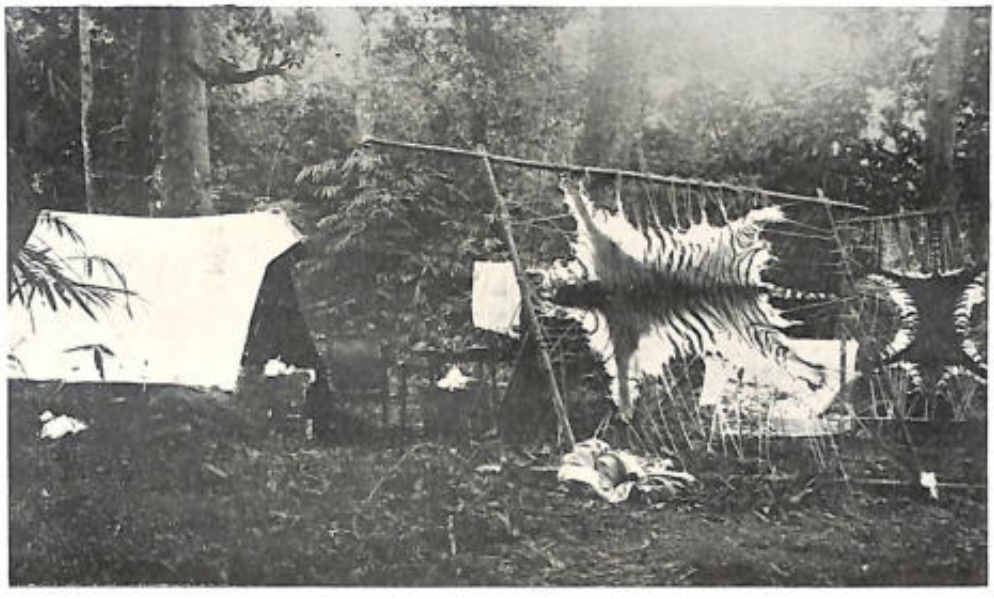
A quarter of a mile up this I heard some jungle-cock crowing not far from the track, and pushing through the bamboos found a small spring under a big rock, around which were numerous jungle-fowl and a cloud of Thick-billed Green Pigeons, so that I was successful in getting a jungle-hen with my first barrel and two pigeons with my second.

Another quarter of a mile up the ridge we came to a point where the track ran along a knife-edge, and on one side of it a jungle fire was burning merrily with a breeze blowing the blazing debris across the path. This was a problem, as the opposite side of the ridge was quite impossible for the ponies, so we had to set to and beat out the flames with branches in the vicinity of the track and then get the ponies past. Two ponies threw their loads and it was most unpleasant recovering them before they got burned, and I then had the other ponies unloaded and led past the fire, manhandling the loads afterwards.

By this time we were all very thirsty and another mile uphill and two more along a narrow track up and down two big ridges were a sore trial before we reached the upper valley of the Hue Pa Suk, camp and precious water.

Camp was on a small flat beside the stream, which here flows down a narrow valley over a bed of large boulders. Under the trees of camp I took a number of specimens of *Neopithecops zalmora* while, about 3 p.m. a brilliant procession of butterflies began to pass up and down the nullah, a few feet above the water. These were mostly *Papilios—zaleucus, varuna astorion, dasarada barata* and *clytia panope* all being taken, but *P. antiphates* was much the most numerous. There were also crowds of a curious moth—black, yellow-spotted and shot with blue—which bore a decided resemblance to a *Danaid*, and which flew steadily up and down 80 yards of the stream but did not seem to go above or below this stretch.

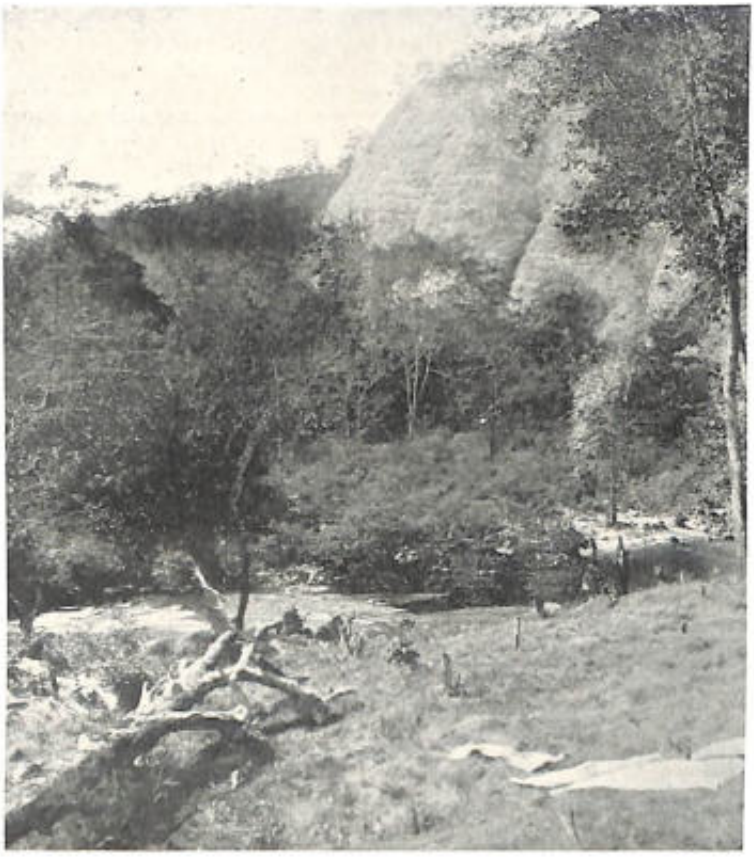
Next day was notable in several ways. About 3 a.m. there was a tremendous crash about 100 yards upstream, and on starting in the morning we found that an enormous tree had fallen right across the nullah and completely blocked the path. Eventually a passage had to be cut uphill of it through the smaller roots. Then the ponies had great difficulties in crossing the stream, owing to the large boulders in the bed, so that in many places we had to offload and give the ponies a hoist to enable them to scramble up on to the bank. The same happened with fallen tree-trunks, which are easily negotiated by elephants but are formidable obstacles to ponies. The eventual result was that we took



A camp. Upper Mewong.



At the highest ford on the Mewong.



From the verandah of the Ta'ok hut.



The highest Megla ford.

seven hours to do three miles up the nullah, and had to camp on a narrow shelf at the foot of the main ascent to the divide between two rocky streams.

The valley had been remarkable for the numbers of *Morphinæ* which were seen and taken, most plentiful being the lovely blue-shot *Thaumantis diores* and its usual associate, *Thauria aliris*. These two flapped about low down in the undergrowth in every isolated patch of evergreen jungle and I secured a number of fine specimens. I did not see these butterflies again until I got back to the Taok Plateau, in Burma, and then only a very few. Very few birds were seen, the one noteable exception being a Malayan Wreathed Hornbill, the only one of the trip. This is curious, as on passing through the valley again this year, in January, I saw numbers of this handsome bird, though mostly higher up the hill.

The unfortunate ponies had nothing to eat that night as there was no grass, though some of them tried chewing the fronds of a fan palm which the drivers cut for them, so they were not in the best of training for the very arduous march next day.

We started in the morning with the most difficult climb of the day:—a steep zigzag for about 300 feet and then across a deep gully followed by another steep zigzag to a point 600 feet above the night's camp. At this point one of the ponies lay down and died. He was carrying a load of only 30 lbs. so was not a great loss economically, but also there was no particular reason apparent for his dying, except a general distaste for life.

Another two miles on an easier grade took us up to a series of small streams and low ridges at 3,700 feet, (we had camped at 2,500 ft.) and here two more ponies refused to proceed, and had to be off-loaded and left behind, the loads, which were light ones fortunately, being split among the men and the other ponies. However we were now over the worst of the ascent, and, after passing a small marshy pond full of elephant tracks, a quarter of a mile up the crest of a ridge brought us to the highest point of the march, 3,990 feet, and over the water-parting. From here a fine-dome-shaped hill, with several open slopes of grass near the summit, was visible through the trees a few miles to the south-east. Above us, but invisible on account of the forest, was Khao Mong Krachu (6,700 ft.), of which we had had an occasional glimpse while travelling up the Mewong.

We now began the descent into the Melamoung, a tributary of the Meklong, starting with a narrow ridge and then a zigzag down a steep slope where I captured a specimen of that rare butterfly *Æmona lena*. A long winding ridge with an easier slope to it then took us down to the bottom of the valley, and ever-green jungle, the whole descent taking about an hour and half.

At that time Umpang, the Siamese post about 40 miles away for which I was making, was a small place in charge of a very minor official and with a dozen gendarmerie, while all its traffic went *via* Mesawt on the Myawadi-Raheng road. Now it is much increased in size and has an Amphur Nai and a whole company of gendarmerie. Consequently in 1920 the track was scarcely ever used except by occasional Karens, and was so overgrown that it was quite indistinguishable in places, while in others we had to push through masses of a high, papyrus-like vegetation in which one could not see a yard in front of one. Even now I should hesitate to try and take ponies over it, but in April 1920 it took us five miserable hours to get three miles down the valley, struggling through thick undergrowth in a steamy hothouse atmosphere, hauling and shoving the unfortunate ponies up steep bits of grade, and humping loads until we were dog-tired when we got in to camp in the first possible sufficiently open place, which we had to clear with dahs to enable us to bivouac for the night.

Next morning we set off again with the remaining eight ponies fit to carry loads, first sending back two men to fetch in the ponies left out overnight and dumping what we could not carry, but it turned out that we had not far to go as about 2½ miles down we came out into some old clearings which contained

plenty of grass for the ponies, so I camped under some fine trees by a clear gravelly stream and sent back for the rest of the baggage.

I had heard from Mr. Kemp of the great hot spring in the Melamoung and the guide said it was a very short distance down the valley, so I walked a quarter of a mile and was rewarded by one of the most remarkable sights I have seen. The spring bubbles up, boiling hot, out of five different places through fissures in a white limestone rock and the whole area is about 30 yards by 20. This space is ringed in with high green trees and dotted all over with brilliant white pieces of limestone set in a thin ooze over which the boiling water flows while, in the early morning, the sun shines on the dense vapour which arises from the spring. Round the marshy edge and on patches of warm mud were the most wonderful assemblies of butterflies, in crowded quivering patches, some about a yard square, while hundreds of others, including many of the great red-bodied swallow tails (such as *Papilio dasarada barata* and *P. philoxenus*) floated about above the water. The whole effect with the bright green trees all round contrasting with the white stones, the sun shining on the steam from the boiling water and the varying colours of the butterflies as they turned and hovered, was most pleasing and curious.

The trees proved to be full of green pigeon, mostly Pin-tailed, so I first attended to the needs of the commissariat and then turned to the butterflies.

The largest assembly was one of Pierids on the east edge of the spring. This contained a close-packed crowd of *Appias lalage*, also many *A. lagela*, a few *Lybethea zelmira*, half a dozen *Prioneris thestylis jugurtha* (all males) and as many *Hebomoia glaucippe*. After a sweep of the net the whole swarm were back again in a few minutes, but the difficulty was to pick the specimens wanted. Three yards away was a crowd of the beautiful black and green *P. sarpedon*, and, just as an experiment, I swept the net through them as they rose and counted the bag: it was forty-two. There were also many assemblies of the *P. cloanthus*, more lovely perhaps than *sarpedon*, but usually there were not more than 15 to 20 in a batch. It was noticeable that *P. antiphates*, which had been so common at Pang Yao and on the other side of the divide, was not at all numerous, while *agamemnon*, which had formed assemblies at Pang Yao, was here unsociable. None of the red-bodied *Papilio* formed assemblies, and I noticed this characteristic throughout my journey. There were very few Nymphalids about though they were plentiful among the trees a few yards from the spring, and at first I thought there were few Lycaenids, but on going to the lower end of the spring I found a bay among the bushes which was crowded with several species of "blues", principally *Lampides bochus*, *elpis* and *celeno*, while the black and white of the three species of *Castallus* was everywhere. *Lybethea lepita* was also common round the spring, but was difficult to catch.

I was back at the spring last January, and found the butterflies not nearly so plentiful. They were mostly of the same species, and the assemblies were in the same spots, but there were notable absentees: *P. dasarada barata* in particular and while on my first visit there were about fifty specimens of a Humming-bird Hawk Moth hovering over a small pool in the shade at the top of the spring, on my second there was not one to be seen. Undoubtedly the real season for the butterflies does not begin until the second half of February, and I found this year, that whereas I took practically no *Arhopala* on the first two-thirds of my trip, I found them comparatively plentiful (as far as these charming dwellers in the evergreen ever are) during the last half of February.

Having taken what specimens I wanted for the time, I retraced my steps to camp, and found the rest of the kit coming in, while a short while afterwards the two men sent after the missing ponies returned with the unfortunate and hungry animals. I also sent off the guide and one of the coolies to the village 12 miles down the valley to get some rice for the camp, of which we had only one day's supply left.

The evening was notable for the obtaining of a second bear, which fell (out of the tree in which it was feeding) to a lethal bullet in the chest. This was an even more interesting specimen of the Himalayan Black Bear than that shot at Miba, and was, I believe, the first authentic record of its occurrence in Siam or so far south: some member of the Natural History Society of Siam will, I hope correct me if I am wrong. This specimen was even more leggy than the first, and had a decidedly "piggy" muzzle: it measured 1½ inches more at the shoulder to only an inch greater in length. The white horseshoe on the chest was reduced to a thin line. I devoted the whole of the next morning to preparing it as an entire specimen for the British Museum, but managed to find an hour before lunch for butterfly hunting at the hot spring, while the men amused themselves with turning the stream and thereby catching a bucketful of small fish, of which I selected specimens of five species for the spirit jar. A round with the gun in the evening produced a couple of Brown-breasted Hill Partridges, which I also preserved, while Maung U went out early next morning and returned with a fine Giant Squirrel (*Ratufa gigantea*,) much heavier and with a finer coat than the other giant squirrels (*R.phaeopepla*) which I had got before down below the hills. I also sat up a night at the spring and was visited by a bull bison and a sambhar, but I did not want the bison, which passed within a couple of yards of me, and it was too dark to shoot the sambhar cleanly.

On April 18th, the rice having arrived, we marched 12½ miles to Ban Melamoung. A trying march, as the ponies had several falls among the boulders of the river-bed, which, as is usual in Siam, formed a considerable portion of the track: also I lost my watch owing to taking an involuntary bath, in the course of which my watch slipped out of the pocket of my shorts, where I had put it owing to the strap being broken.

On the 19th we had a short march of about 4½ miles, which however took as many hours owing to the last two miles being uphill and through an old taungya clearing full of fallen trees lying at every angle and covered with a seven foot growth of "dhiza" weed. I was interested to note on passing through this taungya last January, that the young trees, particularly teak, had begun to push their way up through the weed, and where they were high enough to throw shade the weed had begun to recede from them. This, I suppose, is nature's sequence in re-afforesting a taungya clearing, though the process must take many years. Before climbing the hill to this camp I had seen many Green-legged Hill Partridge and had shot a couple by the river.

I noted that at the time the Brown-breasted were always above the Green-legged, but this year I shot a Brown-breasted in exactly the same spot by the river where I shot the Green-legged, and the next day shot a Green-legged several miles higher up the valley, and two days later shot another Brown-breasted higher up still; so there appears to be no definite rule in the matter.

On this march there were some fine limestone crags on the far side of the valley, which are the haunt of serow.

Camp was by some big rocks on the edge of plateau which turned out to be some four miles across. Out of the rocks flowed a spring of good water and beyond to the south was a long slope of open grass and scattered trees, crowned by a line of jagged rocks. While the tents were being pitched something thudded on to my topi, and putting up my hand, off went a flying lizard, *Draco volans*. I pursued it with the butterfly net, but only succeeded in ruining the net on a tree whose trunk seem to be entirely composed of thorny spikes. These little lizards are both quaint and graceful in flight; while at rest their parachute membrane is scarcely discernible. They are of course only "gliders" not true fliers. I found them here and there all along the route, at no particular elevation, nor did they seem partial to any definite type of forest.

In the evening I went southwards along a slight track across the open country, and, a mile away round the corner of the main ridge, found numerous tracks

of tsine, so sat down in a commanding position at the head of a long strip of jungle to watch for any animal which might come out to feed on the slopes below. I had sent out Maung U in the opposite direction with the gun to try for a bird for the pot, and had only the rifle with me. After waiting about half an hour I saw some animal climbing about the upper branches of a tree about twenty yards away, and examined it carefully through my glasses, and finding it was strange to me went closer to it and had a good look. It was either a Rat-Shrew (*Gymnura*) or some very big species of Tree-Shrew (*Tupaia*). I have only seen museum specimens of *Gymnura*, and this appeared if anything a little larger than any I have seen, and also darker coloured. Not having the gun I was unable to secure it.

No large animal came out to feed, so I returned to camp, and found that Maung U had shot a couple of jungle cock.

On April 20th we began with a pleasant walk across the plateau, and then a steep descent of about a mile and a half to the Melamoung again. We forded it and found on the other side a fine camping ground on an open flat under a cliff, at the base of which were several caves. I should have liked to camp here, but the small quantity of rice we had been able to get from Ban Melamoung was almost exhausted, so we had to make Umpang next day. Accordingly we left the Melamoung for good, and climbing 500 feet, crossed 3 miles of plateau country through varying forest; evergreen, bamboo and open tree and grass. Just before we left the last bit of evergreen I stepped off the path to try and catch an *Arhopala* which had settled on the buttressed trunk of a big tree. I missed the butterfly and the wild sweep of the net disturbed a cock Silver Pheasant from between two of the largest buttresses, and he bolted out so close to me that I nearly secured him with the net. I wondered why he had squatted so close, and on looking at the place was astonished to find a nest containing seven eggs. All the men agreed that the bird was undoubtedly a cock and some of them stated that the cocks also assist in incubating the eggs but I think they would equally readily have stated that the hens always dó all the sitting , if the bird had happened to be a hen. Nawash Ali happened along shortly afterwards and I handed over the eggs to him, but forgot to tell him that I wanted to blow them: one "*jungli murghi's*" eggs were the same to him as any other and on reaching camp he tried to make a pudding for me while I was away butterfly-hunting and finding them hard-set, broke them all in succession trying to find a fresh one.

Leaving the nest we descended a long slope through open jungle to enter a small winding nullah in heavy forest and camp a mile or more down it on a pretty flat in bamboo jungle by the junction of two small streams.

The afternoon was mostly occupied in looking after Nawash Ali who was suddenly violently sick. He had damaged his back in some way, humping loads about on the divide, and became very seriously ill shortly after we got back to India, and was a "passenger" for the rest of the journey. The evening was spent catching skippers on a damp bit of the track, a hundred yards from camp. These little butterflies are most elusive as they fly very fast and are most restless. Some never seem to settle; flying up and down a stretch of path or narrow nullah without cessation.

The 11 mile march to Umpang on April 21st was not notable in any way. First down the valley in which we were camped for about four miles. mostly along a narrow nullah full of dense evergreen, with the usual paddling in the stream, then up a fairly steep ridge and along an open slope where I shot a Blanford's Quail, and down again through a small patch of cultivation to the Um Pa stream. This was about 20 yards wide and 18 inches deep, and we then followed it down for 4 miles, past a Karen village on the left bank and through numerous fords, until we reached the fields of Umpang, and another mile took us across them to the big straggling village of some hundred houses.

I stayed in the guest house, now the residence of the Amphur Nai, and later interviewed the local official, who said he would get in three elephants for me in three days.

It was pleasant looking out over the fields to the hills beyond. Constant travel in big forest and a limited range of vision becomes oppressive after a while ; and to me the dense jungle, although it has its own peculiar fascination, never appeals as do the great spaces and almost limitless views of the great mountains, such as the Karakorum.

I paid off the ponies at Umpang and was glad to change to other transport as they are most unsuitable for the country which I had traversed. If I had elephants, which I had unsuccessfully tried to obtain in Hkambengpet, I would have had little trouble from natural obstacles and none at all from the want of grazing which had been a bugbear all along. Elephants graze themselves well in big forest and they are immune from the attacks of tigers.

Maung U and the pony men had a lively two days in the local grog shops, and were either invisible or useless the whole time. The Siamese guide also left me, and I took on a young hunter of great local repute, who was half Burmese, to replace him. My three coolies, who had come to me at the Klong Klung camp and whom I have previously forgotten to mention, volunteered to accompany me to Kawkareik. These three were of widely separate origin really; one being a Kamoh from the eastern border of Siam, one a Lao from the north, and only one a true Siamese and resident of the village from which they had come to join me. They were hard working pleasant fellows to deal with; the Lao carried the bison skull on the march, while the other two had the mask and the spirit jar slung on a pole between them.

The elephants arrived on the evening of the 22nd and we left next morning, an easy uneventful march of a little over ten miles through a country of fairly open jungle and low ridges. At 2½ miles we crossed the Ya Met; a pretty stream about 20 yards wide and two feet deep, flowing over gravel and stones and well stocked with fish. Half a mile further on we forded the Meklong, about the same size. These two join a little below where we crossed them. On the left bank of the Meklong was the little village of Ban Meklong: on passing this year I found that it had shifted to the other side and is now a large and prosperous village.

On the march another snake was added to the spirit jar. This was a *Tropidonotus* about twenty inches long, which I found in the act of trying to swallow a frog which appeared several sizes too big and was protesting violently. When I annoyed this snake by taking away the frog, it inflated its neck, which then appeared to be bright red. This was due to the skin between the scales being of that colour so that when the neck was distended there appeared to be about two inches of this warning colour.

Long Lung, then a small untidy village and now improved and increased beyond knowledge, was reached about 2 p.m. as we had been late in starting. As we arrived a severe rainstorm burst, and it looked to me as if I were running things a bit fine if I were to get past the Megla fords and over the Ta'ok Plateau before the monsoon set in. This was the last camp in Siam, and next morning we crossed the frontier back into Burma. This was a very pleasant march up easy grades through moderate forest, largely bamboo, where I twice saw but failed to shoot Peacock Pheasant. The water-parting was at the fifth mile from Long Lung, but was hardly noticeable, as the grade was so easy and the little gullies at the top wind about so in the jungle, that it is hard to tell which way they really flow. Descending the east side of a wide valley steadily for about three miles, with a glimpse of a Karen village on the opposite slope, we forded a small stream, the Pipa Choung, three times; and, crossing to the west, entered a small side nullah and climbed to the top of the dividing ridge. Then we descended a dry stony watercourse for about three miles through bamboo jungle before

we came to water at a point where several small streams joined, and, a mile further on, we camped under some high limestone outcrops on a pretty bit of level by a generous flow.

A few yards from camp was a small patch of marshy undergrowth, and over this I saw some small butterflies hovering in a peculiar way, rising and falling perpendicularly. I caught several and they turned out to be *Gerydus ancon*, a species of considerable interest.

In the evening a short walk to the west produced a fine cock Silver Pheasant, which was later assigned to the race *G. I. granti*, as were Ta'ok Plateau specimens.

I had come to this camp to try for serow, whose haunts the new guide said he knew well, as he had shot two there only a couple of months previously; so we started early in the morning up the slope to the east and climbed until we reached the top of the main ridge. Then we continued northward along this until we reached a spur of limestone. Here we searched the tumbled masses of rock and creeper, and found immense accumulations of serow droppings; the deposit at one place alone would have filled a very large sack. None of these were very fresh and we tried further along the ridge and found another spur with similar accumulations, while there were two day old tracks on the top of the ridge. The Burman hunter said that he had shot a serow at each of these places. We searched the whole morning but saw nothing but a sambhar, though we found fresh tracks of a tiger and a bear's digging so fresh that the earth was still crumbling back into it.

While looking for serow I put my head over the edge of a ledge about five yards long, and saw a cock *Gennæus* strutting about at the other end with his tail cocked up like a bantam, whereas all Silver Pheasants are supposed to carry it low at all times. When he saw my head he made several short rushes towards me and passaged about from side to side in most curious fashion, only desisting when I rose a bit higher and showed more of myself when he fled. I suppose he was showing off before a hen which was out of sight further on, and which made off without my seeing her.

The only other event of interest at this camp was the capture of a strange bat which flew into the orderlies' tent. This I skinned but only its skull ever reached England, the skin going astray somehow. It was a *Kerivoula* of sorts.

Next day we marched 11 miles to the Ungrin-Gorli junction. First a winding 3½ miles down the Pong Khwai, which we forded seven times, until we came to the Pong Nam Lan and a curious group of boiling springs, which bubble directly up into the stream and are even hotter than the Melamoung spring. Then we forded two more streams, and, after passing the Mesawt off shoot of the track, we crossed some low ridges and came down to the Unko. Here was quite a short but awkward ford, owing to it being at an angle of the stream where the water had scooped out a deep hole at one side of it.

Then we crossed a shallow valley, where I took several specimens of the large and beautiful *Arhopala centaurus* round an old tree-stump. This seems to be a favourite haunt of this species, and it is the only *Arhopala* I took far from evergreen jungle.

It was very hot indeed for the last two miles, which included the climbing of a fairly steep hill and the descent to the Ungrin, which we crossed to the little hut on the north side belonging to Messrs. Steel Bros.' timber department, and I was glad of the shade and the breeze which blew through it.

Shortly after arrival I saw a Green Imperial Pigeon feeding in a tree and shot it. On falling its crop burst and I found that it contained no less than eight large fruits of the size and shape of a Victoria plum, but quite hard. How these had all been packed into its crop seemed extraordinary, but this year I shot another of these birds which had twenty-three fruits in its crop about the size of damsons, and which also burst its crop on striking the ground. I think the fruits in the first case were those with which the Green Imperial Pigeon

is shown in the plate of the species in Stuart Baker's "Indian Pigeons and Doves". The gluttony of pigeons is amazing and I had thought that our home Wood Pigeon's efforts in stuffing itself with acorns were the acme of greediness until I met with these two instances.

On the next day's march we followed the Ungrin along its left bank for about three miles by a very narrow path through high grass and, passing the little village of Tidu Plu, turned north-west through thick forest. The pack track on this march is now excellent, and Tidu Plu a big village; owing to the extension of the timber extraction operations, but then it was very obscure and we had turned and twisted so much that it was a relief at about the fifth mile to come suddenly to a stretch of rippling water and to realise that we were back on the Megla about four miles above Miba, and had completed a circular trip.

Three fords and a couple of miles throughout high forest brought us to a good camping ground on an open level space between the stream and some high limestone cliffs to the north.

My elephants were two fat old cows and a bad-tempered tusker, which delayed the start every morning by his tantrums. All three were turned out to feed on the trees bordering the river, when suddenly there was a wild trumpet, and I was just in time to see the tusker rush at one of the cows and butt the poor old lady over the edge of the high bank into the river, where she fell into a deep pool with a resounding splash. He was showing signs of intention to commit further outrages, so the drivers ran out and secured him, chaining him to a tree some distance apart.

During the afternoon the Karens showed me a curious poaching trick. They got a hard jungle fruit about the size of a small plum and, taking out the centre, put in a wad of chewed tobacco; I am unable to say whether they added anything else to the tobacco, but I think not. Having prepared several fruits in this manner, they selected a pool likely to hold fish and threw one of these fruits in. It was taken almost immediately by a fish, of about a pound in weight. Some thirty seconds later the fish appeared skating aimlessly about the surface of the water with its head out, and two of the Karens dived in and secured it. The trick was not, always successful, for the next two or three fish all got rid of the bait before they could be captured and in this case they seem to recover completely and immediately; the result of a dozen efforts was a total of four fish all about the same weight as the first one.

On the 28th April, knowing that the elephants would find the steep ascent to the Taok Plateau very trying, I decided to get as near the foot of it as possible, so passed through Ta'ok village and after the ninth time of fording turned southwards away from the river for a mile and camped in evergreen jungle at the junction of two small streams right at the foot of the main ascent.

The result was that we were up on the plateau in the cool of the day and in camp by two o'clock.

In the evening I went out to look for anything that might turn up, catching some fine specimens of *dasarada barata* and *P. philoxenus* on the way out, and, as I entered the big *kwin* for which I was making, I saw a Barking Deer sneaking along the edge of it in the shade of the trees and about 100 yards away. Seeing that it appeared unusually dark, I examined it through the glasses and became quite certain that it was a buck Fea's Muntjac. Unfortunately a stray shaft of sunlight must have caught the lens and the sparkle warned the little animal which bounded straight into the forest. This was very disappointing as it was within half a mile of this spot that I had lost a chance at one of these rare animals on my outward journey.

Going on through the open grass of the *kwin* I soon came to the little patch of marsh on its north edge for which I was making. This was about 100 yards across and surrounded by trees on three sides, by whose edges I had seen tracks of numerous animals on my previous visit. I sat down behind a bush to watch, and, after a severe contest with a number of blood thirsty leeches, was rewarded

shortly after sunset by an ancient bull bison coming out to feed. I first saw the undergrowth move on the far side of the marsh and made out the old fellow standing just inside the forest having a good look round before he came into the open; but when he had made up his mind he stepped boldly out several yards into the marsh and began feeding greedily on the lush grass, sunk nearly to his belly.

He had once had a fine pair of horns, but now, though of great girth, they were worn down to half their original length, and had blunt and ragged ends. I already had the great head I had bagged in the Mewong, so after watching him until it was too dark to stay any longer I left him to graze in peace.

We stayed another day in this camp, and I tried down the valley in the morning on the chance of getting a sight of a Fea's Muntjac, but the leeches were altogether too attentive and I came back in disgust having seen nothing: the natural result when most of one's time is taken up removing the beasts. There had only been one or two light showers of rain, although it was obviously banking up for something heavy very shortly yet the leeches were out in their legions in every patch of evergreen, and I finally confined my operations to butterfly hunting in the open kwins or bamboo jungle, where I was not bothered with them.

On the 1st May we marched to our old first camp on the plateau, and cleared it well to keep off the leeches. In the afternoon I climbed the ridge to the south on the chance of a serow, and sat down between two rocks on one side of it while Maung U took up a position commanding the other side and just over the crest of the ridge behind me; the crest ran uphill to the big rocky peak on which the clouds were already beginning to gather.

After sitting there about an hour it began to rain very heavily and a wait of twenty minutes only seeming to prove that the longer we stayed the more chance we would have of being held up by the stream on return to camp, I got up to go. In the mean time the clouds had descended so low on the hill above that there was only about thirty yards of the crest of the ridge visible above us. As I turned round I was amazed to see a fine tiger emerge from the mist at a fast walk down the crest, so that a few seconds would bring him right on top of Maung U who was still sitting just out of sight of me on the far side. I think I may be forgiven for firing a bit hurriedly under the circumstances, and, although the tiger was only about twenty-five yards from me, I hit a shade too far back. He leapt straight in the air, biting at his flank, and rolled over the crest out of sight and down into the long grass and brambles which formed a thick tangle at the head of a small gully. I ran forward and found Maung U standing distinctly shaken and staring at the spot where the tiger had so suddenly arrived and disappeared in front of him. There was a good deal of blood which the pouring rain fast wiped out, and a fragment of a rib, evidently blown out on the far side of the tiger, adhering by a shred of flesh to a big grass stalk. I searched down the hill a little way, but the gully turned out to be so deep and choked with undergrowth that it would have been folly to go in under the circumstances, so I reluctantly set off for camp, feeling certain that the tiger was lying dead or dying somewhere nearby, but also certain that the heavy rain was greatly reducing my chances of ever finding him. So it turned out next day, for there were no blood traces left, and a prolonged search of the dense cover, in which it was most difficult to move, produced nothing but a couple of wild cats of some sort, which gave me a nasty shock when they bolted right under my feet. I tried to get the elephants to assist, but the drivers had "lost no tigers" and merely hung about at a discreet distance, so I had to give it up knowing that even if the tiger were now found, the skin would be quite useless, and in effect it was found a couple of days later, and some of the gruesome remains brought in.

I had had a most unpleasant night with leeches and rains, so I shifted camp or my remaining two days on the plateau to the open grass by the first stream

nearest to the crest on the Lampha track. From here I saw a fine old bull bison, and caught a great many butterflies, but nothing of note occurred, and I left the plateau and marched down to the giant bamboo camp on May 4th, acquiring some more fine butterflies and birds, while the last shot of the trip was one which bagged a Mouse Deer on the way into Lampha on the 5th, and I was back in Moulmein three days later.

So ended a most interesting trip from every point of view, zoologically and geographically. The net result was some two hundred specimens of birds, mammals and reptiles, and over seven hundred butterflies. I cannot sufficiently express my gratitude to the many friends who assisted me by their hospitality, in making arrangements for my transport, money, stores and the innumerable small matters which go to make a trip of this kind a success, and in particular the Bombay Burma Trading Corporation as a whole and individually were unremitting in their kindness. I must also register my gratitude for the consistent kindness and help which was accorded me by Siamese officials throughout my stay in their country.

Of the birds, mammals and butterflies mentioned in this account, most were identified from specimens actually preserved, this being the case with all butterflies, but I have already had to express my regret for the mistakes made in the vernacular names of some trees mentioned in the earlier portion of my account, and can only plead that there were four languages spoken commonly in my camp, and that, without any book to guide me, I found it extremely hard to check names given me by natives, and could not even be certain that my informant actually knew the name of the tree about which I questioned him, but was merely, in accordance with the immemorial custom of the east, saying the first name which happened into his mind and which would avoid the possibility of displeasing the sahib by an expression of ignorance.

To conclude with, I can only express the pleasure I got from the journey by saying that I have since been over the whole of the return journey again and found it even more interesting than when it was all new to me. I can only hope that I have succeeded in conveying to my readers a tithe of the interest and pleasure which I obtained on the journey itself.

A LIST OF THE HETEROMEROUS COLEOPTERA COLLECTED MAINLY DURING THE WAR, BY VARIOUS MEMBERS OF H. M. FORCES IN MESOPOTAMIA.

BY

K. G. Blair, B. Sc., F. E. S.

That this list is far from being a complete catalogue of the Heteromerous Coleoptera of Mesopotamia we have only to glance through the pages of Junk's Coleopterorum Catalogus to see; but the limited opportunities for collecting enjoyed by officers of H. M. Forces naturally preclude anything more than a sample collection of the fauna being gathered together.

Although the total number of species described from this faunistically interesting region is fairly considerable, the literature concerning them is scattered throughout a large number of periodicals and monographs, without any regional survey having been attempted, with the exception that Professor K. Holdhaus has given us a List of the Coleoptera collected by Dr. Viktor Pietschmann on an expedition to the country in 1910 (Ergebn. Wiss. Exped. nach Mesopotamia, 1910, in Annal. Naturhist. Hofmus. Wien, XXXIII, 1919). A comparison of the list here given with that of Holdhaus is interesting; in the *Tenebrionidæ* for example, of the 43 species enumerated by Holdhaus only 20 find a place in the present list, though in many cases genera are represented by different species in the respective lists. It is possible that some of these differences may be due to discrepancies in identification (many of the species here given being identified from descriptions only), others to the more northerly districts in which Prof. Holdhaus's insects were collected, but in the main they probably indicate how incomplete are the various collections made. Perhaps the most striking difference between the present list and that of Holdhaus is the almost complete absence from the latter of the smaller forms, *e.g.*, the complete absence of *Anthicidæ* and *Mordellidæ*, indicating that the material was obtained by persons other than trained collectors of Coleoptera.

Further material collected by Dr. P. A. Buxton and Mr. W. E. Evans from N. W. Persia, consisting almost entirely of species different from those listed here, has been omitted as belonging to the faunistically different Caspian basin.

Reference to the original description alone is here given; for a fuller bibliography the reader is referred to the several parts of Junk's Coleopterorum Catalogus (1910-1917).

A brief indication of the known range of each species is also given, from which it is evident that the Mesopotamian fauna, at least as regards this group of beetles, is essentially an eastward extension of that of the Mediterranean basin, many of the species having a continuous range, while others belong rather to the Persian offshoot from it with an admixture of Central Asiatic forms. A not inconsiderable number of species are of practically cosmopolitan distribution as warehouse pests, many having no doubt been introduced with the commissariat of the Expeditionary Force, though some may have previously obtained a footing in the country.

I have to thank the several collectors not only for their readiness with which they have placed their collections at my disposal but also for the generosity with which they have enriched the National Collections with any specimens desired.*

Fam.—Tenebrionidæ.

1. *Apentanodes mesopotamicus* Blair.

Blair, Ent. Mo. Mag. 1923, p. 119.

Jebel Hamrin, N. E. of Baghdad, under stone, 11. XII. 18. (*W. E. Evans*)

* For the descriptions of such species as appear to be new see Ent. Mo. Mag. 1923, pp. 118-126.

Near *A. arabicus*, Kirchsb. but the thorax more densely punctate, the elytra finely and densely granulate.

2. *Erodius servillei* Sol.

Solier, Ann. Soc. Ent. France, III, 1834, p. 540.
Ruz, N. E. of Baghdad, under flood refuse, 16. XI. 18. (*W. E. Evans*).
Mosul-Karind (*H. E. Shortt*,); Shergat IV. 20. (*Y. R. Rao*).
Egypt, Arabia, Syria, Mesopotamia, Persia.

3. *Erodius octocostatus* Peyer.

Peyerimhoff, Abeille, XXXI, 1907, p. 28.
Mosul-Karind (*H. E. Shortt*).
E. octocostatus was described from Sinai but the specimen before me(♀) appears to agree with the description of this species.

4. *Amnodeis grandis* Mill.

Miller, Wien. Ent. Monatschr. II, 1858, p. 120.
Shergat. IV. 20. (*Y. R. Rao*).
Asia Minor, Mesopotamia, Persia.

5. *Zophosis punctata* Brull.

Brullé, Exped. Mor., III, 1832, p. 191; Deyrolle, Ann. Soc. Ent. France, (4) VII, 1867, p. 109.
Baghdad; Samara, and Beled. XI. 17. (*L. Harrison*); Baghdad, XII. 18. (*P. Harwood*); near Amara, under clods, XI. 18. (*W. E. Evans*).
Occurs throughout the Mediterranean region, but not hitherto recorded from Mesopotamia. Of the nine forms described by Deyrolle the Mesopotamian examples appear to belong to var. *Vescoi*, Deyr.

6. *Zophosis farinosa* Blair (Oliv. in litt.).

Blair, Ann. and Mag. Nat. Hist. (8) XIII, 1914, p. 483.
Z. testudinaria, Deyr. (nec Fab.) Ann. Soc. Ent. France, (4) VII, 1867, p. 168.
Amara, V. 18. (*W. E. Evans*), VI. 18. (*P. A. Buxton*); Samara and Beled, XI. 17. (*L. Harrison*).
Described from Arabia it appears to extend through Syria and Mesopotamia to Persia to the East, and *via* Sinai into Egypt to the West.

7. *Prochomma clypealis* Blair.

Blair, Ent. Mo. Mag. 1923, p. 119.
Amara; found drowned in pool, III. 18. (*W. E. Evans*,); I. 19. (*P. Harwood*); IX. 18. (*P. A. Buxton*).
Broader than *P. andouini* Sol., with the medium lobe of the clypeus angulate in front. It is curious that this species should have now appeared in three different collections, whilst *P. andouini*, described from Baghdad, does not figure in any of the collections here noticed.

8. *Microhionthis patriciae* Blair.

Blair, Ent. Mo. Mag. 1923, p. 120.
Ruz, N. E. of Baghdad, in flood refuse, XI. 18. (*W. E. Evans*).
A new genus and species near *Hionthis* and *Stegastopsis*, but differing in its small size and in the external apical angle of the anterior tibiæ being strongly produced.

9. *Stegastopsis babylonica* Kr.

Kraatz, Revis. Tenebr. 1865, p. 177.
Amara; under clods on cultivated ground, II. 18. (*W. E. Evans*); Amara, I. 19; Baghdad, IX. 18. (*P. Harwood.*); VII. 18. (*P. A. Buxton*); Beled, XI. 17. (*L. Harrison*).
Apparently confined to Mesopotamia.

10. *Mesostena puncticollis* Sol.

Solier, Annals Soc. Ent. France, IV, 1835, p. 405.

Baghdad, III. 18; VII. 18. (*P. A. Buxton*); XII. 18. (*P. Harwood*); Samara and Beled, XI. 17. (*L. Harrison*); Amara, X. 19. (P. Harwood); II. 18. (*W. E. Evans*).

Appears to be the commonest Tenebrionid in the country; described from Egypt it extends through Syria to Mesopotamia.

11. *Rhytinota evansi* Blair.

Blair, Ent. Mo. Mag. 1923, p. 121.

Jebel Hamrin, N. E. of Baghdad, in flood refuse. XI. 18. (*W. E. Evans*).

Resembles *Tentyria glabra* F. but has the antennal structure of a *Rhytinota*.

12. *Tentyria mesopotamica* Holdh.

Holdhaus, Annal. Naturhist. Hofmus. Wien, XXXIII, 1919, p. 53, Pl. I, Fig. 5.

Samara and Belod, XI. 17. (*L. Harrison*).

This species is probably only a form of *T. puncticeps*, Mill., a Syrian species of which a variety *persica*, Baudi, has been described from N. Persia.

13. *Tentyria palmeri* Crotch.

Crotch, Ordn. Surv. Penins. Sinai, 1872, p. 267.

Ruz, N. E. of Baghdad, in flood refuse, XI. 18. (*W. E. Evans*).

By the kindness of Dr. Hugh Scott of the University Museum of Zoology, Cambridge, I have been enabled to examine the unique type of this species. *T. palmeri* was unknown to Reitter, and omitted from his Bestimmungs-Tabellen, though according to Peyerimhoff it is the *T. glabra* of Reitter, (nec Fab). I believe it to be identical also with *T. giraffa*, All., described from Arabia.

14. *Micipsa similis* Haag.

Haag, Coleopt. Hefte., XIV, 1875, p. 91.

Jebel Hamrin, N. E. of Baghdad, under stone, XI. 18. (*W. E. Evans*). The single specimen is in many ways intermediate between the types of *M. pubescens*, Haag and *M. similis*, Haag; thus the thorax is less strongly strigose than in the former, and more so than in the latter; the elytra lack the minute granules of *M. pubescens*. The types of both species are unique in the British Museum Collection, and it appears to me probable that they are varieties of the same species. Both are from Persia.

15. *Adesmia clathrata* Sol.

Solier, Ann. Soc. Ent. France, IV, 1835, p. 541. var. *babylonica*, Reitt. Wien. Ent. Zeit. XXXV, 1916, p. 14.

Kut, IV. 19. (*F. P. Connor*); Samara, XI. 17. (*L. Harrison*); Baghdad, XII. 18. (*P. Harwood*); XI. 18. (*W. E. Evans*); Umel Hanna, IX. 16. (*C. Beeson*); Hillah, VI. 20. (*Y. R. Rao*); Hinaidi, S. of Baghdad, I. 22; IV, V. 22. (*J. E. M. Boyd*).

Persia and Mesopotamia.

16. *Adesmia cancellata* Klug.

Klug, Symbol. Phys. II, 1830, No. 37, Pl. 13, f. 11, Mosul Karind (*H. E. Shortt*).

This form is doubtfully specifically distinct from the preceding. It appears to have a wider range, extending to Arabia and Egypt.

17. *Adesmia elevata* Sol.

Solier, Ann. Soc. Ent. France, IV, 1835, p. 549.

Baghdad, lower slopes of Jebel Hamrin, XI. 18. (*P. Harwood*); Ramadie, X. 17; Samara, XI. 17. (*L. Harrison*); Karradah, XII. 19. in cowdung (*Y. R. Rao*).

Specimens in the Bates Collection were determined as *A. pulcherrima*, Sol. by Haag-Ruthenberg. This name is omitted from Reitter's Bestimmungstabelle, 1916, in which the species appears to run down to *A. elevata*, Sol. (= *aenea*, Redt.). *A. elevata* was described from Egypt and Aleppo, *aenea*, Redt. from S. Persia.

18. *Microtelus persis* Baudi.

Baudi, Ann. Mus. Genova, VI, 1874, p. 106.
Ruz, in flood refuse, XI. 18. (*W. E. Evans*).
Described from Persia.

19. *Dichillus rugatus* Baudi.

Baudi, Bull. Soc. Ent. Ital. VI, 1874, p. 298.
Kisil Robat, N. E. of Baghdad, under clod in garden, I. 19. (*W. E. Evans*).
Described from N. Persia.

20. *Dichillus nitidulus* Reitt. (?)

Reitter, Deutsch. Ent. Zeitschr. XXX, 1886, p. 137.
Kisil Robat, N. E. of Baghdad, under clods. XII. 18. (*W. E. Evans*).
Described from Syria.

21. *Akis subtricostata* Redt.

Redtenbacher, Denkschr. Wien. Akad. I, 1850, p. 48.
Amara, on wall of old grain store, IX. 18. (*W. E. Evans.*); Beled and Tullugh, XI. 17. (*L. Harrison*); Umel Hanna, IX. 16. (*C. Beeson*).
Persia, Mesopotamia.

22. *Akis latreillei* Sol.

Solier, Ann. Soc. Ent. France, V, 1836, p. 675.
Karradah, on floor, VII. 20. (*Y. R. Rao*).
Asia Minor, Syria, Cyprus, Egypt and Turcomania (in Brit. Mus.).

23. *Scaurus tristis*, Ol. var. *aegyptiacus* Sol.

Solier, Ann. Soc. Ent. France, VII, 1838, p. 170.
Ali Garbi, III. 18. (*W. E. Evans*).

24. *Ocnera hispida* Forsk.

Forskall, Descript. Anim. 1775, p. 79.
Amara, II. 18. (*W. E. Evans*); Baghdad, IV. 17. (*N. B. Kinnear*); XII. 18. (*P. Harwood*).
Widely distributed in N. Africa Arabia, Syria, Mesopotamia, etc.

25. *Ocnera philistina* Reiche.

Reiche, Ann. Soc. Ent. France, (3) V, 1857, p. 214.
Amara, II. 18. (*W. E. Evans*); Shergat, IV. 20. (*Y. R. Rao*).
Asia Minor, Syria, Mesopotamia, Persia, etc.

26. *Ocnera parvicollis* Baudi.

Baudi, Ann. Mus. Genova, VII.
Baghdad, XI. 17; Samara, XI. 17; Ramadie, X. 1875, p. 686, 17 (*L. Harrison*); Ali Garbi, III. 18. (*P. A. Buxton*); Karradah VII. 20. (*Y. R. Rao*); Hinaidi, IV. V. 22. (*J. E. M. Boyd*).
Recorded from S. Persia, and Mesopotamia.

27. *Pachyscelis hirtella* Sol. (?).

Solier, Ann. Soc. Ent. France, VII, 1836, p. 62.
Mosul Karind (*H. E. Shortt*).
Probably only a race of *P. rotundata*, Kr., with the elytra more elongate than usual, in shape like those of *P. villosa*, Drap. From this latter species it differs in acking the decumbent yellowish pubescence between the granules of the thorax

and elytra. *P. rotundata* is a common species in Syria; *P. hirtella* is recorded from the Orient; specimens in the British Museum from Greece appear to belong to this species.

28. *Pimelia arabica* Klug.

Klug, Symbol. Phyic. II, 1830, No. 18, Pl. 12, fig. 5.
Ramadie, X. 17. (*L. Harrison*).
Recorded only from Arabia.

29. *Pimelia kraatzi* Senac.

Senac, Mon. Gen. Pimelia, II, 1884, p. 17.
Beled, II. 18. (*W. E. Evans*); Shergat, IV. 20. (*Y. R. Rao*); Hinaidi, IV. 22. (*J. E. M. Boyd*).
Known only from Mesopotamia.

30. *Pimelia bajula* Klug.

Klug, Symbol. Physic. II, 1830, No. 8, Pl. XI, fig. 8.
Samara, II. 17. (*L. Harrison*); Kut, IV. 19. (*F. P. Connor*); Karradah, Shergat, IV. 20. Hillah, VI. 20. (*Y. R. Rao*); Baghdad, VII. X. 22. (*J. E. M. Boyd*).
Distributed from Asia Minor, through Syria to Mesopotamia.

31. *Pimelia* (*Gedeon*) *parallela* Sol.

Solier, Ann. Soc. Ent. France, V, 1836, p. 125.
Ruz, N. E. of Baghdad, open ground, XI. 18. (*W. E. Evans*); Beled and Samara, XI. 17. (*L. Harrison*); Kut, (*T. F. Lander*), Umel Hanna, VIII. 16, Falahijeh, VIII. 16. Saniyat, IX. 16. (*C. F. C. Beeson*); Shahreban, R. Diala, VII. 18 (*P. A. Buxton*).
This species shews very great variation in size, one of the specimens from Samara, for example, is only 19 mm. in length, while another from the same place is 30 mm.
It is recorded from Syria, Mesopotamia and Kurdistan.

32. *Blaps tæniolata* Menet.

Menetries, Catal. Raison, 1832, p. 198.
Amara, IX—XI. 16. (*C. F. C. Beeson*); Kut (*T. F. Lander*); Shergat, IV. 20. (*Y. R. Rao*).
This is apparently the commonest species of *Blaps* in Mesopotamia, and is found in nearly all collections.
Its range extends from Greece to Persia.

33. *Blaps judæorum* Mill.

Miller, Wien. Ent. Monatschr. V, 1861, p. 178, Pl. IV, fig. 2.
Beled, XI. 17. (*L. Harrison*).
Recorded only from Syria.

34. *Blaps gigantea* Mots. (?).

Motschulsky, Bull. Mosc. XVIII, 1845, I, p. 65.
1 ♀ Um el Hanna, XI. 16. (*C.F.C. Beeson*).
The single ♀ appears to agree with the characters given for this species originally described from Turcomania.

35. *Heterophylus substriatus* Reitt.

Reitter, Deutsch. Ent. Zeitschr. 1898, p. 348.
Jebel Hamrin, N.E. of Baghdad, XI. 18. under stone (*W.E. Evans*).
Recorded from Asia Minor and Mesopotamia.

36. *Dilamus fausti* Reitt. (?).

Reitter, Deutsch Ent. Zeitschr. 1890, p. 150.
Amara, VIII. 18. at light (*W. E. Evans*).

The specimens answer to the description of *D. fausti*, from Ashabad, except that they are not black but dark reddish piceous. It may be that they represent a distinct species.

37. *Scleron fossulatum* Muls.

Mulsant et Wachenru, Mem. Acad. Lyon, 1852, p. 9.
Baghdad, XII. 18. (*P.Harwood*); Amara, I. 19. (*P. Harwood*); II. 18. under clods (*W.E. Evans*); Hinaidi, in grass, IV. 22. (*J.E.M. Boyd.*)
Its recorded distribution extends from Asia Minor through Syria, Mesopotamia, Persia, Afghanistan and Transcaspia.

38. *Scleron evansi* Blair.

Blair, Ent. Mo. Mag. 1923, p. 122.
Kisil Robat, N.E. of Baghdad, XII. 18. under clods (*W.E. Evans*).
Further specimens in the British Museum are from Arabia, Mesopotamia and Persia.
Allied to *S. multistriatum* Forsk. but more elongate, with the elytral ntervals more regularly uniseriately granulate.

39. *Cnemeplatia atropos* Costa.

Costa, Ann. Aspir. Nat. (2) I, 1847, p. 146.
Amara, VI. 18. at light (*W.E. Evans*).
Does not appear to have been recorded from eastward of the Mediterranean, though the British Museum possesses specimens from Arabia, Hedjaz (*Millingen*) and Mesopotamia.

40. *Scleropatrum hirtulum* Baudi.

Baudi, Ann. Mus. Genova, VII. 1875. p. 703.
Amara, VIII. 18. at light (*W.E. Evans*); Babylon (*P. Harwood*).
It is recorded from Russian Armenia, Transcaspia and Mesopotamia.

41. *Gonocephalum setulosum* Fald.

Faldermann, Fauna Transcauc. II, 1837, p. 60.
Amara, II. 18. under clods (*W.E. Evans*); I. 19.(*P. Harwood*); Baghdad, XII 18. (*Harwood*).
Occurs from the Mediterranean basin to Transcaspia.

42. *Gonocephalum rusticum* Oliv.

Olivier, Encycl. Method. VIII, 1811, p. 498.
Amara, II. 18. under clods (*W.E. Evans*); III. 17. (*C.F.C. Beeson*); Tanooma, Basra (*P. Harwood*).
Found throughout the Mediterranean basin and eastwards to Persia and Mongolia.

43. *Gonocephalum mesopotamicum* Blair.

Blair, Ent. Mo. Mag. 1923, p. 123.
Amara, II. 18. under clods by Tigris (*W.E. Evans*).
Allied to *G. tuberculatum* Hope (*elongatum* Guer.) but with the thorax less narrowed behind, the disc more evenly granulate and lacking the irregularities of surface.
N.B.—*G. tuberculatum* Hope, Zool. Miscell. I, 1831, p. 31, is omitted from Gebien's Catalogue.

44. *Gonocephalum consobrinum* Blair.

Blair, Ent. Mo. Mag. 1923, p. 122.
Amara, under clods in garden, II. 18. (*W.E. Evans*).
Probably allied to *G. dorsogranosum* Fairm., though of different aspect; recognised by its broadly parallel form, widely explanate sides of the prothorax, and its regular sculpture.

Further specimens in the British Museum are from Aden, Persia, Baluchistan and Karachi.

45. *Opatroides punctulatus* Brull.

Brullé, Exped. Morée, III, 1832, p. 220, Pl. 40, fig. 9.
Amara, II. 18. under clods (*W.E. Evans*); IV. 17. (*C.F.C. Beeson*); Baghdad, XII. 18. (*P. Harwood*); Hinaidi, IV. 22. (*J.E.M. Boyd*).
Widely distributed in the Mediterranean region and Western Asia.

46. *Lobothorax oblongopunctatus* Reitt.

Reitter, Bestim. Tab. 53, 1904, p. 164.
Jebel Hamrin, N.E. of Baghdad, XII. 18. under stones (*W.E. Evans*)
Described from Transcaspia and Arabia.

47. *Clitobius oblongiusculus* Fairm.

Fairmaire, Pet. Nouv. Ent. I, 1875, p. 495.
Amara, VII. 18. under clods and at light (*W.E. Evans*); I. 19. (*P. Harwood.*)
Recorded from Algeria, Egypt, Arabia, etc.

48. *Latheticus oryzæ* Waterh.

C.O. Waterhouse, Ann. Mag. Nat. Hist. (5) V, 1880, p. 148.
Amara, VII. 18. at light (*W.E. Evans*).
A warehouse and granary pest of almost cosmopolitan distribution.

49. *Tribolium castaneum* Herbst.

Herbst, Käfer, VII, 1797, p. 282, Pl. 112, fig. 13.
Amara, IV. 18. at light (*W.E. Evans.*); Baghdad, XII. 18. (*P. Harwood*).
More generally, but incorrectly, known in collections as *T. ferrugineum*, Fabr. It is, like the last, a cosmopolitan warehouse pest, but very much more abundant.

50. *Palorus ratzeburgi* Wissm.

Wissmann, Stett. Ent. Zeitschr. IX, 1848, p. 77.
Basra, I. 19. (*P. Harwood*).
Another warehouse insect.

51. *Pseudostene subclavata* Woll.

Wollaston, Ann. Mag. Nat. Hist. (3), VII, 1861, p. 250.
Amara, II. 18. under clods, and VII. 18. at light (*W.E. Evans.*)
The specimens before me appear, *ex descr.*, to be assignable to this Egyptian species.

52. *Alphitobius diaperinus* Pz.

Panzer, Faun. Germ. 1797, 37, p. 16.
Amara, VIII. 18. at light (*W.E. Evans*).
This and the following are again common storehouse pests of cosmopolitan distribution.

53. *Alphitobius lævigatus* F.

Fabricius, Species Ins. I, 1781, p. 90.
Amara, II. 18. in horse litter, and V. 18. in drain (*W.E. Evans*).
More generally known by its synonym *A. piceus*, Oliv. (1792).

54. *Cossyphus tauricus* Stev.

Steven, Mus. Mosq. II, 1829, p. 73.
Amara, I. 18. (*P. Harwood*); II. 18. under clods (*W. E. Evans*); VI,. 18. (*P. A. Buxton*); Karradah, at light, VI. 20. (*Y R. Rao*); Hinaidi, at light, V. 22. (*J. E. M. Boyd*).
Its recorded range extends from Italy and Sicily on the west to Turkestan *via* S. Russia, and *via* Asia Minor to Mesopotamia and Persia.

55. *Tenebrio obscurus* F.

Fabricius, Ent. Syst. I. 1, 1792, p. 111.
Amara, V. 18. at light (*W. E. Evans*).
A cosmopolitan species.

56. *Calcar heydeni* Zouf.

Zoufal, Wien. Ent. Zeit. XII, 1893, p. 116, Pl. II, fig. 3.
Amara, VII. 18. at light (*W. E. Evans*); VIII. IX. 16. (*F. P. Connor*); Karradah V. 20. at light (*Y. R. Rao*).
Recorded only from Baghdad.

57. *Calcar bagdadensis* Reitt.

Reitter, Best. Tab. 87, 1920, p. 9.
Amara. II. 18, under clods (*W. E. Evans*).
Recorded only from Baghdad.

Fam.—CISTELIDÆ.

58. *Cteniopus pallidus* Küst.

Küster, Käfer Europ, XX, 1850, No. 82.
Hinaidi, on hollyhock, V. 20. (*J. E. M. Boyd*).
Originally described from Mesopotamia; the British Museum also possesses specimens from Arabia, Persia and Kurdistan.

Fam.—HYLOPHILIDÆ.

59. *Hylophilus pruinosus* Kies.

Kiesenwetter, Berlin Ent. Zeit. V, 1961, p. 241.
Tanooma, Basra (*P. Harwood*).

60. *Hylophilus populneus* Creutz.

Creutzer in Panzer's Fauna Germ. 1796, p. 35.
Tanooma, Basra (*P. Harwood*); Amara, at light, VIII. 18. (*W. E. Evans*).
These are both palaearctic species of very wide distribution.

Fam.—ANTHICIDÆ.

61. *Mecynotarsus bicinctulus* Mars.

Marseul, Monogr. in Abeille, XVII, 1879, p. 42.
Amara (*P. Harwood*).
Known only from Mesopotamia.

62. *Formicomus cæruleipennis* Laf.

Lafertè, in Lucas, Exped. Scient. Algèrie, II, 1847, p. 369.
Amara (*P. Harwood*).
These specimens have the apical half of the femora infuscate as in examples from Algeria. The usual form from Syria and Mesopotamia has the femora entirely red and belongs to the var. *cyanopterus*, Laf.

63. *Fornicomus nemrod* Laf.

Lafertè, Monogr. Anthic. 1848, p. 79.
Amara, at light, VIII. 18. (*W. E. Evans*).
Known only from Mesopotamia and Persia.

64. *Formicomus sp. n.* ?

Aff. *pedestris* Rossi, var. *atratulus*, Reitt.
Reitter, Deutsche Ent. Zeitschr. 1889, p. 33.
Kizil Robat, N. E. of Baghdad, under clod, XII. 18. (*W. E. Evans*).
More finely punctate than *F. pedestris*, elytra more elongate oval with humeri less marked; tooth on anterior femora of ♂ more developed but less so than that of *F. præses* Laf. which it also resembles.

65. *Formicomus hauseri* Pic.

Pic, Misc. Ent. V. 1897, p. 62.
Amara, at light, VIII. 18. (*W. E. Evans*).
Hitherto apparently known only from Turkestan and the Caucasus.

66. *Formicomus ninus* Laf.

Laferté, Monogr. Anthic. 1848, p. 79.
Amara (*P. Harwood*); on flowers of *Lepidium draba*, III. 18. (*W. E. Evans*).
Recorded from Syria, Mesopotamia, N. Arabia and the Caucasus.

67. *Tomoderus harwoodi* Blair.

Blair, Ent. Mo. Mag. 1923, p. 124.
Tanooma, Basra (*P. Harwood*); Amara, at light, V. 18. (*W. E. Evans*).
Resembles *T. compressicollis* from the western Mediterranean but smaller, paler, and more slender.

68. *Anthicus* (*Stenidius*) *tenuipes* Laf.

Laferté, Mon. Anthic. 1848, p. 194.
Baghdad and Mackinn (*P. Harwood*).
An eastern Mediterranean species recorded also from Arabia.

69. *Anthicus debilis* Laf.

Laferté, Mon. Anthic. 1848, p. 129.
Hasharra near Amara, at light (*W. E. Evans*).
Recorded from Sicily and N. Africa; the British Museum possesses specimens from Arabia and Mesopotamia.

70. *Anthicus phoxus* Mars.

Marseul, Monogr. in Abeille, XVII, 1879, p. 87.
Baghdad, (*P. Harwood*).
Though described as a distinct species, *A. phoxus* is placed by Pic in Junk's Catal. Coleopt. pars. 36, 1911, as a variety of the last.

71. *Anthicus motschulskyi* Pic.

Pic, Ann. Soc. Ent. France, 1893, (1894), Bull. p. CCLXXVII.
Amara (*P. Harwood*).
Described from Egypt as a variety of *Anthicus humilis*, Germ., this form has recently been recognised by Von Krekish-Strassoldo as a distinct species (Koleopt. Rundsch. VIII, 1919, pp. 60-76). The single example before me is entirely dark piceous, and agrees fairly well with specimens so determined by Von Krekich-Strassoldo, but has the head and thorax less densely and less strongly punctured.

72. *Anthicus fatuus* Truqui.

Turqui, Anthicid. 1855, p. 14, fig. 4, 4*a*.
Baghdad (*P. Harwood*); Amara, on poplar by Tigris, IX. 18. (*W. E. Evans*).
This Syrian species is identified from figure and description.

73. *Anthicus bremei* Laf.

Laferté, Ann. Soc. Ent. France, 1842, p. 252, Pl. X, fig. 3.
Baghdad (*P. Harwood*).
A Mediterranean species.

74. *Anthicus rhagis* Mars.

Marseul, Mon. Anthic. in Abeille, XVII, 1879, p. 98.
Amara (*P. Harwood*); under clods and old sacks, II. 18. (*W. E. Evans*).
Known only from Mesopotamia.

75. *Anthicus floralis* Linn.

Linnaeus, Syst. Nat. X, 1758, p. 420.

Amara, at light, VIII. 18. (*W. E. Evans*).
A species practically cosmopolitan in distribution.

76. *Anthicus quisquilius* Thoms.

Thomson, Skand. Col. VI, 1864, p. 360.
Baghdad (*P. Harwood*) : Amara, at light, V. VIII. 18. (*W. E. Evans*).
By some authors considered a variety of the last, this species is like it, cosmopolitan in distribution.

77. *Anthicus gœbeli* Laf.

Laferté, Mon. Anthic. 1848, p. 190.
Baghdad (*P. Harwood*) ; Amara, at light, V. 18. (*W. E. Evans*).
Considered by von Krekich-Strassoldo to be a desert form of *A. transversalis*, Villa.

78. *Anthicus tobias* Mars.

Marseul, Mon. Anthic. in Abeille, XVII, 1879, p. 125.
Amara, under old sacks on ground, II. 18. and at light, V. 18. (*W. E. Evans*).
Recorded from Mesopotamia and Arabia, and, as *A. postoculatus*, Fairm. from India.

79. *Anthicus hispidus* Rossi.

Rossi, Mant. I, 1792, p. 46.
Basra (*P. Harwood*).
A Mediterranean species of wide distribution.

80. *Anthicus antherinus* Linn.

Linnaeus, Faun. Svec. (ed. II.), 1761, p. 829.
Amara (*P. Harwood*).
Widely distributed in the Palaearctic region.

81. *Anthicus thyreocephalus* Solsky.

Solsky, Horæ Ent. Soc. Ross. IV. 1866, p. 93.
Baghdad, (*P. Harwood*).
Recorded from Armenia and S. Russia ; the present example agrees with a specimen from Mesopotamia so determined by von Krekich-Strassoldo.

82. *Anthicus niger* Ol.

Olivier, Encycl. method. VIII, 1811, p. 397.
Ruz, flood refuse, XI. 18. (*W. E. Evans*).
Distributed over S. Europe and Syria.

83. *Anthicus crinitus* Laf.

Laferté, Mon. Anthic. 1848, pp. 204, 303.
Amara and Baghdad (*P. Harwood*) ; Amara, at light, V & VIII. 18. (*W. E. Evans*).
Occurs in the Canary Islands, throughout Africa and eastwards to Siam.

84. *Anthicus tristis* Schmidt var. *Truquii* Desbr.

Desbrochers, Opusc. Ent. I. 1875, p. 44.
Amara and Baghdad (*P. Harwood*).
This variety of a common European species was described from Syria. In the British Museum are specimens also from Egypt and Persia.

85. *Endomia tenuicollis* Rossi.

Rossi, Fauna Etrusc. I, 1790, p. 47.
Amara (*P. Harwood*) ; Ruz, N. E. of Baghdad, in flood refuse, XI. 18. (*W. E. Evans*).
A Mediterranean species.

86. *Endomia bivittata*. Truqui.

Truqui, Anthicini, 1855, p. 33, fig. 6.
Makinn, I. 19. (*P. Harwood*); Amara, at light, VIII. 18. (*W. E. Evans*).
Recorded from Syria, Egypt, and Arabia.

Fam.—PEDILIDÆ.

87. *Steropes caspius* Stev.

Steven, Mem. Mosc. I. 1806, p. 166, Pl. X, fig. 9-10.
Amara, at light, VIII. 18. (*W. E. Evans*).
Recorded from S. E. Europe and Turkestan.

Fam.—MORDELLIDÆ.

88. *Mordellistena episternalis* Muls.

Mulsant, Ann. Soc. Linn. Lyon, (2) III, 1856, p. 371.
Amara, on *Lepidium draba*, IV. 18. (*W. E. Evans*).
Occurs from Central and Southern Europe to Turkestan and Persia.

89. *Anaspella clavifer* Mars. (?).

Marseul, L'Abeille, XIV, 1876, p. 25 (*Anaspis*).
A. clavicornis, Schilsky, Küster's Kaf. Europ. XXXI, 1895, 59.
Amara, at light, VIII. 18; and on *Suaeda* (?), desert ground, IX. 18. (*W. E. Evans*).
One dark specimen agrees well with Schilsky's description, from Morocco: four others which do not appear to differ from it except in colour are uniformly flavous. If Schilsky is right in considering *A. clavicornis* only a colour variety of Marseul's species from Egypt, this forms an interesting extension of its known distribution.

90. *Pentaria mesopotamica* Blair.

Blair, Ent. Mo. Mag. 1923, p. 126.
Amara, on flowers of Acacia, VI. 18. and at light (*W. E. Evans*).
Differs from the S. European *P. defarguesi* Ab. in the much shorter antennæ and in colour pattern, the apex of the elytra being pale in the new species but not in *P. defarguesi*

Fam.—MELOIDÆ.

91. *Cerocoma scovitzi* Fald.

Faldermann, Fauna Transcauc. II, 1837, p. 117, Pl. III, fig. 3.
Deltowah, near Baghdad, VI. 20. (*Y. R. Rao*).
Recorded from Transcaucasia, Persia, Asia Minor, Syria, Egypt.

92. var. *rufiventris* Reitt.

Reitter, Deutsch. Ent. Zeits. 1890. p. 179.
Karradah, near Baghdad, V. 20. (*Y. R. Rao*).
R. Dyala, VII. 18. (*H. D. Peile*).

93. *Cerocoma muhlfeldi* Gyll.

Gyllenhall, in Schönherr's Syn. Ins. III, App. 1817, p. 13.
Deltawah (*Y. R. Rao*).
Widely distributed from S. E. Europe to Persia.

94. *Cerocoma bodemeyeri* Reitt.

Reitter, Wien. Ent. Zeit. XXVIII, 1909, p. 103.
Shergat, near Baghdad (*Y. R. Rao*); Hinaidi, on grass, IV. 22. (*J. E. M. Boyd*).
Described from Persia.

95. *Mylabris fusca* Oliv.

Olivier, Encycl. Method. VIII, 1811, p. 100.
Shergat, IV. 20. (*Y. R. Rao*); Hinaidi, IV. 22. (*J. E. M. Boyd*).

A rather variable series, the external subbasal spot seldom connected with the humerus, the median pair of spots frequently absent and the subapical spot usually reduced, thus approaching var. *deleta* in which the elytra are devoid of black markings.

96. *Mylabris bipunctata* Oliv.

Olivier, Encycl. Method. VIII, 1811, p. 94.

On desert land above Amara, on acacia, V. 18. (*W. E. Evans*); Kisil Robat, V. 19. (*H. D. Peile*); Karadah, near Baghdad, V. 20. (*Y. R. Rao*); Dauran, R. Tigris, V. VI 20. (*A. D. Fraser*); Baquabah, R. Diyala, VII. 18. (*H. D. Peile*).

Described from Arabia it appears to be the commonest species of *Mylabris* in Mesopotamia, and subject to comparatively little variation.

97. *Mylabris tricingulata* Redt.

Redtenbacher, Denkschr. Wien. Acad. I, 1850, p. 49.

Mosul-Karind (*H. E. Shortt*).

Apparently recorded only from Persia.

98. *Mylabris sanguinosa* Mars.

Marseul, Abeille, VIII, 1872, p. 417.

Karada, Baghdad, V. 20. (*Y. R. Rao*).

Described from Persia, the British Museum possesses specimens from Kurdistan.

99. *Mylabris maculata* Oliv.

Olivier, Entom. III, 1795, No. 47, p. 7, Pl. I, fig. 9.

Mosul-Karind (*H. E. Shortt*); Karradah, V. 20. (*Y. R. Rao*).

A variable series including forms with the two anterior spots on the elytra conjoined, and an apparently unnamed form in which the median and subapical bands are very wide and almost completely confluent leaving only an inclosed spot near the suture and a small apical patch red (var. near *bijuncta*, Pic).

100. *Mylabris onerata* Escher. (?).

Escherich, Wien. Ent. Zeit. XVIII, 1899, p. 109, Pl. 2, fig. 20.

Shergat, IV. 20. (*Y. R. Rao*); Hinaidi, IV. 22. (*J. E. M. Boyd.*)

The identification is not quite certain. The specimen agrees well enough with the fig., described as a variety of *M. ledereri*, but the insect is allied not to *ledereri* but to *4-punctata*, L. from which it differs in its closer puncturation giving the elytra a more opaque appearance, and in the median fascia being composed not of two spots, but of a single irregularly shaped transverse spot which attains neither margin. Specimens in the British Museum are from Syria, (Jericho and Jerusalem) and Persia. The antennnal structure at once separates it from *ledereri*.

101. *Lydus halbhuberi* Escher.

Escherich Deutsche Ent. Zeits. 1896, p. 210.

Deltawah, VI. 20. (*Y. R. Rao*).

Known from Armenia, Caucasus, Persia, etc.

102. *Lydus syriacus* Linn.

Linnaeus, Mus. Lud. Ulr. 1764, p. 102.

Shergat, IV. 20. (*Y. R. Rao*); Hinaidi, IV. 22. (*J. E. M. Boyd*).

Occurs in S. E. Europe, Syria, Egypt, Persia.

103. *Epicauta textilis* Haag.

Haag-Ruthenberg, Deutsch. Ent. Zeits. XXIV, 1880, p. 82.

Mosul-Karind (*H. E. Shortt*); Amara, on *Suæda*, sp., V. 18. (*W. E. Evans*); Karradah, eating Bringal leaves, VII. 20. at light (*Y. R. Rao*); Hinaidi, IV. 22. (*J. E. M. Boyd*).

Apparently known only from Mesopotamia and Persia.

104. *Melœ cavensis* Pet.

Petagna, Atti. Accad. Napol. I, 1819, p. 40, Pl. 4, fig. 4.
Baghdad (*P. Harwood*).
Widely distributed in S. Europe and N. Africa.

105. *Melœ chrysocomus* Mill.

Miller, Wien, Ent. Monatschr. V, 1861, p. 206.
Kisil Robat, under stones and sacking, XII. 18. (*W. E. Evans*).
More finally and closely punctate and pubescent than typical Syrian specimens but scarcely separable specifically.

106. *Melœ murinus* Brandt & Er.

Brandt and Erichson, Monogr. Gen. Meloes; Nova Acta Ac. Cur. Leop. XVI, 1, 1832, p. 127, Pl. 8, fig. 4.
Jabel Hamrin, N. E. of Baghdad, under stones and empty tins on sandy ground, XII. 18; Harunabad, N. W. Persia, I. 19. (*W. E. Evans*).
Widely distributed in the Mediterranean region.

Fam.—ŒDEMERIDÆ.

107. *Ananconia* (?) *mesopotamica* Reitt.

Reitter, Wien. Ent. Zeit. XXVII, 1908, p. 246.
Kut, IV. 19. (*F. P. Connor*); Shergat, IV. 20. (*Y. R. Rao*).
Described as *Ananconia mesopotomica*, it differs from typical members of that genus in the form of the thorax and in the down-turned apex of the 5th ventral segment. From *Zubkovia turcomanica*, Sem. it differs in its larger size and distinctly transverse labrum.

108. *Ananconia comata* Blair.

Blair, Ent. Mo. Mag. 1923, p. 125.
Amara, at light, VIII. 18. (*W. E. Evans*).
Differs from *A. spurcaticollis*, Fairm. in its smaller size, paler colour with less pronounced markings, and in the narrower, less depressed, and much more closely punctate thorax. The ♂ unfortunately remains unknown.

109. *Isoloxantha fuscipennis* Blair.

Blair, Ent. Mo. Mag. 1923, p. 124.
Amara, VI. 18. (*W. E. Evans*).
Also from Mesopotamia and Persia in the British Museum.
It is with some doubt that the species is assigned to this genus of which the only described representative, *I. handlirschi* Seidl., is unknown to me. From *Ananconia* it differs in the prothorax being without impressions, and in the small size of the penultimate joint of all the tarsi.

NOTES ON SMALL GAME SHOOTING IN THE KHASI HILLS.

BY

EDWARD MCCULLOCH.

WOOD COCK.

Wood cock are fairly plentiful all over the Khasi Hills, except towards the north, where the climate is hot and moist and akin to the plains. As a rule they are to be met in suitable localities from the early part of November to the end of March, though some are occasionally found up to the middle of April. In years when the cold weather sets in earlier than usual some arrive as early as the middle of October but these are only the early comers and it is not till the end of that month that they come in, in anything like considerable numbers.

Dogs are a necessity for cock shooting in these hills as, without them, certainly not more than one bird in every four would be flushed, since they frequent well timbered nullas and ravines with dense undergrowths of shrubs, small trees and ferns, where human beaters are of very little use. Two to three birds to a gun in a day, is an average bag, while anything above three should be considered a very good bag. In the season they will generally be found in most forests with a fair amount of undergrowth and a marshy bottom, or where a small stream meanders through. Sometimes however they have a curious habit of leaving the jungle in the day time and sunning themselves in quite open places, especially on the sunny slopes of some adjacent hill-side. Accordingly if no bird is discovered in beating through a likely piece of cover, the search should not be given up, but all the adjacent open hill sides should be carefully gone through, as it is ten to one that the bird would be found in some little hollow, or on the leeward side of a small patch of dry fern or bushes, close by, sleeping in the warm sunshine. When discovered in such situations they will not rise till almost trodden on and then offer very easy shots as they lazily flap away to the nearest bit of cover.

The best time for shooting them is in the early morning as the birds will then generally be found close to their feeding grounds and can easily be flushed with a good dog or two. If with beaters the bird will sometimes run well ahead and rise far out of shot. In such cases it will be next to impossible to find the bird again the same day, unless it had been luckily marked down when settling. Even then the bird might not be flushed again as they have a habit of running a considerable distance from the place they alight and then hiding in the thickest patch of cover they come across. When this happens all the thickets near the place where the bird was seen to settle should be thoroughly and carefully beaten and trampled down, as when hiding in this manner they will lie very close and not rise till the cover in which they are, is actually trampled on by the beaters.

In localities where the birds are frequently disturbed they will often leave their feeding grounds at day-break and lay up in the thickest cover they can find, sometimes travelling as far as a quarter of a mile or more for the purpose. It is then very little use looking for them in the ordinary manner for they would have become so cunning that they will quietly flit away to another patch of cover, denser if possible, as soon as they get any scent of men or dogs being in the neighbourhood. In such cases they may occasionally be brought to bag by hiding in the evenings near some place where they are known to feed and waiting for them when they come out. It is however by no means easy shooting as they rarely if ever visit their feeding grounds before dusk and the shooting then, is of a necessity, of a very sketchy nature. A quick snap-shot as they flit by, being all the chance one is likely to get, and do what one may, the number of misses made on such occasions would always be far greater than one would care to remember.

In December 1922, I wasted several days of my leave in trying conclusions with a brace of cocks, which used to lurk all day in an extensive fern brake about a mile from the Shillong Peak. At first I tried to catch them near their feeding ground (a patch of open wet land some 300 yards square) by early morning visits, but though I used to arrive on the scene of operations as early as 7 o'clock and sometimes even earlier, it was no go, as they had always left. Failing this, I tried all the usual dodges with dogs and beaters to drive them out of their stronghold but again without success. They were there right enough, and were frequently put up in the centre of the covert by the beaters, but they only rose a few feet and again resettled in the thickest part of the cover where past experience had shown them that it was impossible for either men or dogs to reach them owing to the impassable nature of the ground and the dense mass of thorny creepers. After wasting a lot of time and temper in this manner, I decided as a last resource to wait for them in the evening near their feeding ground in the hope of their coming out early enough to give me a shot. I did this for several evenings, each evening hiding myself under, what I considered the most promising patch of cover, before sundown, and waiting for them to come out. Every evening I used to get a glimpse or two of one or both of them, but they seemed to know where I was hiding and always flew out, from some other point as far away as possible. At last, getting desperate, I tried several long shots at them but without any result. This was the invariable result every evening till I was obliged to give up the contest, as my leave was coming to a close, and leave them in peace.

In the season, wood cock will be found in suitable localities in almost all the jungles within a radius of 10 miles from Shillong, though they are more numerous towards Upper Shillong and the jungles lying on both sides of the Cherra Road. They are also met with in compounds of bungalows which have been neglected and overrun with jungle, and which contain drains and water-courses suitable for their feeding grounds. The Sacred grove or Lyngdoh forest of Mawphlang, which is about a mile from the Mawphlang Dak bungalow (15 miles from Shillong) is also a favourite haunt, and sometimes as many as four or five of them may be put up in different parts of the forest in the course of the day. Mawphlang is easily reached from Shillong, as there is a good metalled road to it, suitable for motoring.

Mairang, or Pyndengumiong, about 30 miles from Shillong and 15 from Mawphlang, is one of the best, if not the best place for cock shooting in these hills, as almost all the patches of jungle in the neighbourhood are well suited for them and will be found to hold one or more birds in each, in the season. Moreover, owing to there being no road for wheeled conveyances the place is seldom visited by sportsmen and any one, taking the trouble of paying it a visit in the months of January and February, is sure of making a very fair bag.

Some birds may also be picked up near Cherrapunji (33 miles from Shillong) and Sohrarim (28 miles) and a few may also be shot in the early part of the season near the Dak bungalow at Dumpep, some 16 miles from Shillong. Laitlyngkot, about 17 miles from Shillong, is another place where I have frequently bagged a fair number in February and March, in the small ravines and nullas, near the village and the Inspection Bungalow. All the above places can be visited from Shillong by motor as they have got well metalled roads leading to them.

A D-B. 12 bore gun is I consider the best for this sport. Smaller bores should be eschewed, as owing to almost all the shooting being done in well timbered localities, where one has to depend on a quick snap shot amongst the trees taken just as one gets a glimpse of the bird, the broader shot pattern of the 12 bore is much more likely to be effective than the closer patterns of the smaller bores. As the shooting is mostly done at close range, and the birds are not hard to kill, No. 8 shot would be found quite suitable, though a few No. 6 cartridges might be taken with advantage for birds rising well away.

Snipe.

Considerable numbers of snipe, both Pintail and Fantail visit the Khasi Hills every season. A few of the early comers may be met with as early as the last part of July or the beginning of August, but the great majority only arrive in the last part of October and the beginning of November. They stay in these hills during the whole of winter and spring and leave by about the end of April, though a few stragglers may be found well into May.

At the commencement of the season considerable difficulty may be experienced in coming across the birds as they are then very arbitrary in their choice of ground and keep together in small parties. Marshy ground covered with grass and weeds, abandoned paddy fields similarly overgrown with grass, etc. are what they generally affect at this period. Sometimes they may also be discovered in standing paddy. At this time several would as a rule be found close together and sometimes as many as a dozen may be flushed from a small patch of cover, while ground similar in ever respect, a short distance off, will be found not to hold a single bird. At this time they will rise singly and not in wisps (as they do later in the season) however close together they may be put up.

Three beaters or more, if available, are desirable if shooting alone as the birds will be found to lie very close and not rise till almost trodden upon. I remember in 1915 while shooting near the village of Mylliemc, some 9 miles from the Shillong Station, a snipe being caught by hand by one of the beaters while apparently asleep in the afternoon sun.

If there are only one or two beaters to be had, the same ground will have to be gone over more than once, otherwise some of the birds would be missed. If there are however two or more guns present on the ground an average of two beaters per gun would be found sufficient. Dogs may also be employed but I don't think they are to be recommended in preference to beaters.

Later on in the season, *i. e.* after the middle of December the birds will be more scattered and will as a rule be found in pairs, though sometimes four or even six may be put up close together from some favourite piece of cover or while feeding in the early morning. They now affect more open cover, feeding in the paddy fields in the night and early morning and lying up during the day in some of the fields where the stubble has been left fairly tall or in any marshy ground close by. Almost a sure find for them at this juncture would be a piece of marshy cover, not too heavy, lying close to a paddy field or fields and with either a moist but not too wet a bottom or with a small drain in the middle. Here generally a couple or two would be flushed (the number of birds depending on the size of the cover) any time after the sun is well up. Another favourite type of cover is a piece of ground lying fallow in the midst of a stretch of paddy fields. If this is not too wet almost all the birds in the locality may be found in it (if of any size) of a warm afternoon. In cold and wet weather, the birds are very restless and keep moving about most of the time. Keeping as they now do to more open cover the birds could be put up more easily and a couple of beaters would be found sufficient even when shooting alone. (Boys are always better as beaters than men as they take an interest in the sport itself, apart from the question of "*Bakshish*").

With the advance of the season the shooting improves and the best shooting is obtained in February and March, when the biggest bags are made. In some localities however, where the birds have been constantly harried, they become so wild that it is hardly possible to obtain a shot at them. Sometimes under similar circumstances they only visit their feeding grounds at dusk and leave at dawn spending the whole day on the adjacent hill sides amongst tall grass and ferns and similar unlikely places hundreds of yards away from their nearest feeding ground.

By the middle of April the birds assemble in considerable numbers preparatory to leaving for their breeding grounds and when flushed rise in wisps. At this time they are generally very wild and will fly far when flushed even though they have not been fired at previously.

Four to five couples may be considered a good bag for the earlier part of the season, while with the advance of the season and the consequent improvement in the shooting, bags of 7 to 12 couple would be the order of the day from February onwards.

The largest bag, to my knowledge, was made by three guns at the Langsken valley, some 14 miles from Shillong, in the last part of March and numbered 37 birds.

The number of birds that visit these hills being quite small in comparison with those that visit the plains annually, heavy bags are not possible but the shooting is much more enjoyable, carried on as it is amongst fine scenery and picturesque surroundings. Moreover the sportsman is spared the heat and discomforts which are more or less attendant while shooting in the plains even in the cold weather. In the earlier part of the season the paddy fields within a radius of 3 or 4 miles of Shillong, will be found to hold some birds but as the grounds are constantly visited by sportsmen it is impossible to make anything like a bag though a few birds may be picked up of a morning.

Mawphlang (15 miles from Shillong) is a good centre for operations as there are extensive snipe grounds within easy reach. The Valley of Langsken about 2 miles to the west and that of Madan Lang Kien about the same distance to the South-West are two of the best snipe grounds in the District and will be found to hold a certain number of birds right through the season though the best time to shoot over them is from February to the beginning of April. There is also a stretch of marshy land near Mawphlang itself which will be found to hold a fair number of birds early in the season. Later on however it dries up and the birds leave. There is a comfortable Dak bungalow at Mawphlang and the road from Shillong is well kept up and suitable for motoring.

From Mawphlang a trip may also be made to Mairang or Pyndemumyong 15 miles away (30 miles from Shillong) where there is an inspection bungalow of sorts. The road to Mairang not being suitable for wheeled traffic, it is seldom visited by sportsmen, and any one taking the trouble of visiting it in the latter part of the season, is sure of some very good shooting in the marshy grounds and paddy fields which abound in the neighbourhood. About the middle of the season the paddy fields on both sides of the Cherra-Shillong road between miles 8 and 10 will generally be found to hold a considerable number of birds, but their number is extremely variable. In some seasons quite a large number of birds being met with while in some years only a few would be found.

In November and December the marshes and paddy fields, lying to the east of the Shillong Peak and extending to the village of Smit (about 9 miles from Shillong), generally contain a fair number of birds, but later on few will be met with as the ground is much shot over.

In the latter part of the season and especially in January and February some good shooting may be obtained in the extensive swamps situated near Cherrapunji (33 miles from Shillong) and also near the village of Sohrarim (28 miles). Both of these places can be easily reached by motor as already mentioned in my note about Woodcock.

During many years snipe shooting in these hills I always used a D.-B. 12 bore gun and though some sportsmen are inclined to favour smaller bores, I personally consider the 12 bore to be the best for this sport. As most of the shooting is done at fair sporting ranges, cartridges loaded with No. 8 or 9 shots will be found the most suitable. A few No. 6 or 7 cartridges should be taken for wild and far rising birds.

Jack Snipe.

These little snipe are exceedingly rare in the Khasi Hills, only a stray one or two visiting it in some seasons. During my experience of many years shooting in these hills I came across only two of them and they were shot in different years as noted below :—

The first was shot one dull misty morning late in November 1915, on a small abandoned paddy field covered with grass and weeds situated some two miles east of the Shillong Peak. It lay very close and though I had already fired a couple of shots at snipe in the immediate vicinity, only rose, when almost trodden upon by one of the beaters and was easily knocked over at the first shot.

The second bird was put up near Mawphlang one evening in the early part of December 1922. It was first discovered on a small patch of moist ground in the middle of a strip of marshy land which had more or less dried up. When first put up it flew straight off to a distance of some 50 yards or so and dropped like a stone on a small patch of grass near some Paddy fields. From here it refused to be dislodged at first and it was only when the grass was systematically trodden down that it rose from a small depression in the ground, where it had been hiding and was brought down quite easily.

In both cases the flight of the birds were quite weak and slow compared with that of snipe and was without any of the turnings and twistings so much indulged in by the latter.

REVIEWS.

I. The Birds of Sind. By Claude B. Ticehurst, M.D., M.A., M.B.O.U., late Capt., R.A.M.C. *Ibis*, Vols. IV-VI. 1922—1924.

In spite of their Military duties during the late War many ornithologists on the different fronts found time to make observations and collect birds. The results in many cases have been published in a number of papers among which may be mentioned Captain I. N. Kennedy's "Birds in the Ancre Valley during the Winter of 191[illegible]7", Major A. G. Sladen's "Notes on Birds observed in Palestine", Mr. I. N. Chasen's "Field Notes on the Birds of Macedonia", Col. Meinertzhazen's "Notes on the Birds of Southern Palestine" and Dr. C. B. Ticehurst and Capt. R. E. Cheesman's papers on the "Birds of Mesopotamia" which appeared in the Society's Journal.

From the ornithological point of view it was most fortunate that Dr. C. B. Ticehurst after receiving a commission as Captain in the R.A.M.C. was drafted to India and on arrival at Bombay was posted to Karachi at which station he remained from 19th October 1917 to 14th January 1920.

Without in any way interfering with his military duties Dr. Ticehurst found time to investigate the bird life of Sind, one of the most interesting provinces in India. He seized every opportunity to study and collect birds round Karachi and whenever possible made trips at all times of the year to places further afield, so that by the time he left Karachi for England he was amply fitted to write on the birds of the province.

Among some of the earlier observers, who collected in Sind is Dr. William Griffiths, a Surgeon in the H.E.I.C., and probably one of the most original botanists India has known. When attached to the Southern Army in the first Afghan War he made a collection at Shikapore where he was halted for about a month. Later in 1884 Dr. J. H. Gould, also a surgeon in the H.E.I.C., and son of the famous ornithologist John Gould, collected birds near Karachi. Unfortunately Dr. Gould's scheme, for making an ornithological reconnaissance in Sind never materialized otherwise the birds of that part might have been better known at an earlier date.

It is however to A. D. Hume—the Indian Civilian—probably better known to readers of the Journal as the principal Author of the Game Birds of India than as an administrator, that we owe most of our knowledge of the Avifauna of Sind.

In 1872 Hume accompanied by Dr. Francis Day, the Icthyoiogist—then Inspector General of Fisheries—and a number of hunters and skinners embarked on two large flat bottomed boats at Jhelum, on which they floated down the Indus to Hyderabad. During the trip Hume and Day together with their collectors went daily in pursuit of birds on either side of the Indus and from time to time made more distant excursions. On reaching Karachi some few days were spent in collecting in the harbour and then the party made a short sea trip to Gwadar and Muscat where additional specimens were secured.

This tour resulted in a collection of some 1,200 specimens representing about 250 species and including three new to Science and 18 new to the Indian Avifauna.

An interesting account of this trip and the birds seen and collected is given in the first volume of "Stray Feathers" and it is on this paper that our knowledge of the birds of Sind is based.

Later Hume's good work was added to and confirmed by Col. E. H. Butler, Scrope Doig of the P. W. D., W. E. Brooks, the East Indian Railway Engineer, and one of the soundest of the many Indian Ornithologists—and Dr. W. T. Blanford of the Geological Survey, author of three of the volumes on Birds in the first edition of the "Fauna".

On his return to England Dr. Ticehurst set himself to critically examine all the birds he had collected, some 1,500 in number, as well as the large number of specimens in the British Museum from the Hume and other collections. This resulted in his describing 5 new races of Sind birds as well as a number from other parts of India.

In dealing with each species the author has given a brief resume of our previous knowledge, bringing it up to date with his own observations and those supplied him by his many correspondents—members of the Society whose assistance he gratefully acknowledges.

There are many observations on migration, habits, mouth parts and description of juvenile plumages not previously known. Careful measurements are given of the specimens he has examined as well as notes on any structural characters of interest. In some cases too, critical remarks are made on allied forms found in different parts of India and Burma, which greatly enhances the value of the paper.

We consider this one of the most useful of the recent papers on Indian birds and it should certainly be in the hands of every ornithologist in the country, whether stationed in Sind or not.

The Avifauna of Sind is of special interest because of its position lying as it does on the boundary between the two Zoogeographical regions, the Palaeartic and the Oriental. Certain birds which belong to the first named region occur in Sind and nowhere else in India. Then too there are over 40 species belong to the Oriental Region which are found no further west than Sind.

As regards migration, Dr. Ticehurst observations point to their being two distinct routes through the Province, the one from the north down the western side of the country to the Persian Gulf and on to Arabia and Africa; this constituting the Eastern wing of a more westerly, to N. to S. movement. The other is the ordinary N. to S. and *vice versa* route which includes the whole of India but not extending to the west of Sind.

There is still much to be learnt about the birds of Sind and we would appeal to members stationed in these parts to carry on Dr. Ticehurst's good work. Not only is more information wanted on the distribution of the different species, but also on the movements of the migratory birds. The juvenile plumages of some Sind birds are still unknown and in many cases the nestlings have never been described. Anyone, who finds nestlings a description of which is not given by Dr. Ticehurst should preserve one or two in spirit and forwarded them to the Society.

N. B. K.

II. The Birds of Africa. *Systema Avium Ethiopicarum*, being a Systematic List of the Birds of the Ethiopian Region by W. L. Sclater. Wheldon and Wesley, London.

The constant changing of the Scientific names of birds is a very great hindrance to the student of ornithology, whether he be a field naturalist or a systematist.

Various attempts have been made, from time to time, to stabilize nomenclature, but in the majority of cases with indifferent success. The root of the matter lies, to a great extent, in the fact that Authors of books and monographs will not take trouble to check the names and synonyms themselves, but rely on the work of others and so mistakes get perpetuated.

The "Check List of North American Birds" and the "List of British Birds" issued by the American and British Ornithologists Unions respectively, are examples of very through work and in both cases they are revised from time to time no changes however are made until they have been thoroughly investigated by the Committee appointed for the purpose.

Shortly after the war Mr. W. L. Sclater paid a visit to the United States and when there suggested to some of the leading ornithologists that Systematic Lists of the birds of the different Zoogeographical regions of the world should be prepared, after the nomenclature and status of each species had been thoroughly investigated. These lists he hope would form a foundation to work on and so avoid the constant changing of names.

Mr. Sclater further suggested that the American Ornithological Union might be responsible for the preparation of the list of birds of the New World, while the British Ornithologists Union undertook those in the Old World, with the exception of Australia, which might be done by the Australian Ornithologists Union.

On his return to England Mr. Sclater approached the B. O. U. and a Committee was appointed to go into the question, while Mr. Sclater himself undertook to prepare a systematic list of the birds of the Ethiopean or African Region.

This then is the brief history, as far as we understand it, of the present volume and we are sure it will fill a great want, but whether the nomenclature is based on a sure foundation or not time alone will show.

In his introduction the author explains the boundaries he has adopted in treating the Ethiopian Region and informs us that his arrangement is based on Mr. A. H. Evan's volume on Birds in the Cambridge Natural History, in which Dr. Gadow's classification is followed. Now Dr. Gadow's views and classification are frequently quoted, but they have been adopted by very few ornithologists and we think, considering the state of flux the classification of birds is in at present, it would have been better to have followed some more familiar arrangement. As for instance the British Mus. Handlist or that of Dr. Reichenow's volumes on the birds of Africa. Most ornithologists would then have been able to find their way about the work, but as it is, this is most difficult, especially as there is neither a systematic nor general index. Possibly an index will appear in the second part, but we think there should be some sort of index with each part or a list at least of the families and genera.

Under the generic names there is a full reference giving the types on which they are founded and after each specific name the original reference and type locality. In addition to the scientific name each species has an English one, but we cannot congratulate Mr. Sclater on many he appears to have invented. Surely it should be possible to find shorter names than for instance the "South African Red-and-Black Billed Kingfisher" or "the Sudan Black-billed Blue-spotted Wood-Dove" Is it not rather hard on an inoffensive bird that it should be called a "Hairy breasted Toothbill? We have generally been accustomed to call *Micropus murianus* the Pallid Swift and do not see why the races found in Africa are called Mouse-Coloured Swifts.

The distribution of each species and sub-species is given in a short and concise form and for migrants, both the breeding range and winter quarters are included.

We are surprised to find no mention in the introduction of any acknowledgment of assistance and we think this must be an oversight, as surely it is almost impossible for one man to write a work of this kind, without consulting others—the more the better.

To all ornithologists who are interested in African birds this book will be very useful and no Museum Curator or Student of Geographical distribution should be without it.

N. B. K.

III. Wild Fowl of the World. By Frank Finn, B.A., F.Z.S. (Hutchinson & Co., Paternoster Row. Price 4/6 nett.)

We have received a copy of this most excellent little book and are surprised at the amount of information that is compressed into its 175 pages. It is divided into four chapters dealing with:—I. Swans and other distinctive Wild Fowl. II. Geese, Whistlers and Sheldrakes. III. Ordinary surface—feeding Ducks. IV. Diving—Ducks. Close on 200 species are described or noticed and it is illustrated with 32 Illustrations on Art Paper and numerous drawings most of which are excellent. The nomenclature followed is that of the British Museum Catalogue of Birds, Vol. XXVII, by Count Salvadori.

Mr. Finn has given us many books about ducks, but as far as we are aware this is the first written in a popular manner comprising such a large field. He is, as every body knows, one of our greatest authorities on these birds and has added much to our knowledge of their habits, etc.

The late Count Salvadori divided the Order *Chenomorphæ* into three sub-orders—*Palamedeæ* or Screamers; *Phoenicopteri* or Flamingoes and *Anseres* or Swans, Geese and Ducks. It is the last of these with which the author deals.

In Chapter I all our Indian Swans are described with the exception of Alpheraky's Swan (*Cygnus minor*) considered by some a distinct species and by others a sub-species of Bewick's Swan (*Cygnus bewicki*), probably Mr. Finn considers it to be the latter. The rest of the chapter deals with the Spurwings, Comb Ducks, Pink-headed Duck, Goose Teals, and Crested Wood Ducks. A good deal of information is given about all our Indian species. In Chapter II, of the Geese which visit us the only one not mentioned is Sushkin's Goose (*Anser neglectus*) a very similar bird to the Pink-footed Goose (*Anser brachyrhynhus*) but larger. The Whistling Teal are next dealt with, our common bird the Lesser Whistling Teal being the smallest species. Mr. Finn mentions that Eastern specimens of the Brahminy Duck (*Casarca ferruginea*) are often much bleached and "may be buff instead of chestnut" this has also come to our notice.

In Chapter III all our species of *Anas* are given including the sub-species (*Anas poecilorhyncha haringtoni*). We agree with the author in calling *Eunetta falcata*, the Bronze Cap Duck, as it is certainly more like a duck than a teal. He tells us that the female quacks: it was known that these birds made a quacking as well as a whistling note, but the quacking sound had not been assigned to any particular sex. Another interesting piece of information is that the female Wigeon (*Mareca penelope*) "has a growling note very unlike the whistle of the male or the quack of other ducks." Mr. Finn also adds to our knowledge of the Clucking Teal (*Nettion formosum*), a species about which Mr. Stuart Baker says "Information of this duck's habits is meagre in the extreme," so we are glad to learn that the courting attitude of the male "is unlike that of any other teal, he does not rear up in the water and bend down his head, but usually shows off on land, raising his head and then jerking it back. This species is indeed active on land generally." Many such interesting pieces of information may be culled from this useful little volume showing the author's keen observation.—*Querquedula querquedula* Mr. Finn properly calls the Garganey Teal, the name Blue-winged Teal really belonging to an American species (*Querquedula discors*). Writing about the Marbled Teal (*Marmaronetta angustirostris*) we are told that "the male in courtship does not rear up but jerks back his head." a fact which does not appear to have been recorded by other authors.

In Chapter IV, writing about the Tufted Duck (*Nyroca fuligula*) we learn that "It is a very good natured species and highly intelligent; it seldom displays and is very peaceable although males are apparently much in the majority" and of the Golden Eye (*Glaucionetta clangula clangula*) "when courting it not only throws back its head, but kicks up the water behind with its feet." We are also told that the Smew (*Mergus albellus*) "is a silent. . . . bird and shows off rather like the Golden-eye, which it resembles when in the down and with which

it associates and sometimes interbreeds." Mr. Finn says that the Himalayan Goosander (*Merganser comatus*)is not now considered distinct, but we notice that Mr. Stuart Baker follows Salvadori in separating it and it is now known as the Eastern Goosander (*Merganser merganser orientalis*).

We should like to add that the descriptions though concise are very accurate especially in the males which lend themselves to short descriptions.

Sufficient extracts have been given to show what a really interesting little book this is and how much knowledge it contains within its small size and we thoroughly recommend to all who take an interest in these handsome and interesting birds. The whole get up of the book is very creditable to the publishers and the price is only 4*s.* 6*d.*

C. M. I.

IV. The Butterflies of Ceylon. By W. Ormiston. ($6\frac{1}{4} \times 9\frac{1}{2}$ inches, 165 pp. 2, coloured, 6 uncoloured plates; H. W. Cave & Co., Colombo.)

In Spolia Zeylanica, 1918-1919, Mr. Ormiston published "Notes on the Butterflies of Ceylon." The book now issued is based upon these notes, which have been revised and brought up to date.

In the preface the author discusses the value of the term "species," "race," etc., the economic value of butterflies and gives some notes on collecting. The book itself consists of a list of the butterflies of Ceylon, with detailed notes on localities, nomenclature, variation and differences between allied species. There are no detailed descriptions, so that a beginner would have to refer to one of the standard text-books. As Mr. Ormiston states in his preface, his notes are only intended to supplement and to bring up to date Moore's "Lepidoptera of Ceylon," published over 40 years ago. On the two coloured plates are given excellent figures of the butterflies, that have been discovered, since Moore's book was written. Of the uncoloured plates, the first contains a diagram of a butterfly, illustrating the venation, the second depicts figures of certain species of the genus *Terias* and on the remainder are given drawings of the male genitalia of all the *Hesperidæ*, and certain species of the genus *Nacaduba*. There are two appendices as well as an Index. In the first appendix there is given a list of the butterflies, whose larvæ are known to feed upon cultivated plants, and in the second a list of the food plants of all the larvæ, so far as is known.

To a collector in Ceylon, this little book contains information that will prove invaluable. The notes regarding localities and times of appearance are very complete and represent the results of many years collecting. The notes on the differences between closely allied species are very clear. Apart from the local interest, the notes on habits, etc., are of general interest and of very considerable scientific value. The validity of doubtful species, more especially in the *Lycænidæ*, has been very fully discussed and a number of debatable points have been cleared up: more particularly in the genera *Spindasis*, *Nacaduba* and the Hesperiid family much useful research work has been communicated. The identity of *Nacaduba noreia*, Felder, appears to have been established, but Mr. Ormiston is at fault in calling the "tailless form" of *Nacaduba nora*, Felder, by Moore's name *ardates*, since Moore in his original description assigned a tail to his species. The correct name of this common and widespread form is doubtful, but we are of opinion that it should rank as a species. A very interesting fact brought to light is that two Hesperids (*Hantana infernus* and *Celænorrhinus spilothyrus*) which have not only been placed in separate genera, but by many authors in separate sub-families, are the opposite sexes of the same species. The following new species and races have been described: *Nacaduba*

sinhala, Amblypodia ormistoni, Amblypodia abseus mackwoodi, Spindasis lunulifera fairliei, Tajuria asida (probably a dry season form of *longinus*) and *Tajuria jehana ceylonica*. The section on the *Hesperiidæ* has been very carefully worked out and contains a great deal of very useful information.

W. H. E.

V. How to identify the Snakes of India. By Col. F. Wall, C.M.G., I.M.S. (Union Press, Karachi, 1923. Rs. 6-8.)

There are no books available to the amateur which really help him to recognise and identify the various species of Indian Snakes. The author's admirable and beautifully illustrated Treatise on the Common Snakes of India, which appeared as a serial in the Journal, deals mainly with the life histories of the common forms while Col. Wall's "Poisonous Terrestrial Snakes of India" is confined to our venomous land species. The use of Dr. Boulenger's standard volume on Reptiles in the Fauna of British India Series requires not only a thorough general knowledge of the subject, but implies also in many instances the skilled use of the dissecting scalpel. Hence many are debarred from taking interest is a subject which would otherwise have provided them with endless interest and pleasure—for few have the leisure, the skill on the inclination to surmount these obstacles.

The object of the author is therefore primarily to help the amateur to recognise and identify our Indian Snakes whether poisonous or not and with these he includes the species inhabiting Burma and Ceylon. He is not concerned as to whether his methods are classed as "scientific" or "unscientific"—utility is the chief motive. The equipment required for the work is simple—primarily the will to succeed, next a watch maker's lens of sufficient high power and a pair of compasses for taking measurements. Armed with these and the dead snake stretched out before you, the author indicates the lines on which your investigation should proceed, and he elucidates his meaning with the aid of simple diagrams.

The book commences with the statement—"Assuming a snake to be dead its identification in most instances is an easy matter" to a man of Col. Wall's monumental experience perhaps,—but to the amateur handling his first specimen the statement may sound over sanguine; particularly when he tries to differentiate between species whose affinities are so close that they appear almost identical. However it might be urged that Col. Wall's book goes a long way in overcoming the difficulties that ordinarily beset the layman in his attempted task. And though written primarily for the man unacquainted with or little acquainted with snakes, it may very likely be of service to others, who though versed in ophiology, may yet be saved much time and laborious research by its use.

The book is obtainable at The Union Press, Elphinstone Street, Karachi, Messrs. Butterworth & Co., Calcutta, Higginbothams, Ltd., Madras, and the American Mission Press, Rangoon—Price, Rs. 6-8-0.

S.H.P.

EDITORIAL.

During the past few months investigations have been in progress which may lead to Bombay becoming a worthy rival of Madras in the matter of a Marine Aquarium and Biological Research Station. Enquiries as to the feasibility of a Marine Biological Research Station for Bombay, having as its object the improvement of the economic Marine Resources of the Presidency, showed that a preliminary investigation of a searching character was essential on the part not merely of Government, who would have to find part of the money, but also on the part of the University, since research is undoubtedly the work of the University and a Biological Research Station should offer opportunities for practical research work by Biology students in local Colleges. Government support is necessary not merely for the financial needs of the main station but also in the founding of local subsidiary stations. The first preliminary must be the selection of the Director and the success or failure of the scheme will largely depend on the man who is selected in the first place. A Marine Aquarium is a necessary adjunct to a research station and though the cost of the advancement of science is not to be weighed in the same scales as is the cost of commerce, there is little doubt but that an Aquarium and Research Station would bring in Revenue—if not directly then indirectly. As an example consider the need of India for manure. Consider the amount of fish available for fish manure—consider how Norway and Sweden have utilised their surplus fish in the form of manure which can be sent in bricks all over the world and yet Indian fish manure penetrates inland but a few miles.

Some very interesting letters have been received by the Honorary Secretary on the question of Game Preservation in India. The first letter was perhaps in the nature of a lament over the days of the past. "Ah! the old days—those were the days for shikar, but now gone are the glories, Man is decadent and cares not, the Government is decadent and cares not, the poacher reigns supreme." The views of others varied however and it seems very desirable that a survey of the subject should be made and published in our Journal. We would appeal therefore to all Forest Officials and Big Game Hunters and others interested in the subject to send us their views in regard to the conditions and extent of Game in the Forests of which they have special first hand knowledge. The points we wish mainly to be brought out are:—

(1) Do existing Game Laws sufficiently serve the purpose for which they were enacted and if not what amendments are necessary?
(2) Have these laws tended to the increase in particular Forests of the larger Game animals such as Rhino, Gaur, Buffalo or Deer?
(3) Whether there is danger of individual species becoming extinct, if so which species and in what areas?
(4) What particular species require particular protection and what form can this best take?

There are so many difficulties in the way of Game Preservation that they fairly seem to bristle. Who is likely to benefit most? The Poacher! Is Government likely to enact special laws which will enable the poacher to be dealt with? We do not wish to be sarcastic, but "Is it likely"? The demand for equality, the demand for the right to possess fire-arms, must these not be acceded to? It may be true that fire-arms should only be required for the purpose of protecting crops and that for this purpose a gun the barrel of which has been reduced a foot is excellent and would be a protection not merely for the crops but also against poaching, but why should the cultivator have to be content with a shortened gun, why should he not be on an equality with others? Are you in these days of democracy going to have different laws for the Rich and the Poor? Again if you make laws which on paper will prevent poaching, how are you going to carry them out? Who is going to pay the

heavy expense ? Heavy the expense must be if you are to have an honest and efficient staff and without such you cannot stop poaching. Who are the most successful poachers ? Well, the law of criminal libel should prevent the answer being given but accusations have been made that if the badly paid forest guard is not a good poacher a successful poacher is certainly the man who augments the forest guard's miserable pay ! It is doubtless very desirable that the pay of the forest guard should be increased but should not the Policeman come first ?

As this Journal will be issued at the beginning of a New Year it is perhaps reasonable that we should review the work of the past year and refer to the hopes and prospects of the New Year. In the past we have tried to make the Journal more popular—it is not for the editors but for the members to say whether we have been successful, but as editors we can and do thank those who have helped us in our efforts. We have a goodly list of names,Mr. Stuart Baker, Colonel Ward, Colonel Evans, Major Hingston, Colonel Burton, Major Stockley, Capt. Pitman, Messrs. Whistler, Inglis, Capt. Bates, etc., and we look for a continuance of help from these and from others. Mr. Stuart Baker is commencing a new Game series "The Indian Waders." This announcement should at once produce the query " When is another Game book going to be issued ? " Alas, the answer is the same as that made a year ago. " When the Members of the Bombay Natural History Society buy the books that are already issued." They were published for the benefit of members. Members can buy them at a price far below that charged to Non-Members, but no ! Only a very small proportion of members have bought the Society's publications when issued in book form, and before the Society can enter on any more speculations it must know that it can rely on the very great majority of its members supporting it. Will members who are not in possession of the first two Volumes of Stuart Baker's " Game Birds of India " kindly order them now and so enable the Society to get on with the publication of other Volumes.

The past year has witnessed considerable progress in the work completed in the Natural History Section of the Prince of Wales' Museum, as is evidenced by the Progress Report printed in this number. We are still hampered for want of funds. Last year H. H. The Maharao of Cutch became a Vice Patron and subscribed Rs. 5,000 to the Society's Funds for the purposes of the Museum. We are glad to record that His Highness the Maharaja of Dhar, a regular contributor to our Journal and a keen Naturalist and Sportsman, has signified his intention to subscribe Rs. 5,000 this year and we welcome him as a Vice Patron. If we could only have a list of 25 Vice Patrons, what a lot of good work we could do.

We open the New Year so far as the Museum is concerned with the placing therein of a complete mounted specimen of an Indian Gaur shot in the Kanara Jungles and mounted by the Society's staff in the Society's work rooms. The Curator of the Society has had nothing to do with the writing of this Editorial—so we can say with propriety that the Society made a very good money investment when they sent him to England to study Taxidermy. We believe Rs. 450 will cover the total expenses in cash paid out in connection with the mounting of this fine Gaur which stands 5'-8" high and which will appear in the show case as though walking out of typical Bison country. The scenery will be reproduced from actual photographs. It is a pleasant thought contemplating the saving effected as compared with having the work done in England. The stickler for the truth may of course say " There has been no saving ". True, if we could not have done the work here we could not have afforded to do it at home. Having finished the Gaur our staff are now at work on a 10' Sword Fish—a graceful beast though with a smallish sword which some fisher folk of Bombay captured at X'mas to their financial gain.

We referred a little way back to the work of the past year. We cannot close without expressing our thanks to Mr. W. S. Millard for all the work he has done for us at home. We also wish to thank the authorities of the British Museum at home and Mr. Fry, who still continues his work for us in connection with the Mammal Survey. Speaking of the Mammal Survey reminds us that the last of the band of Mammal Collectors has been sent to the Andamans. Not for the term of his Natural Life, but, thanks to the kindness of Col. Ferrar, the Commissioner, for 6 months. Col. Ferrar writes:—

> "I will look after LaPersonne. He can get to various good localities where forest camps are located and communication with Head Quarters is frequent and where also there is immunity from Jarawa arrows. I would also take him to Great Nicobar in March. I would secure for him a good butterfly man who is generally knowledgeable and would help much. The dry season has begun and lasts till say end of April. May not necessarily very rainy and generally very good for insects."

LaPersonne did good work in Mesopotamia under Sir Percy Cox and Capt. Cheesman and we hope he will take full advantage of the opportunity Col. Ferrar is affording him and for which opportunity we are very grateful.

Mr. N. B. Kinnear—for so many years Curator of this Society, continues to help us and in his Rooms in the Bird Department of the British Museum, South Kensington, is delighted to meet members of the Society and help them and enlist their help too. His successor Mr. B. C. Ellison, who retired owing to ill-health in 1923, has just published an account of the Prince of Wales' Shikar in India and we hope it will be a successful financial venture for him.

Residents in Sind who are interested in the Bird life of their province will be pleased to learn that Dr. C. B. Ticehurst's comprehensive series of Papers on the Birds of Sind which were published originally in the Ibis are now available in complete sets. Applications for the same should be made to the Honorary Secretary.

A review of Dr. Ticehurst's work appears on page 446 of this number. The reviewer indicates the lines on which members of the Society stationed in Sind could help in carrying on Dr. Ticehurst's admirable work.

NOTICE.

Third International Congress of Entomology.

Information has been received from Dr. K. Jordan, Zoological Museum, Tring, that the Third International Congress of Entomology will be held at Zurich in the second half of July 1925.

No information has been received regarding rates of subscription payable for membership of this Congress.

Any Entomologists in India who are not already Life Members and who wish to take part in this Congress should communicate as early as possible with Dr. Jordan.

Pusa,
5th January 1925.

T. BAINBRIGGE FLETCHER,
Imperial Entomologist.

OBITUARY NOTICE.

Surgeon-General W. B. Bannerman, C.S.I., M.D., I.M.S.

The news of the death in Edinburgh of Major-General W. B. Bannerman, I.M.S., who retired from his appointment as Surgeon-General with the Government of Madras several years ago, has been received by the members of his service and old friends with the deepest regret. For many years he was a member of the old Bacteriological Department, now the Medical Research Department of the Government of India. He was associated with Mr. Haffkine in founding the laboratory in the old Government House, Parel, Bombay, established in the early days of the invasion of India by plague. He did much excellent work in establishing the value of anti-plague vaccine and in popularising its use. He succeeded Mr. Haffkine as the Director of the Laboratory which was then enlarged to fulfil the functions of a provincial laboratory for the whole of the Bombay Presidency for the routine examination of pathological material, for the study of epidemics and for research work generally. In these years numerous enquiries into plague, anti-plague vaccine, into leprosy and malaria were being carried out to all of which he contributed actively or by advice and direction. His opinions were always characterised by great sanity and clearness of thought. He was also intimately associated with the brilliant group of workers comprising the Plague Commission whose headquarters were in the Laboratory. He endeared himself to all who came in contact with him. To the youngest and most inexperienced worker his attitude was that of a friend and co-worker rather than of a director. Further the regard and affection in which he was held by laboratory attendants and menials was very striking. There could not have been a happier laboratory than Parel under his leadership. Subsequent years were spent in Madras as Surgeon-General. It is proper that this Journal should join in the deep regret which will be felt by his friends throughout India at the news of his death, that it records its sorrow at the loss of one of the medical research workers in India and that it should express its profound sympathy to Mrs. Bannerman and to the members of his family.

MISCELLANEOUS NOTES.

No. I.—BIRTH OF A WHITE-HANDED GIBBON (*HYLOBATES LAR*) IN CAPTIVITY.

(With a Photo.)



YOUNG WHITE-HANDED GIBBON (*H. lar*).

Born in the Zoological Gardens, Rangoon. Photo from the *Field.*

Zoologists, I believe, are of opinion that anthropoid apes are not likely to breed in captivity, and it has been said that there is no known instance of such a birth ; consequently, little, if anything, is known as to the age at which these animals become adult, or as to the period of gestation, or as to many other matters of great interest in connection with them. There is no doubt that these animals are very delicate and that the greatest care is required to keep them alive for more than a short time. The birth, therefore, of a white-handed gibbon in the Victoria Memorial Park, Rangoon (Rangoon Zoological Gardens) on the 1st of August 1923 was a matter of very great interest. As the event was, however, entirely unexpected, we have very few details, and could not place on record sufficient to enable our knowledge of them to be increased.

The baby lived for a very short time, owing to an unfortunate catastrophe ; but we are delighted to report that a second white-handed gibbon was born to the same parents on the 19th of May, 1924. Careful notes have been kept, the results of which I will set out later.

We have been perhaps exceptionally fortunate in Rangoon with these animals and have been able to keep them alive for more than seven years, and in one particular case we had one that lived for eighteen years. It may, therefore, be of interest to give a short account of the cages in which they have been kept and the food we have given them.

Gibbons are very susceptible to the slightest change in the weather, and to any dampness in their dwellings.

Our cages are constructed of timber, the side walls being of thick plank carefully dovetailed; the front and the back are composed of expanded metal of a fairly large mesh. At the back we have screens of Willesden canvas, which can be let down when required, and in front we have folding doors of wood, which can be closed over the wire netting. At the top of the cages on each side, there is a plank platform under the roof, to which the animals retire at night, and where they can retire if they wish to avoid the attentions of visitors.

At the back of the row of cages there is a large wire mesh run. It is lofty, and is supplied with swings and stumps; and the animals are let into this outer run for exercise, and they can there obtain all the sun and warmth they need.

The food is considered with reference to each individual animal, and we find that they have their own likes and dislikes in the matter of food. They get milk, bread, rice, eggs, fresh fruits and various sorts of oily nuts.

We find it impossible to leave a male and a female in the same cage. We selected a pair of gibbons that we had had for seven years and which had not been sick during that period. It was reported to the Superintendent that these two had been seen copulating once in the early part of November 1922, and, as the young one was born on the 1st of August 1923, the period of gestation was thought to be about nine months. When the father was let into the outer run for exercise, it was noticed that the mother took her seat close to the expanded metal on the side of the run. The male then clung to the expanded metal opposite her, and copulation was effected through the netting.

In the case of both the young ones born, they were born at night, and the day before the birth the mother refused her food. She seemed dull, restless and frightened. From the appearance of the cage on the following morning, it appeared that the mother must have dragged about the infant until the placenta got broken off. The same was observed on the occasion of the second birth. She kept the baby pressed close to her breast and, from time to time, pulled back its head, gazing at it eagerly and displaying the utmost pleasure in it. She hardly ceased examining it and turning it over and stroking it. She kept it clean with her hands and, for some weeks, would not allow anyone to see it.

The first baby died owing to a catastrophe. The mother and child had been let out into the outer run and, as was perhaps natural, she took the child to the father's cage to show it to him. He took hold of the baby's finger and was fondling it when something apparently frightened the mother, who desired to retire. The father objected and held on to the baby's finger and, between the two parents, the unfortunate infant's finger was pulled off, and it died of septic poisoning on the 12th September 1923.

The parents were observed to copulate between the 15th and 23rd of October 1923, many times, and the second infant was born on the 19th of May, 1924. This puts the period of gestation at about seven months, and it would appear that it could not have been much longer. Enlargement of the breast, and fullness of the stomach only showed in the mother in the advanced stage of pregnancy. The infant clung on to its mother's hair, but the mother kept her arms round it in the earlier stages, and, whenever she could be induced to leave her retiring stage at the top of the cage, she always supported the infant as she came down with her thigh or her foot. She fed the infant from her breasts, and did not allow it to partake of any other food.

The baby was born with its eyes open; the head and ears were comparatively large. It had a moderate quantity of thick hair on the head, and thin, soft and powny hair on the back. There was little or no hair on the outer aspect of the arms and thighs, while the other parts of the body were quite bare. It was impossible to find out anything about its dentition; but the first gibbon which died within six weeks of its birth had four incisors at the time of its death. After

eight weeks the hair has grown very thick and luxuriant on the head ; and the back, the outer aspects of the arms, thighs and hands are now also fully covered with thin and soft hair ; while the abdomen, the forehead, chest and buttocks are still bare. When born, its face was heavily lined and wrinkled, but in a few weeks the skin has smoothed out ; the face is clear and, from looking an old and decrepit object, it now appears young and smooth.

We had kept the outer doors of the cage shut, so that the mother should not be disturbed by visitors, and the only person she saw was the Superintendent, who visited her daily and saw to her food. When it was about four weeks old, I visited it, and, when we opened the doors, the mother and child were on the upper shelter. There were only the Superintendent and myself and a keeper at the back, I called the mother and offered her a mango ; she at once came down and seemed to be quite without fear. She knew us all, which may perhaps account for that. It was interesting to note the way she clambered down, supporting the baby at each step, and, when seated at the front of the cage, peeling and eating the mango with one hand, she kept holding out the baby's hand towards us, with the intention probably of teaching it to catch hold of the wire netting. This gave us a very excellent view, and time to record the progress made in the matter of the hair, but we could see no sign of teeth.

We have so far not attempted to take any photographs ; indeed, it would be almost impossible, partly because the mother would not come forward with the child, and partly because in the rains in Burma the light is too poor to enable photographs of any value to be taken of animals inside a small cage. It is hoped to be able to do so before long.

S. M. ROBINSON, M.B.O.U.

[These two successive records of the birth of a white-handed gibbon in the Rangoon Zoo are of extreme interest. The first incident was reported in the *Field* (November 22, 1923). Sir Sidney Robinson's record furnishes more definite evidence in regard to the period of gestation which is now computed to be *seven* months and not *nine* as originally believed. Previous to both these records Mr. A.W. Ogilvie reported the birth, in semi-captivity, of a white-handed gibbon in the Journal of the Natural History of Siam (Vol. VI, No. 1, p. 137). Mr. Ogilvie states that in April 1914 he purchased 5 gibbons, 2 white and 3 black which he turned loose in his compound. (Both males and females of the Hoolock (*H. hoolock*) and the White-handed gibbon (*H. lar*), in addition to their black colouring exhibit, in certain individuals, a yellowish-grey phase referred to by Mr. Ogilvie as white). In March 1920 one of the females was noticed to be pregnant and in May gave birth to a young one. A black male, obviously the father, (the mother was a light coloured individual) attached himself to her. The other gibbons were chased from their accustomed trees and were never allowed into the compound.

In September 1922, when Mr. Ogilvie wrote his note, the young gibbon though over two years old and quite big enough to feed for itself still clung to the mother when she moved rapidly from tree to tree and, what is remarkable, was still nursed by her and was never seen to take the solid food provided for the other monkeys. It will be noted in this instance, when the gibbons were kept under conditions nearly natural as possible, the male gibbon remained with the female. Mr. Hornaday, the Chief Taxidermist of the U.S. National Museum, in his "Two years in the jungle" records the shooting of a female gibbon with a baby. He states that a male gibbon which bolted with the rest of the party returned to the scene on hearing the cries of the baby gibbon, and was also 'collected' ; he concludes that the male met its death solely on account of its paternal affection, sympathy and courage in the face of danger.

The photograph is reproduced from the *Field*, November 22nd, 1923, and is the portrait of the Gibbon referred to in the earlier part of Justice Robinson's note,—EDITORS.]

No. II.—A CENTRAL PROVINCE TIGER.

Far from the beaten track, and rarely visited by white man save the wandering sportsman, lies a small village on the banks of one of the large rivers which flow through the Central Provinces.

In the vicinity of the village is a small cultivated area, beyond which the jungle extends for many a long mile; across the river, which flows south, is an extensive, semi-cultivated and undulating plain, the haunts of a few herds of Black Buck, dotted here and there with villages of flimsy, inflammable "bastis," and intersected by deep water courses and nullahs, tributaries of the mother river. Hills there are none and the jungle for the most part consists of thinly-wooded grass land, cut in all directions by broad, sandy nullahs, shaded with large forest trees and ever green bushes. Actually on the river bank this grass jungle gives way to tall forest principally composed of teak trees. The river, nearly three-quarters of a mile broad opposite the village, in April—the time of the year about which I am writing—is reduced to a small and not over-deep stream of a few hundred yards in width. To the north there is but little cover in the river bed, but half-a-mile south of the village there is a large, swampy area consisting of reed-fringed back-waters and damp, low-lying islands covered with coarse vegetation and rank herbage, containing many a cool and shady hiding-place beloved of the great striped cat during the blistering midday heat of an Indian Summer's day in these parts. This then is the habitual haunt of tiger, and the fact of one being killed there does not deter another from immediately filling its place.

Having some years previously shot with considerable success in this tigerish stronghold, it was with great hopes that I set out on a second venture in April 1913, and my zeal was by no means lessened by hearing of the cattle-slaying prowess of a striped monster now haunting these jungles. This information was given me by the inhabitants of all the villages that I passed through on my forward march. Being pressed for time I camped at a village some six or seven miles away to try for a panther, and sent my orderly on ahead to arrange for "baits" to be tied up; and I instructed him to send me news at once if a kill occurred. After the evil reputation which stripes had acquired, I was hardly surprised to receive news of a "kill" the very next morning, and, much to my astonishment, I received a tremendous reception from the hospitable Gonds, who welcomed me back to their village as quite an old friend, and promised me excellent sport.

As the village "kotwal" said:—"Hazur, the tiger has carried off the "kill" into the thick cover amongst the islands, and the sahib knows that he will not leave his hiding-place again till evening, so a mid-day beat is bound to be successful." So too, I thought; but "the best laid plans of mice and men, etc.," and as I climbed up to the "machan" fastened in the same tree as on a previous successful occasion, I felt distinct misgivings when I noticed that the vultures and crows had gone down to the remains of the "kill," but I quickly concluded that my striped friend had retired deeper into the sheltering recesses of the rank cover growing on the islands. I was hardly seated in my elevated perch when a loud yelling and banging of drums announced the start of the beat, which, although opening under such auspicious circumstances, was doomed to failure.

Beyond large numbers of pea-hens, a few gaudy peacocks, some dull plumaged herons and a crow pheasant (or coucal) with chestnut wings and coral-rimmed eyes, the beat was a blank.

In spite of a fair amount of previous experience in tiger shooting I omitted to make a searching enquiry into the past history of this particular beast, and this omission stood between me and success the whole time. I put down his absence in the beat to the fact that it might still be a little early in the season for him to lie up in the river-bed cover which was naturally a good deal more

inundated than at the end of May or early in June, at which period of the year I had had my previous experience of this piece of jungle.

A few days later another "bait" was taken at the same spot, and a second mid-day beat proved equally fruitless. This second failure should have warned me that I was pitting my wits against a tiger of considerable cunning, but as the shikari some hours afterwards casually informed me that he had seen the tiger on the "kill" that morning, but had not thought it worthwhile to tell me, as I was going off shooting in another direction, I attributed this second defeat to the fact of the shikari and his followers probably having frightened stripes off his "kill."

Having spent the best part of a fortnight in futile efforts to bag this beast, I left him alone for about ten days, and went off to another tiger's haunts some fifteen miles away, where I tried to do some shooting by moonlight.

When I returned to the habitat of my old friend of the river bed, I found the moon was rising rather late for me to make much use of it, and a few days after my arrival I actually saw stripes start off on his crepuscular wanderings. I had been out after Cheetal (spotted deer), which swarmed on the river bank during the afternoon and evening. I was watching the antics of a party of pea-hens, as they suspiciously advanced towards the edge of the jungle, when suddenly they scattered silently in all directions. The reason soon manifested itself in the shape of a large tiger—my elusive friend who had such a liking for beef. But as the shot offered was a risky one, I let him alone and watched him disappear towards the river—and my "baits;" and I felt very hopeful of a "kill." The behaviour of the pea-hens after this was simply extraordinary, as they came out of the jungle in single file in a kind of follow-my-leader procession, about ten yards behind the tiger, and whatever the leader did was minutely and almost mechanically copied by the remainder.

Sure enough there was another "kill" that night, but the beat was once again a blank. At last I realised that I had to deal with a very cunning brute and a few questions quickly elicited the fact that this tiger had been fired at before—and quite possibly wounded; hence his shyness of beats and the works of man, under which category he rightly classed the "baits." But his partiality for beef would not allow him to leave alone the buffalo calves ("bodas"), and his cunning and experience always enabled him to leave the 'kill" in ample time to save his own skin. My time was now growing very short, and with only a few days' shooting left in those jungles I determined to risk the possibility of getting a shot in the darkness, sitting over a "bait." Instead of tying up the young buffalo in the river-bed as usual, I tethered it on the bank near by and sat up in a tree at the edge of the jungle which was a few yards away from a patch of white sand where the unfortunate little animal was fastened. I started my vigil about 8-30 and wearily the hours dragged on, till I was startled from my drowsiness by the appearance of the fitful gleams of a fast waning moon, at about 3-30 in the morning. The "bait" could now be seen quite plainly, but at such a late hour of the night it was highly improbable that the tiger would still be hunting. But it is the exception which proved the rule, and so, on this very night, stripes had had bad hunting and, with the warning presentiment of approaching dawn which would herald the light of another day, he suddenly bethought him of those cool islands covered with luxurious vegetation near which he had so often found a lonely buffalo calf tied up and left to its fate amidst the unseen and lurking terrors of the night. So it was that he silently padded along towards the village, and, at a point a bare hundred yards short of my "machan", he turned down into the river-bed, had a drink from a backwater and, strolling leisurely towards his expected meal, found nothing. But a movement in the thick swampy cover in front of him arrested his attention, and a few minutes later the waiting sportsman's ears were greeted with the dull sounds of a strug-

gle, and the hoarse, throaty death-rattle of a bull nilghai rang out through the night. This was about 4-0 a.m., and three-quarters of an hour later, together with my orderly, I descended the tree and we made off towards the village. After daylight we searched the river-bed, and outside the cover found the carcase of a bull nilghai which had hardly been touched, save for a tiny portion close to the tail—the reason for this probably being that the tiger had heard us descend from the tree and had forthwith departed. This was a foolish mistake to have made, for, had we remained in our night's quarters until after day-break, I should in all probability have got a shot at stripes on his "*kill*" in broad daylight. On a closer inspection of the carcase we discovered that this was a nilghai bull I had wounded and lost two nights before, and which must have eventually taken refuge in the thick cover of the river-bed, where there was an abundance of fresh fodder and water close at hand.

The "kill" was in a very suitable place as it was overlooked by a large evergreen tree, whose branches were covered with thick masses of shiny, dark green foliage; and it was in a well-concealed position, about fifteen feet up this tree, that I had a "machan" fastened. Covering up the carcase with branches, in order to keep off the scavenging vultures, I determined to return before sunset to take up what I hoped would this time be a successful vigil.

All my fondest hopes, however, were scattered in every direction by the stormy aspect of the evening, and a steady breeze blowing from the river towards the jungle caused the most gloomy forebodings. About 6-0 p.m. found me in the "machan"; and an enormous bank of jet-black clouds slowly creeping up from the south-west gave promise of—to say the least of it—a wild night. As I still had very vivid recollections of spending some hours in the rain, on a very wild and stormy night, two years previously, holding down the canvas of my tent, owing to several guy ropes parting; I sent back my orderly to the village at half-past-six to see that the camp was in good order, and everything secure. He had hardly disappeared into the jungle, when I saw the tiger stalk majestically out of it about three hundred yards lower down, and, descending into the river-bed over a pile of black rocks, was lost to view. This was luck indeed, and it seemed to me that I was about to have the opportunity of getting a shot at him by daylight.

But there was the treacherous wind still to be reckoned with, and as the seconds became minutes, which gradually drew out from ten, twenty, to half-an-hour, then an hour, followed by darkness, my hopes were dashed to the ground; and, as the storm burst shrieking around me, I wrapped myself up in a blanket and went to sleep. A few minutes before 5-0 a.m. I woke up with a start, instinctively feeling that some creature was afoot, and, hurriedly seizing my 12 bore—loaded with lethal bullet—I waited and listened. There were a few seconds of utter silence, followed by the noise of some heavy body forcing its way through the thick cover. No tiger could make such a noise, and yet what else would try and move so stealthily? A few pale beams of moonlight threw into relief the mounds and bushes at my feet; and a semi-shining, moving body shaped like a narrow and elongated diamond was revealed in its clumsy progress towards the carcase. As it slithered down a grass-covered mound and arrived alongside the carcase, I recognised it to be a huge "mugger" (crocodile); but it was almost impossible to distinguish in the dark recesses of the hollow where the remains of the nilghai lay.

Strenuous tugging, followed by an appalling stench, showed that the nasty saurian was trying to tear off whole, one of the putrefying limbs. Doing my best to take accurate aim at the indistinct target, I fired; and a tremendous thrashing of the mugger's tail denoted that my shot had taken effect. As it laboriously crawled off into the bushes, the second barrel was not so lucky, and I had to wait in patience for twenty minutes, when the fast bright-

ening day brought with it my orderly and a party of villagers, who expected to find the tiger dead at last! It was not hard to follow the crocodile's track, made all the more conspicuous by frequent, large pools of gore; but of the wounded creature itself there was no trace, for after a hundred yards the track disappeared into the water.

After this, a few brief moments of investigation revealed the riddle of the night. The tiger, evidently suspicious, had advanced with the utmost caution—halting frequently;—and, when within 150 yards of his "kill", he had sat down under a bush to make certain that all was safe. After a wait which may have lasted thirty minutes, or even an hour, he had returned to the jungle by the way along which he had come.

And so I bade farewell to the Huldee tiger.

The villagers had not withheld the fact of his previous escapades with other sportsmen in order to spoil my shoot; but simply because they thought it was of no importance for me to know it.

So it will happen I fancy that this tiger will defeat many another sportsman in the future as the villagers will persist in their stereotyped beat during the mid-day heat, after the usual "kill" near the river-bed, and he will only fall victim to chance or be brought to bag by a remarkably cunning "bandobast."

C. R. S. PITMAN.

No. III.—THE "SAMBHAR CALL" OF THE TIGER.

With reference to the controversy about the tiger using a call like a sambhar, the following incident that occurred at dusk the evening before last (June 9th) here in the Billigirirangan Hills (S. E. Mysore) may be worth recording.

At about 3-35 p.m. I took up a position on the rocky top of a high conical hill to spy for sambhar. It was on a clear cold evening with a high wind.

The hill, really a prominent knob, was surrounded by open grass slopes and glades, interspersed with patches of dense, ever-green jungle (sholas). Owing probably to the presence of wild-dog across the big valley to the N., where I had seen no sambhar during the preceding two days hunting, but had been fortunate enough to shoot one of the red brutes, the sambhar seemed to be collected in the surrounding sholas. By about 6 p.m. there were altogether 30 sambhar of all ages feeding in scattered groups within 600 yards of the hill in different open spaces. But, charming as the spying was—so reminiscent of Scotland—no shootable stag showed up. At about 6 p.m. a good stag walked into a glade of about two acres, some 250 yards from and below me. My orderly and shikari were watching from the other side of the hill top, and by the time that I had got my rifle from the former and collected the latter, the stag had moved across the glade and was standing just outside the edge of the thicket. It would have been a 200 yards chance from where we were, but by a detour back, round, and down, it would have been easy to get into some rocks above him and not more than 100 yards away. Never doubting that the stag would stop to feed, we made the move, but on gaining our point the stag had disappeared. From his line of movement I conjectured that he would probably pass through the shola which he had entered, and which here filled a narrow, gorge-like, valley below my point of vantage, and join a party of 12 hinds and calves feeding in the next open glade, some 300 yards further on. I accordingly crept along the face of the hill until I was above the latter, and sat back to watch. We had sat for about 15 minutes, and the light was getting very bad, when the shikari gave a grunt of disgust and with a sort of "wash-out" signal and a slow wave of his hand indicated that our stag had gone the wrong way, pointing up at the open grassy hillside opposite

where, some 350 yards away, I saw what I took to be our stag moving slowly across the face above us. I should here explain that this shikari, Bomina, is a Shologa, (the local hill-tribe, famous as trackers) of about 45 years of age, who has been in the employment of Mr. Ralph Morris and of his father before him, for many years; a most experienced man, and reported to be the best shikari on these hills. As I looked up the beast "spoke." I have been 'barked' at by scores of deer and it didn't for an instant occur to me to doubt that it was the voice of a sambhar. It did occur to me to wonder what on earth could be disturbing the brute. Looking back now it seems to me that the note had not *quite* the almost metallic ring of the sambhar's bell. It was perhaps nearer to the harsh or gruff "bark" of an old Scotch hind. But this is only an afterthought. Bomina *certainly* didn't doubt that it was our stag. Mechanically I put up the glasses, and to my astonishment as I picked the animal up, the black stripes of a huge tiger greeted my eyes! During the moment that I held the glasses (12 × Goerz) on to him I distinctly saw his head lower and his ribs contract, and the same identical call came across to us. This time, *because I knew it was a tiger*, the call sounded to me the voice of a tiger—a high-pitched "ough." But this was *only because I had seen him*, Bomina when I turned to him still sat in placid disgust, only turned to gibbering excitement when I said "tiger" and seized the rifle. The sequel is immaterial and I am not a little ashamed at having taken a shot at such a range. But after 3 hours spying, with a favourite rifle (275 H. V. Rigby) in the hand, and a big tiger in the open the temptation was too great. A magnificent male tiger, 9′ 3″ between pegs, and immensely deep-bodied and heavy, rolled over and over down the slope and was dead when he reached the jungle at the bottom.

I have endeavoured to record all the circumstances attending this deception, accurately and without exaggeration. I would emphasise the following points. Had I not had a glass, this highly experienced shikari and I would have gone back to camp sure that the tiger had been our sambar stag. The brute spoke clearly and loudly "*Vurie*" and on the second occasion I saw him "go through the motions" of speaking with a very powerful glass. The cry in no way resembled the ordinary cry "Eh-Vurh" (Genl. Wardrop's spelling) the second syllable, very much contracted and very much higher pitched might convey an idea of it. The tiger's line of approach (confirmed next day), a sambhar path, was from directly up wind of us and the brute sauntered along, stopping repeatedly. There are very few tigers left on these hills, owing to the monsoon having started. They have nearly all retired to the low ground, and I have noticed only one (a different) tiger's tracks in the past week, when tracking bison. I am positive that there was no sambhar near the tiger, whose voice I could have mistaken for his, because I looked over the slope below him, i.e., nearer the shola, for several seconds before picking up the tiger. Finally, as we walked down in the dark, my mind full of tiger, and a real sambar hind "belled" at me close to camp, I nearly jumped out of my skin so nearly did the call resemble that which I had last heard and was pondering over.

A. W. H. JAMES (Major).

Attikan, Mysore,
June 11th, 1924.

[Summarising the various notes that have appeared on the above subject in this *Journal*, Major James' observations bring forward the following points:—

If we presume that the "sambhar call" of the tiger was used in the present instance with the object of deceiving the sambhar and giving the tiger the necessary advantage in stalking his quarry, we have the assertions of other observers who state that it is highly improbable that any sambhar could be deceived by the "mimic" call of a tiger, which, though it may be easily mistaken for the call of a sambhar when heard alone, is readily recognizable when the two animals are heard calling together. Allowing for this fact it is argued,

however, that though undeceived by the "mimic" call of the tiger, sheer animal curiosity might induce the sambhar to tarry in the vicinity and give the tiger such advantage as he requires to bring his stalk to a successful issue. Instances of game animals being successfully "called up" by human agency are quoted in support of this theory.

Other observers assume that the "sambhar call" of the tiger is a 'mate call' delivered either to warn or make his presence known to his mate. Neither of these suppositions however explain the tiger's use of the "sambhar call" on occasions when the stalking of sambhar, or the calling up of his mate, were presumably not the objective in view.

Mr. W. S. Thom puts forward the theory that the supposed "sambhar call" of the tiger is a note expressive of sudden alarm or suspicion. He gives an instance of a tiger "uttering the titting calls" when prevented from coming to his "kill" by the noise of villagers and their cattle passing in the vicinity. He writes that these notes were uttered by the tiger "either whilst in a suspicious or discomfited frame of mind, or as a sign of fear or displeasure, or as a warning to both man or beast that he was in the vicinity." Mr. Thom was certain that the "animal had no mate with him." The second instance is that of a tiger "titting" when brought up suddenly on his way to his "kill" by the noise made by the men who were erecting a *machan* over it. It was only then writes Mr. Thom that the short sharp nervous notes of alarm began to be uttered at intervals.

The incident related by Mr. Dunbar Brander of a tiger making the "sambhar call" when he walked the brute off its kill in tall grass, and Major Stockley's observations in regard to the tiger disturbed at the bottom of a ravine, might also be interpreted as notes of suspicion or alarm.

In the instance narrated above by Major James it might also be inferred that the tiger gave vent to his "sambhar call", when engaged in stalking the deer, on suddenly becoming aware of the presence of man.

It is only possible to conjecture the motives which impel the tiger to utter this peculiar call, but the supposition that it is a note of apprehension uttered by the animal when it is in doubt, or when suddenly disturbed by human agency, appears to be a not unlikely explanation of the phenomenon.—EDITORS.]

No. IV.—A VERY FEARFUL PLACE.

When a road travels through a pass, when the pass lies through thickly wooded foot-hills, when ordinarily motor traffic is allowed in the pass only in day time and when the night traffic consists of country carts and herds of sheep and goats, it is not unnatural in India to find the pass endowed with a reputation. Such was the Mohand Pass, some ten miles from Dehra Dun, as we found it, although it took some days for us to discover the existence of the reputation and one incident to give us the measure of it. The following tale then is constructed from a series of experiences that befel one or the other of our party in the Mohand Pass on the way to or from a block of forest reserved for shooting.

Just after dusk a car came swinging up the curves of the road bringing back to Dehra Dun two disappointed souls who had sat long cramped hours in machans without success. They sat slackly, their conversation was disjointed, and they were not impressed when an animal, crossing the road, probably a jackal, was thrown into relief by the headlights. The next moment, however, when the jackal reached a small bank at the side of the road and casually climbed to safety, both sprang into activity. The jackal was discovered by its outline to be a panther, every spot distinct; and the rifles in the car were unloaded! Conversation did not flag for the rest of a journey in which the initiation ceremony had been completed. The second day was a blank; the third day a panther was seen three miles farther on at 6 p.m. by an inoffensive car.

On the fourth day a car full of expectant people was repeating the first day's journey after nightfall, but except for a Sambhur hind, some country carts and a small dog, the limits of likely panther patrols had almost been passed before a stationary lorry was disclosed. As we approached an Indian ran into the compass of the lights with outstretched hands and we pulled up. Rather excitedly he explained in the vernacular that the back axle of his lorry had broken (a very natural concession to the law of loads!) and that before dusk he had sent for assistance to Mohand. With these words he snatched a coat from his lorry and seated himself on the step of our car. As he did so the top of a tree overhanging the road began to rustle and, as the rustle descended, visions of the climbing proclivities of panthers flashed across our minds; indeed one of the party from the back of the car suggested in joke that we might shoot. It was as well that we did not follow his advice for presently another Indian burst on to the road from his perch in the tree and seeing the position of his companion promptly and without a word sat himself also on the step of the car. This seemed to us, without any adequate explanations, to be stretching the bounds of our hospitality too far and the interpreter of the party got busy. The only words he could extract were "your honour, this is a very fearful place!"—with prayers to be taken out of it. To a car of English make with responsive springs, on a bad road and with an already heavy load this request presented difficulties; there was also the safety of the goods in the derelict lorry to be considered. Our passengers, however, were insistent that "Safety first" was the primary rule for all motor traffic, and without more ado we removed them to the safety zone and dropped them at a way-side temple.

The fifth day brought the climax and may seem to point to an easy and comfortable method of shooting panthers, unjustified, alas, by subsequent journeys.

Soon after 8 p.m., three members of the party set out on their return journey from Mohand, having purposely delayed their departure to permit panther, *pere et famille*, to get abroad; of these three, two had two loaded weapons apiece and the third, next the driver, one. Directly after leaving Mohand some country carts were passed creaking their way to Dehra Dun, and, one mile from the start, the head lights showed up a panther strolling unconcernedly along, also to Dehra Dun. The brakes screeched, the gun in front stood up and in the still slowing car, fired at the panther not three yards from the bonnet of the car. He missed, and as the panther bounded off to the left, another missed also with both barrels of a 12 bore (contractile and S. G.)! It is interesting to note that the next day revealed the fact that the panther had left the road at a culvert. From the parapet of the culvert it had sprung to a tree, from this tree it had leapt to the branch of another tree and thence to the ground; we traced it's course by claw marks. This leaves no doubt of the keenness of a panther's eyesight in darkness.

There was nothing to be gained by commiseration and explanations, so the car proceeded, to pass shortly a second small convoy of carts on their way to Dehra Dun. Hardly had it cleared the carts before some one stuttered "here's another" and there she was, walking along the road, an exact replica of the first. This time the car was allowed to stop dead before the first shot was fired. The panther paused for a moment half way up a small bank it had reached and was scaling to the darkness beyond, and was severely hit. Following the shot, pandemonium broke loose. The panther, biting and snarling at it's wound, turned catherine-wheels in the dusty road, and at it one automatic rifle, one magazine rifle and one 12 bore shot gun spoke simultaneously. When the automatic rifle had fired itself silent, it's owner started with a 470 high velocity and the first shot from this stopped all further movement on the part of the panther and left everyone rather dazed. A few stones verified her death and it only remained to place her on the mudguard, cheek by jowl with one of the headlights and, seasoned by the remarks of some exuberant cart drivers, to carry her home in triumph.

She was a female 6 ft. 2½ inches between pegs. The panthers of Mohand, I daresay, no longer observe the maxim *via trita, via tuta.*

Honesty impels me to note the sequel to this adventure. The taxidermists affirm that the panther skin contains but three bullet holes! Eleven shots were fired.

SIMLA,
11th July 1924. ROSTAND.

No. V.—HUNTING WITH THE CARACAL IN THE 17TH CENTURY.

During the seventeenth century the East India Company repeatedly urged its servants abroad to send home strange birds and beasts for presentation to the king; and such appeals were especially made during the reign of Charles II, whose interest in the subject is well known. In response to one of these demands, President Aungier and his Council, writing from Swally Marine on 7 November, 1671 (*O. C.* 3594) said that their efforts to procure some suitable birds had been fruitless, but they were sending a 'beast called Siagosh', which they hoped would prove acceptable. They enclosed (*O. C.* 3596) a description of the method of hunting with this animal, and directions for its treatment. These seem sufficiently curious to merit quotation.

The Method Used by Those in India in Hunting with the Siagosh.

"His keeper hath an horse appointed for him to ride on, and behind him there is a small padd of wood, quilted, made for the siagosh, where hee sitts. And when he comes to his game (which is hares, coneys, peacokes, callongs[1], large hernes, storks, pelicans, and all sorts of lesser fowle, patridges, pheasants, geese, and ducks), his keeper, bringing hime in sight of them, haveing kept him very hungry some time before to make him sharp at his sport, puts him sofely (*i.e.*, softly) downe from his horse, haveing first shewed the game unto him, and leaves him then to work himeselfe; which hee will, if hee bee very hungry, in very suttle ways to attaine his end. The President hath tryed him with severall hares, wherewith he hath made exelent sport. Hee runs very swifte, turns nimbly, and seizes feircely. When he has seized his game, some small time must bee given him to ly upon it, when his nature is to ly as if himselfe were dead. Afterwarde his keeper may goe to him and, covering his eyes with a hood of leather made on purpose (as they use with haukes), may take his pray from him, giving him a piece in his mouth. It is a creature much esteemed by the Princes of these parts next to the leapard, of whose nature he is in all respects. He will seize upon small deare, if put upon them, espetially that if he be hungry; but it is early[2] adventured on creatures above his strenght, though his feirceness is such that he will adventure at any thing. He must bee kept very warme in the sharpe a(i)re of England, for he hath bine brought up very tenderly here in India. In his game he must not bee affrighted by too much company, for that disturbes him and takes him from his game. His usuall food is raw flesh of any creature, especially the tendrest part of it; but care must be taken knoe salt be given him, nor any bones. The times of giveing him his meat is about 8 or 9 a clock in the morning; when hee eats about halfe a pound, and sometimes more, according to his stomack. He drinkes little or noe water; but his meat, when given him, is usually washed and moysned first in water. When he is ill and refuses to eat his meate, they use here to steepe his meate in urine and so give him it,

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[1] The Eastern Crane, *Megalornis grus lilfordi*, called in Hindustani *kulang*.

[2] 'Rarely' seems to be intended.

which recovers his stomack. Also in cold weather they give him three of four cloves, covered in the flesh which they give him, once in a weeke. When he is lame, they give him mummy [3] with his flesh; which, keeping him warme, doth soone recover him."

From an earlier letter (1 June, 1671 : *O. C.* 3567) we learn that this animal had been presented to President Aungier by Diller Khan, in return for some English greyhounds. It is described as 'a beast of game, called here a siagosh, esteemed a great rarity among the noblemen'.

The animal thus described was evidently a caracal, a species of lynx formerly used in India for killing small game, much after the fashion of the cheetah. The name is derived from the Persian *siyah-gosh*, 'black-ear' and it is interesting to notice that 'caracal' comes from a Turkish term having the same significance. The earliest use of the name, according to *Hobson-Jobson*, occurs in Friar Jordanes (about 1330) in the form of *siagois*; while Alexander Hamilton (*New Account of the East Indies*, 1727) perverts it into 'shoe-goose'. A writer in the *Times* (3 Aug. 1886) goes still further; for meeting with an account of a 'shah-goest' brought to England in 1760 as a present for Mr. Pitt, he boldly declares that the creature was 'evidently a shawl goat.'

The letter of 7th November, with its enclosures, went home by the *London* and reached the East India House on 21 May, 1672. Unfortunately, the log of that vessel has not been preserved, and we have consequently no means of learning how the caracal fared during the voyage. Nor is it possible to discover whether it ever reached England; for the Court minutes make no mention of the animal, and the letter sent to Surat in reply contains no reference to the subject.

LONDON, W. FOSTER, C.I.E.
4th August, 1924.

[The Caracal (*Felis caracal*) occurs in the Punjab, Sind, North Western and Central India and the greater part of the Peninsula except the Malabar Coast, but it is nowhere common. Outside India the species occurs in Mesopotamia, the highlands of Persia, and in Arabia and throughout a large part of Africa. Blanford mentions that it is easily tamed and is trained to catch birds such as peafowl, cranes, etc., and small deer, gazelles, hares, foxes, and also to kill for sport. Blyth mentions that a favourite amusement in parts of India is to pit these cats against each other to kill pigeons out of a flock. Indian Princes are said to have kept a number of them for hunting. Vigne, who saw them thus used, says that their speed is, if possible, greater in proportion even than that of the hunting leopard. We trust that Sir W. Foster will find the time and inclination to send us other Natural History Records of the past and we congratulate him on the honour bestowed on him at the New Year.—EDS.]

No. VI.—THE INDIAN GREY SQUIRREL (*FUNAMBULUS PENNANTI.*)

The following notes on the Indian squirrel may be of interest to Naturalists; illustrating as they do some of the strange antics of these fascinating little creatures:—

On the morning of the 8th August 1923, as I was about to enter my house, I noticed a mother squirrel with its young one clinging on to its breast, (like monkeys carrying their young) running towards a lamp-post and then along a small piece of piping which projected towards the wall but was a little distance away from it. Here her difficulties began, the objective being a hole in the wall and she was evidently in doubt whether she could leap the intervening space safely

[3] A medicine prepared from Egyptian mummies.

with her off-spring clinging on to her. After some slight hesitation she risked the jump and landed safely on the wall, but, sad to relate, Master (orMiss) squirrel lost his (or her) grip and would have fallen on to the hard ground had not my Private Secretary, who was watching the performance from the foot of the lamp-post, caught it in mid-air and saved its tender limbs from the severe shock. The ungrateful mite showed its ingratitude to its rescuer by giving him a good bite and some scratches. In the meanwhile her mother safely lodged herself in the hole for which she had made that bold attempt.

I have often watched a pair of these interesting little creatures having a figh on the branch of a tree, frequently the defeated one falls to the ground, and even when the height has been great the squirrel has shown no sign of injury, though it reached "terra firma" with a loud thud.

A pretty sight which I witnessed one morning would lead to the belief that these active and noisy little people occasionally indulge in social amenities and enjoy a dance as much as human folk. The ball-room was the top of a pole and a party of 7 happy squirrels were going through a series of quite intricate evolutions as if they had been trained by a regular "*maitre-de-ballet*" and each time they turned on their haunches up went their tails simultaneously and in the most fascinating manner. Unfortunately I have only seen this Revue (or whatever the squirrel name for the dance may be) on this one occasion.

While writing this article this morning I saw a squirrel dancing of her own accord over the nails stuck on the top of a wall. The top of the wall was secured with French nails (wire nails) about 4 inches high, sharp and pointed.

DHAR, DHAR STATE,
August 1924.

UDAJI RAO PUAR,
Maharaja of Dhar (C.I.).

NO. VII.—HABITS OF THE BROWN FLYING SQUIRREL (*PETAURISTA PHILIPENSIS*).

While on Mammal Survey work in South India (Pulni Hills), I had occasion to observe these beautiful animals in their natural state. These squirrels, like the rest of their kind, are nocturnal in their habits; coming out when it is nearly dark. The day is spent in the hollows of trees and among dense foliage. A common hiding place is amongst the dried fronds of the tree fern. They always seem to return to the same hiding place especially if it be a hollow in a tree. Sometimes as many as two or three may occupy the same dwelling place.

When disturbed during the day, they escape by climbing up a tree as far as is necessary and then parachuting to the next tree and continuing to do so until out of danger. As a rule, they are reluctant to leave their hollow or hiding place by day. On one occasion I came across a pair in a hole in the trunk of a tree and one of them had its tail hanging out, I fired at the tail two or three times in spite of which the animal refused to come out; so eventually I sent up a man to poke them out which he did. I secured both specimens and on examining them I found that one had part of its tail nearly severed from the body.

These squirrels parachute a considerable distance sometimes nearly as much as a hundred yards. When alighting on the trunk of a tree they do so almost noiselessly, the only sound being a slight "tut". Their flight from one tree to another is downwards and then slightly upwards. At another time one of these, in the course of its flight, passed above a small tree, it suddenly shot downwards and alighted on the opposite side of the tree to which it would have originally landed.

I have known these animals to parachute on to spiny stemmed trees and not show any sign of their being hurt in the least.

When alarmed or wounded they give out a peculiar cry not unlike that of a cat and keep it up at intervals without moving from the spot. When frightened by a light they run down the stem instead of parachuting and disappear in the undergrowth. These squirrels appear to breed all the year round. I have found embryos in different months. There is usually only one at a birth. The young one remains with its parent till it is almost full grown.

The nest is made in the hollow of a tree and is lined with leaves and other soft material including fur from the parents. Green leaves are also employed.

Their food chiefly consists of fruits of various kinds and young leaves. *Elacocarpus serratus*, Hook. f. and other species of this genus and *Pyguim gardneri*, Hook. f. seem to form their chief diet during the summer months. I am also inclined to believe that they feed on insects and birds' eggs as I found parts of insects in the stomach of one which I shot.

These animals are eaten by the local inhabitants. On one occasion I tried to eat one myself, but owing to the peculiar smell about the animal even when cooked I did not relish it.

BOMBAY NATURAL HISTORY SOCIETY,
December 1924. C. McCANN.

No. VIII.—DETERMINATION OF THE AGE IN BLACKBUCK.

Can the approximate age of a Blackbuck be determined by the rings on the horns or is it merely local as with the length of them ?

In the case of Chinkara, Dunbar Brander in his "Wild Animals of the C. P." puts the number of rings on a mature buck as 16 or 17. He puts Blackbuck at 4 or 5 twists according to the length of horn but does not mention rings. In studying local (Satara District) Chinkara heads I can confirm this, the average of 8 mature heads show 16 or 17 clear rings and between $\frac{1}{4}$" and $\frac{3}{4}$" of horn which is not present in immature heads.

In the case of Blackbuck only local heads are considered in the theory put forward for argument and this does not hold with one 25" head from the C. P.

Within a 50 mile radius of Satara the normal length of a fully grown head is 19"—20", 21" being exceptional. Taking 16 heads all between 19" and 21" nearly all have 3 complete turns. In nearly every case there is a length of crinkled horn at the base which cannot be called a ring. This varies from $\frac{1}{4}$" to $1\frac{1}{2}$" approximately. Heads having 38—43 rings have all a certain length of this crinkled horn.

4 heads have 35 rings and no crinkles at base.
1 head has 40 " " "
1 " " 36 " very slight "

In every case the distance between the rings increases considerably 6" from the base. None of the 16 heads have more than 43 rings. By a rough estimate it appears that after throwing 35—40 rings the yearly growth of horn is comparatively slight.

I have no idea of the normal life of a Blackbuck, but supposing he attained full growth at 6 years of age he would throw 6 or 7 rings a year and after that the crinkled growth would slightly increase every year. This is probably an over estimate of the growth as a 6 months old buck, in captivity, but apparently normal and allowed its freedom, only just has the tips of its horns showing. In an immature local head of 12" there are 18 rings. This buck showed no signs of adopting mature male colouring, nor was he more than $\frac{2}{3}$rds to $\frac{3}{4}$ths the weight of the average fully grown buck. I should put him down as in his 3rd year.

Now the C. P. head shot near Pachmarhi is 25" in length, has two complete turns in the horn, shows 47 rings and is crinkled for about $\frac{1}{4}$" at the base and is in every way a much bigger and heavier horn. In every case the left horn has been taken.

The above note was written by Captain Parker, from whose collection of horns the details were obtained. It touches on the possibility of judging the age of blackbuck by the rings on the horns. Perhaps some of your correspondent could throw further light on the matter.

SATARA,
25th July 1924. C. H. BRISTOW, I.C.S.

No. IX.—PROTECTIVE COLOURATION IN WILD ANIMALS.

I have read in the Bombay Natural History Society's Journal, Volume XXIX, No. 4, Mr. K. Kunhi Kannan's comments on my article on "Protective Colouration in Wild Animals", and I am afraid I cannot take the credit he gives me. For in the light of my present knowledge I find, of the three principles I arrived at, only one is really true; though generally speaking the theory as a whole is very near the truth.

Subsequent to compiling the paper in question I have read Professor Thayes' book on the subject, referred to by Mr. K. Kunhi Kannan, and have become a firm believer in the theory therein put forth. To my mind Professor Thayes has so amply proved his theory that it passes to the realm of fact; and I know, since reading his book, there has been for me an added zest and interest in studying this question of Protective Colouration in the Jungles.

In my paper I propounded three principles; to quote from the article "Thus I conclude that all wild animals possessed protective colouration and its power of protectiveness lay in its power of concealing its owners when seen against their common backgrounds, which power was due to (1) possession of counter-shading, (2) possession of body patterns that were pictures of the wearer's common back ground", and the third principle I expressed was that "Mimicry" played no part in this protectiveness. Since reading Professor Thayes's book I find that of these three principles expressed only one is entirely sound *i.e.*, possession of counter-shading. Professor Thayes shows clearly that Mimicry does play a part, small though it is, in the general scheme for Protection; more so in the case of birds.

As to my second principle, *i.e.*, possession of body patterns that were pictures of their owner's common background. This is only correct in part; and needs a lot of padding. I have used the term "picture" loosely. In the paragraph preceding that quoted in my article I have said "*i.e.*, that where an animal in the jungle is invisible to an observer his body patterns must approximate to the *patterns of his background*, etc." By the term "picture" I meant "pattern of his background." But Professor Thayes shows clearly that in fact the animal's body patterns are actual *pictures* in *prospective* of that animal's *average* back ground, or part thereof, in *actual detail*.

Also I find written under July 1919, in the notes from which I compiled my article, after setting out the paragraph heads, and their order, for the article which I finally sent to the Bombay Natural History Society, the following "also theory fits in with those of determination by environment, natural selection, and survival of the fittest. This seems all right, and the facts prove themselves in practice, and experimentally, but the explanation of how the body patterns are pictures of the background *beats me*, unless it be that that they are pictures in the sense as a man looking out over a landscape imagines he sees a minute picture of all before him, when in point of fact his eyes take in no detail at all."

So that taking all in all, with my present knowledge after reading Professor Thayes' work, I see that I have come upon a theory that is almost but not quite correct; and have done so blindly; much as our ancestors must have learnt to use a bow and arrow, without realising the explanation of its working, or the scientific principles involved.

I find that my suggestion for the difference of colouration in males and females of animals is in accordance with Professor Thayes' discoveries. Those interested in this subject should certainly read the Professor's book; and after doing so will become, I am sure, firm believers in his theory. There is one point he mentions, which I have never seen mentioned in this connection by other writers, and that is the relative importance to animals of the senses of sight, hearing and smell. Of first importance he places sight, not only because of its great swiftness (*i.e.*, velocity of light) over that of sound, hearing and smell (rate of prevalent wind) but because it operates only in straight lines, whereas sound or smell can be wafted about by the wind; and also it is the final sense by which the predator catches his prey, or the prey avoids the final rush of the predator. He says: "Thus at these crucial moments in the lives of animals, when they are on the point of catching, or being caught, sight is commonly the indispensable sense. It is for these moments that their colouration is best adapted, and when looked at from the point of view of the enemy, or prey, as the case may be, proves obliterative."

It seems to me that by considering the development, in animals, of these three senses from the beginning of time; and by working out the development, through the ages, of colour in animals, strictly following Thayes' laws of protective colouration, an interesting article could be written expounding a theory of how certain animals of to-day have developed vivid colour patterns to a degree: others abnormal sense of hearing; and again others wonderful eye sight; to the exclusion or detriment of the other senses.

Also I must note that the Butterfly that I stated was commonly found among dead leaves under a tea bush does not owe its concealment to "Mimicry" as stated by me. On closer examination I find it is a perfect example of Professor Thayes' theory. It has distinct wing patterns, and perfectly graduated obliterative shading.

BRUCE P. TAILYOUR.

MANGAMALLAY ESTATE,
VANDI PERIAR, S. INDIA.

No. X.—NOTES ON THE "ORNITHOLOGY OF KASHMIR."

In Volume XXVIII (p. 990) of the Journal was published an article by Mr. Hugh Whistler entitled "A contribution to the Ornithology of Cashmere." It happened that I was spending a few weeks' leave in Kashmir at the same time a Mr. Whistler, arriving in Srinagar on April 9th and leaving again on May 14th. All my time was spent in the Valley with the exception of two days when I went to the top of the ridge below Mahadeo and overlooking the Shalimar at a height of about 9,000 ft. On comparing my notes with Mr. Whistler's article I find that my observations corresponded closely with his and, in at least one case, it is probable that we saw the same individual birds. A number of species, however, which I noticed, do not find a place in his list and it has occurred to me that the following notes may be of interest as a supplement to it.

One or two of these species I saw on May 12th and possibly they would not ordinarily be seen in the Valley so late in the year. That day was the beginning of a spell of abnormally cold weather; there had been a severe storm in the hills and snow lay low on the ridge overlooking Srinagar. Immediately after it, several new species, some of which I could not identify, appeared in the Nasim Bagh, where I was living, and I have no doubt they had been driven down by the unusual conditions in the hills.

The numbers and nomenclature are taken from Mr. Stuart Baker's Hand List.

443. The Grey Drongo—*Dicrurus leucophæus* (subs. ?).

I saw a considerable number of Drongos in the Valley and am sure that, as suggested by Mr. Whistler, they were the Grey and not the Black Drongo. The notes of the two species are somewhat different.

719. The Black-headed Myna.—*Temenuchus pagodarum.*

Seen at Uri but not in the Valley.

764. The Verditer Flycatcher.—*Stoparola melanops melanops.*

One seen at Verenag, which lies at the foot of the hills, overlooked by wooded slopes.

774. The Brown Flycatcher—*Alseonax latirostris.*

This was one of the birds seen in the Nasim Bagh after the snowstorm. I am not quite certain of the species but believe it was this one, partly because it had a ring of white feathers round the eye, something like that of the White-eye but not so conspicuous.

834. The White-capped Redstart.—*Chaimarrornis leucocephala.*

Common on all rapid streams where they emerge from the hills.

835. The Blue-fronted Redstart—*Phœnicurus frontalis.*

One seen in the Nasim Bagh during the cold spell in May.

843. The Plumbeous Redstart—*Rhyacornis fuliginosa.*

Common on all rapid streams where they emerge from the hills.

853. The Red-flanked Bush-Robin—*Iantha rufilata.*

In pine woods on the Mahadeo ridge about 9,000 ft. A female appeared in the Nasim Bagh during the cold spell.

909. The Blue-headed Rock-Thrush—*Petrophila cinclorhyncha.*

None seen till May 12th, when a number appeared in the Nasim Bagh.

935. The Brown Dipper—*Cinclus pallasii tenuirostris.*

At Verenag and Achibal, at both of which places there is a rapid stream coming out of the hills, and on the stream above the Shalimar.

978. The Black and Yellow Grosbeak—*Perrisospiza icteroides icteroides.*

A few seen on the Mahadeo ridge at 8,000 ft. or 9,000 ft.

1057. The Eastern Meadow Bunting—*Emberiza cia stracheyi.*

Mr. Whistler says that he saw none of this species. But in my notes I find it mentioned as very common, especially in rough country and in the hills, while I did not definitely identify *E. stewarti* except at about 8,000 ft. and over on the way up to the ridge.

1087. The Wire-tailed Swallow—*Hirundo smithii.*

Along the road up as far as Garhi.

1143 (?) The Skylark—*Alauda* ?

A Skylark is plentiful in the Valley wherever there is cultivation but I do not know the species. Presumably it is either *A. gulgula guttata* or *A. arvensis intermedia.*

1137. The Eastern Calandra Lark—*Melanocrypha bimaculata.*

This is not apparently found wild in the Valley but it is exceedingly common as a cage bird.

1359. The Kashmir Roller.—*Coracias garulla semenowi.*

Not very common but a few seen at different places in the Valley and as low as Garhi. They were always in pairs and seemed to keep to the same locality.

1389. The White-breasted Kingfisher.—*Halcyon smyrnensis* (sub sp.) ?

Seen below Garhi. I thought I heard one in the Nasim Bagh but may have been mistaken.

1431. The Kashmir (?) House Swift—*Micropus affinis* (sub sp.?).

I saw a few on the way up to the Mahadeo ridge.

1474. The Himalayan Cuckoo—*Cuculus optatus.*

One heard in pine forest on the back of the Mahadeo ridge at about 9,000 ft.

1586. The Collared Pigmy Owlet—*Glaucidium brodiei.*

Heard in pine forest on Mahadeo ridge at about 9,000 ft.

1794. The Monal—*Lophophorus impejanus.*

A cock seen at about 8,000 ft. on the Mahadeo ridge, on an open grassy slope devoid of cover.

1777. The Koklas—*Pucrasia macrolopha* (sub sp.?).

Common in the pine woods behind the Mahadeo ridge and also on the nearer slopes of the ridge where there was sufficient cover.

1946. The Black-winged Stilt—*Himantopus himantopus himantopus.*

A small flock appeared on tbe Dal Lake early in May.

1992. The Brown-headed Gull—*Larus brunnicephalus.*

There was a small flock of these birds on the Dal Lake throughout the last days of April and the first week of May. I have no doubt this was the same flock as that mentioned by Mr. Whistler. I think however that they were Brown-headed and not Black-headed Gulls. I had numerous opportunities of watching them and my reason for believing them to be the Brown-headed species is that in flight their wings showed up as white with a black tip, in the centre of which was a distinct white patch.

2036. The Little Cormorant—*Phalacrocorax javanicus* (?).

Isaw a small flock on the Jhelum between Srinagar and Islamabad. I am not sure of the species.

2065. The Common Grey Heron—*Ardea cinerea cinerea.*

Fairly common on the Dal Lake, and also on the Jhelum. A number of them had nests in a large chenar tree near the Nishat Bagh, in which there were a great number of nests of the Night Heron. I was surprised one evening to see one of these birds fly down and settle on deep open water well away from the shore and swim about slowly. At intervals it would catch something and fly away with it and then return to the same spot. I did not know that Herons ever did this.

2077. The Indian Pond Heron—*Aerdeola grayii.*

Seen between Domel and Garhi but not in the Valley .

2081. The Night Heron—*Nycticorax nycticorax nycticorax.*

Very common on the Dal Lake, especially near the Nishat Bagh, where there was a large heronry in the chenar tree mentioned above. During the day numbers of them roosted in withy beds near this tree. I also saw many of them carrying sticks for building purposes at all times of day, and occasionally in dull weather I saw some feeding by day. Those that were roosting in the withies would start carrying sticks to their nests with great energy as soon as they were disturbed, and it was through this curious habit that I first discovered the heronry.

2111. The Mallard—*Anas platyrhyncha platyrhyncha.*

Two or three seen on the Jhelum about April 18th.

2123. The Shoveller—*Spatula clypeata.*

A small flock appeared on the Dal Lake on May 5th and remained one day.

L. S. WHITE, I.C.S.

No. XI.—BIRD NOTES IN KASHMIR IN WINTER.

Many have sung the praises of the Valley, its beauties and its joys, in the Spring, the Summer and the Autumn, but one hears very little of Kashmir in the Winter and a short description of Srinagar and its surroundings at this season more especially with reference to bird life, may be of interest.

First a few words on the climate. November and December are, as a rule, characterised by hard frosts and bright sunshine. About Christmas comes the first snow fall after which, until the end of February, the valley is more or less under snow, with fresh falls at intervals and very little sunshine. March ushers in the spring, though not infrequently there are setbacks in the shape of fresh falls of snow, which, however, do not lie long.

Throughout the winter the Chenars, the Willows and the Poplars which were so gorgeous in October in their crimson, their orange and their gold are all leafless and the scene is as wintery as one can well imagine.

The river Jhelum runs very low, but does not freeze. The lakes, the Dal, the Anchar and others freeze round the edges, and in hard winters may freeze from end to end. By the middle of October nearly all the summer visitors—the Bee-eaters, Paradise Flycatchers, Orioles, Reed Warblers, Swallows and Starlings—have departed. A few Tickells Ouzels remain till the end of October, feeding on the apple crop—also an occasional Rufous-backed Shrike may be seen as late as November.

The great majority of the Wagtails (Hodgson's Pied Wagtail and the Grey Wagtail) also disappear by the end of October, but a few of both species, more especially the former, brave out the winter and may be seen along the banks of the Jhelum or by the Dal lake even when snow is on the ground. Most of the Hoo-poes also leave in October but an occasional bird may be seen even in winter.

While the summer visitors have been gradually leaving for warmer climes, another movement of birds has been going on simultaneously, *viz.*, an immigration of birds from the surrounding hills which are driven down from higher, colder altitudes by the approach of winter, to seek the comparative warmth and more generous food supply of the valley below.

By the middle of November the outward and inward migrations are practically complete, except for the few birds such as the Chough, the Accentors and the Pine Bunting which are driven down later on by the snow.

The birds which may be seen in winter in the neighbourhood of Srinagar may be conveniently divided into three classes :—

(1) The permanent residents.
(2) The regular winter visitors.
(3) Occasional winter visitors.

(1) Permanent Residents.

Corvus coronoides intermedius—The Himalayan Jungle Crow.

This crow is found in Srinagar as well as on the surrounding hills and in the valleys up to at least an elevation of 11,000 feet. They are not numerous in Srinagar.

Corvus splendens splendens—The Indian House Crow.

Common in Srinagar and much more numerous than the last species. It also occurs in Baramulla and between Baramulla and Srinagar, but not elsewhere in the valley. It is strange that this species, which resists the fiery heat of the plains, should be apparently quite happy in the snow and keen frost of Kashmir.

Corvus monedula collaris—The Kashmir Jackdaw.

Found in incredible numbers in and around Srinagar, and also up the side valleys to about 9,000 feet. Throughout the winter they leave Srinagar daily in large flocks of hundreds or even thousands of individuals. They leave in a vast stream every morning about half an hour before sunrise, flying roughly south along the Jhelum river and return in the evening about ½ hour after sunset. Presumably they go to feed in the extensive areas of cultivation found upstream along the Jhelum river. Early in February they pair off and select nesting holes in trees or buildings but they do not lay till the first week in May.

Parus major kashmiriensis—The Kashmir Grey Tit.

A common bird in the station throughout the year.

Molpastes leucogenys—The White-cheeked Bulbul.

Bright, cheery and very tame. Frequents house boats and other river craft in the winter. Also numerous in gardens and even in the Bazars.

Myiophoneus horsfieldi temminckii—The Himalayan Whistling-Thrush.
Not very common near Srinagar but a few may generally be seen among the big rocks at the foot of the Takht on the North and West side.

Cinclus pallasii tenuirostris—The Brown Dipper.
Common on the streams leading down to the valley.

Acridotheres tristis tristis—The Common Myna.
Very common in Srinagar. Does not seem to mind the snow.

Carduelis caniceps caniceps—The Himalayan Goldfinch.
To be seen in large flocks in winter especially on the south-east slopes of the Takht. They feed on the seeds of a small thistle-like composite from October to December and in January and February on the seed of the Chenar. They begin to sing, often in chorus, in February.

Passer domesticus parkini—The Kashmir Sparrow.
Numerous in Srinagar throughout the winter. Mr. Hugh Whistler maintains that the numbers of the resident community are largely swelled by a migratory host which arrives from the plains in the spring and leaves again in the autumn. I have been unable to confirm this. They breed under the eaves of houses, also in trees and commence to lay in the end of April.

Ceryle rudis leucomelanurus—The Indian Pied Kingfisher.
Not uncommon in the vicinity of Srinagar. A very early breeder.

Alcedo atthis pallasii—The Central Asian Kingfisher.
Exceedingly common in summer. Less so in winter. Very tame and confidential.

Strix aluco bidulphii—Scully's Wood-Owl.
Common in and around Srinagar as well as on the hills up to the limit of tree-growth. Its usual call is a loud Hoo.....Hoo-oo-oo-oo. With a marked interval of about 4 seconds after the first Hoo. Another call sometimes heard is a loud quack. Yet another call is a curious soft "Coo" resembling closely by the ordinary call of the Indian Ring Dove.

Bubo bubo bengalensis—The Rock Horned Owl.
Two or three pairs frequent the steeper rocky slopes of the Takht, where they also breed in the spring.

Gyps himalayensis—The Himalayan Griffon.
Occasionally to be seen on the cliffs and crags in the vicinity of Srinagar.

Milvus migrans lineatus—The Black-eared Kite.
Numerous in and around Srinagar.

Alectoris græca chucar—The Chukar.
Common on the hills around Srinagar. A number of coveys are generally to be found on the slopes of the Takht, where they are preserved.

Ardea cinerea cinerea—The Common Grey Heron.
Common on the lakes. There are several breeding colonies within 10 miles of Srinagar.

Nycticorax nycticorax nycticorax—The Night Heron.
Common—Breeding colonies near Nishat Bagh, and at Hazrat Bal.

(2) Regular Winter Visitors.

Pyrrhocorax pyrrhocorax—The Red-billed Chough.
To be seen about Srinagar only when the snow is down on the hills, in January.

Lophophanes melanolophus—The Crested Black Tit.

Lophophanes rufonuchalis rufonuchalis—The Simla Black Tit.
Both the above species visit Srinagar in the winter and may be seen on the willows, hunting for insects in small parties. At this season both species may always be seen in the Blue Pine wood on the Takht.

Trochalopterum lineatum griseicentior—The Simla Streaked Laughing-Thrush.
These birds arrive in Srinagar from the neighbouring hill forests towards the end of September leaving again in April. During the winter months they

frequent gardens and also the rocky ground at the base of the Takht.

Certhia himalayana himalayana—The Himalayan Tree-Creeper.

Very common in winter, hunting over the trunks of willows for insects.

Tichodroma muraria—The Wall Creeper.

This beautiful little bird, grey with crimson wings, is not uncommon from November to March on the rocky slopes of the Takht and elsewhere in and around Srinagar. When the snow came down in January a Wall-Creeper used to visit the writer's houseboat almost daily searching over the wooden walls and mosquitoproof netting for insects.

Troglodytes troglodytes neglecta—The Kashmir Wren.

Common on the rocky slopes of the Takht, occasionally also in gardens in Srinagar.

Planesticus ruficollis atrogularis—The Black-throated Ouzel.

Very common from November to March in and around Srinagar.

Picus squamatus squamatus—The Scaly-bellied Green Woodpecker.

Occasionally heard and seen near Srinagar in winter.

Dryobates himalayensis—The West-Himalayan Pied Wood-pecker.

More numerous than the last.

Anthus roseatus—Hodgson's Pipit.

Common in marshy ground, *e.g.*, below Khunamoo

(3) Occasional Winter Visitors.

Sitta leucopsis—The White-faced Nuthatch.

A pair were seen throughout the winter months in the Blue Pine wood on the Takht.

Œnanthe sp—A Pied Chat.

Possibly *O. picata* was seen once, in January, on the southern flank of the Takht.

Phœnicurus erythronotus—Eversmann's Redstart.

Seen in December and January on two or three occasions in the orchards near Gupka.

Laiscopus collaris rufilatus—The Turkestan Hedge-Sparrow.

A pair were observed on a rocky precipice on the Takht on December 14th. Both were secured and they proved to be the above species.

Laiscopus himalayanus—The Altai Hedge-Sparrow.

Two out of a flock were shot on March 17, on the Southern slope of the Takht.

Prunella atrogularis—The Black-throated Hedge-Sparrow.

A single specimen was seen and shot at Pari Mahal.

Metoponia pusilla—The Gold-fronted Finch.

A single bird was seen at Pari Mahal on November 29 and a small party at the same spot on March 14.

Emberiza leucocephala—The Pine Bunting.

A small flock were seen for some days towards the end of November frequenting Colonel Ward's farm at Pandrethan.

Circus ? sp.

A pale Harrier, possibly *C. macrurus* was seen several times in the winter.

Vanellus vanellus—The Peewit.

A few were seen in the swampy ground below Khunamoo in November and December.

By the third week in February the return of the Starlings may be expected, followed by the Swallows in the first week of March, safe heralds of spring, and so ends the Kashmir winter.

Srinagar,
Kashmir.

B. B. OSMASTON, C.I.E., I.F.S.

No. XII.—BREEDING OF THE EASTERN WHITE-SPOTTED BLUETHROAT (*CYANOSYLVIA CYANECULA ABBOTTI*).

I have read with much interest Captain Bates' beautifully illustrated and fascinating article in the last number of the Journal entitled "Birds nesting with a camera in India."

Having only just returned from a bird's nesting trip extending over much the same ground, the account of Captain Bates' experiences were of special interest to me.

Facing page 950 is an excellent photograph of a nest and eggs attributed to the Eastern White-spotted Bluethroat (*C. c. abbotti*) from the fact that a bird of this species was observed in close proximity to the nest. I venture to think, however, that this is incorrect. Last year in Ladakh I found this Bluethroat as well as the Red-spotted variety breeding in great numbers in the valleys at from 9,000' to about 12,000 feet. Nests are invariably cup-shaped and are never domed or semi-domed, and the eggs are, in colour, a more or less uniform brownish green, something resembling the eggs of the European Nightingale.

On the other hand Captain Bates' nest and eggs agree exactly with those of the Himalayan Rubythroat (*Calliope pectoralis pectoralis*). This latter is a common bird in the Lidar Valley between 9,000 and 12,000 feet elevation, frequenting open rocky slopes with junipur scrub.

Several nests of this bird were found by me this year, mostly with young, and one contained a young cuckoo (*C. canorus telephonus*). One nest a little below the Kolahoi Glacier contained 4 fresh eggs which agree exactly with Captain Bates' description. These were taken in June 22nd. So far as I know the Rubythroat is the only one of the *Turdidæ* which builds a domed nest.

Whether the Eastern White-spotted Bluethroat breeds in Kashmir proper, West of the Himalayan Range, is I think extremely doubtful. Personally I have not observed this bird in Kashmir in the summer months. The chief breeding of this species is undoubtedly Ladakh where they frequent the low thorny scrub in, or near, stream beds especially in damp or swampy spots.

SRINAGAR, KASHMIR. B. B. OSMASTON.

No. XIII.—NESTING OF THE YELLOW-THROATED SPARROW AT KALAN, SHAN STATES (*GYMNORIS XANTHOSTERNA XANTHOSTERNA*).

I found the eggs of this bird in a hole in a dead tree stump. I shot the bird and have no doubt about it. It was found at Kalan in the Southern Shan States, and, as this is outside its previously known habitat it is of interest. Some years ago I saw what I now think may have been this bird near Maymyo, Northern Shan States. There were many holes in a rotten tree stump and and I assumed they were the Pegu House Sparrow and did not shoot one. On sending my man up, the whole stump broke and the eggs were smashed.

There was a small amount of dead grass at the bottom of the nest hole but there was little or no attempt at a nest.

There were 4 eggs, green, heavily marked with greenish-brown; in two the top of the larger end was solid greenish-brown. Size ·75 × ·58.

S. M. ROBINSON, M.B.O.U.

[Blanford places the eastern limits of the bird "To about the longitude of Midnapore in Bengal"; its discovery in Kalan denotes a considerable extension of its range. —EDS.]

No. XIV.—NESTING HABITS OF THE INDIAN WHITE-BREASTED KING-FISHER (*HALCYON SMYRNENSIS FUSCA*).

Most birds, during the breeding season, are fastidious in keeping their nurseries perfectly clean and free from dirt and filth. But the evidence regarding

Halcyon smyrnensis fusca is exactly the contrary. "In Hume's Nests and Eggs" (Vol. III, p. 15) we read—"I have never found any nest, so to speak, but both the passage and chamber often contain remains of frogs, mole-crickets and the like."

I have come across many nests of the White-breasted Kingfisher and I have noticed that while some really containskeletons and carcasses of frogs and rodents there are others which are quite perfectly tidy and clean. I believe that this bird has the habit of cleaning its nest as much as others, and, in the instances where skeletons and dead frogs and moles have been found, the explanation I think is that either the table was laid out for dinner or the remains of a meal lay still unremoved.

These ground-burrowing birds have to contend against the depredations of many quadrupeds. I had under observation a nest of *H. s. fusca* which was one day found dug up with the contents gone. The nature of the excavation pointed unmistakably to a fox as being responsible for it.

This Kingfisher seems to cherish a strong dislike for the Mungoose as well. If this animal comes within so much as hailing distance of its nest, the bird at once attacks it. On the 1st June last I noticed a most interesting incident in which a pair of Kingfishers (*H. s. fusca*), in defence of their hearth and home, gave battle to a mungoose. A mungoose was sniffing past a hole in the bank of a small pool of water. Suddenly, with a loud shriek, a King fisher pounced on the marauder which,without offering resistance,at once turned tail and fled. The bird was joined by his dame and from their vantage position in the air they occasionally darted at the animal. The kith and kin of Kipling's wonderful creation, the heroic Rikki-Tikki-Tavi, sneaked away as fast as it could. This animal is very much in evidence in summer, prowling about in our gardens and, I am sure, is responsible for much of the destruction of birds' eggs and the massacre of nestlings.

The above incident suggested the existence of a nest of the above Kingfishers within the hole around which the Mongoose was found loitering. I had this hole dug up and found it to be a circular passage 3 ft. long, at the extreme end of which was the chamber which formed the nursery containing four unfledged young ones. The passage was so smooth that it looked as if it was chiselled out with great care. The nest contained not the least trace of any bone or carcass.

CALCUTTA,
April 1924.

SATYA CHURN LAW,
M.A., B.L., F.Z.S., M.B.O.U.

No. XV.—DISTRIBUTION OF THE HIMALAYAN IMPEYAN PHEASANT OR MONAL (*LOPHOPHORUS IMPEJANUS*).

Through the kindness of my friend Mr. Cooper of the Imperia lForest Service, and also of the Political and Assistant Political Officers at Sadiya on the North-East Frontier of Assam, I am able considerably and definitely to extend the habitat of this fine pheasant.

Beebe in his sumptuous Monograph gives the distribution as follows:—"The Himalayan Impeyan may be said to occupy the entire Himalayan range of mountains. It has been found in Eastern Afghanistan, and thence eastward through the North-West Frontier Provinces, Kashmir, Garhwal, Nepal, Sikhim, and for some distance in Western Bhutan, as far indeed as any reliable records have been obtained." Stuart Baker in his "Game Birds of India"gives it as — "Afghanistan, Chitral, and the Western Himalayas through Kashmir, Garhwal Nepal, Sikkim, Native Sikkim, Bhutan of the Chambi Valley and South Tibet."

From the latter distribution I think we must now eliminate British Sikkim

as Mr. Stevens, on whose authority Stuart Baker apparently includes it, now doubts whether it occurs there, it is still however to be found in Native Sikkim, I came across it there during a trip last June. According to a distribution map of this bird as collected or observed by Major Bailey, C.I.E., made while I was on a visit to him, it appears to be found slightly further East in Bhutan than given in Beebe's map and probably extends right across that country. He has lately got specimens alive from Ha in Bhutan.

The first intimation I got as to the further Eastern extension of this species was in a letter from Mr. Cooper, dated Sadiya, 7th February 1923, in which he wrote:—"However, I send herewith a photo of a Monal pheasant which I believe to be *impejanus* and not *sclateri*. (The photo is not good and is therefore not reproduced but the spatulate feathers could just be seen on the top of the head.) In Baker's book he puts the east limit of this pheasant at Bhutan. If this is *impejanus* he certainly goes east of Mishmi Hills. This pheasant was brought as a present to the A. P. O. here from the Delei Valley or east of it."

I showed this letter and photograph to Mons. Delacour when he was here and at first he thought it might possibly be *l'huysii*, but on examining it carefully through a lens the spatulate feathers of the crest were quite plain. About the end of last year, through the courtesy of the Political and Assistant Political Officers at Sadiya, I was able to get positive proof of this. Four skins of Impeyan pheasants were kindly sent to me, three of which were *sclateri* and one a cock *impejanus*. I wrote enquiring as to the locality in which they were found and received the following reply from Mr. Godfrey, Asstt. Political Officer, dated Sadiya 28th January 1924: "The monals, the skins of which we sent you were found near the snow line (8,000') on either side of the Delei valley. Mishmis state that they are also found as far east as the hills of the Dou Valley. I had an ordinary monal cock brought in last year (evidently the one whose photograph Cooper sent me. C. M. I.) but it died as soon as the weather became hot and unfortunately I was unable to save the skin. . . . . The Mishmis have only one name *Pia-Padai* for the Monals and make no effort at distinguishing the various kinds."

As no skins have been forthcoming from the Dou Valley, we cannot say whether both species or only *sclateri* occurs there but that both are found in the Delei Valley is now proved. There still remains a big gap between Bhutan and this valley from which no specimens have been obtained but it seems improbable that *impejanus* should occur in an isolated tract far from its ordinary habitat and I think we may correctly presume that it is found, in suitable country, right across from the S. E. of Kabul to the Delei Valley in the Mishmi Hills on the North-East Frontier of Assam.

DARJEELING,
28th July 1924.

C. M. INGLIS,
F.Z.S., F.E.S., M.B.O.U.

No. XVI—THE MECHANICS OF THE SOARING BIRD.

May I invite the aid of the members of your Society to solve the problem of what may be called the "Mechanics" of the *soaring* bird. The information I seek is not contained in any text book in English or French on soaring flight.

(1) *Efficiency.*—We measure the efficiency of an aeroplane by the angle of its glide. The steepness or "flatness" of the gliding slope is entirely governed by the resistance ("drift" or "drag") of the aeroplane. In a typical modern aeroplane we find it hard to better a slope of 1 in 8. What is the gliding angle of typical soaring birds—say of the common vulture (*Pseudogyps bengalensis*)

and the cheel or common kite (*Milvus govinda*)? The difficulty in measuring this angle is that any air movement whether horizontal or vertical will falsify the results. The most hopeful line of attack is to disturb soaring birds on stil days after sun down when " soaring " has ceased. Some success has been achieved on these lines, but many more observations are required.

(2) *Wing characteristics.*—Assuming that the gliding angle of a soaring bird is very fine we must attribute much of the efficiency to the wing section employed. The smoothness of the body, absence of struts, etc., will only partially account for the good gliding angle (in an aeroplane these resistances are only about 30 per cent. of the whole) since the greatest single resistance is almost certainly the horizontal component of the air pressure on the wings.

Now a wing may be defined by its dimensions, *i.e.*, length and breadth or as we say span and chord, by its chamber or the curvature of the wing with regard to the cord, and by its angle of incidence with which the chord meets the air. The first characteristic is easily obtained and data are in existence, the last is a matter of averaging many estimates under different conditions, *i.e.*, ful spread climbing (this is usually " circling ") or half furled gliding just horizontally. The camber is difficult to get. A fresh killed bird may be taken, turned upside down and the wings extended to any one typical soaring attitude. The camber now seen is a false one since in flight the wings must be supporting the weight of the body. We must therefore load the single wing with sand to represent half the weight of the body and this sand loading should be graduated from root to tip and front to rear : the greater load being nearest the root and nearest the front edge respectively. It is difficult to distribute this load scientifically, but as a rough guide the inner half of the wing should sustain $\frac{2}{3}$rds of the wing load, and the forward $\frac{1}{2}$ of the wing should sustain $\frac{2}{3}$rds of the load appropriate to any given " segment ". For example if the single wing loading of a large vulture were 99 ozs., 66 ozs., would be sustained by the inner half the wing and 33 ozs. by the outer—(these loads would be graduated within their respective halves so that a given square inch nearer the root would be heavier loaded than any square inch further in a line along the span towards the tip). Now of the 66 ozs. on the inner half 44 ozs. would be borne by the *front* half of the $\frac{1}{2}$ wing and only 22 ozs. by the rear. By a rough and ready loading in this manner followed by a fixing of the wing and the removal of the loading material we shall get some small idea of the camber employed. This will vary all along the wing, and I should like a drawing of say 5 typical sections along the half span for wings both full spread and half furled.

(3) *Tail functions.*—I should be glad of observations on the functions of the tail.

In an aeroplane if we raise the rear edge of the tail the wind pressure on the raised edge depresses the whole after portion of the machine and the result is a climb : in a bird the result appears to be precisely the opposite, the tail being jerked up to *descend*.

In an aeroplane the vertical rudder is turned towards the side to which it is desired to turn : a cheel is constantly revolving its tail without apparent influence on its direction. And when a movement of the tail accompanies a turn sometimes this tail movement appears to be in the " correct " sense judged by aeroplane practice, and just as often incorrect. In other words a marked depression of the starboard end of the tail may accompany a turn to starboard *or to port*.

There is little doubt that a bird steers with its wing tips, but what then is the function of the tail? Its movements are apparently small in vultures, but it is never still in the case of the cheel. Dissection may show that the root of the tail is the seat of a great number of sensory nerves from which we might infer that the tail is largely a wind vane to feel the currents, or some other explanation may be put forward. The matter is of considerable interest.

There are other points still obscure, but this letter is already long enough. A reprint of a lecture on "gliding" which will appear in the April journal of the United Service Institution of India will give any of your members who are interested food for more thought.

Any observations sent by your member to me at Headquarters, Royal Air Force, India, will be gratefully received.

R. A. F. HEADQUARTERS,
DELHI, 12*th January* 1924.

J. A. CHAMIER, C.M.G., D.S.O., O.B.E.,
Group Captain,
Royal Air Force.

With reference to Capt. Chamier's enquiry on the above subject I hope our members in general, and Capt. Chamier in particular, will not consider this effort of mine, a case of fools stepping in where angels fear to tread! As one keenly interested in the flight of the larger birds the subject is full of interest to me, but whether the observations of a layman can be of the least use in shedding light on Capt. Chamier's difficulties is quite another matter.

However, on the assumption that even negative information might lead to something and give rise to comments by some who have already studied the subject, and induce others to watch for, and work out, the points raised by Capt. Chamier, I take the liberty of starting the ball rolling.

(1) *Efficiency.*—I have tried to observe the angle of slope of a soaring bird on several occasions, but am afraid I have not met with much success. Capt. Chamier says that any air current will falsify the result, and how is one to know whether there is any air current just where the birds happen to be soaring?

I have selected a period of the day when, so far as I could judge, it was dead still. Not a leaf stirred and even the sand one threw up fell only just off the vertical.

A number of vultures rose from the ground and began to soar.

A great deal of flapping of wings was necessary until they rose about 100 or 150 feet from the earth but, thereafter, they were able to circle on steady pinions, their wings being at full stretch.

Elevation was not gained by these birds gradually throughout the spiral but, seemingly, at only one point in the circle. They flew round clock-wise, and I noticed that they rose visibly when furthest from me and facing north and then, as they turned, they seemed to lose elevation. After a little time some of them changed direction and circled in the opposite direction, *i.e.*, anti-clock-wise. This change, however, did not effect them in so far as they too gained elevation when facing north and lost it when they turned.

I concluded that they gained when they breasted an air current and lost it when they turned and flew down wind and therefore the wind must be blowing from north to south. I again tried throwing up a little fine dust and noticed that a little of it was blown off the vertical to the west, *i.e.*, what breeze there was must have been from east to west.

There was no appreciable difference in speed at any point of the circle and the birds flew at about the same pace whether breasting the current or flying with it.

Occasionally an individual could be seen with an appreciable slope from head to tail but this was the exception and, for the most part the birds remained on an even keel, so far as one could see, and yet they gained elevation all the time. In under ten minutes they were mere specks.

There was a certain amount of "banking" when they turned from the point at which they gained elevation and the wing on the inner side of the circle was distinctly lower than the other.

On another occasion I watched a number of vultures leave the trees on a canal bank, quite near me. There was an appreciable wind blowing and the birds went straight up against it and began circling almost at once on outstretched

wings. This time there was a very appreciable difference in speed between their breasting the current and coming down with it. A Tawny Eagle joined them and it was very noticeable that the current effected him much more than it did the vultures.

Whereas the vultures went round absolutely evenly, except that they "banked" a good deal, the eagle seemed to have trouble in keeping his balance and flight was distinctly unsteady. The vultures made very little play with their tails whereas the eagle's was continually on the move.

As, however, it is necessary to make observations when there is no current of air, I am afraid the above observations are of not much use from Capt. Chamier's point of view.

Might I, however, suggest observations being made of a captive bird taken up in an aeroplane on a still day and released when 500 feet or so up. The bird should be hooded (an ordinary falconer's hood made to a size to fit the bird) and two tiny holes made in the hood above the eyes, just sufficient to let in a ray of light from above. A bird thus hooded would almost certainly begin to soar since it could see nothing below it. The bird would have to be kept for some days and accustomed to the hood, and I would suggest a Bonelli's eagle for the experiment as they are not difficult to procure and are strong steady flyers. The whirring of the engine and propeller might effect the bird, but this could be eas ly got over by keeping the bird near such noises for two or three days. If a "rufter" hood is used and not too tightly fastened on the day that it is taken up for its flight, the bird would be able to get rid of it in time, in the event of its getting away.

An observer in an aeroplane, a little distance away, would then be in a position to note the extent of air currents prevailing and every movement of the bird.

I have also tried disturbing birds after sun-down but in each case they have gone straight away with beating wings and given no opportunity for observation.

(2) *Wing characteristics.*—I have only had two opportunities of obtaining the camber of an eagle's wing, but the attempts were futile. On both occasions I was in a hurry and could not give much time to the experiments. I tried a sand-loading but a big percentage of the sand trickled through between the feathers.

Whereas it more or less stuck to the stiff primaries, the softer secondaries were displaced and the sand went through. A fine bit of silk placed over the wing might do the needful.

To get correct measurements appears to necessitate very great care and each wing must be stretched to *exactly* the same extent and exactly the same distance above the ground. Two measurements I took of the same eagle did not tally and the camber of the two wings, of the same bird, were different.

In this respect not only must the camber of different species vary considerably, but the camber of the same bird must be frequently changing.

If we look at the upper surface of an outstretched wing of an eagle it will be noticed that from the extreme front edge of the wing there is a steep slope upwards to the radius and ulna. Thereafter it is gradual to the point whence the feathers (secondaries) curve downwards. The under surface of the wing is concave and the greatest depth will be found in the region of the first and second secondary. The secondaries grow from the ulna. If the radius and ulna were rigid the camber would be uniform under all conditions, but there is considerable play between them and to what extent would this movement effect the camber? The elevation of the ulna, the least bit, above the radius, would, I take it, make a considerable difference to the end of the secondaries, and similarly a depression of the ulna would tend to lower the end of the feathers attached to it. If this movement is constantly in progress while a bird is in flight, is the camber not also changing accordingly?

In flight, if we watch a vulture, it will be noticed that the tips of the primaries are frequently turned up at the ends. Sometimes more and sometimes less, depending probably on its speed or the force of the air currents. If a kite happens to be flying round at the same time and in the same place, its primaries appear to be hardly effected.

(3) *Tail functions.*—From watching birds in flight I agree with Capt. Chamier that the tail is not used as a rudder to change direction.

It has always struck me that it is more of a balancing agent than anything else. If we take the Raptores it will, I think, generally be found that birds which have very light bodies in comparison with their expanse and which are required to fly slowly searching for their prey, have also long tails (comparatively) and make much more use of them than heavier birds with shorter tails. The kites, Black Eagle, Harriers, are all long winged, light bodied birds. They spend their time circling slowly round and round, turning and twisting this way and that and their tails are ever on the move. Owing to their long wings they seem to be much more effected by air currents than a heavy vulture for instance, whose tail is short in comparison and not very much in use.

A kite without a tail, by no means a rare sight in India, has no difficulty in turning whichever way it pleases though its flight is erratic and unsteady.

An Osprey is an exception; he is a long winged, light bodied bird but has a short tail. On the other hand most of his hunting is done on beating wings and not on outstretched steady pinions.

A Kestrel hovering frequently makes great play with its tail while absolutely stationary in one spot.

I fear I have no idea whether the root of the tail of a bird is a mass of sensory nerves or not.

DHARAMASALA, PUNJAB,
June 1924. C. H. DONALD, F.Z.S., M.B.O.U.

No. XVII.—OCCURRENCE OF *PELICANUS ROSEUS* IN THE VIZAGAPATAM DISTRICT.

The sea-port town of Vizagapatam has a large back-water behind it. It is now in process of drying up, thanks to the Salt-factory. It is also the dumping ground for the city's rubbish and, if the project for a harbour at Vizagapatam materialises, it will soon be pumped dry, thus depriving many members of the bird-world of a favourite resort. As it is, the back-water is a large land-locked tidal swamp four miles in extent with one or two long narrow arms running tortuously far inland. One of those arms or channels has on one side, a boggy surface extending for almost a mile, and the mud, being knee-deep, the channel is unapproachable from the land. It is only by a boat that one can go up the channel. But the whole of it is not navigable. Aquatic birds like Whimbrels, Curlews, Storks, and Plovers are very common here.

One day in October last, approaching through the salt-beds to the west of the backwater, I advanced towards the extreme end of the above-mentioned channel. Standing by the water's edge, I noticed a group of about half a dozen Storks (*Ciconia alba*), some feeding and others preening themselves. Sitting apart from them, at a distance of about two or three yards, were two shorter and bulkier birds unrecognisable with the naked eye. With the aid of my glasses I identified them to be *Pelicanus roseus*. They were sitting quietly without movement. I was at a distance of four or five hundred yards at least from the birds; further approach was impossible as my boots sank deeper at every step. Constant firing in the area had made the birds shy, so that, though we were moving about at such a distance, the birds grew restless. The Storks first grew suspicious, raised their head and craning their neck forward looked in our direction. Then all of them rose. The Storks rose gracefully, the Pelicans

heavily with slow beats of their large wings. All went up together gradually in spiral motions. For a long time they—the Storks and the Pelicans—described great circles overhead, with each circuit rising a little higher till at last they became mere specks in the sky. Gradually they moved away out of sight towards the west.

What struck me most was that not only were the Storks and Pelicans feeding side by side in evident amicability but all through the flight they kept together. For half an hour I watched them soaring in the sky, not once did they separate. Without a field-glass one could hardly have distinguished the birds.

About eighteen miles to the South of Vizagapatam is a picturesque lake surrounded by hills, locally known as Konda-kerla (Konda=hill; Kerla=lake). From November all through the winter it is a pleasure resort of aquatic birds, e.g., Ducks, Coots and Grebes among others. During a visit to this place I noticed also a single *Pelicanus roseus* flying across the lake. Later it was brought to me, having fallen to the gun of a young enthusiast, and proved to be a yearling. It appears that in winter the Pelicans commonly occur in the district.

CALCUTTA,
April 10th, 1924.

S. C. LAW, M.A., F.Z.S., M.B.O.U.

No. XVIII.—IDENTITY OF THE "DEVIL BIRD" OF SOUTH INDIA.

"———the diabolical shrieks attributed to this species by Layard and others are probably produced by another owl (Blanford, F.B.I. III. p. 276 on *Syrnium indrani*).

For many years I have tried to shoot a "Devil Bird" in the act of emitting its painful howls in order to identify it, but, though I have more than once fired at one, I had never been successful till one day in February when a cooly brought me an unfortunate Brown Wood Owl (*Strix indranee indranee*) with a broken wing and otherwise badly knocked about, while the man was carrying the bird it emitted a feeble but hardly mistakably "Devil Bird's" shriek.

The "Devil Bird" is well known in most South Indian Planting Districts for the horrible nocturnal noises it makes. I do not think I have ever heard these screams except between the months of November to February or March, inclusive, so possibly they may only be uttered during the breeding season.

Of course I do not claim that this episode definitely establishes the identity of the "Devil Bird"; the similarity of the cries may have been fortuitous, but I think it probable that the "Devil Bird" is the Brown Wood Owl. A definite and final identification would be of interest.

A. P. KINLOCH, F.Z.S., M.B.O.U.

NELLIAMPATHY HILLS,
21*st June* 1924.

[The identity of the Devil-Bird remains a mystery. Writing on the subject (Vol. X, p. 88) Mr. A. L. Butler referring to the Wood Owl, *S. indrani*, states this species is generally credited with being the "Devil Bird" but he was of opinion that the name was applicable to the Forest Eagle Owl (*H. nepalensis*). It can hardly be a breeding seasonal cry of such a common bird as *S. indrani* or every one on the island (Ceylon) would have heard it again and again. Failing the Eagle Owl Mr. Butler assigns the cries to the Bay Owl (*Photodilus assimilus*). Stuart Baker (Vol. XI, p. 233) writes "I should think it probable that the shrieks attributed by Layard and others to the Brown Wood Owl may be made by Bay Owls (*Photodilus*)." Mr. A. M. Primrose (Vol. XVI, p. 163) in his notes on the birds observed in the Nilgiris and Wynaad writes that his attention was called by a neighbour to a most eerie cry which he said was made by the 'Devil Bird,' and, having seen a pair of Eagle Owls (*H. nepalensis*) near the garden a day previously, concluded it might be their call. Sir Emerson Tennent in his 'Natural History of Ceylon' gives the gruesome legend

connected with the "Devil Bird": a husband suspecting the fidelity of his wife killed her child, whose paternity he doubted, and on his return placed before her a curry prepared from its flesh, of this the unfortunate woman partook but discovering a tell tale finger in the brew she fled in frenzy to the forest and there destroyed herself. On her death she was changed, according to Buddhist belief into an *Ulama* or "Devil Bird" which still at night horrifies the villagers by repeating the frantic scream of the bereaved mother in her agony.—EDS.]

No. XIX.—PYTHON ATTACKING A SPANIEL.

Perhaps the following short account may interest you, in fact I think the occurrence is probably unique.

Whilst camped at Bomanballi I was out with my wife, Mr. Wagle, foreman of Sambrani Sawmill, and my dog (a spaniel) on the 11th May forenoon, choosing a site for a tent. The dog was running ahead amongst some bushes when we heard terrible yells as though something was killing the dog. I rushed up with my walking stick and found the dog caught by a python. The python was coiled round the dog several times and all I could see of the dog was a small portion of its hind quarters. I beat the python as hard as I could with my stick and gradually it uncoiled itself until the dog was able to escape. The dog was streaming with blood from the mouth and chest but wanted to return and fight the python. The python measured 11¾ feet and had apparently been waiting patiently in the hope of catching a monkey as they were playing in a tree under which it was lying. The dog was bitten on the under lip and on the chest but no bones were broken and it was otherwise unhurt. The python was killed (or at least so we thought) and carried back to camp and left under a shady tree whilst we had breakfast prior to skinning it. Shortly afterwards a small boy ran into the tent and said the python was still alive. Sure enough it was not only alive but had very nearly succeeded in catching one of our chickens. This time we made sure of its death. It was the second python caught within a fortnight within a few hundred yards of our tent.

N. D. KANARA,
CAMP VIA DHARWAR,
30th May 1924.

R. G. SMITH, CAPT, I.F.S.,
Asstt. Conservator of Forests.

[In the "Snakes of Bombay Island and Salsette" published in Vol. XXX, No. 1, an incident is recorded of a python attacking a terrier dog.—EDS.]

No. XX.—NOTES ON THE EFFECT OF THE BITE OF MCMAHON'S VIPER (*ERISTOCOPHIS MCMAHONI*).

I had occasion to-day to get the loan of Major Wall's "Poisonous Terrestrial Snakes of our Indian Dominions", from a neighbouring planter, as one of my coolies had been bitten by a snake. In reading through it I came across your identification of *Eristocophis mcmahoni*.

It so happens that I have been resident in Baluchistan for many years (since 1903 to 1918), and have had no fewer than five cases of bite by this Viper. In one case of bite, where the snake was killed, I sent the reptile to the Curator, Quetta Museum, but unfortunately the bottle containing it was broken *en route*, and until to-day I have remained in ignorance of the identity of the snake.

I note you say as regards the poison that nothing is known.

If the following facts are of any use I shall feel that I have done some little good.

That the snake is very little known is obvious, since I have made exhaustive enquiries as to its identity, and have been told varying facts (or fallacies). That it is one of the Kraites, a species of *Echis*, a rock adder, etc.

My experiences of the snake have been as under:—

In 1917, at Kach, a woman was brought to the station suffering from a bite on the right instep. She had been carried in from a village 14 miles away, and

had not been brought immediately after the accident, several hours had been spent in magical cures by her relatives and friends. I saw her about several hours after the venom had been injected. (The dead snake accompanied her.) She was then conscious, but appeared unable to sit up, was weak and feverish (I am not a medical man). She seemed unable to move the injured limb which was much inflamed and swollen. Complained of thirst but was unable to swallow. The eyes were partially closed, and no persuasion would induce her to raise her eye lids. She complained of pain in the abdomen, which was inflated and drum like, and a feeling of pressure under the breasts. I hurried her to the nearest hospital (by train), but she was practically gone before she reached it. She died shortly after admission. A bronze-coloured mark about the size of an ordinary man's ring surrounded the bite.

The next case was one of the sepoys of my unit. He was doing sentry duty and rested his left hand on the sangar wall. (I was on tour and was some 18 miles N. of Fort Sandeman.) He was bitten on the end of the left thumb just under the nail. He came to me immediately and I cut the whole of the fleshy portion of the underpart of the thumb away. This must have been inside of a minute of his having been bitten. I put a ligature above the elbow and allowed all the blood that would come to run out. I then made him hold his thumb in a cup of vinegar and salt (I had nothing else with me). The arm swelled very much, and remained so for 3 days. The pain was so great the man was constantly requesting me to shoot him and rid him of the agony. After the third day the swelling subsided,, but the hand and wrist broke out in ugly ulcers.

The third case was a youth of 15. He had been bitten in the stomach just above the root of the penis while asleep. There was no certainty as to time, but certainly 4½ hours had elapsed before he was brought into my camp. The snake was found and killed in his blankets. Here again I had no remedies for snake-bite and the nearest hospital was 30 miles off and no means of conveyance at hand. The patient was in a comatose condition. I administered whisky internally, and incised, but was afraid to go too deep. Tried artificial respiration, but the patient got worse. The stomach was very distended, the testicles and penis, and both thighs were abnormally swollen. The boy died about 1½ hours after I had seen him. He had had no treatment before I saw him. Here again the bronzy coppery coloured mark round the wound was quite distinct and blood coloured serum was oozing from the wound and penis.

The fourth case was a sepoy bitten on the back of the hand within a few feet of me. I saw the snake strike and immediately raised the skin on the back of the hand and cut out a piece the size of an eight anna piece and rubbed in permanganate of potash which I happened to have. The snake was killed by other sepoys and was certainly a McMahon's Viper (as were the others).

In the last case a man came in to my camp and stated a snake had bitten him (he described the above Viper). His hand was very swollen. (He had been bitten on the third finger.) On this occasion I had medical assistance with me and the man was treated by the doctor. He left us the next morning saying he felt quite well, although the hand and arm were still swollen, and the coppery coloured mark was very visible. I do not know how he fared afterwards.

The snake is not often seen in Southern Baluchistan, but is more frequently met with as one travels North from Quetta, and it is, I am told, abundant in Mekran and on the coast line of the Persian Gulf. This, however, I can only state as hearsay.

I must apologise for taking up your time with this long screed, your book from which I have obtained the identity of McMahon's Viper is dated 1913, so that it is possible that you have much more information on this snake than was then procurable.

KIL KOTAGIRI,
NILGIRIS. C. J. SHAW, CAPT.

No. XXI.—RECOVERY FROM THE BITE OF A COMMON KRAIT (*B. CANDIDUS*).

In July last, I was called early one morning to identify a snake which had bitten the cook working in a neighbour's bungalow. I found the man sitting on the door step with a large dead Krait (*B. candidus*) at his feet. He told me that on awakening and feeling by his pillow for his matches, he put his hand on the snake which bit him on the finger. He killed the reptile and rushed to the memsaheb for help. The lady incised the wound (very superficially) and rubbed in crystals of permanganate of potash and tied a ligature above the wrist. The local doctor was sent for and arrived half an hour after the incident; he deepened the incision, causing the finger to bleed very freely, and rubbed in more of the permanganate.

Beyond a swelling and pain in the hand below the wrist, due probably to the ligature, the man complained of no ill effects and suggested going off to the bazaar and getting on with his day's work. At 6-30 p.m. that evening, when I next saw him, he was in bed and said that he felt quite well. At 9 p.m. he complained of giddiness and pain in the shoulder; these symptoms passed of by midnight and the next day the man was back at work in the kitchen apparently well and fit.

The Krait was a particularly robust looking individual, measuring 3′ 6″, and from its distended condition I presumed that it had recently fed. On cutting open the stomach I found that it swallowed 3 or 4 large pieces of *cooked* meat, presumably kitchen scraps: rather an unusual meal for a snake!

BOMBAY NATURAL HISTORY SOCIETY,
10th October 1924. S. H. PRATER, C.M.Z.S.

No. XXII.—NOTES ON THE STATUS OF SOME PARASITIC HYMENOPTERA IN SOUTH INDIA.*

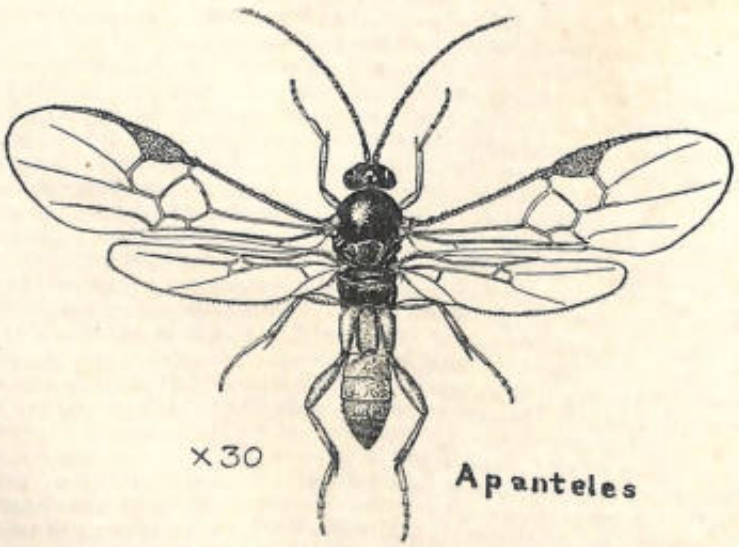
(*With* 3 *plates.*)

The parasitic Hymenoptera constitute a vast complex, in many respects, far more remarkable group than most other insects. Apart from the striking peculiarities in their general form and in the nature of their life-histories as parasites on other creatures, characters which in themselves might form absorbing themes of study for the pure scientist, their relations to other insects and to mankind give them a position of unique importance in the insect world. Their economic importance is based on the fact that many of them act as natural enemies of many insects which are injurious to cultivated crops and thereby check the rapid multiplication of such pests; in other words, they help man in controlling insect pests, often even without his knowledge. Well does Sharp remark in his classical volume on insects that "the parasitic Hymenoptera is one of the most neglected of the great groups of insects though it is of greater economic importance to mankind than any other." In spite of this two fold importance the study of the parasitic Hymenoptera found in India has not till now engaged the serious attention it deserves from entomologists, either from the purely Zoological or the economic aspect. This neglect cannot be attributed to the paucity of these insects in the Indian region, since numerous forms of this group are very commonly met with all over India; and it is very likely that entomologists in different parts of India possess at least a few of these insects in their collections. Most of these insects are comparatively small in size and do not make themselves so very conspicuous as some of the butterflies, beetles or grasshoppers to attract quick and sufficient attention; and of course the recognition of their economic importance is of very recent origin. Anyway it is felt that the time has already arrived to pay the attention that these insects deserve. In order, however, to properly appraise the utility or otherwise of these insects, it is essential in the

* This paper was read at the Indian Science Congress, Bangalore, in January 1924.

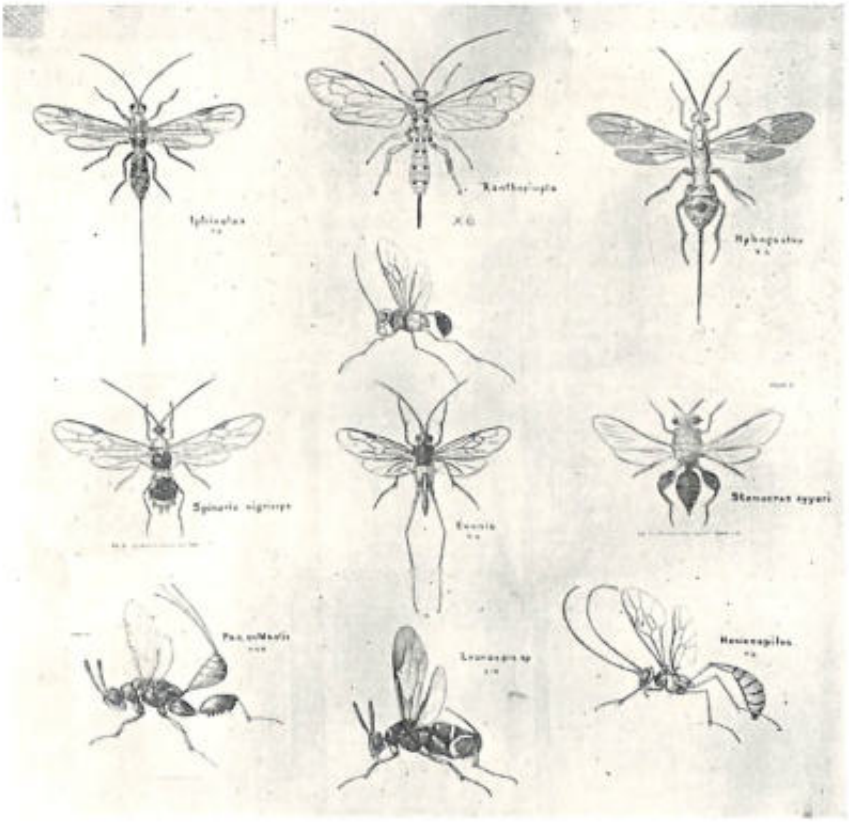
first place to get the parasitic fauna of the country properly identified and the correct relations which each insect bears to its surroundings properly noted, so that there may be no mistakes or confusion created. Though in the catalogues and papers of systematists like Brulle, Dalla Torre, Szepligeti, Cameron, Morley, etc., there are stray records of a few species from South India, very little in the shape of reliable information is available on these insects ; nor were any serious attempts made towards a systematic or biological study of them until very lately. The first attempt in this direction was made in 1912 and it is gratifying to note that it was made in this state (Mysore) by Dr. Coleman. He got together some material and had them properly studied by specialists, and as a result one or two systematic papers on these Mysore forms were published by Viereck in the Proceedings of the United States National Museum.† The writer of this paper has been paying some special attention to these insects in S. India for some time past, and with the idea of securing a working basis for detailed studies in the future, he got some of the commoner forms of South Indian parasites identified as far as possible, and published two lists‡, one in 1919 and another in 1921 including almost all parasitic Hymenoptera of economic importance so far studied in S. India. He has been carrying on his studies in the same direction since then, and in this paper the idea is to invite the attention of entomologists, especially those who are interested in the economic aspect of the subject, to the importance of the study of these insects by very briefly describing the bionomics so far known of a few typical species found in S. India.

Of the parasitic groups of the order Hymenoptera the superfamilies Ichneumonoidea (including chiefly the families *Braconidæ*, *Ichneumonidæ* and *Evaniidæ* and the *Chalcidoidea* together form what may be aptly classed as parasites *par excellence* among insects, playing the most important role as natural enemies of various creatures. The insects noted below are only a few of the many common and typical species noted in South India.

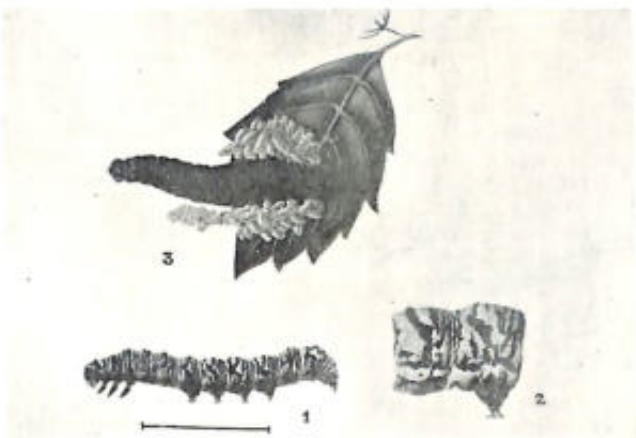


Braconidæ.—In this family which is very well represented in S. India, the commonest genus appears to be *Apanteles* (see fig. above). This genus

† Proc. of U. S. Nat. Museum, Vol. 42, 1912-13.
‡ Proceedings of the 3rd & 4th Entomological Meetings—Pusa, 1919 and 1921.



Some South Indian Parasitic Wasps.



Caterpillars of *Zalissa venosa* parasitised by *Apanteles*. (From Lefroy.)

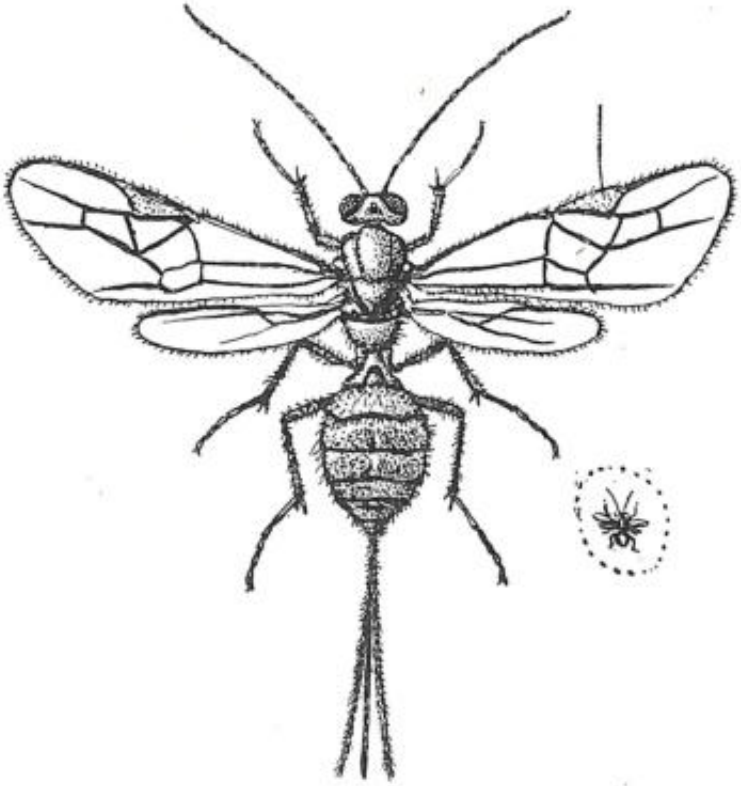


Fig. 1.

Fig. 2.

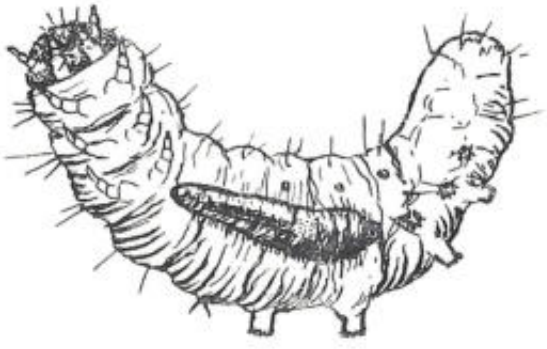


Fig 3.



Fig 1. *Microbracon.* Fig 2. Caterpillar attacked by a parasitic grub.

Fig. 3. Parasitic grub magnified.

includes numerous very closely allied species of small wasps usually of a dark brown colour and with transparent wings. These insects have been found to parasitise the larvæ of numerous important lepidoptera and beetles, some of which are pests of first class importance to the farmer. The hosts of *Apanteles* till now noted include hairy caterpillars (Spp. of *Amsacta*, *Psalis*, *Pericallia*, *Euproctis*), noctuid larvæ (Spp. of *Prodenia*, *Chloridea*, *Cirphis*, *Euplexia*), butterfly larvæ (Spp. of *Papilio*, *Udaspes*) and the crab caterpillar (*Stauropus*). The host, which is a caterpillar, in these cases does not exhibit any external signs of the presence of parasites until the grubs of these latter come out from inside the host's body to pupate. Evidently in this case the adult parasite thrusts its eggs inside the body of the caterpillar and the grubs that hatch out of the eggs remain feeding inside until pupation, which takes place outside, on the body of the host. Within a few hours after emergence outside, each of these yellowish white larvæ spins a small white oval silken cocoon within which it changes into the pupa. In the meanwhile the host shrivels up and dies, showing a large cluster of white parasitic cocoons attached to its body (see fig. 2, plate I). In some cases the dead caterpillar is covered over by a large mass of these cocoons loosely covered by fluffy silk. As many as a hundred parasites have been noted to emerge from each host. These parasites often kill a good percentage of caterpillars in certain seasons and the writer has noted this more than once in the case of the Noctuids *Chloridea* and *Euplexia*, the Citrus *papilio* and the crab caterpillar on Red gram and tamarind. The genus *Microbracon* (see plate II) is another braconid commonly found, but the species appear to be less numerous and not so very cosmopolitan in taste as *Apanteles*. The species are as big or slightly bigger than Apanteles and the female has the ovipositor clearly extending some distance beyond the anus ; in colour some are honey coloured while others are brown or red brown. Species of this genus have been noted to attack, among others, the cotton bollworms (*Earias* and *Pectinophora*), the lablab pod borer (*Adisura*), the cholam stem borer (*Chilo*) and the brinjal bud worm (*Phthorimæa*). The capacity of one species *M. lefroyi* to effectively act as a natural control against the cotton bollworm (*Earias*) was observed in the Punjab a few years ago and I believe trials are even now continued in the use of this parasite. This genus represents a type of parasite where the eggs are generally attached to the body surface of the host quite exposed. From three or four to about eight or ten eggs are attached to the host caterpillar ; the shining yellowish white grubs that hatch out also feed exposed. Pupation takes place in rough silken cocoons ; but in this case being few, the cocoons do not show themselves conspicuously as a white mass as in *Apanteles*. Of the other striking species of Braconidæ noted, we have species of the genera *Glyptomorpha*, *Iphiaulax* and *Microplitis*. In these examples the host generally harbours a single host as far as observed in South India. *Glyptomorpha* includes fairly large species having flavous or reddish brown colour with the ovipositor very long in some. *G. deesae*, *G. nicevillei* and *G. smeenus* have been noted to attack boring caterpillars and beetle grubs in cane, cholam and pulses. Species of *Iphiualax* (see plate I, fig. 1), are commoner in the forests and one or two have been noted as parasites on wood boring beetle grubs, chiefly longicorns. The most interesting feature of some of these wasps is the extraordinary intelligence or instinct displayed by the female in spotting out the host larva inside the plant stem and parasitising the same from outside by the mere sense of touch. This is of course found also among many of the Ichneumonid parasites with long ovipositors. The genus *Microplitis*, though not rich in S. Indian species, is interesting from the fact that the one common species *M. ophiusae*, which the writer has described in a recent paper§ is an important and specific parasite of the semilooper caterpillar (*Achæa*) damaging the castor plant. The presence

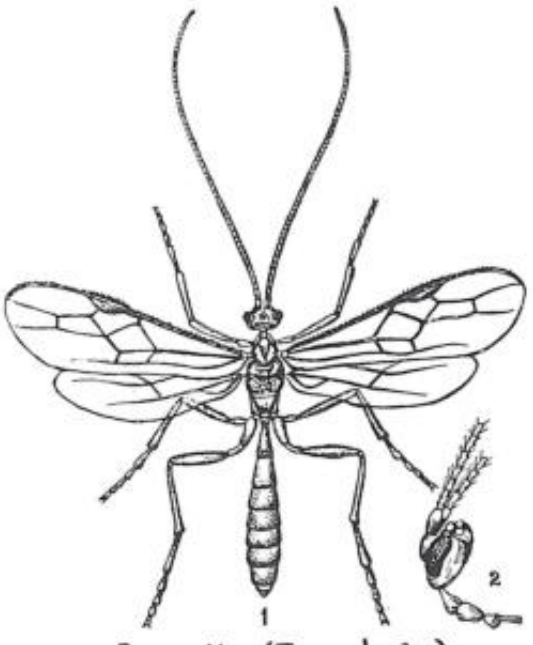
§ "An undescribed natural enemy of the castor semilooper," Bombay N. H. S. Journal, XXVIII, p. 298. (Plate).

of this parasite becomes visible as in the case of *Apanteles*, only when the full fed grub comes out and pupates, and in this insect the buff coloured oval cocoon is always found attached as a sort of cushion underneath the tail end of the unfortunate host. In certain years this parasite acts as a fairly efficient natural enemy of this castor pest. Plate III shows a braconid parasite *Troporhogas* and its host the *Nerium* caterpillar *Daphnis nerii*; the writer reared out as many as sixty-eight parasites from one attacked caterpillar.

Ichneumonidæ.—Excepting in a few structural details these insects resemble the *Braconidæ* in every way and their life habits too are similar. Many Ichneumonids are larger in size, some of them being giants among parasitic wasps. The ovipositor is prominent and in some cases four or five times the length of the body. Most of these spend their larval life inside the bodies of their hosts which are mostly caterpillars. Some of them spin large sized compact silken cocoons. Of the common forms so far noted in S. India we have species of *Xanthopimpla*, *Henicospilus*, *Pristomerus* and *Ischnojoppa*. The genus *Xanthopimpla* (see plate I) is represented in S. India as far as we know by two or three species of medium sized flavous insects often spotted in black. These have been noted as parasites of boring caterpillars in sugarcane, maize, Agathi and Cholam; *X. nursei* is one of the commonest found attacking the cholam pest *Chilo simplex*. The species of *Henicospilus* (see plate I) are easily identified by their reddish colour and long limbs and particularly from the long latterly compressed and curved abdomen; these are fairly large insects and the larva constructs a hard tough cocoon for the pupa. Species of *Heniscospilus* have been noted chiefly on hairy caterpillars such as Lymantrids and Lesiocampids (*Euproctis*, *Taragama*, etc.). *Pristomerus and Ischnojoppa* are smaller forms that have been noted on borers in brinjal, agathi, etc.

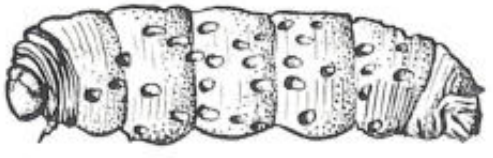
Evaniidæ.—The species of this family are easily distinguished by their curious build, the most striking being the strongly compressed petiolate abdomen attached to the dorsal surface of the thorax. In South India the commonest forms noted are one or two species of *Evania* (see plate I) frequenting our houses and parasitising the egg capsules of cockroaches. Compared to the other groups this family does not include many forms.

Chalcididæ.—This superfamily is as big or even bigger than the *Braconidæ* or *Ichneumonidæ* though we have very little knowledge of this group; and unlike those two families the *Chalcididæ* include a comparatively greater variety of forms also. The majority of them are small in size, some being among the smallest insects. The striking features noted in the majority of them are the elbowed antennæ and the almost veinless wings. Correlated with the complex varieties in general form they also exhibit remarkable modes of larval life. Previous to the publication of the writer's list referred to above we had no record of any Chalcids from South India. The commonest forms so far noted appear to be species of *Chalcis*, *Eurytoma*, *Leucospis* and *Stomatoceras* (see plate I) among the fairly large forms, and species of *Scutellista*, *Elasmus*, *Aphycus*, *Tetrastichus* and *Trichogramma* of the smaller species; there is little doubt that hundreds of more species still await recognition. Species of *Chalcis* recognised by their black or black yellow colour and the curved hind leg are extremely common and attack many caterpillars—Nymphalids very commonly. *Eurytoma* and *Stomatocerus* have been found to attack the nettle grub (*Parasa*), the Coconut caterpillar (*Nephantis*) and gall flies. The smaller species are found in numbers on various scale insects and some of them parasitise eggs of various moths, bugs and beetles. One insect *Scutellista* deserves some special mention. It is a small compactly built bluish black insect that has been noted to be a very effective natural enemy of the black scale (*Lecanium nigrum*) which latter is often a bad pest of cotton and other plants. It is chiefly an egg parasite and the grub devours hundreds of eggs from inside the scale of the female Coccid. This insect has also been used



Parasite (Troporhogas)

(1) Parasite. (2) Swollen Palpus of male.



Parasitised Caterpillar

Showing exit holes of parasites.

A Braconid parasite (*Troporhogas*) and its host the Nerium Catterpillar (*Daphnis nerii*).

in America as an important check on another scale (*L. oloeæ*). Mention may also be made here of the curious long and beautifully coloured Chalcids (*Podagrion*) (see fig. in plate I, Parasite on Mantis) which are often reared as parasites from the egg cases of the common Mantis.

In this necessarily brief paper the writer has only touched on some of the main features of the subject and even from the above it may be evident how very interesting and useful such a study will be; but the more important fact, which the writer wishes to emphasize on, is the utter scantiness of our knowledge regarding these extremely interesting and useful insects. There are numerous points in the bionomics of these parasites which await solution and in which not only the entomologist but all Zoologists are sure to be interested in. In some foreign countries not only has the study of these insects advanced considerably but the knowledge so gained is being utilised in the direction of pest control.

I know of entomologists who have come to India in search of parasites and who have actually taken with them some of these insects to Australia and America. In fact I met one gentleman, Mr. Compere, who remained in this very city (Bangalore) for a few months and took with him over 15,000 live parasites of the fly pest found on guava fruits. It may be evident from such things that our country abounds in "Hymenopterous parasites" and it may be added that the collection and preservation of these insects demand very little special training or knowledge or extra technique; they could be reared easily whenever different kinds of larvæ are bred in cages.

In conclusion, it may be repeated that a systematic and biological study of the parasitic Hymenoptera will not only add to our knowledge of the hymenopterous fauna of our country, but will also considerably help economic entomologists in laying the foundations of what is now known as the biological control of insect pests; the writer feels that this brief paper, with all its inevitable defects, may perhaps contribute a share, however small, towards that consummation.

T. V. RAMAKRISHNA AIYAR, .A., F.Z.S.

No. XXIII.—AN UNDESCRIBED COCCINELLID BEETLE OF ECONOMIC IMPORTANCE.

(With a plate.)

In the course of a systematic study of the *Coccidæ* which the writer has been pursuing for the past few years, he has had opportunities of paying some attention to the bionomics of a few of the more important and economic forms noted in S. India. While studying the nim scale *Pulvinaria maxima*, Green, a destructive pest on the 'nim' tree (*Azadarichta indica*) in S. India, a small lady bird beetle was noted as a natural enemy, and latterly it has been found to be a fairly effective natural check on the scale insect. This beetle is a species of *Scymnus* and so far as the writer is aware an undescribed form. Specimens submitted to the British Museum were returned unnamed, with the information, however, that the species is not represented in that institution. As the insect is an important one and may have to be referred to in future publications, an attempt is here made to describe the insect and give it a name to facilitate future references.

Scymnus coccivora, new species.

Length 1·75 mm., breadth across elytra 1·25 mm. General form—elongate oval, strongly convex above, elytra as long as the breadth across the insect. Head small, remains hidden under the broad prothoracic shield. Eyes large, antennæ well developed but small; femora of legs stout, the edges of elytra faintly rimmed. Body surface smooth, clothed with thin pubescence of small white hairs. Head and prothorax scantily pubescent. The front between

the eyes comparatively smooth and shining. General colour is a light ochraceous brown; in some it is to a certain extent golden yellow, while in others the brown colour supervenes and shows a darkish brown ground colour. Head and prothorax generally have the ground colour of the body, though in some, there is a shining dark brown patch at the median dorsal region of prothorax. The elytra have distinct violet or bluish brown markings which are characteristically arranged; by means of this arrangement the species is easily distinguished. Each elytron has three such spots. One, the biggest of the three is at the interior angle of the inner edge of the elytron, the second is also situated at the inner edge but further down the median line, the third and the smallest towards the middle of the outer margin of each wing cover, but placed a little away from the edge. In the resting posture of the insect due to the close juxtaposition of the spots at the median dorsal line, there appear 4 distinct markings on the dorsal surface of the insect, two big ones one behind the other along the middorsal region and two small more or less roundish ones, one at each side (see figure). In some specimens the median markings are found fused presenting a median dorsal long violet brown patch; in such forms the prothorax also shows dark brownish tinge. The legs are transparent brown. The ventral side is also brown except in some forms where the meso-metasternal region has a shining dark brown appearance.

Locality.—Coimbatore S. India. *Host.* The larva of the beetle is predatory on the eggs of *Pulvinaria maxima* Green. It has also been bred from *Pseudococcus virgatus*, Ckll. on custard apple, Coimbatore, and on *Pseudococcus lilacinus*, Ckll. on fruit stalk of edible *Ficus*, also from Coimbatore. The important host so far noted is the 'nim scale.' The adult beetle has also been noted to feed on the larvæ of the nim scale. The insect has been noted as a very efficient natural enemy of the 'nim scale' so much so that in certain seasons the scale pest is very little, in evidence on previously infested trees. The other species of *Scymnus* recorded from S. India and which the writer has seen are *S. xerampelinus*, Muls., *S. luridus*, Muls. and *S. guimeti*, Muls. From these and other unnamed species of Scymnus in the Coimbatore collection *S. coccivora* can be easily distinguished by the brighter ground colour and the characteristically arranged violet brown markings of the elytra. The larva is an active greyish green creature having the body fringed with long waxy processes which give it the appearance of some mealy bugs like *Icerya*, *Pseudococcus*, etc. It feeds voraciously on the eggs of the 'nim scale' and is often found buried unseen inside the egg masses of this host. The pupa which is of a light reddish brown colour fringed with short erect brown hairs is also attached to the leaf close to or often inside the egg sac of the host. The pupation period occupies 5 to 7 days.

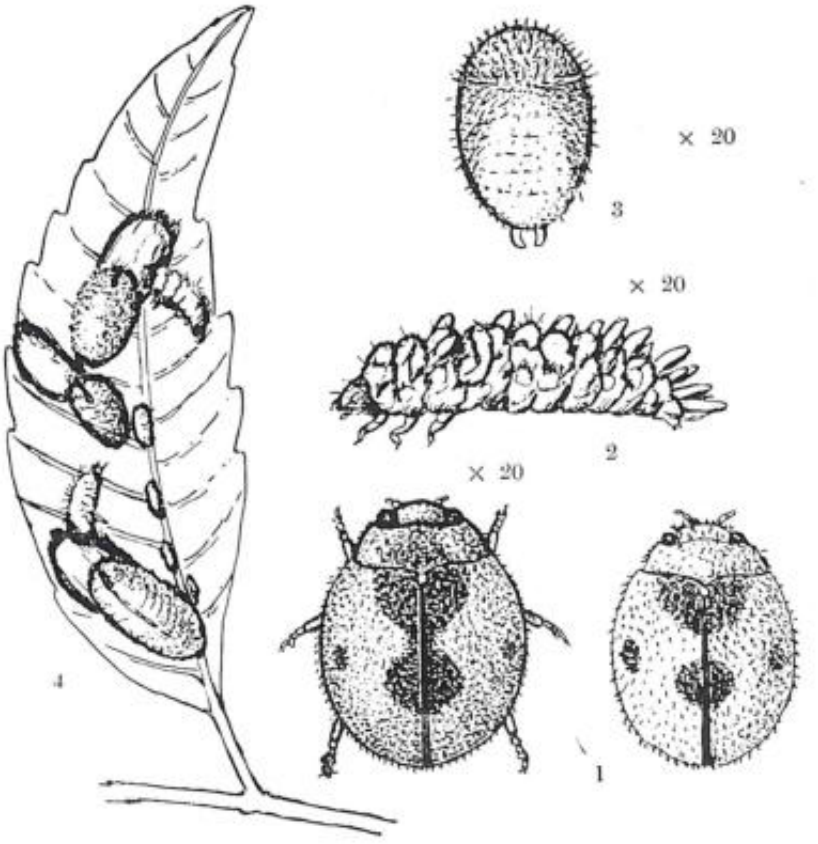
Species of *Scymnus* are well known all over the tropics as effective predators on *Coccidæ* of different kinds and a thorough study of the bionomics of the different species of such *Coccinellidæ* inhabiting any tract will prove of great benefit to economic entomologists who are anxious to try biological methods of control.

Previous references to this insect are found in (1) plate VIII, page 29 of the writer's bulletin on 'A contribution to our knowledge of S. Indian *Coccidæ*, 1919 and (2) in page 116 of Subramanyam's paper, 'On some *Coccinellids* from S. India' published in the Report of the Fifth Entomological Meeting, Pusa, 1923.

The writer acknowledges his indebtedness to the Imperial Bureau of Entomology for kindly examining the material submitted to them and giving necessary information.

COIMBATORE,
July 1924.

T. V. RAMAKRISHNA AIYAR,
B.A., F.E.S., F.Z.S.



SCYMNUS COCCIVORA, Ramakrishna.

1. Adult beetles showing slight variation in the colouring.

2. The beetle grub. 3. The pupa.

4. Beetle grubs feeding on eggs of scale insect (P. maxima Gr.) on a leaf.

No. XXIV.— CHIRAGH DIN.

Chiragh Din—Shikari, naturalist and a prince of hypocrites, used to be quite one of the characters of Dera Ismail Khan. He owned land near the R. Indus, a short way downstream of D. I. K., and appeared to be quite prosperous, though he often complained to me that the wild pig did much damage to his crops, and in consequence was always trying to cadge a few rounds of lethal bullet off me so that he could sit up for the marauders. He was nearly always taken on as a regimental or private shikari and during the summer months of close season he used to make quite a lot of money by collecting eggs and birds' skins for various keen ornithologists. Many are the well known ornithologists who have been stationed at D. I. K. and who have found the services of Chiragh Din invaluable, and it was some of these earlier naturalists who had trained him so carefully in the work in which he was so useful to me. Many of his old friends have prematurely entered the great beyond and I often wonder if Chiragh Din has gone that way too. He was getting old in pre-war days and latterly I have had no reply to the letters that I have written him. He was a real old cadger, always wanted something and he had the very deepest of pockets which he liked to feel well lined. He was frequently lazy to exasperation, and many a nice clutch of eggs have I lost through his infernal apathy. But in spite of all his faults there was something entirely likeable about the man and I always looked upon him more as a friend than a servant. When he chose; his work was excellent; he could make up birds skins very well and he cleaned eggs excellently with only one hole; while he could always furnish useful and reliable data in regard to any eggs, nests or skins which he had collected. With eggs he was always extremely careful and I hardly ever remember him producing damaged specimens when he brought me unblown clutches. What he did not know about the shooting in the district was not worth knowing, and one could safely leave all arrangements in his hands for even the longest shikar trip. When the time came to go, the requisite number of camels and drivers, tongas or ekkas would always be ready, as well as all necessary arrangements made for putting up at various dak bungalows and rest houses. As the first Quail of the season came in, there would be old Chiragh Din waiting for you at your bungalow on your return from the Regimental office. He had "khabar" (news) of Quail, and could arrange a nice little shoot early next morning a few miles out on the Tank road—would the Sahib come? Or else, further a field, an irrigation canal had burst its banks and flooded a huge tract of land where the early Snipe, Duck and Teal were plentiful. Or it might be a Black Partridge shoot in the tamarisk scrub near the river, or yet a hot and tiring day after Sand Grouse on the burning scrub-covered plains near the frontier foothills. He was equally good after crocodile on the Indus; he had the vision of a hawk and rarely did a party of his return without success. On such occasions, in the evenings on the way back, he usually managed to put up quite a good Black Partridge and Houbara shoot in the scrub and crops near the river. He was a magnificent shot with his rather antiquated 12 bore hammer gun, the only Indian shikari I ever came across who took his birds on the wing. I well remember one morning when the quail were thick in a small patch of green barley, having been decoyed and collected there with the aid of numerous call-birds. Every bird that broke back was instantly downed by Chiragh Din, and I don't think he missed a single one. Our nesting season used to start about October, and Chiragh Din knew every nest of importance for miles around. It was a pair of the noisy Black-winged Storks (*Xenornynchus asiaticus*) that breed in October in a large thorn tree a few miles downstream. In November a pair of Eagle Owls (*Bubo* ?) and a colony of White-backed Vultures (*Pseudogyps bengalensis*) which nested in a small wood of Shusham (*Dalbergia sissoo*) and Peepul Trees (*Ficus religiosa*), also a few miles downstream, were the principal trophies. In

December the Tawny Eagles (*Aquila vindhiana*) and Pallas' Fishing Eagles (*Haliaëtus leucoryphus*) were nesting in tall trees near the river, and Chiragh Din knew of every nest. At the beginning of the year in February it was the Punjab Raven (*Corvus corax lawrenci*) which attracted attention, the same pair of birds laying as many as three full sets of eggs. They were quite common and usually breed high up in tall thorn trees, though nests are occasionally found at the tops of date palms. Chiragh Din rendered me the most valuable services in the help he gave me in collecting Ravens' eggs and on one occasion he brought me a newly laid Laggar Falcon's egg, which he had taken out of a Raven's nest which contained five fresh eggs. In the same month the Great Grey Indian Shrike breed (*Lanius lahtora*) and here again it was thanks to my Shikari's help that I obtained some nice clutches.

As the spring advanced into the months of March and April, eggs of every kind became plentiful and I frequently went out on the most successful nesting trips with Chiragh Din who was an adept at egg finding. Many eggs were found of the Laggar Falcon (*Falco jugger*), the Shikra (*Astur badius*), White-eyed Buzzard (*Butastur teesa*), Indian Courser (*Cursorius coromandelicus*), White-cheeked Bulbuls (*Otocompsa leucotis*), Common Babbler (*Argya caudaa*), Striated Babbler (*Argya earlii*), Purple Sun Bird (*Arachnechtra asiatica*), Indian Skylark (*Alauda gulgula*), Crested Lark (*Galerido cristata*), Red-wattled Lapwing (*Sarcogrammus indicus*), Indian Ring Dove (*Streptopelia cambayensis*), Rose Ringed Paroquet (*Palæornis torquatus*), Indian Roller (*Corracius indicus*), Common Mynah (*Acridotheres tristis*), Sand Martins (*Riparia riparia*) Streaked Wren Warblers (*Prinia gracilis lepida*), and many others. Later in the season as the Summer came on there were plentyof River Ternsand Swallow Plovers and other small Plovers breeding in the Sandbanks in the River,while nests and eggs were also found of the Black Partridge (*Francolinus francolinus*), Grey Partridge (*Ortygornis pondicerianus*), Common Grey Quail (*Coturnix coturnix*), Common Sand Grouse (*Pteroclurus exustus*), Pond Herons (*Ardeola grayi*), Drongos (*Dicrurus ater*), and Bee-Eaters (*Merops viridis*).

Many a profitable day did I spend with Chiragh Din, and many a nice set of eggs has found its way into my collection through his agency. Even the tiniest eggs, such as those of *Prinia* he blew skilfully with a single hole. On one occasion he got hold of a Powindah, a Subiman Khol from Afghanistan who was a bit of a naturalistand who said he could procure for me all manner of eggs from S. Afghanistan and the vicinity of Cabul. Chiragh Din gave the man several lessons in blowing and packing eggs, marking the separate clutches, etc., and then presented him with a set of metal blow pipes and egg drills. The man promised to bring down a huge collection of eggs for me in the following autumn. Of course I never for a moment expected that the man would fulfil his promise, in fact I quite thought that I had seen and heard the last of him. The Great War intervened, and the following autumn the Regiment left D. I. K. and moved overseas. Shortly after Xmas I received a very funny letter from Chiragh Din and he said "The man from Cabul has come but the egg blowers were flown away in a flood in the Gumal, so he has brought no eggs." That letter is the last memento I have of Chiragh Din—I have neither heard from him nor of him since, and I only hope that he may still be alive to take an active interest in Shikar and Natural History in a very much altered D. I. K.

There will probably be many who read this memoir to whom the name of Chiragh Din will recall the happiest of memories.

KENYA COLONY,
19th January 1924.

C. R. S. P.

REPORT ON THE PROGRESS AND CONDITION OF THE NATURAL HISTORY SECTION, PRINCE OF WALES' MUSEUM, FOR THE YEAR ENDING 31ST MARCH 1924.

BY

S. H. PRATER, C.M.Z.S., CURATOR, BOMBAY NATURAL HISTORY SOCIETY.

FINANCE.

Government Grant.—The maintenance and operations of the Natural History Section for the Fiscal year from the 1st. April 1923 to 31st. March 1924 were provided for from the grant of Rs. 19,000 received from the Government of Bombay.

In accordance with the Terms of Agreement between the Bombay Natural History Society and the Board of Trustees, Prince of Wales' Museum, a contribution of Rs. 7,650 was made by the Society, being half the cost of the salaries of the Curator and Assistant Curator.

Donation.—In addition to the grant of Rs. 19,000 received from Government a sum of Rs. 11,977 was available against expenditure on show cases. The additional funds were due mainly to the donations received in the previous year from Sir Dinshaw Petit, Sir Fazulbhoy Currimbhoy and Messrs. R. D. Tata & Co. The generosity of these gentlemen made possible the erection of new show cases for the Bird Gallery which were completed during the year at a cost of Rs. 10,438-14-3. Without this extraneous assistance it would not have been possible to undertake this urgently needed provision.

Mounting of Specimens.—Mounting of specimens entailed an expenditure of Rs. 7,815 of which Rs. 6,053 represents the cost of specimens mounted in London, the balance being the actual expenditure incurred by the Museum Preparation Department. 27 large and small Mammals, 121 Birds and a number of casts of Fishes and Reptiles were prepared by the department during the eight months in which it was in active operation (climatic conditions necessitate an almost complete suspension of mounting work during the monsoon). By a comparison of estimates the output of the department is computed to represent a saving to the Museum of a little over Rs. 3,000.

While the position as regards the future mounting and preparation of specimens is satisfactory, the question of the provision of additional show cases and equipment still continues a problem. As pointed out the show cases constructed for the Bird Gallery were erected entirely through the generosity of private donors who contributed to the funds of the Section.

Show Cases and Equipment.—The annual grant received from Government while sufficient to cover the actual maintenance charges of the Section leaves little for the provision of show cases and equipment and it must here be indicated that the Section is now dependent on private donations for the purpose.

Inadequacy of Initial Grant.—The initial grant of Rs. 40,000 provided under Government Resolution No. 1443, dated 19th December 1921, to cover the cost of installation of the Society's collections in the New Museum was totally inadequate for the purpose. It is extremely regrettable that conditions of financial stringency should hamper the development of the Natural History Section in its very infancy. An adequate initial grant would have placed the various departments on a satisfactory basis and would have facilitated their natural development. As matters stand at present the provision of cases and equipment for the Reptile, Fish and Invertebrate Section cannot be undertaken. It follows therefore that these Sections must suffer and the Curator's plans for their development must continue to remain in abeyance until such time as it is possible to exhibit the material, in possession of the Society, under conditions where it can be shown to advantage and in circumstances which do not involve so considerable a risk.

It is apparent, that so long as the balancing of the annual budget remains so acute a problem withGovernment, the Museum must continue to be dependent on the support of the general public. An appeal by Sir George Lloyd, the late Governor of Bombay, to the businessmen of the City did not yield the expected results.

The possession of collections and the providing of a building to contain them does not unfortunately constitute all that is necessary for the establishment of a Museum. If the necessary funds be not forthcoming for its maintenance and development, such an institution must necessarily continue to be at a serious disadvantage in fulfilling the purpose for which it was created.

Staff.

Sub-Committee in charge of Natural History Section.—On the amendment of the Museum Act in September 1923 the control of the Natural History Section was vested in a Sub-Committee of 3 Trustees known as the Sub-Committee in charge of the Natural History Section.

In accordance with the terms of the agreement between the Society and the Trustees, Mr. R. A. Spence, Honorary Secretary, and Revd. Father Blatter, S. J., Ph. D., F.L.S., were nominated by the Society to serve on the above Committee while Dr. M. A. F. Moos, D. Sc., was nominated by the General Board.

Appointment of Curator and Assistant Curator.—In March 1923 Mr. B. C. Ellison, the Society's Curator, was granted 6 months leave out of India. Mr. S. H. Prater acted as Curator during his absence. On Mr. Ellison's resignation of his appointment in August 1923, Mr. Prater was appointed Curator with effect from the 1st September 1923. Mr. Chas. McCann was appointed Assistant Curator on probation for a period of 6 months with effect from the 1st January 1924.

Mammal Gallery.

In April 1923 the exhibits in the Mammal Gallery consisted mainly of flat skins arranged on sloping frames. Unsuitable as this material was for purposes of exhibition, it helped to fill a temporary gap ; but the end of the year saw a complete transformation in the Gallery, the flat skins for the most part removed and replaced by properly mounted specimens, wooden shelves replaced by plate glass and the older methods of labelling substituted by diagrams, clearly printed descriptive labels and distribution maps.

Arrangement of Exhibits.—The main policy in the new arrangement of the exhibits has been in the first instance to place on view in the gallery a series of mammals arranged in strictly systematic order. Such a classified series is essential in the arrangement of the exhibits if they are to attain their full educational value. The drawback to the method is that long series of animals, mounted individually, tend to produce a monotonous familiarity that becomes tiresome and fails to rouse the necessary interest in the average visitor.

It is therefore the policy to limit the synoptic series to comparatively few types of Mammals such as would suffice to define the main characteristics of each group of Mammals and would demonstrate the limits of a particular group and indicate its genetic relationship to other groups.

Natural Groups—By restricting the synoptic series it would be possible to find the space for that far more attractive and instructive method of exhibition the formation of natural 'groups' which show an individual animal in its natural surroundings or, better still, illustrate actual portions of a given area with its animal and plant life. Our efforts in the direction are illustrated in two of the cases completed during the year, one of a tiger at a drinking pool, the other of the Markhor, both these cases besides showing the colour and the size of the animal tell us something of its life and the conditions under which it has its being. A case illustrating animal and plant life in the Sind Desert is now under contemplation.



EASTERN STEPPE EAGLES (*Aquila nipalensis nipalensis*) male and female from ANDHERI, BOMBAY.
(Birds set up in the Society's rooms and now on exhibition in the Bird Gallery at the Prince of Wales' Museum, Bombay.)

The Work of the Taxidermist's Department.—The total number of specimens mounted for the mammal gallery during the year was 54, of which 27 large and small mammals were prepared in the Society's work rooms by the Taxidermist's Department. The work of Mr. Charles McCann in this connection is especially to be commended, and the very satisfactory results that have been so far attained are due in no small measure to the enthusiasm and keenness displayed by the staff from the very outset.

Notable acquisitions.—Among the more notable acquisitions to the Mammal Gallery is the fine example of the Great Tibetan Sheep presented by Major F.M. Bailey, a pair of Punjab Oorial presented by Col. R. W. Burton and a Sind Ibex presented by Major C. H. Stockley. A great deal still remains to be done as regards filling up blanks.

Special Requirements—The following animals are particularly required :—

Himalayan Ibex.—*Capra sibirica.*
Sambhar.—*Cervus affinis.*
Brow-antlered Deer.—*Cervu eldi.*
Serow.—*Capricornis sumatrensis.*
Snow Leopard.—*Felis unica.*

We trust that members of the Society who are in a position to do so will help in obtaining for the Society complete skins and skulls of the above animals. Full instructions will be forwarded on application to the Curator.

Bird Gallery.

No cases were available for the Bird Gallery at the commencement of the period under review. A selection of bird skins was however temporarily arranged on sloping screens in the Mammal Gallery. Designs for cases for the Gallery were prepared by the Curator during April 1923. They were based on the type of case now in use at the Edinburgh Museum as being the most in keeping with the general structure of the gallery and the space available.

The construction of the show cases by Messrs. Choong Sang commenced in May and the work was completed in September1923, a delay was occasioned by the non-arrival of the plate glass from England so that the cases were not available for use till October and the gallery was first opened to the public in November.

The work of preparing the material for the cases was taken up in April. 121 specimens were mounted by Mr. P. F. Gomes (of the Society's staff) during the year, under the supervision of the Curator. These were mainly fresh specimens collected locally. The accompanying plate illustrates a pair of Steppe Eagles mounted in the Society's laboratory. The artistic merit of the work has received favourable comment.

Collection of material.—The possibility of obtaining fresh material was a great advantage as a freshly killed specimen lends itself much more readily to the work and yields much better results; the relaxing and setting up of old dried skins is much more difficult and is not always satisfactory. We are endeavouring therefore to obtain fresh skins for the work in hand and appeal to members of the Society for help in this connection. I should like especially to mention the valuable assistance we have hitherto received from Col. Burton who has taken one of the Society's collectors with him on his various expeditions and has thus been instrumental in obtaining for us a fine series of carefully prepared bird skins from the Kumaon Terai. Further collections are now being obtained in the Himalayan region.

To Mr. H.Whistler, the Museum is indebted for some beautiful Pheasants' skins, among these being a pair of Monals, a pair of Koklass, and a fine male Cheer Pheasant, the female of the last species was presented by Mr. A. E. Jones. The specimens have been artistically mounted and help towards the completion of the series illustrative of Indian Game Birds. For purpose of comparison

with Indian species a few English Game Birds were mounted for the Museum in England—these include a pair of English Pheasants, a pair of Black Cock, Red Grouse and Grey Partridges, the birds being presented by Mr. W. S. Millard and Mr. Alan Hay.

No attempt has been made to arrange the specimens in systematic order owing to the paucity of the material at our disposal, the defect will be remedied as soon as sufficient progress has been made and a more fully comprehensive series of specimens becomes available.

A notable Exhibit.—A notable addition to the gallery is the exhibit representing a branch of the Silk Cotton Tree in full flower together with the various birds attracted by the beautiful blooms—the flowers and buds have been faithfully reproduced in wax, care being taken to use a high melting point wax which will not be effected by the temperature during the hot weather. The happy assembling of the beautiful scarlet flowers and birds (the latter include Rosy Starlings, Mynahs and Orioles) make up a very striking and beautiful exhibit. The plate illustrates the case with its accompanying label.

I wish in this connection to especially mention the services of Mr. Savardekar, our artist and modeller, who after many attempts successfully accomplished the work in an exceedingly satisfactory manner.

Reptiles, Amphibians and Fish.

In April 1923 a single gallery on the mezanine floor was available for the Reptile, Fish and Invertebrate Section.

The Exhibits include representations of the common forms of Lizards, Snakes, Tortoises and Frogs in the form of casts and spirit specimens. The standard of arrangement is rudimentary, as no suitable cases or equipment are available for the proper display of the material. Further the space is extremely limited as the gallery also includes a series of cases illustrating Common Indian Butterflies, Moths and Beetles, etc.

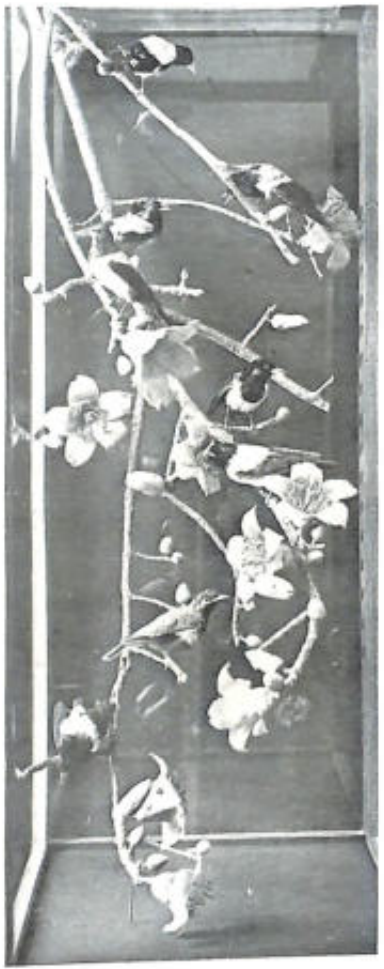
However in July 1923 the Verandah Gallery, till then in occupation by the Forest Section, was handed over to the Natural History Section with the result that the Invertebrate Cases were removed from the Reptile Gallery and were replaced by 4 cases containing the common local forms of Marine and Fresh Water Fishes. The Fishes shown consisted almost entirely of spirit specimens. This method of displaying Fish or Reptiles is admittedly unsuitable, as the specimens immersed in spirit have very little exhibition value, because of distortion, shrinkage and loss of colour.

Casts.—'Mounted and painted' skins may be effective with certain types of fish and reptiles particularly with species which possesses close-set substantial scales, but its disadvantage is that it does not reproduce the smooth gleaming bodies of most species because of the shrinkage and drying of the skin. Plaster or wax casts, although they possess certain obvious disadvantages, would seem to be the most suitable medium for exhibition purposes—provided they are well produced and carefully painted.

During the year progress was made with the preparation of casts of various fish and snakes; the moulds were prepared with parafin wax and the actual casts in plaster of paris. Most of the material completed has not been exhibited owing to the fact that suitable cases are not available. Beyond the actual preparation of material for exhibition purposes the Curator's plans for the development of these sections must be withheld until adequate funds are available for providing cases and equipment for displaying the exhibits under proper conditions.

Invertebrate Gallery.

In July 1923 the verandah gallery, till then in occupation by the Forest Section, became available to the Natural History Section and plans were then



Birds in relation to Plant Life

Birds assist in the spread of plant life by carrying the seeds of plants and dropping them in distant spots, either when feeding on the fruit or during process of digestion. Further certain plants are adapted for fertilization by birds which are attracted to the flowers in search for honey or insects.

In the present instance the Silk Cotton Tree, the subject of our exhibit, is fertilized either by the dispersal of the pollen due to the movement of the birds amongst the flowers or by the pollen adhering to the bill and head feathers which are brought into constant contract with the stigmas when the birds are feeding.

The flowering seasons of certain trees play an important part in influencing local movements of birds. In Bombay the arrival of the Rosy Starling (*Pastor roseus*), a cold weather migrant into India, coincides with flowering of the Silk Cotton Tree (*Bombax malabaricum*). The tree flowers late in January or early in February and the Rosy Starlings then visit the Island in large flocks and spend a greater part of the day in company with many of our local birds such as crows, mynahs, and orioles, feeding on the abundant nectar the beautiful scarlet flowers provide. The Red Coral tree (*Erythrina indica*) also flowers at this time and attracts equally large and mixed assemblies of birds.

At the close of the flowering season at the end of March the Rosy Starlings leave our neighbourhood and except for a few isolated individuals are seen no more.

The case shows a branch of the Silk Cotton Tree in bloom with the various birds attracted by its flowers. The birds represented are 6 Rosy Starlings (*Pastor roseus*), an Indian Black-headed Oriole (*Oriolus xanthornus xanthornus*) and the Common Mynah (*Acridotheres tristis tristis*).

Bombay. February—March 1924.

Photo of Group in Bird Gallery, Prince of Wales' Museum, with explanatory label. The flowers and buds were modelled in wax in the Society's Laboratory.

prepared by the Curator for the arrangement of the various departments to be represented in the Section. With the exception of the Mollusca and the Insects the Society's collections are notoriously weak in Invertebrates and it was realized that a considerable amount of fresh material would have to be acquired before even an elementary series of exhibits could be arranged to outline the various classes of Invertebrates. In this connection it might be mentioned that the authorities of the Indian Museum had expressed their willingness to assist the Society with duplicate material, and arrangements were also made with the Zoological Supply Section of the Madras Fisheries Department for the purchase of various types of Marine Invertebrates. In the meantime the work of preparing the material at our disposal was carried out.

Student Series.—In regard to Molluscs an introductory series, being a guide to the Study of Molluscs, was prepared by the Curator. This series included actual specimens, wax models, diagrams and photographs with explanatory labels arranged as guides not only to the casual visitor but also to students in the local schools and colleges.

It is a model of similar introductory series which it is our intention to prepare in connection with other departments, represented in the Natural History Section.

The introductory series of Molluscs was supplemented by the synoptic collection showing the common forms of Indian Marine and Fresh Water Shells. A series illustrating the various orders of Insects was prepared during the year.

Abandonment of gallery necessitated.—The arrangements in connection with the new gallery for Invertebrates were however abandoned as experience has shown that it is impossible to utilise the verandah gallery for the purpose intended without occasioning the complete destruction of the material exhibited. The gallery is exposed to direct sunlight during the hottest part of the day and, during the monsoon, conditions were further complicated by excessive moisture and damp. Unless adequate provision is made for protecting the exhibits the gallery must be condemned as being entirely unsuitable for exhibiting any material which would be effected by excessive light, heat or damp.

A temporary arrangement has been made by which a part of the Invertebrate collection is now temporarily shown in the Bird Gallery. But as fresh material is rapidly being acquired for the Bird Section it will be necessary before long to find a fresh location for these exhibits. Certain proposals have been placed before the Board of Trustees which if acceded to will solve the present difficulty.

It is sincerely hoped that a settlement will be arrived at and that the public may have the benefit and the enjoyment of these collections which it is now impossible to display owing to lack of suitable accommodation.

Labelling.

Considerable attention has been paid to the labelling of the various exhibits, particularly in regard to the Mammal Gallery where the exhibits are now taking a permanent form. The labels within the cases are printed on grey and neutral tinted card, which it is sincerely hoped will resist the climatic condition which obtain in Bombay, where printed labels seem rapidly to deteriorate by becoming mottled and disfigured. Labels outside the cases have been framed in glass in *passe partout* style. Of the many problems that confront the Curator, that of labels is perhaps the most elusive, a specimen without an informative label is valueless as an exhibit, and on the other hand a label is useless unless the visitor can be induced to read it.

The average person who enters a Museum simply to see the exhibits passes along until he is attracted by some particular specimen or group, when, if his interest is sufficiently aroused, he reads the label. It is therefore necessary that the terms of the label should be couched in more or less popular language

to meet his requirements. Often it is necessary, particularly when defining the various orders and suborders which are naturally based on anatomical differences, to be more or less technical, but even here, an attempt has been made to simplify the labels as much as possible and to avoid the use of, and when this is inevitable, explain the meaning of technical terms. Our whole idea has been to suit the label to the intelligence of the average visitor. To suit the needs of a large body of our visitors who are unable to read English, a start has been made with the preparation of labels in two vernaculars, *i.e.*, Marathi and Gujerati. Our policy is to confine vernacular translations to the general labels. The whole question is full of difficulties, particularly as regards the finding of suitable terms to convey the correct interpretation. Through the kindness of Prof. V.N. Hate of the Wilson College a series of labels in Marathi were prepared during the year for the Mammal Gallery. These have unfortunately not been printed owing to lack of funds but it is to be hoped that the idea will be given effect to.

Reference Collections.

The Society's reference or study collections and Library continue at the old quarters at 6, Apollo Street.

As is the case with most Zoological collections that are brought together through amateur agency, the Society's collections are chiefly representative of those departments of Zoology which appeal more widely to the sportsmen and amateur naturalist. With the exception of Butterflies and Moths and possibly of Marine Molluscs the Invertebrates are poorly represented.

History of the Collections.—The Society's Mammal Collection, with the exception of its fine collection of Heads and Horns of Indian Big Game, was brought together as a result of a Survey of the Mammals of India, Burma and Ceylon instituted by the Society in 1912 with the object of making a systematic survey of the Mammals of the Indian Empire and of supplementing with the material collected, the existing Mammal Collections at the National Museum and other Museums in India and abroad. Two names are intimately associated with the success of the undertaking: Mr. W. S. Millard, then Honorary Secretary of the Society, and the late Mr. R. C. Wroughton.

The Society's Bird Collections which now number nearly 10,000 specimens have been entirely contributed by members. Names that may be specially mentioned in this connection are those of Mr. E. C. Stuart Baker, the leading authority on Indian Avifauna, Mr. E. H. Aitken better known as 'Eha' the author of many charming works on Indian Natural History, Mr. C. M. Inglis, Mr. A. N. Primrose, Mr. H. Whistler and Lt.-Col. Walton.

The Reptile collection, particularly the Ophidia, is mainly the work of Col. Wall, I.M.S., who, in addition to his many important publications on Indian Snakes, has contributed a very large series of specimens to the Society's Museum. Other active workers were Mr. H. M. Phipson and the late Revd. Father Dreckman, S. J.

The Fish collection brought together by Mr. H. M. Phipson is chiefly representative of the local Marine forms.

The Mollusca, which is fairly representative Marine forms of the West Coast of India, includes a large series of land Molluscs collected chiefly by the late Mr. E. H. Aitken, the late Mr. A. Abercrombie, Mr. T. R. Bell and Lt.-Col. H. D. Peile.

Prominent Contributors to the Society's Insect collection were Mr. T. R. Bell, the late Col. C. Swinhoe, and Brigadier-General H. C. Tytler.

Congestion and inadequacy of Storage Equipment.—The Research Collections are not open to the general public but are reserved for the use of members and of advanced students and people specially interested in any branch of Zoological

Research. The problem of accommodating the mass of continuously accumulating material under suitable conditions remains as acute as ever. The transfer of that part of the Society's collection which was suitable for exhibition purposes has not appreciably relieved the congestion which prevailed at the time of the transfer.

One of the principal requirements in the arrangement of study collections is that the specimens should be stored in a manner in which they will be readily accessible; that these conditions are not forthcoming as far as the research Collections of the Society are concerned is due to the complete lack of space and the absence of suitable storage equipment, the reason for the latter being as usual a cramping lack of funds which has been and continues to be our despair and our inspiration.

Notable Acquisition.—Among the more notable acquisitions to the reference collection received during the year was a collection of 143 Mammals presented by Major C. H. Stockley representing specimens collected by him in Kashmir and in the Salt Range, Punjab.

A Collection of 196 Birds were presented by Sir Percy Cox and Major R. E. Cheesman, representing material from the Cox—Cheesman collection obtained in Mesopotamia through the agency of Mr. V.S. LaPersonne, one of the Society's collectors employed by Sir Percy Cox for the purpose.

Our thanks are also due to the Trustees of the British Museum for 55 birds' skins being material collected during the Mount Everest Expedition of 1921.

A very interesting collection of Butterflies, being 88 specimens, was presented to the Society by Capt. J. G. P. Drummond from Loimwe, Southern Shan States, Burma.

Publications.

Research Work.—The following papers, being the result of research work on Museum material, were published in the Society's Journal during the year 1923-1924 :—

On the Capped Langurs, by Martin A. C. Hinton.

On Tree Shrews from the Mergui Archipelago, by Oldfield Thomas, F.R.S.

The Mouse Deer (Tragulus) of the Mergui Archipelago, by Oldfield Thomas, F.R.S.

The Large Langurs of the Ratufa Gigantea Group, by Oldfield Thomas, F.R.S.

A New Mouse from Madura, S. India, by Oldfield Thomas, F.R.S.

On the Forms contained in the Genus *Harpiocephalus*, by Oldfield Thomas, F.R.S.

On a collection of Mammals made by H. Stevens in the Darjeeling District, by T. B. Fry.

On a collection of Reptilia from Waziristan and the adjoining portion of the N. W. Frontier Province, by Capt. C. M. Ingoldby and Miss Joan B. Proctor, F.Z.S.

On a Collection of Batrachia from S. Waziristan, by Prof. C. R. Narayan Rao.

On a Collection of Mammals from Naga Hills, Assam, by J. P. Mills.

The Distribution and Geographical Races of the Gulandi Bush Rats (G. ellioti), by Oldfield Thomas, F.R.S.

On some Squirrels from the Mergui Archipelago, by Oldfield Thomas, F.R.S.

On a Collection of Snakes from Sinlum Kaba, by F. Wall, I.M.S.

A Review of the Asiatic Species of *Contia*, by Col. F. Wall, I.M.S.

Educational Work.

Nature Study.—The Nature Study Committee formed by Government as a result of representations by the Society with Father Blatter, the Society's representative as Chairman, continued its work, classes for teachers were held at

St. Xavier's College during the year and at the conclusion of the term two specially conducted classes were held by the Curator at the Museum for the benefit of teachers from local and mofussil schools. A similar conducted tour was arranged for the pupils of Men's Training College, Poona.

The lines on which the Museum could co-operate with the Board of Education in the teaching of Nature Study are revealed by a study of the principles adopted by the Provincial Museums in England.

Methods in Vogue.—Taking as types the Museums at Manchester and Norwich, we find that in Manchester a room is set apart in the Museum where pupils are brought by masters, hear lectures, examine special exhibits illustrative of the subject in hand and afterwards are conducted over particular Sections of the Museum by their respective Masters. Nature classes are held in the Museum throughout the day, each school having its appointed time. In Norwich a lecturer is appointed by the Board of Education whose duty is to give lectures on "Nature Study" to pupils of various schools. Classes of 25-30 pupils are brought to the Museum in charge of a master. Four lectures are given per diem. In both institutions the children bring rough note books in which they afterwards write up their notes. They are also encouraged to make drawings of the exhibits and at the end of term an exhibition of the best note books and drawings from different schools is held in the Museum. The system has, incidentally, tended greatly to enhance the popularity of the Museum.

In the arrangement of the various exhibits in the public galleries neither of these institutions set themselves out to provide particularly for the needs of Nature Study; they confine themselves to providing the material for illustrating lectures from exhibits in the general collection.

A Museum differs from a school, in that it does not attempt to teach Science or History as the school teaches these subjects, but rather it bases, or should base, its instruction on the study of its exhibition material, though this instruction may be supplemented by the loan of exhibits and other side activities provided they do not cramp the strictly Museum work.

Methods of Co-operation.—The Natural History Section is anxious to co-operate with the Education Department in the teaching of Nature Study in Schools:—

(I) By the loan, where possible, of exhibits for illustrating lectures.

(II) By arranging for special conducted tours for pupils from the local schools.

(III) By rendering assistance to, and advice to, teachers.

(IV) By assisting in the publication of charts and descriptive pamphlets illustrative of the commoner forms of Indian Animal and Plant life.

Lectures.

The meetings of the Society's members and friends were held at the Museum during the year when the following lectures and papers were read:—

"A visit to the Natural History Museums of Great Britain," by S. H. Prater.

"The Fish supply of our Western Coasts," by R. A. Spence and S. H. Prater.

"The Snakes of Bombay and Salsette," by S. H. Prater.

"The Red Ant," by Major Hingston.

"The Honey-Bee," by Mr. J. Addyman, M.L.C.

Visitors.

Owing to the absence of recording turnstiles we are unable to give precise figures in regard to the number of visitors to the Museum. This is a deficiency which should be remedied as early as possible as it is essential that the infor-

mation should be available in order correctly to gauge the extent to which the Museum is being made use of by the general public. There has however been a steady increase in the number of visitors particularly on holidays.

The Natural History Section was visited by H. E. The Right Hon'ble Sir Leslie Wilson, P.C., G.C.I.E., C.M.G., D.S.O., Governor of Bombay, on the 28th March 1923. His Excellency was received by Mr. R. A. Spence and Members of the Committee and was conducted over the Section by the Curator.

Among other distinguished visitors were H. E. the Right Hon'ble the Earl of Lytton, P.C., G.C.I.E., Governor of Bengal, H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E., vice-Patron of the Society, and H. H. The Maharaja of Baria.

List of Donors to the Collections during the year 1223-24.

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British Museum (Natural History).—65 *Birds from the Mt. Everest Expedition,* 1921.

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Morris, R., Attikan Estate, Mysore.—1 *Giant Stick Insect.*

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Prater, S. H., Andheri, Salsette.—82 *Birds' Skins.*

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Spence, R. A., Bombay.—1 *Common Snipe.*

Stirling, J. H., Jodhpur.—1 *Russell's Viper.*

Stephens, B. W., Nowgong.—1 *Saw-scaled Viper* (E. carinata).

Stockley, Major C. H.—*A collection of* 143 *Mammals from Kashmir and the Salt Range, Punjab,* 1 *Skull of Spotted Deer,* 1 *Skin of a Serow,* 1 *Black Buck,* 1 *Chinkara,* 1 *Kashmir Stag,* 1 *Sind Ibex,* 1 *Skin and Skull of an Oorial,* 28 Mammals and Birds from Burma, 1 *Malay Sambhar,* 2 *Muntjacs.*

Superintendent, Victoria Gardens, Byculla, Bombay.—2 *Flying Fox,* 1 *Cheetah,* 1 *Cattle Egret,* 2 *Common Teal,* 1 *Magpie Robin,* 1 *White Stork and* 1 *White-headed Laughing Thrush.*

Tailyour, B. P., Mangan Gully, S. India.—1 *Silk Moth.*

Taylor, W. R., Ingoin, Burma.—1 *Krait.*

Tugersee, M. S., Karwar, Kanara.—2 *Grey Flying Squirrels.*

Waite, H. W., Jhelum, Punjab.—1 *Common Krait and* 1 *Wolf Snake.*

Walker, J. S., Darbhanga.—1 *Banded Krait.*

Wanand, K. C., Kumaon.—1 *Striated Laughing Thrush.*

Whistler, H., Dharmsala.—15 *Mammals,* 2 *Monauls.* 2 *Koklass Pheasants,* 1 *Cheer Pheasant and* 1 *White-crested Kalij Pheasant.*

Wilson, Sir Arnould, K.C.I.E., C.S.I., C.M.G., D.S.O., Bikarz, Bushire.—1 *Desert Monitor.*

Wood, H. F. A., Nilgiri.—1 *Palm Civet* (Albino).

PROCEEDINGS.

PROCEEDINGS OF THE MEETING HELD ON THE 25TH NOVEMBER 1924.

A meeting of the Bombay Natural History Society was held in the Prince of Wales' Museum, Bombay, on Tuesday, November 25, The Revd. Father F. Blatter, S. J., presiding.

The following thirty-four new members were elected:—The Honorary Secretary, R.A. Mess, Hyderabad, Sind; Mr. R. Trevor Roy, Pegu, Burma; Mr. D. Turnbull, Ambasamudram, S.I.; Mr. R. A. Preeston, Monywa, Burma; Mr. E. A. Paterson, Calcutta; Capt. E. M. West, Myitkyina; Mr. P. R. Sherred, Kumaon, U.P.; Major H. C. Winchworth, R.A.M.C., Bangalore; Mr. R. W. D. Morgan, Calcutta; Lt. A.M. Garrett, R. E., Bangalore; Mr. J. F. Macdonell, Bombay; Raja Deosaran Singh Deo, Ruling Chief, Jashpur State; His Excellency Sir Spencer Harcourt Butler, G.C.I.E., K.C.S.I., Burma; Mr. Cedric J. Gow, Madras; Babi Shri Jamiatkhanji Manvarkhanji, Nawab of Balasinor; Sir Norman Pringle, Bart., Monywa; Col.-Commdt. H. B. D. Baird, C.M.G., C.I.E., D.S.O., Belgaum; The Head Master, Government Collegiate High School, Bangalore; Mr. Louis Bisgaard, Bangkok, Siam; H. H. Raja Lakshman Sen, Raja of Suket State; Mr. C. W. Scott, I.F.S., Rangoon; Mr. Frank Bissett, Peermade, S.I; The President, Mess Committee, 1st Bn., The Worcestershire Regiment, Meerut, U.P.; Mr. Narayanlal Bansilal, Bombay; Mr. K. A. L. Hill, I.C.S., Calcutta; Mr. A. A. Rozalla, Simla; Lt.-R. O. Jermyn, Meerut, U.P.; Viscountess Goschen, Government House, Madras; His Excellency Sir William Marris, K.C.S.I., K.C.I.E., United Provinces; Mr. C. R. Ranganathan, I.F.S., Dehra Dun, U. P.; Mr. Henry Lall, Dehra Dun, U. P.; Mr. J. H. Burder, Calcutta; Mr. P. M. Wilkins, North Coorg; and Mr. P. W. Davis, I.F.S., Madras.

A REALISTIC REPRODUCTION.

Mr. R. A. Spence, the Honorary Secretary, invited those present to inspect the new desert group case recently installed in the Mammal Gallery of the Museum. The case illustrates an actual portion of the desert country at Gholamala, Karachi District, Sind, with its characteristic animal and plant life and has been designed to show the visitor to the Museum the desert-dwelling animals and plants in their natural environment and to illustrate the influence of the desert climate and surroundings on the indigenous fauna and flora.

With a view to reproducing as natural an 'atmosphere' as possible Mr. C. McCann, the Assistant Curator, was sent on an expedition to the Sind Desert in June where he made a collection of Desert animals and plants and also collected other accessories such as sand, stones etc. A series of photos of a particular portion of desert country were also taken. With the help of this material a careful reconstruction of the spot selected was made. The difficulties of giving a correct impression in a limited space of an extensive desert landscape with its distant horizon can easily be imagined particularly when the desired effect has to be produced with a horizontal 'built up' foreground and a vertical painted background. But with patience and repeated experiment the technical difficulties were overcome and the correct perspective and continuity maintained.

Mr. K. B. Savardekar, the Museum Artist, is to be complimented on his very successful treatment of the painted background. Unfortunately the funds at the Society's disposal did not admit of its sending the artist to Sind to make actual studies of the desert, but in spite of this disadvantage he has succeeded in giving a graphic impression of the desert landscape which lends itself agreeably to the requirements of the case. The whole group as at present exhibited is a distinct advance in methods of Museum exhibition in this country and

follows the lines now adopted with such success by the American Museum of Natural History, New York. The Curator and his staff are to be congratulated on their achievement.

ANIMAL LIFE IN THE INDIAN DESERT.

Mr. S. H. Prater in the course of his lecture on Animal Life in the Indian Desert explained the main features of the new ' group ' case and discussed the influence of the desert climate and its surroundings on animal and plant life. The Indian desert region which may be taken to include the Provinces of Sind, Cutch, Western Rajputana and a part of the Punjab forms the eastern corner of the great Palearctic Desert which extends from the Atlantic Coast of N. Africa through part of Arabia, South Persia and Baluchistan. It was difficul to define the term desert, it does not follow the popular conception of limitless stretches of sand devoid of vegetation—few areas of the earth's surface were devoid of vegetation and a country which may be extreme desert at a certain season may at another be covered with luscious vegetation while the transformation from desert to semi-desert and from semi-desert to normal is gradual and ill defined. The term desert has been extended to cover those portions of the earth's surface where the climate was hostile to animal and plant life, where normal agriculture was impossible and where nearly all the existing forms of animal and plant life were modified to sustain life in this peculiar environment.

The causes which gave rise to desert conditions in India were chiefly explained by the fact that the areas in which desert conditions obtained were inaccessible to the main branches of the South West Monsoon. It was the extraordinary deviation from the normal which marked the desert climate as distinct. Extremes of heat and cold, sharp contrasts in the relative humidity and dryness of the atmosphere, long droughts, torrential rains, violent winds and other phenomena were the factors against which the animal and plant life had to contend against in their struggle for existence.

Influence of Environment.

The influence of environment was as important in desert life as the influence of climate. The soil in the Indian desert region was mainly sandy, certain tracts were stony, and comparatively small areas could be described as rocky. A sandy soil was perhaps the most hostile of environments to animal and plant life, it presented the most difficulties to the animals and plants attempting to colonise it. In the Indian Desert Region the bulk of the vegetation consisted of shrubs and perennial herbs capable of drought resistance. There were a few trees and these were generally stunted or thorny or prickly.

The majority of desert plants were deep rooted and capable of absorbing moisture from deep below the ground, thus certain species remained green throughout the year; other adaptations to assist plants to struggle against adverse condition were reduced leaves, hairiness, succulence, coatings of wax, thick cuticle and protected stomata, all with the object of reducing transpiration and conserving the available supply of moisture. The influence of the desert environment on its animal life was equally striking.

The various species of Gerbilles inhabiting the Indian Desert all conformed in general structure to a type which has been evolved under desert conditions in all the continents of the world, *viz.*, the Jerboa or Jumping Rat—an animal with very short fore limbs and very long hind limbs which was able to move over the soft sand by a series of leaps and bounds after the manner of a Kangaroo. The Jerboa was not found in the Indian Desert Region but in the various species of Indian Gerbilles inhabiting the desert the same modifications of structure were to be seen toa lesser extent, and as animals of widely separated genera conforming to this type of structure were found in all desert regions.

it is concluded that these modifications have been evolved as a response to the peculiar environment of the desert.

Hardy Desert Dwellers.

Desert dwelling animals were able to withstand long periods of drought while others were totally independent of water, relying for their supply on dew or on their animal or vegetable food. They were capable of resisting intense heat and such of them as were unable to withstand surface conditions in the desert during the hottest parts of the day resorted to various devices to reach a more equable temperature.

The strong wind that prevailed with such violence in the deserts was not without its effect on its animal and plant life. Among the modification of structure due to the violence of the wind the most remarkable was the wingless condition of many desert insects or the reduction in the size of the wings. This is particularly noticeable in many of the desert grass hoppers, mantises, cricket. The same phenomenon is to be observed in non-desert regions which are exposed to violent winds.

The most interesting aspect of desert animals was their colouration. The majority of desert animals were coloured buff or sandy or reddish grey and bore a resemblance in colour to the ground on which they lived. The general theory held so far was that the colouring was protective. While this theory might cover a certain proportion of desert forms it could not be extended to cover all desert animals when their habits were considered individually. It could not for instance be applied to animals which hunt or are hunted at night, or to animals which lived an entirely subterranean existence.

Climatic Factors.

The cause which gave rise to this peculiar colouration was one which affected every type of animal, it did not discriminate between prey and captor nor between creeping and flying animals, nor between nocturnal and diurnal animals. A combination of climatic factors rather than the optical properties of the background may possibly be responsible for the peculiar colouration of desert animals. As a general rule darker and more richly coloured representatives of a given species were found to occur in India where the rainfall is greatest.

As a general rule animals and birds which inhabited Southern India, the Eastern Himalayas and Tennaserim showed a greater intensity of colouration than those inhabiting the Deccan and the Central Provinces and these again were darker than the forms from the desert region. The defective colouration of desert animals may possibly be explained by the physiological reaction of their organisms to dry atmosphere and heat which seemed to be inimical to the production of pigment except in a dilute form. The lecturer recommended those present to read Mr. P. A. Buxton's recent book entitled "Animal life in the Desert" which dealt very interestingly with the various problems raised in the above discourse.

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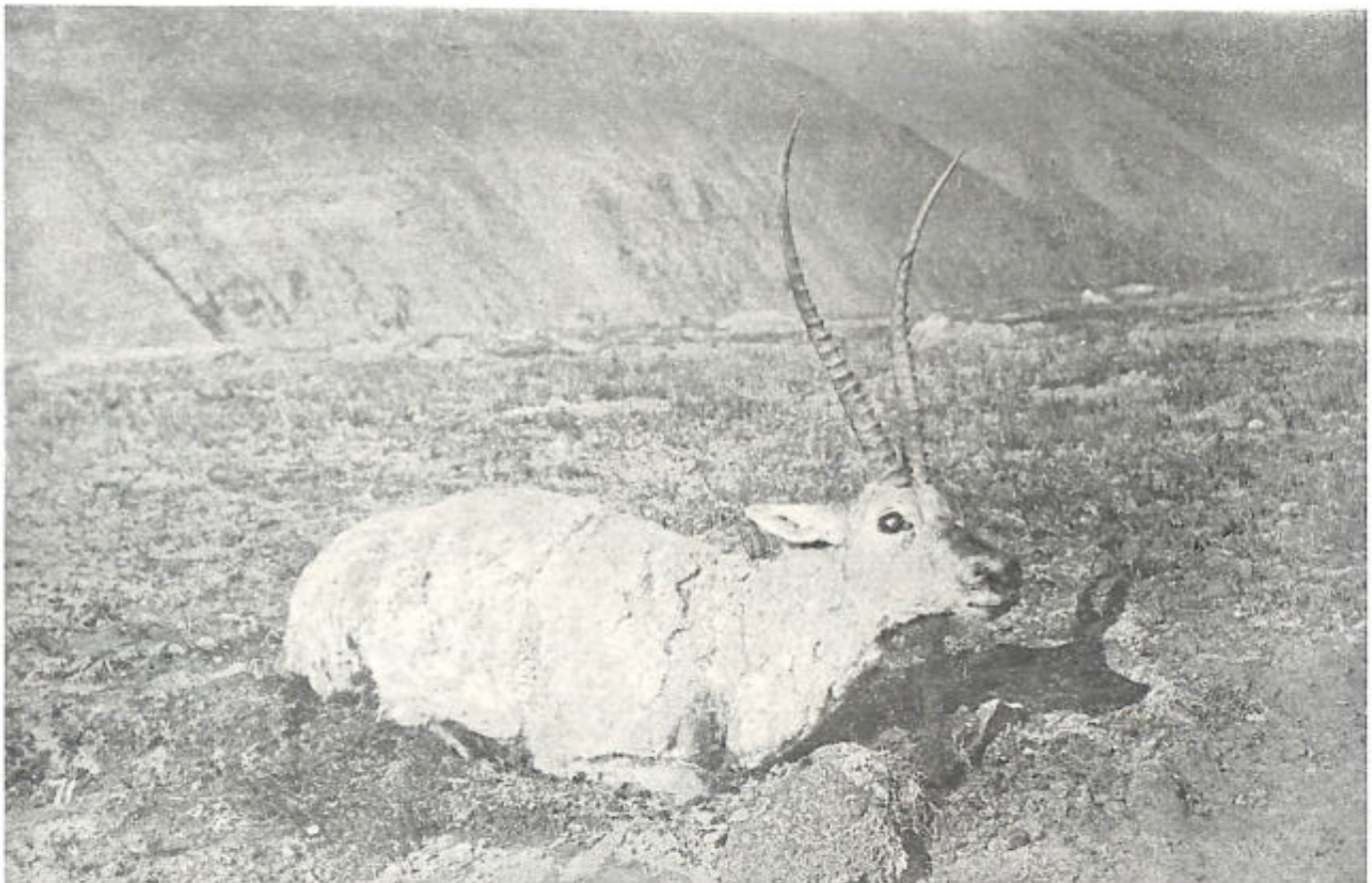
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TIBETAN ANTELOPE (*Panthalops hodgsoni*).

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THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES.

BEING NATURAL HISTORY NOTES.

BY

COL. A. E. WARD.

PART IV.

(*Continued from page* 131 *of this Volume.*)

(*With* 1 *plate and* 11 *text figures.*)

Family—BOVIDÆ.

The present article deals with some members of this family which were excluded from my previous article on the Bovidæ. The various Indian Central Asian Antelopes, Gazelles, the Saigas and the Nilgai are grouped in the following 4 sub-families :—

I. *Saigīnæ* (The Saigas).

II. *Panthalopinæ* (The Tibetan Antelope).

III. *Antelopinæ* (Antelopes and Gazelles).

IV. *Tragelaphinæ* (Nilgai).

I. Sub-family—*SAIGINÆ.*



FIG. 1.—Saiga Antelope (*Saiga tartarica*).

THE SAIGA ANTELOPE—*Saiga tartarica.*

The late Mr. P. W. Church mentions having seen a pair of horns at Urumtsi and heard of these Antelopes to the North (Urumtsi is between 400 and 500 miles west of Kuldja); he mentions that as the horns are considered to have medicinal properties they may have come from other parts. However he was not very far from the habitat of the Saiga. It lives in Siberia and Western Turkistan, to the westward and northwestward of Kuldja and in Southern Russia. Reports of this animal were received from my collectors high up in a branch of the Volga near the Ural mountains and this tallies with the habitat assigned to it.

I am greatly indebted to Messrs. Rowland Ward & Co. for the illustration reproduced above which shows the curious inflation of the nose and the peculiar

position of the nostrils, the animal was shot by Mr. S. H. Miller. The dimensions of the horns are :—

Length 13″, Girth 5½″, Tip to tip 3½″ ; they are light coloured.

In the autumn the summer coat of yellow fawn begins to assume a whitish tinge and in winter it is said to become pure white. The height of a buck is about 29 inches. Some are said to be taller.

II. Sub-family—*PANTHALOPHINÆ.*

TIBETAN ANTELOPE—*Pantholops hodgsoni.*

The *Chiree* of Ladak—*Tsus* and *Choosh* further northwards.

Habitat.—The great plateaux of Tibet. It is mostly met with by sportsmen in the Chungchenmo and during migrations in the Karakoram at elevations up to 18,000′ and seldom under 14,500′. Plate I shows the kind of ground on which the Chiree dwell.

The colouring varies according to season and not infrequently to a considerable extent in individuals. The face is brown, or at times nearly black, but above the nose there is nearly always a blackish patch. The accompanying plate does not show the curious swelling on the nose distinctly, this is very marked at all seasons of the year. The buck in the photo was shot before it had lost its winter coat : this coat consists of an extraordinarily dense mass of upright wool of a very pale brown colour often with a pinkish tinge ; when the dead body is handled this wool comes away in handfuls, it literally peels off in lumps—this is the protective portion of the winter coat and is the outside fleece, in this respect it differs from the Ibex and other upland animals, in which the *pushm* or *under fleece* provides the required warmth. The side of the head and neck are grey with sometimes a shade of brown. Inside the ears and the stomach are greyish white, the forelegs are partly blackish brown, and the hind legs are generally entirely of that colour, but in the colouring of the legs, there is often slight but distinct variation. Most of the buck I have shot were obtained in May, when the colour is hard to describe, they were ragged with part of the winter and part of the summer coat showing. One or two months later in the year the colour might be described as reddish light brown on the back.

On shooting a buck and carefully looking it over, the large inguinal glands will attract attention and the already mentioned thickening of the nose, also the coat of wool which is 2″ or more in depth. Compared with the black buck as to size, the Tibetan animal is larger, the skull, which has a large nasal cavity, is considerably longer and the height and length greater.

The following are measurements made in May and June.

Height including woolly coat.	Weight.	Horn.	Locality.
35″	85 lbs.	24″	Under the Demjor-lo
36″	85 lbs.	26½″	Kyam Changchano.
35″	90 lbs.	24″	Kieung-la.

Some writers put the maximum weight at 120 lbs. I doubt it, in the autumn probably all the three bucks mentioned might have increased by 10 lbs. but not more and many full grown animals are smaller. An average length of horn is 22″ to 24″ by 6″ girth. A female stood 28″ but another was nearly 30″. The record horns of the buck are I think 28″.

General Notes.—The small bore high velocity rifle makes the stalk much easier than it was years ago. Look at plate 1, and see the ground to be crawled over. There must be large numbers of this migratory antelope still existing, for immense herds were to be seen in favourable localities at certain seasons. When migrating they follow the same tactics as many of the Gazelles, the sexes separate and move in herds of many hundreds. When on the grazing land, they are found in flocks of from 3 to 10 or more, then they may get amongst the ravines, and into the fairly steep hill sides, but I have never seen an antelope on what could be called rocky slopes.

They are greatly pestered by Bot flies, on removing the skin, scores of the grubs of this fly are found, they do not penetrate the flesh.

At first Antelope steak is rather a welcome dish, but try it for every meal for six weeks and you will hate the mention of it for ever.

The statement so often made that the horns of Tibetan Antelope are in shape very similar is to a great extent true but there are exceptions. All horns have at times " freaks." Amongst a group of bucks was one with lyre-shaped horns which turned rather outwards and then curved inwards right up to the tips: the length was 20 inches. The bucks had scooped out the sand and I fondly hoped that the lyre-shaped horns might belong to some Gazelle, but all the same I was very pleased not to miss my shot when the Antelope stood up, until it did so there was nothing at which to shoot.

In a hollow in a hill side I found a single horn in a wolf's den, which was erect at first and then turned inwards rather abruptly, but this horn was short.

III. Sub-family—*ANTELOPINÆ.*

ANTELOPES—Genus—*ANTELOPE.*

THE BLACK BUCK OR INDIAN ANTELOPE—*Antelope cervicapra.*



FIG. 2. THE BLACK-BUCK (*Antilope cervicapra*), JHIND STATE.
Right horn 30"; Left horn 31$\frac{7}{8}$".

Hiran and *Herna* of the Dogras and in India.

So few Black Bucks are left near Jammu, the only province which interests the reader, that it is scarcely worth while to enter this Antelope in our lists.

Dunbar Brander in his " Wild Animals in Central India" gives a long description, and very interesting reading it is.

Unlike the Tibetan Antelope the suborbital glands are present. The inguinal glands though large are not nearly so much developed as in the Tibetan animal. The male when young is coloured fawn like the doe but gradually assumes a darker tone becoming practically black on the back making a sharp contrast with the white belly. There has been a good deal of correspondence regarding " brown-backed bucks ". Some fully matured animals with fine horns are for a long time brown.

The size of this Antelope seems to vary but little in the numerous districts it inhabits, the measurements given by Dunbar Brander.

Height at shoulder	Length	Weight
32″	4′	90lbs.

represent a well developed animal.

The photo of the head figured above, kindly supplied by the Bombay Natural History Society, is the record. Other horns are 30″, 29″, 28¾″.

Albinos are rare. I have however seen two in a wild state. There are several known instances of the female carrying horns. One I shot in the Moradabad District, U. P., had the horns lying flat close to the skull curving from the ears backwards.

As to the controversy regarding this Antelope drinking, they certainly do so in the hot weather—when camped on the borders of the Rewa State, close to jheel, both Chital and Black Buck came regularly to drink, of course Chital are thirsty animals, but Antelopes certainly drink.

As a rule the largest horns are found in certain fixed localities.

I never succeeded in getting a big head in Aligarh from amongst the enormous number seen, but curiously enough I shot a very fine head at Amsote not far from Hurdwar, and a head which measured nearly 30″ (horns) was killed between Fattehpur and Mohan, on the Saharanpur-Mussoorie road.

Many people have kept tame black buck, they are apt to be vicious. In a very large enclosure where Antelope, Chital, Sambhar and Hog Deer wandered, a very fine Black Buck was the one animal to be avoided, eventually it slew a male Hog Deer.

Fighting bucks were often kept by Indian princes, the animals are generally keen to go at one another, but as they are roped up by the keepers, and pulled back not much harm is done. Judging by the distance which a herd buck will in a wild state sometimes chase an interloper, the use of the rope in these encounters is probably a necessity.

GAZELLES—Genus—*GAZELLA.*

Lydekker when dealing with the gazelles of Ladak and Central Asia, in his book " The Game Animals of India, Burma and Tibet " adopted as his type for these Gazelles a race of the Persian species and called it *Gazella subgutturosa typica*, giving as his reason, that this was the only gazelle found within the area included in his book. These articles however go much further afield, so there is no reason to follow the same course.

I have endeavoured with all the information, coupled with what knowledge I have, to try and indicate the locality occupied by each race, but this is not easy, especially when dealing with the different allies of the ' *gutturosa gutturosa* ' type.

The Central Asian and Indian Gazelles included in the genus *Gazella* are divided into two subgenera as follows :—

I.—Sub-genus—PROCAPRA.

includes the following species :—

1. Gazella (Procapra) picticaudata.
2. ,, ,, przewalskii.
3. ,, ,, gutturosa.

2 races of No. 3 are recognised :—

A. Gazella gutturosa gutturosa.
B. ,, ,, altaica.

II. Sub-genus—GAZELLA.

4. Gazella sub-gutturosa.

2 races of No. 4 are recognised :—

A. Gazella sub-gutturosa sub-gutturosa.
B. ,, ,, sairensis.

5. Gazella yarkandensis.
6. Gazella siestanica.
7. ,, fuscifrons.
8. ,, bennetti.

In order to follow the geography of the countries where these animals are found it will be necessary to look at the map of Ladak and of Sikkim and Southern Tibet for No. 1. Then that of Mongolia for No. 2. Turn to Western China for No. 3. Next for No. 4 part of the country from Asia Minor—Persia to China has to be studied. For No. 5 the maps of Yarkand and Kashigar suffice. It is rather a relief to look up Seistan bordering on Baluchistan and Afghanistan for No. 6 and 7, for these countries are near to India. While No. 8 is purely Indian.

Material aid will be got from Rowland Ward's 8th Edition of the Big Game Records, in regard to Kennion's Gazelle a specimen of which I have never seen in the body.

Some of the photographs from which the plates are herein produced are probably taken from the same specimens as in Lydekker's work for owing to the kindness of the British Museum, Colonel Harry Ward was able to give me a great deal of assistance (see part IV—Game Animals of Kashmir etc., page 882 of the Journal, 20 Dec. 1922) and took the photographs in the B. M. Other photos are reproduced from the B. M. Catalogue of Ungulate Mammals.

Sub-genus—PROCAPRA.

TIBETAN GAZELLE—*Gazella (Procapra) picticaudata.*

Goa of Tibet : *Ragyo* in Northern Ladak.

Distribution.—This is the Gazelle which is best known to the majority of sportsmen who shoot on the borders of Central Asia. It is an inhabitant of Northern Ladak—Spiti and Tibet. It lives on the plateaux in the open country and is seldom seen on the mountain sides, it does not descend in Ladak much below 14,000', and is found at higher elevations in summer time.

Colour.—The plateaux of Tibet are very hot at midday and the winters are intensely cold, hence as must be expected, the Goa assumes a long coat at the latter season, this is a grizzled and sandy colour. In summer the hair is pale rufuous and comparatively short. The buttocks are white, the tail is dark brown and very short : the disc round the tail is white. The lower parts are lighter than the back and gradually merge into almost pure white underneath. No suborbital gland, or knee tufts. Females hornless. Height at shoulder 23 to 24"—weight 40 to 45 lbs. The horns are much curved backwards then slightly forward at the tips and are covered with rings almost to the top.

Notes.—It is rare to see more than 8 to 12 in a herd. In the country, more accessible to most sportsmen, this gazelle is scarce, and does not appear ever to collect in large flocks.

Blanford quotes a recorded length of horn at "15·75," measured along the front curve, and a basal girth of 4". This length is very great and Ludlow's trophy of $14\frac{1}{8}$" by $3\frac{3}{4}$" has not I believe been excelled in recent dates.

PRZEWALSKII'S GAZELLE—*G.* (*Procapra*) *przewalskii.*



FIG. 3.—Prezewalski's Gazelle (*Gazella* (*Procapra*) *przewalskii*).

Distribution.—This Gazelle is said to have its habitat in parts of China from Kansu northwards to the bend of the Yellow river, and also in Mongolia—also eastward to the north of Pekin.

Notes.—The head figured above is that of an animal in winter coat and is reproduced from the B. M. Catalogue. The pronounced inward turn of the horns at the tips appear to form a character by which it is considered a distinct species. The most that can be said in support of this distinction is the shape of the horns and the large size.

It closely resembles the Goa, perhaps in summer it is rather more brown.

Females are hornless.

The bucks carry horns of about 12" in length, and these are rather stouter than those of the Goa.

The Mongolian Gazelle—*Gazella* (*Procapra*) *gutturosa*.
The *Hwung*—*Yang* or Yellow Goat of China.
The *Djeron*—*Terrev* (Turki).

These names are however employed locally for most of the Gazelles. If the Altai animal is distinct the following two races may be recognized, *i.e.*, *Gazella gutturosa gutturosa* and *Gazella gutturosa altaica* :—



Fig. 4. Mongolian gazelle—(*G. gutturosa gutturosa*).

The name *gutturosa* was given because the throat of the bucks swells during the pairing season, this is due to the dilation of the larynx which gives a swollen appearance to the upper portion of the neck.

Distribution.—The habitat of the typical race *gutturosa gutturosa* is Northern and North-East Mongolia to the vicinity of the Gobi desert, to the hills northward of the Tian-Shan and also to the north and north-east of Pekin. A closely allied race comes from part of the Altai.

Notes.—The Mongolian Gazelle is as far as is known the largest of any of the Central Asian races. One shot north of the Gobi measured 28″, a second 27½″, in some books it is stated that this Gazelle stands as high as 30″ at the shoulder.

The skulls illustrated show the heads of the typical race *gutturosa gutturosa*.

The tail is very short like that of the Goa. There are indications of knee tufts. No face marking. The rump is white. Females are hornless. A good pair of horns on an old buck measured 12″ in length by 4½″ in girth, they are of a greyish brown hue, and are stout and strong.

This is not a " Gazelle of the desert " nearly to the same extent as are other races, nor is it addicted to resting during the day in an open bare grassless plains. Unless much worried by men or wolves, it does not penetrate far into the hills, but is found on grass flats and in the ravines in the lower hills.

Like the Tibetan Antelope and some of the Tibetan Game Animals, the does congregate in the spring, the herds running into many hundreds, they then move into reasonably good and open grazing ground, there in May and June the young are born : wonderfully active the little creatures are, and they need to be if the wolves are not to take too heavy a toll.

The late Ney Elias mentions coming across herds of hundreds all the way from the bend of the Yellow river to the Altai—most of these were probably the Mongolian Gazelle, though some were probably *G. procapra przewalskii*: this was about 40 years ago—and it was from that intrepid traveller's specimen of this Gazelle that Blyth gave the name "*procapra gutturosa*." It was about 1879 that Biddulph shot a then unknown Gazelle on the Maralbashi country, this must have been the Yarkand race (the "Saikik").



Fig. 4. Altai Gazelle—*Gazella gutturosa altaica.*

Distribution.—The typical locality of the Altai race (*G. gutturosa sairensis*) is given as the "Suok Plains near the little Atlai, N. W. Mongolia. The photos above illustrate the Altai race. The colour of the animal is a light fawn with pale cheeks, the small suborbital glands are to be seen. The face is devoid of markings.

The record horns are I believe just under 14" and I see Rowland Ward quotes $13\frac{3}{4}$" by $4\frac{1}{4}$". The horns of the specimen figured above are 11 inches.

Sub-genus—Gazella.

The Goitered Gazelle—*Gazella sub-gutturosa.*

Persian name "Ahu".

The various races of the Goitered Gazelle wander over a very large area in Asia Minor, Northern Persia, the Caspian Provinces—Turkestan and parts of China proper.

G. sub-gutturosa is essentially a desert animal and is found in small herds, which probably do not get together except when migrating. They have not the habit of going much amongst broken country and are hard to stalk. They are often found in the open desert during the day time.

It is hard to give the limits of the habitat of the races and still harder to say when the variations are sufficiently constant and marked to separate the races

or tend towards establishing a distinct species. Two races are recognised :—
(A) *Gazella subgutturosa subgutturosa* and (B) *Gazella subgutturosa sairensis.*



FIG. 6. (*a*) Goitered Gazelle (*G. subgutturosa sub-gutturosa*).

The Goitered Gazelle (*G. S. sub-gutturosa*) is the typical race from Persia and the Caspian.

The Goitered Gazelle stands about 26" at the shoulder, thus it is considerably larger than the Goa, and is smaller than the Mongolian gutturosa gazelle.

The photo above shows heads of the typical Persian race, these specimens are in the Hume collection.

The tail is long, and measures about 8 inches, it is dark coloured. Knee tufts are well developed, cheek marks are more or less clearly defined; suborbital and groin glands exist.

Colour.—The colouring of the upper parts is rufuous, the lower parts lighter, buttocks white, with a clear brown line separating the white from the rufuous fawn above and at the sides. On the younger bucks a dark line extends from below the eyes to the base of the horns and there joins, and forms a frame to the white or pale fawn on the upper part of the face but this marking is faint on old bucks. The bucks appear to carry finer and less stumpy horns than the Mongolian race. The horns of a good specimen tape $14\frac{1}{2}$" with a girth of $4\frac{1}{2}$" with the ridges clearly marked.

The second race of goitered gazelle (*G. subgutturosa sairensis*) is the form from N. W. Mongolia.

Jairam of Turkistan.

The typical locality of the race is given as "Saiar, or Jair Mountains, Zungaria.

The Gazelle of the Saiar is larger than the typical Persian race, standing 27" at the shoulder but with smaller horns.



FIG. 7. (*b*) Sair Goitered gazelle (*Gazella subgutturosa sairensis*).
The heads figured show distinctly the dark lines under the eyes but the face in front is devoid of the markings or nearly so, they were probably bucks killed in the winter.

Fig. 6. shows a typical but very fine pair of horns, for as a rule the Gazelle from the Sair carries a poor head.

THE YARKAND GAZELLE—*Gazella yarkandensis.*



FIG. 8. Yarkand Gazelle (*Gazella yarkandensis*).

The *Jeron* or *Saikik*.

Distribution.—The Type locality is given as the "plains of Yarkand, Chinese Turkestan." This Gazelle is found in the vicinity of Kashgar and Yarkand and eastward of the Khotan river to the Tarim country and Lob-nor, this is the country to the southward and westward of the habitat of the Mongolian species. It is a large sized gazelle.

The ears are long and the face markings very pronounced, unfortunately I have no photograph of a set up head.

The colour above is fawn, so also is the forehead, in this it differs from other allied races.

The Gazelles afford sport to hawking parties, in Kashgar an eagle is flown which pitches on the head of a doe and pecks viciously, whilst the flapping of its wings bewilders the gazelle, and enables the horsemen to ride up and catch it. Hawking used to be a very popular recreation in many parts of Central Asia.

Fig. 7 illustrates a head in the Hume Collection, it represents a very fine specimen. The horns, 16" in length, are densely ridged which was not always the case in the Yarkand specimens first obtained in 1879.

The record horns are I believe those figured in Rowland Ward's Eighth Edition of records, page 237, they are 17"—4½".

THE SEISTAN GAZELLE—*Gazella seistanica*.



FIG. 9. Seistan Gazelle (*Gazella seistanica*).

Distribution.—Apparently Northern and Eastern Persia.

The Type locality is given as "Seistan, Eastern Persia"

This, I take it, is the name now given to the gazelle which is found in Seistan, to the north-west of Baluchistan and to the south of Afghanistan. It is figured in Rowland Ward's Records, and the locality of the recorded heads are Northern Persia.

The bucks appear to carry horns which are generally smaller, but rather resemble those of *yarkandensis*, see photo of *yarkandensis*.

I was under the impression that the gazelles which were very occasionally to be seen and still more rarely to be shot to the westward of the Peshin Valley were the same as this animal—but I have not enough to go upon. However *seistanica* is described in the British Museum Catalogue as being "closely allied

to *yarkandensis* "; and although *yarkandensis* and *seistanica* are now regarded as distinct species I am however inclined to adhere to the original idea that these gazelles are merely races of *G. subgutturosa sub-gutturosa*.

At the risk of boring the readers of the Journal I propose to dwell on the recorded distinctions between *yarkandensis* and *seistanica*, the most noticeable is the " white muzzle of the latter." Next the forehead is sometimes greyish in *seistanica*, this is a slight difference and may be simply "old age," and there is a whitish band at the base of the horns and an indistirct nose spot above the white muzzle. I have never seen this on any specimen of a Yarkand Gazelle. As to the smaller amount of white on the buttocks in *seistanica*, there is no doubt that the white varies in different individuals of *yarkandensis* but it has to be admitted that the small extent of white if constant, creates a difference, because the tendency towards white is one of the distinguishing features of the Seistan animal. Still it would appear as if the evidence to justify establishing distinct species amongst many of the Central Asian animal is not sufficient.

At one time I was in correspondence with an eminent American Naturalist who deplored the hasty decisions to sub-divide species, but, as he remarked, " it is easier to do this, than to rectify the error when done."

The animal figured above is from a photo by Col. Kennion and is reproduced from the B. M. Catalogue.

KENNION'S GAZELLE—*Gazella fuscifrons*.



No. 10. Kennion's Gazelle (*Gazella fuscifrons*).
From Lydekker, *Proc. Zool Soc.* 1911.

Distribution.—Seistan and the borders of Baluchistan.

This Gazelle is, as far as I can ascertain, closely allied to the Chinkara. The female carries horns of considerable length which have frontal ridges. Apparently the horns tend towards a turn inward at the tips and the maximum length of a buck's horns is about 14 inches.

I have not had the pleasure of meeting Col. Kennion since he shot this gazelle and have not in consequence been able to get any information In the B. M. Catalogue of Ungulates Kennion's gazelle is described as being "apparently somewhat smaller than *sistanica*" (shoulder height probably about 28"), the male is without a 'goitre'. There is no marked inturning of the horns as in *sistanica*. I have already commented on the colour differences.

THE INDIAN GAZELLE—*Gazella bennetti.*



No. 11. Indian Gazelle (*Gazella bennetti*).

THE *Chinkara* OR "RAVINE DEER" OF SPORTSMEN.

In former years a few of these Gazelles were to be found in the foot hills bordering on the Punjab, they have now been practically shot out from South and South East of Jammu—hence it is only in Baluchistan and in Persia, to the West of Khelat, that this Indian Gazelle is found in the country mentioned in these articles.

Male.—Height at shoulder 25", at croup 28" (from a big buck), length 40" to 42"—the ear is about 6" long—horns 11" to 14"—record 15¾"—weight from 45 lbs. to a little over—horns rather upright, curve quickly backward and slightly forward at tips, which are from 4" to 8" apart.

Female.—Weight 30lbs.—horns from about 5" to 7"—as long as 8" are recorded.

I have not kept records of many measurements, and have in fact only shot one female which was of the weight mentioned. The horns of the male have many ridges almost to the tips—those of the females are generally devoid of these rings or ridges but are not invariably smooth. I saw a pair of horns in Quetta and in Peshin which were distinctly ridged. Dunbar Brander mentions that female Chinkara in certain localities in the C. P. carry annulated horns.

Colour.—The colour of the upper part is a fawn chestnut, the chin and lower parts and inside the thighs white. Tail blackish. The knee tufts generally very dark brown, the white caudal disk, which is present in the Tibetan Gazelle, is absent in the Chinkara. Face markings of white with a rufuous border and from the horns to above the nostrils a darker tinge of rufuous.

Some of the Northern India animals are very much paler in colour, and the gazelles of S. E. Persia seem to be closely allied.

General Notes.—Chinkara are gregarious, it is however rare to see more than half a dozen together. They inhabit broken ground and eschew the open plains, thus differing in their habits from their Central Asian allies. It is not at all uncommon to see twins—but probably one young one at a birth is the general rule. With a light small bore rifle the pursuit of this dainty gazelle is rather an entrancing kind of sport which can be indulged in without going into camp, the drawback is that this animal does not show up well in the daytime, for it generally rests until late in the evening. Outside the area with which we are now concerned Chinkara are found in most parts of Northern India and southwards into Mysore.

The photograph is by Major C. H. Stockley.

Sub-family—*TRAGELAPHINAE.*

Genus—BOSELAPHUS.

THE NILGAI (*Bosephalus tragocamelus*), *Portax pictus* of Jerdon.

This well known animal is common in Jammu, it is sometimes called *Roz* but *Nil* is the common name.

This is the only representative of the subfamily in India, for others we have to turn to Africa.

The suborbital glands are present, so are the interdigital, there are no inguinal glands.

Colour.—The colour of a bull is either bluish brown or bluish grey, the female is a brownish grey, both sexes have white on the cheeks, and white rings on the legs above and below the fetlock. The stomach is whitish and there is a white throat patch. There is a tuft of black hair on the throat of the male and both sexes have manes. The young are brown. The female is hornless. The male carries horns of 8″ to 9″ long and about 8″ in girth. A very exceptionally long horn was 11¾″. Two heads of 12″ have been recorded in the Society's Journal.

Measurements of a large bull shot in Kumaon.

Height.	Length.	Tail.	
54″	86″	18″	exclusive of the tuft.

The weight was about 580 lbs., but the scale was not very accurate when weighing heavy animals.

General Notes.—Nilgai live in the so-called Game reserves in Jammu, and wander where they please. As a rule they live in the scrub jungle during the day, but in the mornings and evenings and sometimes throughout the day they graze in the fields. Much damage has been done by the herds of Nilgai hence they are now out of favour, but until lately the mantle of sacredness has protected them.

A big blue bull is often solitary, otherwise Nilgai are seen in small herds.

How deceiving the lumbering gallop of the bull is! It takes a good horse to overtake a Nilgai, and a very good one to run down a female but if on easy ground both can be ridden down and speared. When at all hemmed

in the blue bull will charge if wounded. I can remember being out on two occasions when this occurred.

We were riding in line through a detached piece of grass looking for a wounded bull which got up between two horses and made straight at the nearest, luckily on the right side. On the other occasion I did not see the charge, but one horse was upset though not damaged. In captivity they are dangerous. There is a grim satisfaction in shooting females and even young Nilgai, for they are absolutely pestilential in the crops. Certain parts of Kumaon jungles hold numbers—any way they are not wasted when dead for the Mahouts will eat them although they do not appreciate an old bull, but for the skin they get rupees, hence they are quite ready to load the carcass on to a pad elephant.

(To be continued.)

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMAH AND CEYLON.

Report No. 37(*a*), Nepal.

By

T. B. Fry.

Collection	..	..	No. 37(*a*).
Locality	..	..	Nepal.
Date	..	..	May 17, 1922 to May 17, 1923.
Collected by	..	..	N. A. Baptista.

A Collection made by Col. R. L. Kennion between August 19 and December 23, 1920, and another by N. A. Baptista between January 17 and April 20. 1921, were examined and commented upon by Mr. M. A. C. Hinton in Report No. 37* (Nepal); and in addition to considering the actual specimens obtained he wrote very fully on the known fauna of this country.

Later during the period May 17, 1922, to May 17, 1923, Mr. Baptista working in the districts lying to the west of Katmandu collected some 591 specimens, most of which belong to species to which reference was made in the above mentioned Report; in fact only two new species were discovered, *viz.*, *Apodemus* (*Nemomys*) *gurkha* described by Mr. Thomas in "Scientific Results," and *Neodon sikimensis*, to which attention will be drawn under their respective headings.

In view of the foregoing facts no detailed report of this Collection appears to be necessary so the following List only, with occasional remarks, is submitted for publication in the Society's Journal.

(1) Macaca mulatta, Zimm.

The Bengal Monkey.

(Synonymy in No. 7).

Chengli, ♂ 1; Bouzini, 5,000′, ♀ 1.

"Found in large troops in Nepal, not sacred, period of gestation about six months, usually only one young at a birth, do much damage to crops.

"Vernacular names:—*Ratto Bandar* (Pahari); *Mugger* (Bhotia)"—*N. A. B.*

(2) Pithecus schistaceus, Hodgs.

The Himalayan Langur.

(Synonymy in No. 15.)

Satthar, 11,000′-12,000′, ♂ 1.

"These animals are said to pair in February and the young to be born in May, but this needs verification. They are not destructive to crops like other monkeys."—*N. A. B.*

(3) Rousettus leschenaulti, Desm.

The Fulvus Fruit Bat.

(Synonymy in No. 11.)

Boitari, ♂ 4, ♀ 4.

(4) Cynopterus sphinx, Vahl.

The Southern Short-nosed Fruit Bat.

(Synonymy in No. 6.)

Satthar, 12,000′, ♂ 3, ♀ 1.

"Common in Nepal, frequently found on plantain trees. It breeds in December. Eaten by Passis only."—*N. A. B.*

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* Jour. Bom Nat. Hist. Soc., Vol XXIX, p. 399.

(5) RHINOLOPHUS AFF. HIMALAYANUS, K. And.

The Himalayan Horse-shoe Bat.

(Synonymy in No. 37.)

Bouzini, 5,000′, ♂ 1.

(6) RHINOLOPHUS LUCTUS PERNIGER, Hodgs.

The Great Black Horse-shoe Bat.

(Synonymy in No. 14.)

Banss Bahari, ♂ 1 ; Bouzini, 3,000′, ♀ 1.

(7) RHINOLOPHUS ROUXI, Temm.

The Rufous Horse-shoe Bat.

Sipuri, 6,000′-8,000′, ♂ 1.

(8) HIPPOSIDEROS ARMIGER, Hodgs.

The Great Himalayan Leaf-nosed Bat.

(Synonymy in No. 14.)

Hathiban, 5,000′, ♀ 5 ; Bouzini, 5,000′, ♂ 1, ♀ 4; Bachek, ♂ 3, ♀ 5 Dano Kharka, 12,000′, ♀ 4 ; Bachek, ♂ 3, ♀ 5.

(9) PIPISTRELLUS BABU, Thos.

The Babu Pipistrel.

(Synonymy in No. 26.)

Bouzini, 5,000′, ♂ 2 ; Sipuri, ♀ 1.

(10) MYOTIS SICARIUS, Thos.

The Sikkim Myotis.

(Synonymy in No. 26)

Banss Bahari, ♀ 4.

(11) SORICULUS CAUDATUS, Horsf.

The Sikkim Brown-toothed Shrew.

(Synonymy in No. 15.)

Satthar, 12,000′, ♂ 1 ; Apoon Hill, 12,000′, ♂ 1, ♀ 3 ; Apoon Sotti-danda, 12,000′, ♂ 1.

" Very common at about 12,000′ ; trapped on steep rocky banks. Vernacular :—*Chichunder* (Nepalese), *Reimboo* (Bhotia)."—*N. A. B.*

(12) SORICULUS NIGRESCENS CENTRALIS, Hint.

The Nepal Dusky Shrewlet.

(Synonymy in No. 37.)

Satthar, 12,000′, ♀ 1; Bouzini, 5,000′, ♂ 4, ♀ 5 ; Sipuri, ♂ 1 ; Tarro-Bir, ♂ 1.

Probably rarer than *S. caudatus*.

(13) PACHYURA, sp.

Gorkha, ♂ 1, ♀ 1 ; Chengli, ♂ 1 ; Deorali, ♂ 1 ; Boitari, ♀ 2 ; Dorom-danda, 12,000′, ♂ 1.

This genus has still to be studied. Eventually it may be found that two or three distinct species occur in Nepal.

(14) PACHYURA PERROTTETI, Duvern.

The Indian Pigmy Shrew.

(Synonymy in No. 4.)

Knaping, ♂ 1.

Probably comparatively rare but owing to its small size it may easily escape notice.

(15) FELIS AFFINIS, Gray and Hardw.

The Jungle Cat.

Hathiban, 5,000′, ♂ 2 ; Syartang, ♂ 1 : Satthar, 12000′, ♂ 1 ; Mircourt, ♂ 1, ♀ 2 ; Knaping, ♂ 2, ♀ 1 ; Manglopani, ♀ 1.

(16) VIVERRA ZIBETHA, L.

The Large Indian Civet.

(Synonymy in No. 14.)

Banss Bahari, ♂ 1 ; Gorkha, ♂ 1 ; Chengli, ♀ 1 ; Boitari, ♂ 1, ♀ 1 ; Satthar, 12,000′, ♀ 2 ; Syartang, ♂ 2, ♀ 2 ; Mircourt, ♀ 2.

(17) PAGUMA GRAYI, Benn.

The Himalayan Palm Civet.

(Synonymy in No. 15.)

Hathiban, 5,000′, ♀ 1 ; Bachek, ♀ 1.

(18) HERPESTES AUROPUNCTATUS, Hodgs.

The Small Indian Mongoose.

(Synonymy in No. 27.)

Hathiban, 5,000′, ♂ 1, ♀ 1.

(19) HERPESTES NIPALENSIS, Gray.

The Small Bengal Mongoose.

(Synonymy in No. 19 under *H. auropunctatus.*)

Sepetar, ♂ 1 ; Boitari, ♀ 1 ; Satthar, 12,000′, ♂ 1 ; Knaping, ♀ 1 ; Syartang, ♂ 1 ; Mircourt, ♂ 2, ♀ 1 ; Manglopani, ♂ 1.

H. nipalensis differs but slightly from *H. auropunctatus*, the grizzling being finer and the under parts lighter coloured, but it is note-worthy that the two forms are found in Nepal.

(20) HERPESTES URVA, Hodgs.

The Crab-eating Mongoose.

(Synonymy in No. 23.)

Gorkha, ♀ 1 ; Chengli, ♀ 1 ; Boitari, ♀ 1.

(21) CANIS INDICUS, Hodgs.

The Jackal.

(Synonymy in No. 1. under *C. aureus.*)

Hathiban, 5,000′, ♂ 2 ; Syartang, ♀ 1 ; Doromdanda, 12,000′, ♂ 1, ♀ 1.

" Destructive among poultry, and does damage to corn and sugar-cane "—*N. A. B.*

(22) CHARRONIA FLAVIGULA, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15.)

Sepetar, ♂ 1 ; Satthar, 12,000′, ♂ 1, ♀ 2 ; Mircourt, ♀ 3 ; Apoon Hill, 12,000′, ♂ 1, ♀ 3 ; Knaping, ♀ 1 ; Syartang, ♀ 1.

(23) MUSTELA SUBHEMACHALANA, Hodgs.

The Himalayan Weasel.

(Synonymy in No. 23.)

Barpak, ♂ 1.

"Lives on small birds and eggs."—*N. A. B.*

(24) PETAURISTA CANICEPS, Gray.

The Grey-headed Flying Squirrel.

1842. *Sciuropterus caniceps*, Gray, A. M. N. H., x., p. 262.
1843. *Sciuropterus senex*, Hodgson, J. A. S. B., xiii, p. 68.
1889. *Pteromys caniceps*, Blanford, Mamn., No. 231.

Apoon, 12,000′, ♂ 4, ♀ 1 ; Barpak, ♂ 1, ♀ 2.

(25) PETAURISTA MAGNIFICUS, Hodgs.

Hodgson's Flying Squirrel.

1836. *Sciuropterus magnificus*, Hodgson, J. A. S. B., v., p. 231.
1842. *Sciuropterus nobilis*, Gray, A. M. N. H., x., p. 263.
1844. *Sciuropterus chrysothrix*, Hodgson, J. A. S. B., xiii, p. 67.
1889. *Pteromys magnificus*, Blanford, Mamm., No. 229.

Satthar, 12,000′, ♂ 5, ♀ 2.

(26) PETAURISTA NOBILIS, Gray.

The Himalayan Flying Squirrel.

(Synonymy in No. 23.)

Tarro Bir, ♂ 1.

This and the foregoing squirrel are much alike, but each shows certain well marked characters, which appear to be stable and not merely seasonal, which suffice to distinguish the one from the other.

(27) DREMOMYS LOKRIAH LOKRIAH, Hodgs.

The Orange-bellied Himalayan Squirrel.

(Synonymy in No. 20.)

Sipuri, 6,000′-8,000′, ♂ 1 ; Satthar, 12,000′, ♂ 1, ♀ 2.

(28) TOMEUTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in No. 23.)

Hathiban, 5,000′, ♀ 2 ; Chengli, ♂ 1 ; Kuwapani, ♂ 2, ♀ 2.

(29) BANDICOTA NEMORIVAGA, Hodgs.

The Bengal Bandicoot.

(Synonymy in No. 19 under *B. elliotana*.)

Manglopani, 12,000′, ♂ 1.

(30) GUNOMYS BENGALENSIS, Gray and Hardw.

The Bengal Mole-Rat.

Chengli, ♂ 2 (1 juv.), ♀ 1 ; Mircourt, ♂ 1 ; Syartang, ♂ 1.
" Eaten by most people."—*N. A. B.*

(31) RATTUS EHA, Wr.

The Spectacled Rat.

(Synonymy in No. 23.)

Apoon Hill, 12,000′, ♀ 1.
Eighteen specimens of this rat were collected in Sikkim by Mr. Crump, and were recognised as a new species by the late Mr. Wroughton.

(32) RATTUS FULVESCENS, Gray.

The Chestnut Rat.

(Synonymy in No. 15.)

Bouzini, 5,000′, ♂ 2, ♀ 2 ; Apoon Hill, 12,000′, ♂ 2, ♀ 1 ; Satthar, 12,000′, ♂ 2, ♀ 1.

(33) RATTUS NIVEIVENTER, Hodgs.

The White-bellied Rat.

(Synonymy in No. 15.)

Satthar, 12,000′, ♂ 2, ♀ 2.

(34) RATTUS RATTUS BRUNNEUSCULUS, Hodgs.

The Common Nepal Rat.

1845. *Mus brunneusculus*, Hodgson, A. M. N. H. (1), xv, p. 267.
1889. *Mus rattus*, Blanford, Mamm., No. 272.

Gorkha, ♂ 1, ♀ 2 ; Chengli, ♂ 5, ♀ 3 ; Deorali, ♂ 1 ; Syartang, ♂ 1 ; Manglopani, 12,000′, ♂ 1, ♀ 1.

(35) RATTUS RATTUS RATTOIDES, Hodgs.

The Nepal House Rat.

(Synonymy :—See *R. brunneusculus.*)

Satthar, 12,000′, ♀ 1.

(36) MUS HOMOURUS, Hodgs.

The Himalayan House Mouse.

(Synonymy in No. 15.)

Satthar, 12,000′, ♂ 2, ♀ 1 ; Apoon Hill, 12,000′, ♀ 1 ; Barkek, ♂ 1 ; Syartang, ♂ 3, ♀ 2 ; Laprak, ♂ 1.

The name *M. homourus* has been retained to distinguish this bluish-bellied mouse from the darker form *M. urbanus*.

(37) MUS URBANUS, Hodgs.

The Common Indian House Mouse.

(Synonymy in No. 5.)

Bouzini, 5,000′, ♂ 1.
This dark-bellied mouse has been noted in various Reports as *M. manei*, *M. dubius and M. urbanus* but it has lately been settled that the last name should be accepted for the present.

(38) APODEMUS (NEMOMYS) GURKHA, Thos.

The Nepal Apodemus.

1923. *Apodemus* (*Nemomys*) *gurkha*, Thomas, J. B. N. H. S. Vol. XXIX, p 838.

Satthar, 12,000′, ♀ 1 ; Apoon Hill, 12,000′, ♂ 2 ; ♀ 2 ; Apoon Sottidanda, ♀ 2 ; Barpak, ♂ 2 ; Laprak, ♂ 4, ♀ 3.

Mr. Thomas published a description of this new species in the Journal under "Results."

(39) NEODON SIKIMENSIS, Hodgs.

The Flower Mouse of Sikkim.

1849. *Neodon sikimensis*, Hodgson, A. M. N. H. (2), iii, p. 203; genotype, *N. sikimensis*.

1863. *Biscunedens*, Hodgson, in Gray Cat. Spec. and Drawings, Mamm. and Birds, etc., of Nepal and Tibet, Brit. Mus., ed. 2, p. 2 ; genotype, *B. perfuscus* apparently a M. S. name for *N. sikimensis*. *Arvicola*, *Microtus*, and *Pitymys* of later authors.

Apoon Hill, 12,000, ♂ 1.

In January 1923 Mr. M. A. C. Hinton after studying a large number of voles collected by Mr. G. Forrest in Yunnan published a paper in the Ann. and Mag. N. Hist. Ser. 9, Vol. xi, p. 145, in which he revived the name *Neodon*.

"The name *Neodon*, applied long ago by Hodgson to the Flower Mouse of Sikkim (*Microtus sikimensis*, of current literature), is available for this genus, since this species proves on examination to be a conspicuous member of the group, although its characters and relationships have hitherto been but imperfectly understood."—*M. A. C. H.*

The present specimen is rather young and cannot be satisfactorily distinguished from *N. sikimensis* and it is therefore hoped that more specimens from Nepal may be forthcoming.

(40) LEPUS RUFICAUDATUS, Geoff.

The Common Indian Hare.

(Synonymy in No. 15.)

Bouzini, 5,000′, ♂ 2, ♀ 2 ; Sipuri, ♂ 1, ♀ 1 ; Deorali, ♀ 1 ; Boitari. ♀ 1 ; Syartang, ♂ 1, juv.

(41) OCHOTONA ROYLEI NEPALENSIS, Thos.

The Nepal Mouse Hare.

Satthar, 12,000′, ♂ 3, ♀ 2 ; Apoon Hill, 12,000′, ♀ 1 ; Apoon Sottidanda, ♂ 4, ♀ 6 ; Barpak, ♂ 7, ♀ 4.

(42) NEMORHAEDUS HODGSONI, Pocock.

The East Himalayan Goral.

(Synonymy in No. 37.)

Deorali, ♂ 1, ♀ 1 ; Apoon, 12,000′, ♂ 1.

(43) MUNTIACUS VAGINALIS, Bodd.

The Bengal Rib-faced Deer.

(Synonymy in No. 2.)

Banss Bahari, ♂ 1 ; Chengli, ♂ 1 ; Doromdanda, 12,000′, ♀ 1 ; Deorali, ♂ 1 ; Mircourt, ♀ 1.

(44) MOSCHUS MOSCHIFERUS, L.

The Indian Musk Deer.

(Synonymy in No. 23.)

Apoon Hill, 12,000′, ♂ 1.

EARLY STAGES IN THE DEVELOPMENT OF SOME FRESH WATER FISHES IN THE PUNJAB.

BY

M. HAMID KHAN, M. Sc., F.R.M.S.

With three plates.

Material for study was collected during the breeding seasons of 1921-24 from Departmental farms at Madhopur, Chhenawan, and from different places near the River Beas. The specimens were examined in the living state under a microscope and fixed in different reagents for further study. It is, however, intended to give in these pages a bare outline of the early stages, without going into microscopical details, with a view to help a fish-culturist " to differentiate between the successive ages and stages of growing fish, and between fry of the same age, belonging to species, which may be closely allied zoologically, though far apart economically "(17).

Ophiocephalus marulius is taken as a type of the *Ophiocephalidæ*, *Wallago attu* of the *Siluridæ*, and *Labeo gonius*, *Cirrhina mirgala* of the *Cyprinidæ*.

Ophiocephalus marulius.

Freshly laid eggs were taken from the pond, and kept in a live-car under observation, and their growth and development was from time to time compared with those in the pond.

Outline of the embryo becomes defined within twelve hours. The embryo appears on the left side of the yolk in a belt-like manner. The tail end is swollen, transparent and granular, while the head end is darker. Overnight stage shows the appearance of unpigmented eyes, auditory vesicles and heart. Just before hatching, heart gives off aorta, which passes dorsally to the posterior end to turn back into caudal vein. The latter vessel passes *in toto* into subintestinal vessel just near the attachment of the tail to yolk sac. Subintestinal vessel is formed by the vitelline veins which receive yolk capillaries, and anteriorly open into the heart. Anterior caudal vein brings blood from head, and emerges from behind the auditory vesicle, and breaks up into a set of venous spaces, which together with vitelline network spreads over the surface of the yolk and then goes to the heart (Fig. 1).

The embryonic development goes on rapidly, but depends considerably on the temperature of water, and hatching takes place within 30 to 65 hours. Some eggs hatched out while examining under microscope. The movements of tail ruptures the vitelline membrane, and the embryo appears like an egg with a whip like addendum at one end. Total length is 4·5 m.m., head with yolk sac being 2 m.m. and tail 2·5. The newly hatched larvæ lie on one side, and move their tails now and then, and when they swim they either rotate or spin round. The eyes are colourless, black pigment being confined to the lower portion of the yolk in a semicircular band (Fig. 2.). A few hours later yolk circulation becomes complicated and the caudal vein breaks up into branches, and is joined by the posterior cardinal vein near the bend of the yolk sac (Fig. 3). Blood in the latter vessel flows backward, so that the aortic and cardinal blood circulation is in the same direction. Eight hours after hatching the tail has elongated to 3 m.m. Pigment has appeared in the eyes. Yolk sac circulation forms a complicated system of cappilaries. An invagination, which later on forms anus, is seen in the tail region. Hinder extremity of notochord lies straight and there is amassing of tissue a little before its extremity forming the primordium of the caudal ray system. Heart beats 238 times in a minute. Ten hours later, dorsal aorta and caudal vessel have lengthened backwards, and in the anterior part of the caudal region, close to the posterior extremity of the

yolk sac aorta gives off intersegmental vessels along the anterior face of myotome septa. These vessels run dorsally to form a pair of parietal vessels, which anteriorly fall back into the dorsal aorta just anterior to the auditory vesicle. At this stage pigment becomes scattered and appears in the form of stellate cells in the region of yolk.

Second day hatchings grow from 5·6 mm. to 6 mm. Head becomes distinctly marked off from the yolk sac, and an invagination for the future mouth appears antroventrally (Fig. 3). Eyes are profusely pigmented. Stellate pigmented cells spread round the notochord, multiply, extend to the anterior region of the head, and tend to make the animal opaque. Intersegmental vessels are seen in the head region as well, and their blood circulation is very irregular: in some it flows dorsally to the parietals and in others reversely without any definite alteration or arrangement. Pectoral fins appear as slight bud like out-growths, just behind the auditory vesicles. The posterior part of the embryonic fin shows fine striations.

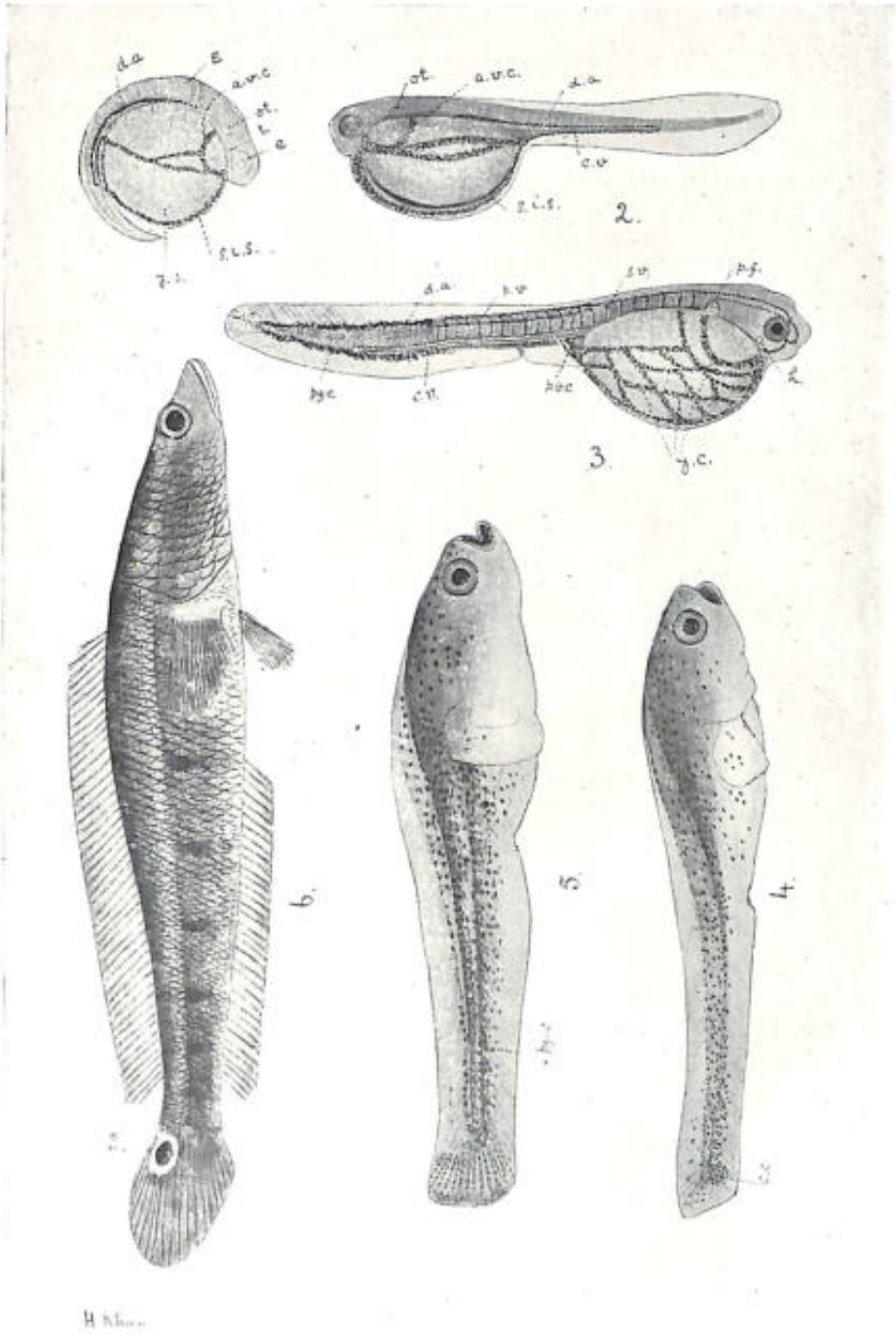
Third day animals measure 7 mm. mouth is open, and respiratory movements have begun. There are no external gills. Lower jaw is well developed, and shows regular rythmic movements. The head is thickened dorsoventrally. The pectoral fins are well developed, and help the animals in their rapid movements. They swim on the surface of water with yolk sac directed up, but when disturbed they go at once to the bottom and remain there for considerable time. Gut is visible as simple tube with muscular rectal walls, but not yet opened posteriorly. Yolk is reduced. Pigment cells are scattered throughout the whole body; and the dorsal and ventral embryonic fins are equally pigmented. Nostrils appear anterior to the eyes.

Next day larvæ measure 7 to 8 mm. Air sacs appear dorsal to the yolk bag, anteriorly, just behind the pectoral fins; and the animals now swim with the yolk sac directed downwards. Pigment cells have become rounded in many places, and lie more on the ventral surface than on the dorsal.

Fifth day shows no increase in length and the animals remain at the bottom for a long time. Spherical pigment cells are arranged in rows on the anterior extremity of the upper and lower jaws, where later on teeth are formed. Alimentary canal is convoluted and opens to the exterior posteriorly, while yolk disappears completely. Black pigment is now visible only in the ventral embryonic fin. Notochord is curved dorsally at its posterior end. Pectoral fins have enlarged and are striated, and have stellate pigment cells (Fig. 4).

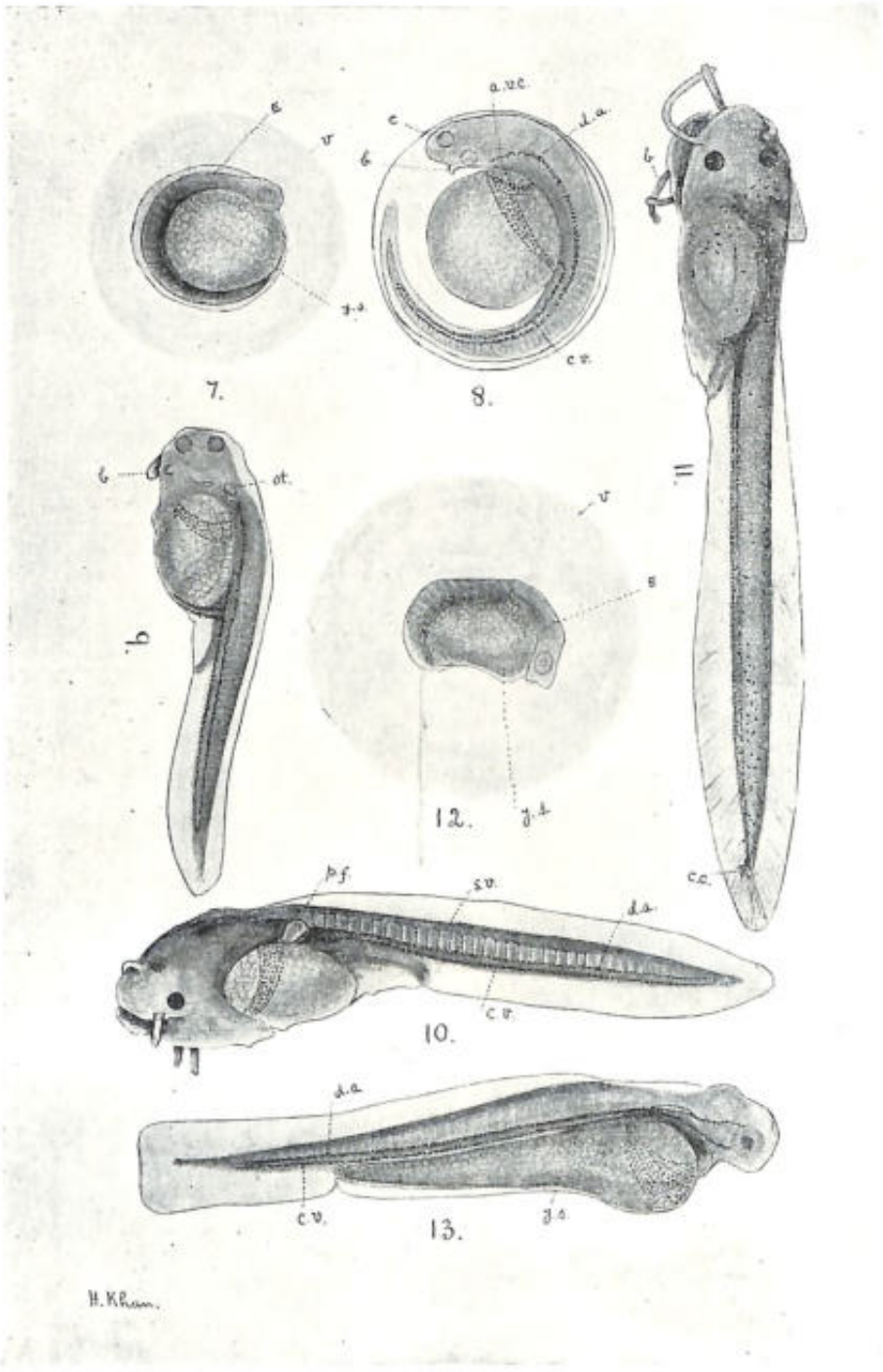
Next two days neither show any increase in length nor any other remarkable change. It may be noted here that since the formation of alimentary canal and the disappearance of yolk, the growth has not been uniform; but the rate of growth so far has been practically the same between the animals kept in live-car for observation and those in the pond with the parents. The total length in both cases is 8 mm.; head 3 mm.; tail 5 mm. The structure is also the same for the obvious reason that so far they have been getting their food supply mainly from the yolk.

On the eighth day the young ones in the pond, which so far have remained in one place, leave their nest and wander about along with their parents. It is now that a remarkable difference in growth occurs between animals in their natural environments and those kept in confinement. The animals kept in live-car, were fed on minced sheepliver, sieved through a piece of muslin cloth, or with liver-soup and sometimes with infusions of bacteria and mosquito larvæ. They were kept under the same environmental conditions as the fry in the pond, but still they did not show healthy growth. Further structural changes, formation of caudal rays and development of external form of body which took a week in the pond specimens, were completed in three weeks in those kept in captivity and their critical stage appeared with the formation of caudal rays, they became sickly, were attacked with fungus and died in large numbers.



Early stages in the development of some fresh water fishes in the Punjab.

(For explanation see end of article.)



Early stages in the development of some fresh water fishes in the Punjab.

(For explanation see end of article.)

On the eighth day circulation in the tail has reached the posterior extremity. The intersegmental vessels are present in the posterior region as well. The pigment cells are round, and are found in a group on the ventral surface of notochord near the posterior end ; and to this mass is given off from aorta a capillary vessel, which turns back and pours its blood in the caudal vein. This is the beginning of caudal capillary system which forms the basis of caudal circulation and marks the development of caudal rays. Next four days show the complication of capillaries, increase of pigment cells (Figs. 14, 15, 16, 17). Pigment cells become arranged in radial rows throughout the caudal fin and the blood vessels too, take the same direction.

Formation of caudal rays depends mainly on the healthy growth of the fry. In warm water, rays first appear on the 10th day, while in cold temperature the growth is retarded. Development of rays begin from the ventral surface and as notochord curves dorsally the rays are drawn towards dorsal surface.

The caudal rays appear as transparent yellowish white strips, in between the radially arranged pigment cells. The loops of blood vessels join together and combine into one. The vessel which carries blood to the ray flows beneath it while the afferent ones lie on its either side. Three basal pieces are also seen.

On the twelfth day (Fig. 5), eleven fully developed caudal rays are visible, segmented at their free ends and striated. Four basal cartilages can be distinctly traced. Caudal circulation is typical (Fig. 18). Just below the posterior end of notochord, the caudal artery branches, and each branch carries bloodtothe finary, and then turns back near the end of the fin, and pours its blood into another system of capillaries, which run on both sides of the fin rays and join to form the caudal vein. The length of body is 10 m.m. On the sixteenth day, caudal fin shows indication of separation from the embryonic fin. The animals have become very active. They come to the surface, exude small air bubbles and then go down and come up, thus causing small whirlpools, which make their presence visible from a distance. Some fry were kept in a dish: They at first came to the surface after 30 to 36 seconds, but later on their breathing became quicker and they were seen rising up after 10 to 20 seconds.

On the 17th day length varies from 15 to 20 mm. Caudal fin is separated off ventrally while dorsally it is still continuous. Eighteenth day marks the end of the larval period by the appearance of ventral or pelvic fins as rudimentary buds in the mid ventral line, a little behind the level of the pectoral fin. The caudal fin separates off completely from the embryonic fin. On the 21st day there are 16 caudal rays; and a yellow band runs dorsally and laterally from the eye to the end of the caudal fin, covering seven caudal fin rays. The fry hide at the bottom when approached, and remain under water for considerable length of time.

Rate of growth of the same lot and of the same year shows considerable difference, and is considerably affected by change in weather, temperature and other environmental conditions. Measurements for the last three years from the same locality do not correspond. For the first four or five weeks the difference in growth is remarkable. Some of the measurements for the last two years are given below:—

	1922.	1923.
1st Week.	8 mm.	8 mm.
2nd Week.	15 mm.	10 mm.
3rd Week.	27 mm.	14 mm.
4th Week.	42 mm.	24 mm.
5th Week.	51 mm.	42 mm.
6th Week.	58 mm.	58 mm.
7th Week.	....	63 mm.
8th Week.	74 mm.	67 mm.
11th Week.	90 mm.	80-83 mm.
12th Week.	98 mm.	99 mm.

Caudal ocellus near the proximal end of the caudal fin appears, in fry ranging from 70 to 90 mm., as a reddish yellow mark, in which later on black oval area becomes visible. Black area measures 1·5× 2 mm. and yellow one 5×3 mm. At this stage fry has white ventral surface, dark grey dorsal and yellowish green sides with one deep yellow lateral band running from the eye to the end of the caudal fin just above the lateral line, and four distinct and two indistinct bluish green transverse bands, running across the body and over the dorsal surface, but interrupted at the lateral band (Fig. 6). Caudal fin is bluish black, pectoral yellow with blue tips, dorsal is dark, grey, while pelvic and anal are yellowish in colour. A few weeks later ventral surface becomes silvery white with slight bluish tinge, while dorsal is of dark greenish blue colour. The lateral band is deep bluish brown and loses itself in the dark back ground of the dorsal surface and becomes less perceptible. Below this band the colour of the body is light yellow mixed with blue and green. There are six to seven transverse bands of bluish green colour. Caudal fin is yellowish tinged with black, dorsal is dark grey and other fins are reddish yellow. The age of the fry at which ocellus appears varies from eight to eleven weeks.

Willey (17) gives his observations on *Ophiocephalus striatus* and S. Raj (15.) briefly describes the development of *O. punctatus* and *O. gachua*, but the life history of *O. marulius* has not yet been studied. Though it does not differ much from its allied species in its general outline, yet the short time taken to finish its larval development, is remarkable. A comparison is therefore made of the corresponding stages of *O. marulius* and *O. striatus*.

Ophiocephalus marulius.

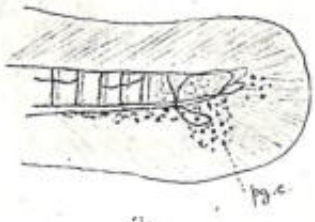
Days after hatching.	Total length.	Principal events.
1st	4·5-5 mm. ..	Yolk sac circulation at first simple becomes complicated. Black pigment cells appear and eyes at first colourless becomes pigmented. Invagination for future anus visible.
2nd	6 mm.	Stellate pigment cells appear. Mouth opens for respiratory movements. Pectoral fins arise. Posterior part of embryonic fin shows striations.
3rd	7 mm.	Pigment scattered equally. Gut visible as simple tube. Caudal vessels are drawn backwards.
4th	7-8 mm. ..	Air sacs formed and embryo swim with yolk bag directed downwards. Pigment cells spherical in some places and lie more on the ventral surface.
5th	7-8 mm. ..	Yolk completely disappears. Black pigment cells on ventral surface only, while dorsal is yellowish. Spherical pigment cells in rows on anterior extremity of jaws. Alimentary canal opens to the exterior posteriorly. Pectoral fin striated and has stellate pigment cells.

Days after hatching.	Total length.	Principal events.
6th	8 mm.	Dorsal aorta and caudal vein have reached the end of notochord.
8th	....	Amassing of pigment cells on ventral surface of caudal fin and beginning of caudal capillary circulation.
9th-11th	....	Arrangement of spherical pigment cells in radial rows, appearance of caudal fin rays and complication of capillary system. Posterior end of notochord is turned up.
12th	8 m.m.-10 mm. ..	Eleven caudal rays jointed and articulated with basal cartilages.
13th-17th ..	10-20 mm. ..	Caudal fin separated off ventrally and movements are very active and the fry rise to surface to take in air.
18th	15-20 mm. ..	Rudiments of ventral fins appear. Caudal fin is separated off completely from the dorsal and anal fins.
19th-21st ..	26 mm.	A yellow band runs on the dorsal surface and ventral one has bluish colour with black tinge.
	Ophiocephalus striatus (Willey).	
1	3·5 mm. ..	Yolk sac circulation established, pigment cells develop their black coloration; pigment begins to appear in the eyes.
2 & 3	4·5-5 mm. ..	Pectoral fins arise, mouth opens and respiratory movements commence.
4	6·75 mm. ..	Larvæ leaving the surface and swimming freely at all levels. Bright yellow spots over eyes.
7	7 mm.	Larvæ swimming and turning in unison at the slightest concussion. Caudal cartilages appear.
12-15	6·75 mm. ..	Posterior end of notochord bends up.
28	8-10 mm. ..	Caudal rays jointed and articulated with the basal cartilages. Larvæ rise to surface to take air.

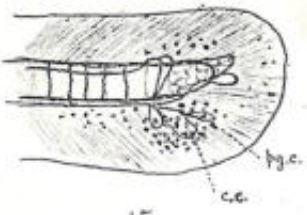
Days after hatching.	Total length.	Principal events.
37	10 mm. ..	Primordia of dorsal and anal rays.
40	10·25-13 mm. ..	Rudiments of ventral fins appear. Dorsal and anal fins separating from caudal.
63	17 mm.	
73	25 mm.	The fry hide in the mud.

In *Ophiocephalus striatus* " sixty-three days old fry are coloured a soft reddish brown or brown and pink, quite different from the black and yellow of *O. punctatus*. The general colour-effect is dominated by a broad lateral reddish orange band occupying almost the entire height of the myotomes, commencing from the eye on each side, and ending behind with a rounded edge at the base of the caudal fin concentric with the terminal contour of the latter. The iris is golden with a red flush ; there is a bright golden occipital point ; and the basis of the anal fin is dense black along its whole length. The colour of the fry is essentially that which it had acquired at half the size ; and it retains this colour until it has doubled the size, after which the definitive markings begin to appear. Instead of the reddish brown sub-translucent ground colour of *O. striatus* fry, *O. punctatus* fry are characterized by a blackish ground colour, upon which the bright golden yellow bands stand out clear, namely a pair of lateral bands about half the width of *O. striatus* fry bands, occupying the central third of the height of the myotomes and ending behind in a point extending about one-third of the length of the caudal fin into the substance of the fin. Along the length of the back is a golden yellow line running along the basis of the dorsal fin and presenting a more or less distinct interruption in the occipital region in front of the fin at the spot where there is a minute golden speculum in *O. striatus* fry. Besides all this, the *O. punctatus* fry present a clear yellow spot on the snout and do not possess the black basis of the anal fin." (16).

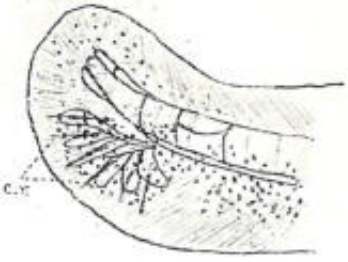
Fungus belonging to *Saprolegniaceæ*, attacks both the adult as well as the fry. It possesses a non-septate branched mycelium, multiplies asexually by club-shaped sporocysts, producing numerous bi-cilliate swarm spores, which emerge, move about in water and finally germinate in another place and produce a new individual of Saprolegnia. Huxley's (5) investigations show that the fungus settles on the portions of the skin of an apparently healthy fish, where there are no scales, and send mycelial or rhizoidal branches through the epidermis into the inner layers of the skin, causing at first local and then general disturbance of the system. Experiment by Rushton (14) on Rainbow trout supporting that of Patterson shows, that Saprolegnia is not the first cause but only a secondary one and only follows a bacillus or attacks on injured surface. In one of our fish tanks owing to the stoppage of water supply for over two months two fish out of thirty-seven survived in 1917. In December 1920 two big fish died in the same tank and they had patches of fungus growth on their body. Inspection of tank showed an overabundance of *spirogyra* and other Algal plants which were immediately removed and no death occurred in the adult fish after that. Fungus again appeared in July 1921 among fry kept in captivity in live-cars. In many cases the fry had their caudal portions discoloured with distinct filamentous outgrowths of Saprolegnia. The live-cars



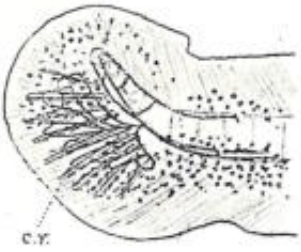
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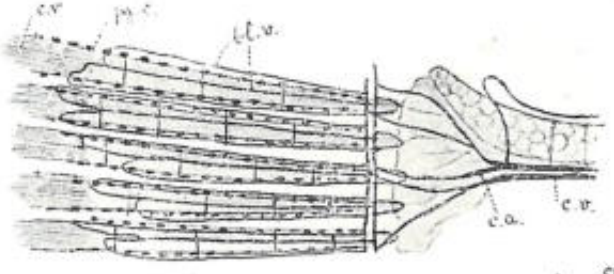
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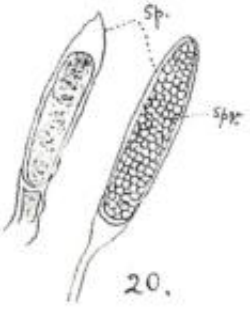
17.



18.



19.



20.

H. Khan.

Early stages in the development of some fresh water fishes in the Punjab.

(For explanation see end of article.)

were then smeared with powdered salt, dried in the sun and washed in running water and fry put in there. These precautions reduced the death rate by 79 per cent. The following causes may, therefore, be assigned for its appearance :—

(1) Overabundance of Spirogyra and other algal plants.
(2) Injuries due to rough handling and overcrowding.
(3) Collection of food in the live-car.
(4) Incomplete aeration or stagnant water.

The treatment for fungus should commence as soon as it appears if not it soon eats into the body and weakens the fish, making the cure more doubtful.

The growth of young fry with their parents is, as already remarked, far better than that of those kept in confinement in their earlier days. After six weeks the fry begin to scatter about, and it is then that they are taken from the tanks and kept in live-car and fed on minced goat's liver, goat's blood mixed with wheat flour or minced fish of common local variety. The growth of *Ophiocephalus marulius* is remarkably rapid and depends much upon the quantity and quality of food. Seventeen weeks' fry measure 118 m.m., from the tip of the snout to the end of the tail fin. Power of endurance possessed by *Ophiocephalidæ* is a well known fact and adult fish *O. marulius* have been carried long distances by road, while six months old fry have been carried by rail over 200 miles in ordinary tin carriers, and long distances by road for more than forty hours, with frequent change of fresh water and suitable food at regular intervals.

Of all the *Ophiocephalidæ*, *O. marulius*, *O. striatus* are the best sporting as well as edible fish—and most profitable from the point of breeding. The mature fish grow to more than three feet while other members do not attain more than one foot in length. *Ophiocephalidæ* are becoming very rare in the Province and are seldom seen in the market. They are considered a delicacy and fetch good price but their cannibalistic habits, as well as limited number of eggs, together with the fact that their fry are scattered during rains, which set in, soon after they have spawned and are lost and destroyed in large numbers in their wanderings, do not in any way tend to increase their numbers.

Culture of *Ophiocephalidæ* is not a difficult process as they are purely tank fish, and do not require any special environment for spawning. Fifteen hundred fry, three to four months old, were kept in two pits dug near a persian wheel well, supplied with fresh water from the well and fed on minced sheep liver twice a day. They were taken out after a month and were found to be in extremely good condition. It may therefore be said that any pond with fresh water will do for *Ophiocephalidæ*.

Cyprinidæ.

Early stages of *Labeo gonius*, *Cirrhina mirgala* and other members of the family differ much from the corresponding stages of *Ophiocephalidæ* and there is no mistaking of the two at any stage of their life. *Ophiocephalidæ*, moreover, spawn before the rains set in, while *Cyprinidæ* lay their eggs during the rains. In *Labeo gonius*, twelve hours after spawning, embryo is clearly differentiated with a pair of colourless eyes (Fig. 12). Heart appears a few hours later, as simple tubular structure giving off aorta and receiving vitelline veins. Newly hatched embryo, has a posteriorly drawn-out yolk bag with a band of black pigment. Blood circulation is that of typical Teleostean embryo. Eight hours after hatching pigment appears in the eye and intersegmental vessels are given off by aorta (Fig. 13).

Second day shows opening of the mouth and commencement of the respiratory movements. Pectoral fin appears as bud like structure. Blood circulation has become complicated, owing to the formation of aortic vessels to the external gills. From the ventral aorta are given off aortic arches, uniting to form the dorsal aorta, which gives off intersegmental vessels in its route and then turns

back posteriorly to join the caudal vessel. Anterior and posterior cardinals are also present.

Yolk is absorbed on the 3rd day. Air sacs are visible. Stellate pigment cells are scattered over the body. Pectoral fins are well developed and help the fry to move about in the little pools, in which they have been left by their parents, in search of food. Caudal vessels are drawn to the extreme end. On the fourth day, the notochord is bent dorsally, and caudal capillary system is formed. In two days the vessels take on radial direction, and rays begin to appear on the 6th day. On the 9th and 10th days there is well defined curve of the notochord with 18 caudal rays and typical caudal circulation. Length varies 7 to 8 mm. Alimentary canal is simple tubular structure. Black pigment cells are rounded on the head, while stellate on the body and intestine. Ventral surface is silvery and caudal fin is slightly forked.

Stages in the development of caudal fin illustrate the fact, that homocercal tail of the adult is secondarily derived. Fin rays appear on the ventral side. The region where they are present soon forms a lobe ; and an externally heterocercal tail is produced. Dorsal embryonic lobe is without fin rays and contains the notochord. The ventral lobe continues to develop ; and soon projects beyond the dorsal, which gradually atrophies and finally disappears, and the ventral lobe forms the permanent tail fin, which, though internally asymmetrical. assumes an externally symmetrical form.

On the eleventh day the length is 9 mm. Dorsal fin is becoming marked off from the embryonic fin. On the sixteenth day six rays are seen in the dorsal fin which is now separated off completely from the caudal fin. Body is opaque owing to pigment cells. Dorsal surface is of dark colour, while ventral is brilliant white mixed with yellow and blue tinge. Iris is bright scarlet with yellow around and black pigment dorsally. On the seventeenth day, length has increased to 10 mm., and caudal fin becomes constricted off ventrally as well. from the embryonic fin. One row of scales is visible dorsally as tile like coverings. Twenty days old fry are bluish silvery white in colour on the ventral surface ; greenish blue with purple in visceral region and reddish in the head. Caudal fin is completely separated off on the 21st day and more scales appear.

A great deal yet remains to be done in connection with the study of developmental stages of *Cyprindæ*. To this group belongs a vast number of edible and sporting fishes and their culture should be the main object of a Pisciculturist. They yield far larger number of eggs than any other fresh water group of Fishes.

Siluridæ.

Wallago attu embryos differ from those of *Labeo gonius* and *Cirrhina mirgala* in possessing a round yolk sac like that of *Ophiocephalidæ* (Fig. 7). Embryo differentiates in less than twelve hours and hatches out in twenty-four hours (Figs. 8, 9). Newly hatched out embryo shows two pairs of lobular projections at the antro-ventral end of the head : these grow to form the barbels. On the second day pectoral fins appear ; and mouth opens for respiratory movements, (Fig. 10). Pigment cells are scattered. Gut lies dorsal to yolk sac, which is much reduced. Eyes are pigmented. Head is broad and flattened. External gills are present. Caudal circulation has reached the posterior extremity. Intersegmental arteries are also developed from dorsal aorta. Third day shows the formation of capillary vessels in the caudal portion (Fig. 11). Gut opens to the exterior. The embryos are very active. Their mouths are wide, and tails long. They attack each other and catching their fellow from its thinner posterior portion, whirl it to and fro, break it into two and devour it.

LITERATURE.

(1) Balfour, F. M. .. .. .. "Comparative Embryology."
(2) Bean, T. H. .. .. "A plea for the systematic study of fish diseases." Trans. Amer. Fish. Soc., 1909.

(3)	Budget	" Budget Memorial." Edited by G. Kerr
(4)	Dwight Lydell	" The habits and culture of the Black Bass." U. S. Fish Comm. Bull., 1902, pp. 39-44.
(5)	De Barry	" Comparative Morphology and Biology of the Fungi, Mycetozoa and Bacteria."
(6)	Holt, E. W. L.	" On the eggs, and larval and post-larval stages of Teleosteans ". Sc. Trans. Roy. Dub. Soc., Vol. V. (Series II). July 1893.
(7)	Jenkinson, J. W.	" Vertebrate Embryology," Oxford, 1913.
(8)	Kerr, J. G.	" Text Book of Embryology". 1919.
(9)	Kingsley, J. S., and Conn, H. W.	" Some observations on the Embryology of the Teleosts." Mem. Bost. Soc. of Nat. Hist, Vol. III, No. VI, Ap. 1883.
(10)	Kuntz, A.	Bull. U. S. Bur. Fish., Vol. XXXIV, 1914, pp. 407-29.
(11)	Kuntz, A and Radcliffe, L.	Bull. U. S. Bur. Fish., Vol. XXXV, 1915-16, pp. 87-134.
(12)	Lechmere, A. E.	" Methods of Reproduction in the Saprolegniaceæ ". New Phytologist, Vol. X, 1911.
(13)	McIntosh, W. C.	" On the life-history of the Shanny (Blennius pholis. L.)" Wissenschaftliche Zoologie, Nov. 1905, pp. 368-378.
(14)	Rushton	" Salmon and Trout Magazine ". No. 23, Sept. 1920.
(15)	Raj, S.	" Rec. Ind. Mus.". Vol. XII, 1916.
(16)	Willey, A.	" Spolia Zeylanica ". Vol. V, 1908, p. 145.
(17)	Willey, A.	" Spolia Zeylanica ". Vol. VI, Pt. XXIII, Dec. 1909.

Explanation of the Plates.

av.c.=anerior vena cava ; *b*=barbel ; *bl. v.* blood vessel ; *c.a.* = caudal artery ; *c.c.* caudal capillary ; *c.v.*=caudal vein ; *c.r.*=caudal ray ; *d.a.*=dorsal aorta ; E=embryo ; *e*=eye ; *fg*=fungus filament ; *h*=heart ; *o.t.*=auditory sac ; *p. f.*=pectoral fin ; *pg.c.*=pigment cells ; *p.v.*=parietal vessel ; *p.v.c.*= posterior vena cava ; *s.i.s.*=subintestinal vessel ; *Sp.*=sporocyst of *Saprolegnia* ; *Spr.*=Spores ; *s.v.*=intersegmental vessel ; *t.o.*=tail ocellus ; *v.*=vitelline membrane ; *y.c.*=yolk capillaries ; *y.s.*=yolk sac.

Ophiocephalus marulius.

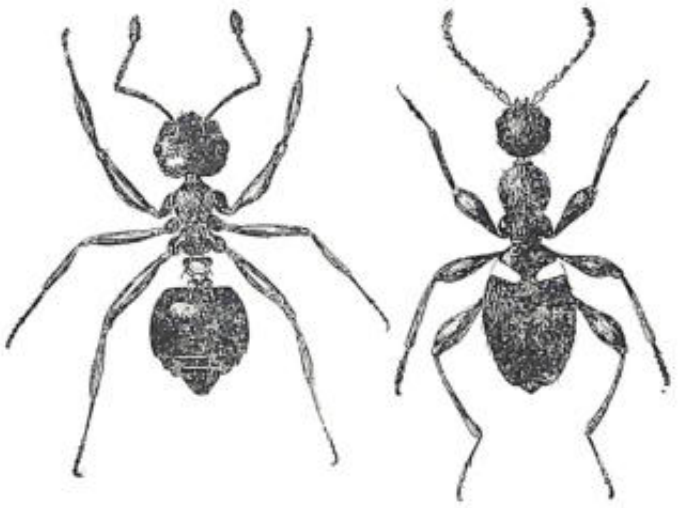
Fig. 1 : Egg with Embryo fully developed, two hours before hatching.
Fig. 2 : Newly hatched Embryo.
Fig. 3 : Second day Embryo (after hatching).
Fig. 4 : Fifth day Embryo.
Fig. 5 : Twelfth day Embryo.
Fig. 6 : Fourteen weeks old fry, with caudal ocellus.
Figs. 14, 15, 16 and 17 show development of caudal capillaries and formation of caudal rays in the tail fin of *O. marulius.*
Fig. 18 shows caudal circulation.
Fig. 19 : caudal portion with fungus growth.
Fig. 20 : Sporocysts of *Saprolegnia* with spores.

Wallago attu.

Fig. 7 : Egg with Embryo, twelve hours stage
Fig. 8 : Egg with Embryo fully developed.
Fig. 9 : Newly hatched Embryo.
Fig. 10 : Second day Embryo.
Fig. 11 : Third day Embryo.

Labeo gonius.

Fig. 12 : Twelve hours stage.
Fig. 13 : Newly hatched Embryo.



1. 2.



3.

The Cremastogaster Ant.

1. *Cremastogaster auberti*. X 10.
2. Beetle (*Formicomus ninus*) that mimics ant. X 10.
3. Byre of Cremastogaster Ant, composed of seeds. Natural size.

THE CREMASTOGASTER ANT.

BY

MAJOR R. W. G. HINGSTON, I.M.S.

(*With a plate.*)

Common Ants of Baghdad—Characters of Cremastogaster—Its nest—Food supply—Treatment of dead and wounded—Erection of abdomen—Pastoral activities—Architecture of byres—Care of cattle—Instinct of communication—Olfactory sense—Judgment of workers—A beetle mimic.

The observer at the fringe of the Baghdad oasis cannot fail to find his notice soon directed to the varied kinds of ants. The most prominent are those which inhabit the soil. There is *Messor*, the harvester, a maker of roads. It loves to establish itself near some cultivated field where it fashions a smooth and conspicuous thoroughfare between the harvesting area and the granaries in the nest. This thoroughfare is the highway for the movements of the ants along which they incessantly pass to and fro. We see them first exploring the field of harvest, then converging with their burdens to the extremity of the path, then advancing steadfastly along the road until they disappear through the entrance of the nest. None can fail to notice these industrious streams, so constant in purpose, so determined in effort, so free from all obstruction or confusion, so striking an example of well organised labour in which each is fulfilling its share in the toil.

In the vicinity we are sure to find another kind of ant. This is the large and formidable *Myrmecocystus*, which digs deep galleries into the bare sand, selecting if available some sloping bank. The workers are very different from the peaceful harvesters, their character being that of the rapacious hunter, active, swift, individually powerful, and capable of overwhelming all kinds of insects which they drag as provender into the nest. In their movements they are not confined to special roads, but they scour the sand in all directions, each worker securing its individual capture by virtue of its own activity and strength. At the nest we will observe the more remarkable of their performances, such as their skill in evacuating large piles of sand, their manner of ejecting dead insect shells, their wonderful method of conducting a migration by which one worker seizes hold of a comrade and transports it bodily to the new home.

The habits of these species I have elsewhere discussed*. For new material we must turn to more secluded haunts. In the shady gardens we will meet with another kind, one smaller and less conspicuous than the inhabitants of the sand, a species that keeps almost exclusively to the vegetation and known to science as *Cremastogaster auberti* (var. *sorokini*).

It is not likely to attract immediate attention, being peaceful in its habits, methodical in its behaviour, and neither like *Messor* going in search of seeds, nor like *Myrmecocystus* pursuing prey. It indulges rather in the tranquil occupation of a quiet pastoral life. Its length does not exceed one-seventh of an inch, though it is of moderately sturdy build. In front is the somewhat square-shaped head with minute black eyes and club-like antennæ. Behind this comes the thorax raised into an arch and furnished with two projecting spines. A slender nodulated waist connects this with the abdomen, of which the noticeable feature is the triangular shape with the base in front where it joins the waist and terminating in a sharp apex behind. There is some variety in its pattern of colour, the head and thorax being a reddish brown, the abdomen a glossy black. Its body is altogether naked save for a trace of fine silky hairs. (*See Plate*).

The nest is constructed in the hollow of a tree, often in some crumbling cavity of the trunk, or, if near the ground, in a decomposing root. Occasionally they may occupy a crevice in the soil or the tubular cavity of a dead hollow stick. In

* In "A Naturalist in Himalaya."

India I have seen an allied kind choose the thorns of an acacia and empty the pith from a stalk of elephant grass in order to establish a suitable nest. The broken end of a branch is a favoured situation. There the exposed wood soon passes to decay. It becomes soft, is easily tunnelled, and falls to the attack of boring beetles which perforate the decomposing stump. The ants take advantage of the beetles' excavations and appropriate the tunnels for their own use.

The entrance to the nest is but a mere slit, quite unlikely to attract attention and with little or no excavated debris outside. The interior is hollowed into smooth chambers which communicate with one another by narrow galleries and contain the usual larvæ and eggs. Males and females also will be found in the passages, and, of course, a number of the worker caste. From the gateway proceeds a steady line of ants, some ascending, others descending, up and down the trunk of the tree. As excavators they show no conspicuous talent, never heaping up piles of ejected debris after the manner of the vigorous inhabitants of the soil.

They gain most of their sustenance through pastoral activities, attending on different kinds of bugs which supply them with a limpid juice. Much also is obtained by just biting at the foliage or at the young unopened buds. Certain leaves have little glands which emit fluid, and this excretion is acceptable to the ants. They will carry off small particles of animal matter. The minutest insects too will be taken to the nest, some of which are probably captured alive. But, like many ants, it is fluid that they really seek, and will accept either animal or vegetable juice. They will suck up the liquid from a disembowelled insect, or encircle a drop of syrup in peaceful contentment, all crowding round the delicious nectar in a greedy motionless ring.

These ants are partial to many kinds of trees, being commonly found on the poplar and mulberry, less often on the pomegranate and palm. The cultivated fig is a particular favourite, since its leaves are often crowded with the liquid-giving cattle and its timber honeycombed by insect pests. The ants are thus supplied with their two requirements, a profusion of food distributed through the foliage and nesting places dug into the branches and trunk. A species of *Capparis* also attracts them, its beautiful white flowers and purple tipped stamens being one of the chief adornments of this soil. They are constantly licking at its stems and leaves, though they come to it mainly for the buds and fruit. Indeed every part of this thorny shrub appears capable of supplying something to the ants. At the buds they chew the soft external coat and reach the vegetable tissue direct. The fruit supplies them with a richer provender. It opens widely so as to expose the seeds which are sunk in a sweet gelatinous fluid coloured a bright red. Round this viscid material the ants collect, often a large number at one open fruit all eagerly sipping at the juice.

Their peaceful character is evident in their treatment of the dead and wounded. Most ants, when they meet with an injured comrade, are thrown into the greatest flurry and excitement, often dashing at it with wide-open jaws, attacking it with the same intensity and vigour as if it were an enemy rather than a friend. They often treat it after the manner of cannibals. The *Myrmecocystus*, for example, after first lynching it, drags it for provender into the gate. The *Œcophylla* employs it to a simlar purpose, the workers coming round it in a murderous ring and literally stretching it to death. They treat their dead with the same disrespect and bring them to the formicary for use as food. It is otherwise in the case of the peaceful *Cremastogaster*. I place some dead and injured comrades near the nest. There is no display of violent hostility, no indication of any serious alarm. After a little while the workers take up their dead, carry them quietly to some distance from the formicary where they lodge them in a retired nook amidst the leaves. Thus these ants make some decent disposal of their dead which to other kinds are of value solely as food.

It is a well-known habit of the *Cremastogaster* ants that they erect their abdomens at right angles to their bodies when they happen to be alarmed. In this little species the behaviour was not conspicuous. At times, when closely pressed, it would certainly do so, but never in that persistent angry manner which we observe in some of the larger kinds. In a previous book I have made mention of this special habit, and suggested that its purpose was to serve as a balance during the ascent and descent of a tree. But I now feel sure that this explanation is incorrect. The behaviour is part of a defensive plan. At the tip of the abdomen is a fragile sting, so minute as to be invisible without the help of a lens and suitable only for delicate work. It cannot, for example, pierce the skin of the hand, but, in other parts, such as the neck, where the integument is thin, the spear can give a sharp prick. A reservoir of poison communicates with the weapon, and the fluid may be seen exuding from its tip in the form of a watery drop. When the *Cremastogaster* meets with an insect enemy, as I have observed in the larger kinds on Indian trees, it immediately erects the triangular abdomen and emits the venomous juice. The attacker, which may for instance be a *Prenolepis* ant, knows clearly the meaning of this abdominal erection. It hurriedly withdraws from the danger signal and thus escapes any injurious effect. The elevation of the abdomen is a warning act, part of the defensive scheme of operations associated with the possession of poison and sting.

Such strategy can be of use against only the smallest enemies. It could scarcely serve as a protection from birds. But birds, as a rule, are not partial to ants. They probably dislike the formic acid taste. The woodpecker, however, is a formidable enemy. Though in Mesopotamia it is extremely rare, yet in wooded districts no other bird feeds so habitually on *Cremastogaster* ants. Moreover, the ants seem aware of their enemy, at least the larger species on Indian trees instinctively adopt a method of escape. With the edge of my killing-bottle I have sometimes struck the tree immediately below a *Cremastogaster* ant. It was a sharp and sudden tap such as a woodpecker makes on the bark when hammering with its chisel beak. And often when I did so the ant stood still, fixed itself motionless close against the bark. No doubt it imagined that its enemy had arrived, and instinctively felt that the immobile attitude supplied the best chance of its being passed unseen.

These ants, as I have said, are of a pastoral disposition, depending in the main on other insects which, like cattle, supply them with a valuable juice. In this connection the aphids are of great importance. The workers go in search of them all over the tree. They find numbers on both the stems and leaves of the poplar, but the place of selection seems to be the stalk close to its junction with the leaf. In their search they employ the plan of circumnavigation, especially when investigating the smaller leaves. This is a methodical system of examination, the ant running round the edge of one leaf before passing on to explore the next. It is a good example of their orderly activities as a result of which the whole mass of the foliage is surveyed.

When they find a group of aphids they pay it close attention. The workers collect around it in a cluster, not displaying any emotion or excitement, but just quietly attending the herd. Their antennæ may be seen in continuous motion, since these organs are made to stroke the bodies of the aphids as if to induce them to render forth their juice. At intervals we will observe the emission to take place. Each little aphid hoists up its abdomen, squeezes out from the tip a drop of limpid fluid which the ant that is stroking it immediately devours. All over the tree we may detect these little parties, each a quiet pastoral association in which the ants are the herdsmen and the aphids the herds.

This poplar aphid is very minute, to the naked eye little more than a speck. The members of the herd are usually wingless, being for the most part young and immature forms. At this stage they are somewhat fusiform in shape. The head end is blunt, supplied with eyes and antennæ, while the hind extremity is

distinctly pointed and prolonged into a kind of tail. Its structure is so delicate as to be almost transparent, and its general colour is a pale green with a tinge of brown upon the head. At the tail extremity is the tiny pore through which the excretion is emitted to the ants. Here and there in the clusters we meet with an adult, a little insect of graceful and delicate structure with a dark body and white lacy wings. It receives the same attention from the herdsmen as is given to the undeveloped forms. Its association with the herd is only temporary. Hitherto it has been a mere reservoir of liquid, a stationary apparatus for the withdrawal of sap. But now it has developed gauzy wings ; its reproductive instinct claims attention, and it flies off to find another resting place where it becomes the parent of a new group.

The strength of a commune of *Cremastogaster* ants will depend in the main on the numbers of these herds. A tree covered with cattle will maintain a multitude, while one that bears a few scattered groups can support only an impoverished nest. These aphids withdraw a great quantity of sap and must often do considerable injury to the trees. This is particularly the case with the apricot. They infest the tree in immense numbers, so much so that the fluid falls from them like rain and coats the verdure in a sticky juice. Other insects then come to reap the harvest, especially the hornets and certain species of wasps which eagerly drink the sweet honey-dew.

The special preference which *Cremastogaster* gives to the fig is due, like the poplar, to the cattle on its leaves. Almost every fig tree in these shady gardens maintains its quiet procession of ants. The herd is, however, different from that on the poplar. It is composed of a cluster of scale insects or coccids, another of the heterogeneous group of bugs. This little insect is oval in shape, soft and delicate, looking almost structureless except for the fact that its margin is sinuous and its body divided into rings. It is hidden from view in a kind of fluffy material, the product of its cast-off skins. These accumulate around it so as to form a white coat which makes it look like a flake of snow.

The coccids usually occupy the base of a leaf. They also align themselves along the midrib, wrap themselves around the green stalk or assemble on the stem of the fruit. Often they collect in a dense cluster with their edges overlapping like a heap of coins and buried in their discarded skins. Both old and young are represented in the herd. The foliage around them often glistens as if with varnish. This is due to the viscid secretion of the coccids having escaped and then dried into an inspissated layer. The ants attend these cattle in the same way as they do the aphids, standing around them like patient herdsmen and titillating persistently with their attennary threads.

These ants, like certain other kinds that tend on cattle, construct special habitations for the shelter of the herd. But the byres of the *Cremastogaster* are neither very common nor are they built in that wonderfully elaborate manner such as is displayed by the *Polyrhachis* ants. I found one of their sheds in the fork of a pomegranate tree. It was a triangular shaped edifice wedged into the cleft and somewhat less than an inch in length. Its structure was composed of delicate material, an assortment of fine particles of vegetable tissue built into a compact wall. Inhabiting this tabernacle was a pair of coccids, a meagre collection for so elaborate a shed. Yet even so few were of great value to the ants ; otherwise they would never have expended the labour of enclosing them in a firm wall. The reason is, of course, that their value is continuous. Day and night they give forth their droplets of fluid which is probably sufficient for a number of the ants.

I found another exquisite type of chamber fashioned exclusively from downy seeds. There is a profusion of such material at the end of the summer, the trees being in places so laden with fluff as to appear under a fleece of snow. Some is shed from the seeds of the poplar ; more from the smaller plants. The byre

composed of it was on the trunk of a poplar tree. It was oval in shape, about the size of a walnut, smooth in the interior, but on the outside rough so as to look like a fluffy ball. Though delicate in structure, it was closely interwoven, the downy plumes being so knit together as to form an unbroken wall. At one extremity was a small gateway, the only opening into the cavity of the cell. It was merely a slit of the narrowest dimensions and just sufficient to permit the entrance of the ants. Some stems of the poplar passed through the interior round which the aphids were closely packed like cattle stabled within a shed. The whole habitation was delightfully snug, as soft and cosy as if composed of wool, and a most efficient protection for both the cattle and the ants. (See plate).

A neat pattern of byre is occasionally met with fashioned out of a poplar leaf. The leaf has been folded longitudinally so that the lateral edges come together and the midrib marks the line of the fold. The edges are observed to be connected with silk which results in the formation of a leafy tube. The open ends of the tube must then be secured, and the ants effect this by constructing a wall. From below they carry up minute particles of debris which they build into a barrier at the ends of the tube. Near one edge of the barrier they leave a narrow slit, just wide enough to give them entrance into the tunnel, and, since a similar slit is made at both extremities, they are provided with two opposing gates. The resulting habitation is about an inch in length. It is shaped in the form of a flat triangle with a fissure-like cavity enclosed all round. Within, of course, is the accustomed herd feeding on the tissue of the leaf.

The folded structure of this leafy habitation reminds us of the architecture of the red ant. This latter species habitually nests in the foliage, drawing a number of leaves together and uniting their edges with a layer of silk. Sometimes, however, it employs a single leaf, bending it transversely so as to bring the apex to the base and then connecting the margins all round. This habitation of the *Cremastogaster* is, therefore, somewhat similar. A single leaf is taken and bent upon itself. It differs in that the fold is longitudinal instead of transverse, but more essentially in the fact that the *Cremastogaster* uses debris for the purpose of closing the ends of the tube. The red ant has no notion of such building operations. It is most expert at folding and approximating leaves and at weaving quantities of delicate silk, but it knows nothing of the art of accumulating debris tingor of the building of such material into a wall. When a gap exists in the nest of the red ant, the only method of securing the opening is by closing it with layers of silk.

But we must be careful not to overestimate the skill of the *Cremastogaster*. The tunnel, thus fashioned, is a complex piece of work, its edges being linked with threads of silk, its extremities closed with walls. It seems as if this ant combines two separate instincts, the erection of debris and the elaboration of silk. But this, I think, would be a false conclusion. It is greatly to be doubted if the occupying ants were responsible for the silken portion of this byre. I have never seen them employed in the manufacture of such material, though other kinds, of course, produce it in abundance, employing their larvæ for the generation of the threads. In this instance it seems more probable that a species of spider was responsible for the silken portion of the byre. The ants found the habitation partially constructed, its edges in apposition and connected with threads. They took the spider's industry to their own use, strengthened the chamber, added walls to its extremities, and thus by a combination of robbery and workmanship fashioned an excellent byre.

An idea can be gained of their mode of architecture when a breach is made in the wall of a byre. A few workers come out to attend to the damage and allocate to themselves the business of repair. They pull the little fragments back into place, piling them up and so adjusting them as to restore the broken part of

the wall. I see no special mechanism for holding them together, nothing analogous to the interlacing of threads such as other ants employ to bind the bricks. The architecture of the *Cremastogaster* is more primitive and simple. The bricks just naturally adhere to one another through the intertangling of loose shreds of tissue or the interlacing of plumed seeds.

On neighbouring trees we will find another type of byre-builder. This is a species of *Polyrhachis*, a larger, more powerful and more expert ant. It is partial to a different kind of vegetation, frequently choosing the orange and the peach. As an architect it is far more elaborate than the *Cremastogaster* since it spreads long tunnels over the trunks and branches,constructing them of debris interwoven with silk. The *Cremastogaster* can claim none of such remarkable efficiency ; it superimposes and to some extent interlaces its fragments, working more like a bird at the building of its nest.

These works of construction are sufficient to indicate that the ants take great care of their valuable herds. Some workers remain continually with them, since those cattle, which have involved the ants in such labour, must on no account be left to themselves. Here is an example of their watchful care. I cut away a byre and thus expose the herd which had been enclosed probably for many weeks. But the workers in the vicinity soon came to the rescue and gave attention to their precious charge. Each took up an aphid in its jaws, some managed to get hold of two or three, and they quickly conveyed the exposed cattle to the shelter of the main nest.

Although these ants do not combine for the purpose of aggression, nor join their forces for the shifting of loads, nevertheless they possess that instinct of communication by which one ant can call out its comrades from the nest. In most ants the instinct is for the purpose of attack or in order to rescue a captured prey, but it has for the *Cremastogaster* the more peaceful use of bringing others to a discovered herd. Its manner of operation is according to principle, being conducted after the plan of the *Phidole* or the *Camponotus* which has been elsewhere described. Nevertheless there are certain details of interest which deserve a few brief notes. In order to see the operation I give a dead grasshopper to an ant. The wanderer is attracted to this rich morsel, immediately attaches itself, then bites at the integument, but soon, realizing the immensity of the discovery, runs down the branch in the direction of the nest. If it happens to meet a comrade the information is communicated. We observe the manner in which their antennæ meet. It is not just the usual passing touch such as occurs when the ants move ordinarily about. This is a more prolonged and agitated titillation, and has the effect of transferring to the second ant the enthusiasm possessed by the first. Then they separate and move in opposite directions, the discoverer descending to the main nest, the other ascending to where the treasure lies. We follow the discoverer down to the gate. Almost immediately on its entrance the workers issue forth. They do not emerge in any special formation. It is not a multitude like the legion of the *Phidole* nor a compact troop as in the *Camponotus* ants. The party of the *Cremastogaster* is a straggling line, each worker separately emerging from the gateway and independently ascending the branch. The discoverer does not lead them. On the contrary they are despatched and the ant that has brought the news may not emerge until many of the party have been sent on their course. Thus the instinct in *Cremastogaster* has reached considerable perfection in that the issuing column can reach the treasure without further help from the discovering ant.

The interrupted file ascends the tree, hastily, enthusiastically, in a long procession, and obviously aware of the good things in store. Reaching the grasshopper, each ant takes a grip of it ; more and more follow and join in the combination until very soon the discovered insect is enveloped in a black mass of ants. The behaviour that follows is somewhat different from that of other species.

The *Phidole* army, for instance, falls violently on its victim, the troop of the *Camponotus* tears it limb from limb. Here, however, we observe a more quiet assemblage. The workers gather round it in great numbers. They bite at the integument, suck the exposed flesh, sometimes pile themselves thickly over it and encircle it in a dense ring. But there is no display of hostility or anger. Each worker merely tries to get a fragment for itself. This is in accordance with *Cremastogaster* habits. These ants are conspicuously individual in character ; each one is in the habit of waiting separately on cattle and independently taking its share. Thus when they come forth to this rich discovery, they cannot, like other ants, combine to make use of it, but each pursues an individual course. It is for this reason that the issuing party is so straggling. The *Phidole* must advance in a multitudinous body in order to overwhelm and subdue the prey. The *Camponotus* for the same reason must join in a compact troop. But for this ant such immediate combination is unnecessary ; hence the workers can emerge in a broken file.

As the *Cremastogaster* does not combine for the subjection of a victim, so also it cannot join to transport the mass. The *Phidole* or the *Camponotus* would have quickly moved it and transferred it bodily to the safety of the nest. But the *Cremastogaster* workers simply heap themselves about it. Each tries to break away a little fragment or to fill its belly with a droplet of the juice. But never do they make the slightest effort to shift it. They lack completely that instinct of combined transportation, and just feed on the carcass till it is an empty shell.

The reason is that under ordinary circumstances the *Cremastogaster* ant summons forth its comrades because it has happened to find a new herd. Their combination is peaceful, while in other ants it is aggressive. For their pastoral operations the art of capture is unnecessary, nor is the instinct of transportation required. It is easy to observe how they call assistance to the cattle. To a vigorous community I give a fresh herd. The ants had spent the season with aphids on the poplar, so I supply them with coccids on the leaf of a fig. The strange herd and foliage did not in the slightest disconcert them. The first worker that discovered them realized their value, but made no attempt to keep the treasure to itself. On the contrary it hurried down to the nest, distributed the news of the new fountain above, and very soon the snow-white heap of coccids was enveloped in a crowd of ants. Thus the workers in their discoveries show no greed for themselves. Their object is to tell of each fresh addition so that all may partake of the liquid store.

I have discussed in connection with other kinds of ants the mechanism by which this communication is performed. It has been shown that the discoverer, on returning to the nest, lays out behind itself a line of scent, and that the ants after emergence reach the treasure by following back along the scented track. There can be little doubt about their sense of smell. I place a nodule of camphor across their path. They are immediately disturbed by it and are reluctant to touch it. They come close up with the object of examining it, but quickly withdraw from the unpleasant odour and make a detour in order to get round. It is not that they are affected by the sight of the camphor, for other white objects are touched without hesitation when similarly placed so as to obstruct their line. Like other kinds of ants that move in files, they recognise their road by this faculty of smell. Anything that disturbs the scent confuses them and checks the ordered progress of their march.

But we are here considering the mechanism of communication, so I will mention an experiment connected with the act to show how precise is the olfactory sense. A long straight branch ascends from a nest and divides some distance higher up into three subsidiary stems. At the tip of one stem I give an insect to a worker. Very soon it establishes a line of comrades which moves first up the main branch, then out along the special stem. While this is in progress I do the

same on a second stem. The second ant hurries back with the news, and, on reaching the main ascending branch, runs direct into the file that the first ant called forth. It communicates with them, evidently tries to turn them, but the workers, though obviously excited by its touch, yet refuse to deviate from the correct path. They move out along the stem of the first experiment, that is the one to which they were primarily despatched. The second ant can gain no assistance from those despatched by the first ant ; it must complete the journey to the nest in order to send forth a party for itself. The fact is that the ants will not be confused when confronted with two diverging lines of scent. Certainly they show some little hesitation on reaching the point where the main branch divides. A few may move an inch or two in the wrong direction, many waver before choosing the correct stem. The diverging attractions obviously perplex them ; but this, we will notice, is little more than momentary, and all in the end take the right course. The ants will thus stick to the line of scent which the discoverer supplies them at the gate of the nest. Though other discoverers may meet them on the journey and though they may be agitated by this further information, nevertheless they keep to the primary impulse and maintain the line of the original scent. I repeat the operation on the third stem. In this way another discoverer is started, which on its descent to the main branch comes in contact with a pair of streams. Again I observe the same result. These streams will not be turned from their original directions. The third discoverer must descend all the way to the nest before it can collect its own party and despatch them to its individual find.

Thus, in this way, three streams pour forth from the nest. While on the main branch they all unite, and the ants ascend in a common flow. But where the stems diverge the stream breaks into tributaries, each tributary representing that particular portion despatched by the separate ants. How wonderfully efficient is the faculty of smell which results in such precision and accuracy of movement when confronted with diverging streams.

Another interesting point about the act of communication is that the instinct of the ants seems tempered with judgment in that the number of the workers called forth to the discovery is proportionate to the bulk of the find. Some of the first arrivals, after a preliminary investigation, make their way back again to the nest in order to summon still more to the scene. But they do not act imprudently, nor waste their numbers ; sufficient only for the purpose are despatched. An experiment will indicate this resourcefulness of operation. I cut a grasshopper into three unequal portions. The first is one-fifth of an inch in length ; the second is twice the bulk of the first, and the third twice the bulk of the second. I give these three pieces to separate workers on different parts of the same tree. Each discoverer, of course, brings back the news, and in a few minutes three streams of ants are ascending to the pieces of flesh. I give them plenty of time to continue the operation, not meddling with them for forty minutes, by which time the business must be absolutely complete. I then count the ants at the different pieces. Twenty-eight have been despatched to the smallest fragment, forty-four to the one of intermediate size, and eighty-nine to the largest piece. These numbers, it will be noticed, are roughly double of one another, which is the same proportion that exists between the bulk of the fragments supplied.

This same relationship may be observed to exist wherever the ants attend to their herds. A few aphids will have with them only two or three workers, while a large and vigorous cluster may attract twenty or more. One might imagine that all would crowd to the spot whenever a store of precious food was found. But they do not adopt such indiscriminate action ; they are possessed of a better and more frugal organization, and will not unnecessarily waste their strength. There seems to be some element of judgment in the act. If they sent forth the numbers for the purpose of capture or to carry off a burden, as in the case of the

Phidole, then it would be easier to understand the behaviour. It would merely be a case of the accumulation of reinforcements until sufficient had arrived either to quell the struggles or to cause the burden to move. The accomplishment of the purpose for which the ants were summoned would be the sign that sufficient had arrived. But these ants, as we have seen, do not combine for such an object. They all appear to act individually, each carrying off its own morsel to the nest. It would, therefore, seem that they are able to exert some little judgment, and to realize just how many are sufficient to deal with each source of supply.

In our observations of the habits of this *Cremastogaster* species we are sure to meet with a little beetle which forms an interesting association with the ants. It is not of the kind that visits the nest, but one that joins in the outdoor activities of the workers, especially in their domestic operations on the trees. It is most likely to be found on a bush of poplar, particularly one where crowds of ants are industriously tending their herds. If we are to find it we must search with considerable care, since it bears a very remarkable resemblance to one of the ordinary ants. It is in fact an excellent mimic, fashioned and clothed in such a manner that it can scarcely be distinguished in the midst of its friends.

This beetle is *Formicomus ninus* of Laferte and belongs to the family *Anthicidae*. (See plate).

Let us place it side by side with a worker ant and observe the resemblance between the two. In size and conformation they show very little difference. The beetle's head, though smaller than that of its model, resembles it in general shape. It has similar black spots to serve as eyes, and the antennæ are superficially like those of the ant. Behind it has the same kind of constricted neck, an ant-like thorax raised into an arch ; a fair attempt has been made at the triangular abdomen by means of the pair of close fitting shards which are given that characteristic shape. But the most interesting feature is to be found in the coloration. The general scheme bears a perfect resemblance, the reddish brown of the head and thorax, with the glistening black of the triangular abdomen, being identical with that of the ant. The beetle, however, has something additional of which its model does not show a trace. There is on the back of its wing-covers, just behind the waist, two patches of white, one on either side. Each of these spots is oval in shape ; it extends to the outer edge of the wing-cover but does not quite reach in to the middle line. Thus this part of the beetle presents the following appearance. On either side there is a light-coloured area, and between the two a line of black connecting the triangulated wing-covers with the chest.

An examination of the ant will explain the reason. It possesses a remarkably constricted waist, in fact the thorax is linked to the abdomen by little more than a mere thread. There is nothing of the kind in the conformation of the beetle, since it is the natural characteristic of this Order to have a broad, or at least, a moderately broad waist. Here, therefore, we observe a marked defect in the close resemblance between the beetle and the ant. In the one the waist is a broad hinge ; in the other a slender thread. But the plan of colouration just described has for its object the restoration of this defect. Its purpose is to produce a false impression by giving the beetle the appearance of a waist. The two white patches on the sides of the wingcovers do not appear as if part of the beetle. They contrast so markedly with the surrounding black that their appearance is that of a deficiency in structure, as if a notch had been cut out of either side. The black line between them seems to be the true connection, and thus thorax and abdomen appear linked together by a slender artificial waist. Nature has thus wonderfully clothed the beetle, even to so minute a detail in its conformation, in order to make perfect its resemblance to the ant. Its bodily structure cannot be sufficiently altered, hence recourse has been had to a method of deception through the production of a false effect.

This little beetle, so remarkably adapted, wanders about on the stems and leaves. It lives in the open, seeking no concealment, and moves freely in the midst of the ants. Its accustomed haunts are identical with theirs, the cattle-laden foliage being the place of selection, though it also descends to explore the bark or investigate the debris underneath the tree. All its actions are peculiarly antlike. It has their rapid mode of ordinary progression, its legs working and antennæ trembling in their characteristic agitated way. Also, when engaged in searching the vegetation, it is in the habit of working round the edges of the leaves after the same methodical manner as the ants. Thus not only in structure, but in habits and behaviour there is a marked resemblance between the two.

The beetle seems to live a vegetarian existence, frequenting the poplar for the sake of its sap, as is also the purpose of the *Cremastogaster* ants. The beetle, however, receives the liquid direct, while the ants obtain it through the intermediation of the herd. In its wanderings we will frequently observe it to halt and commence to lick at the surface of the leaf. It may remain for a long time biting at the foliage as though able to get out the sap. These halts frequently take place near the base of a leaf, at which point there is a pair of minute papillae that seem to attract the beetles to the spot. These are little glands which secrete a fluid that supplies the beetles with their most abundant food. The mimics and the ants live in perfect harmony. I never see a sign of hostility or friction. Though both compete for the precious fluid, yet they work together in rural peacefulness, the one existing on the products of the vegetation, the other, it may be said, domesticating a herd. The beetle is thus solely an outdoor visitor, a companion of the ants in their pastoral life.

We have here an excellent example of mimicry, since the beetle, as a consequence of its close resemblance, is lost to all but the most observant eye. There can be little doubt that the purpose of the mimicry is to supply the beetle with a garment of defence. These worker ants live a life of comparative immunity. Had they many enemies, they could not work with such freedom on the foliage, tending their herds in these conspicuous heaps. They are supplied with a sting and a reservoir of acid which must be sufficient to keep enemies off. But the little mimic, on the other hand, is altogether unprotected, having no weapons, nor poison, nor any knowledge of attack. Its search after sap must take it into the foliage where it will be fully exposed to view. Numerous dangers will there confront it, and, in all likelihood, it would cease to exist unless supplied with some suitable defence. It has, therefore, assumed the appearance of a worker, and, by living in the midst of the busy commune, is mistaken for one of the well-protected ants.

In this study of the habits of the *Cremastogaster* we have not met with anything of very striking originality, though we have observed a combination of organized methods different from that of any other kind of ant. The points of interest are the peaceful character of the workers and their peculiar love for certain types of vegetation because of the rich liquid food. Their pastoral activities take most of their attention, and they expend much labour in the erection of byres, though they have not arrived at the most perfect type. They are efficient enough in conveying information, in despatching their comrades to new supplies of provender, and are wonderfully skilful in following a path by means of their sense of smell. They are totally deficient in the capacity for transportation, at least beyond the carrying of an individual load. On the other hand they show some judgment in the distribution of their forces, despatching sufficient, and no more than sufficient, to deal with each source of supply. Lastly we have observed their companionship with a beetle which they effectually but unconsciously protect.

SOME NEW ALPINE GRASSHOPPERS OF THE GENUS *CONOPHYMA* ZUB. FROM CENTRAL ASIA.*

By

B. P. Uvarov, F.E.S.

Sub-family—Catantopinæ.

Conophyma zubovskyi, sp. n.

Closely allied to *C. semenovi*, Zub.

♂. Larger than any known species of the genus. *Antennæ* longer than the head and pronotum together. *Head* moderately reclinate. Frontal ridge slightly convex in profile, narrowed at the fastigium, practically parallel-sided elsewhere, obliterate about half-way between the ocellum and clypeus, sulcate in the middle, punctured between antennæ. Face with coarse, but sparse, punctures and rugulose. Cheeks coarsely punctured and rugose. Vertex moderately sloping, longer than broad, scarcely convex and coarsely punctured in front, smooth and practically flat behind; median carinula irregular and low, but well distinct; lateral margins punctured, very obtuse, carinated only behind. *Pronotum* cylindrical, thick; its disc very coarsely, though not deeply, punctured and rugulose; distinctly convex; first transverse sulcus irregular, nearly obliterated, not cutting the keels; second sulcus well developed, broadly bi-sinuate, cutting all three keels; third sulcus straight, cutting deeply all three keels; median keel low, thick, irregular, partly obliterated by the rugosities of the disc, more especially so at the front margin and in metazona; lateral keels distinct only in front of the second sulcus, practically obliterate behind it, slightly convergent backwards and feebly concave between the front margin and the second sulcus, slightly divergent behind it; prozona 2½ times as long as metazona; hind margin slightly roundly excised. Lateral lobes gibbose between the sulci, concave in the lower hind portion, coarsely rugose. *Mesonotum* somewhat longer than one half of metazona, coarsely punctured and rugose except at small irregular spaces on its sides at the anterior margin; median keel very low, subobliterate. *Metanotum* not quite twice as long as metazona of pronotum, coarsely punctured and rugose, except at fairly large semi-oval spaces at the sides; hind margin straight; median keel low, thick. *Abdomen* with the first tergite slightly longer than metazona, coarsely punctured and rugose; the following tergites also punctured, but the coarseness and depth of punctures decrease gradually; median keel developed throughout the abdomen, although low. Last tergite with two large lobes, shaped as equilateral triangles, their distance from each other being less than the basal width of one lobe. *Supraanal plate* transverse, trapezoidal, slightly widened behind, with two triangular, rounded apically teeth, placed close to the lateral margins near their middle and connected by a fine transverse suture; the surface impressed, more deeply so near the hind angles which are rounded, incrassate and very finely punctured and rugulose; median sulcus distinct in the basal half, with its margins convex distally obliterate; hind margin scarcely bi-sinuate, with a short, broadly triangular median lobe. *Cerci* strongly compressed, slightly incurved, projecting well beyond the supra-anal plate, rounded apically.

The types of new species described in this paper are in the Zoological Museum of the Russian Academy of Sciences, Petrograd; some para-types are in the British Museum (Natural History) and in the collection of the Turkestan Entomological Station, Tash-Kent.

*The present paper is a supplement to Mr. Uvarov's previous paper on the *Acrididae* of C. Asia published on page 260 of this volume.

Coloration blackish-olivaceous, shining. Lateral lobes of pronotum testaceous-yellow below, blackened above. Abdomen with testaceous submedian spots at the anterior margins of the tergites 3-6. Supra-anal plate nearly black. Hind femora brownish, without any pattern; the knees blackish. Hind tibiæ pale olivaceous-yellow.

♀ (paratype). Only the third sulcus cutting the median keel of pronotum. Median keel sharp and distinct throughout pronotum and abdomen. Lower valvae of ovipositor minutely serrulate, without teeth. Coloration olivaceous-green; no submedian spots on the abdominal tergites.

	♂ (type.)	♀ (paratype).
Length of body	21 mm.	27 mm.
,, pronotum	5	6
,, hind femur	12	13

Described after 4 ♂ ♂ and 2 ♀ ♀ from Ladyar-Tau, distr. Osh, province Ferghana, 20, vi, 1913; and 1 ♂ from the Alai mountains, Ferghana, in Prof. R. Ebner's collection.

The female of this species is extremely alike a female of *C. semenovi*, differing from it only in the somewhat larger size and in more roughly punctured and rugose body, but the structure of the male genitalia, and particularly of the supra-anal plate is very peculiar in the new species. It is obvious, however, that the plate of *C. zubovskyi* represents no entirely new features not observed in *C. semenovi*, but may be regarded as a further stage of specialization. Indeed, the remarkable sublateral teeth on the plate of *C. zubovskyi* may have developed out of low gibbosities observable in *C. semenovi* and connected in that species also by a transverse suture (not mentioned in the original description, because it is not always distinct). The new species is also well separated from *C. semenovi* geographically.

It gives me a great pleasure to be able to dedicate this remarkable species to the author of the genus, the well-known Russian orthopterist Mr. N. N. Zubovsky whose unfortunately not numerous papers on *Acrididæ* of Siberia and Central Asia represent a standard of clearness and fulness in systematic work.

Conophyma mitchelli, Uv.

This species has been described by me (Ent. Mon. Mag., 3rd Ser. vii, p. 269) after a single female from Srinagar, Kashmir, about 12,000 feet, and a fresh lot of insects collected by Mr. F. J. Mitchell in the Kashmir between 11-13,000 feet and sent by the Bombay Natural History Society to the Imperial Bureau of Entomology includes another female and the undescribed male, which gives me an opportunity of describing it here, as follows:

♂. Smaller than the female and much more slender. Antennæ a little shorter than the head and pronotum together. Face strongly reclinate. Frontal ridge sulcate throughout. Fastigium of vertex narrow and long, with the lateral carinæ well developed, but without the median carinula; temporal foveolæ as in the female. Eyes about as high as the subocular distance (in the female distinctly less than that). Pronotum more elongated than in the female, and more rugose; transverse sulci well developed; metazona equal to one half of the prozona; the median keel developed throughout; lateral keels in the first section of the prozona distinct, though somewhat irregular, almost straight, somewhat convergent backwards; between the sulci and in the metazona they are very irregular, gradually divergent. The two oval impressions on the upper part of the lateral lobes are marginated from below by thick folds (which are present in the female also, but no so well developed and regular). Hind margin of the pronotum obtusely excised, with the margins convex. Mesonotum,

metanotum and abdomen as in female. Last tergite with two rounded triangular teeth, about as broad as they are long and separated from each other by an interspace distinctly broader than one of the teeth. Supra-anal plate scarcely longer than it is broad, slightly narrowed behind, with the hind angles broadly rounded; hind margin with a triangular median projection, which is shorter than it is wide at the base. Cerci conical, slightly incurved, projecting beyond the anal plate, but their actual length is not more than that of the plate. Subgenital plate obtusely conical recurved.

Coloration of the male (as well as that of the female in the collection studied) is somewhat different from the type. Male is blackish-brown from above, and in both sexes the angulated black fascia on the lateral pronotal lobes is well in contrast with the brick-red (brighter in the female) of their front margin and of the hind lower portion. In both sexes the sides of the abdomen are black, but all these differences from the type cannot be regarded as important.

Measurements of the male are, as follows: length of body 15 mm.; pronotum 3·25 mm.; metanotum 1·5 mm.; hind femur 8·5 mm.

The discovery of the male of *C. mitchelli* enables me to state definitely that my doubts as to the species belonging really to the genus *Conophyma* are not justified. This is a true member of the genus, although very distinct from other known ones by the strongly rugose body. The zoo-geographical value of this conclusion is in the fact that all other species of *Conophyma* are known from the high mountains of the Russian Turkestan, and *C. mitchelli* appears to be the most southern representative of the genus which gives an evidence of a close relationship between the alpine faunas of all the great mountain ranges of Central Asia. It makes it also highly probable that other species of *Conophyma* will be discovered in Himalayas.

Conophyma miramæ, sp. n.

Similar to *C. sokolowi*, Zub., but belonging to the group of *C. semenovi*, Zub. in the structure of male genitalia. ♂. Size under medium for the genus. *Antennæ* in the type broken. *Head* moderately reclinate. Frontal ridge somewhat convex in profile, gradually widened downwards, more strongly so below the ocellum, obliterate near clypeus, shallowly sulcate throughout except in the dilated lower portion. Vertex sloping, nearly twice as long as broad, narrowed anteriorly, slightly impressed behind, without the median carinula and with the lateral carinulæ well distinct between the eyes but obliterated in front. *Pronotum* short; its disc practically flat, feebly bi-concave and with faintly indicated large punctures near the lateral keels in front of the first sulcus, indistinctly rugulose in metazona, bearing four pairs of very low, scarcely perceptible, smooth tubercles arranged as follows: the first pair close to the front margin of disc, equidistant from the median and the lateral keels, second pair in front of the first sulcus and the third pair between that and the second sulcus, nearer to the median keel than to lateral ones; the fourth pair of elongate tubercles between the second and third sulcus, nearer to the lateral keels than to the median one and each of the tubercles enclosed between two shallow impressions. Transverse sulci all cutting lateral keels; first one shallow, nearly obsolete, straight; second sulcus well developed except near the median keel where it is obsolete and does not cut the keel; third sulcus well developed throughout, cutting all keels, broadly rounded-angulate in the middle. Median keel obliterate close to the front margin, well raised and convex in profile in the rest of prozona, quite distinct in metazona. Lateral keels well developed, callous throughout except between the first and the second sulci where they are obliterate, straight and slightly convergent backwards in front of the first sulcus, very slightly concave and divergent behind the second sulcus. Prozona two and a half times as long as metazona; the latter very obtusely excised behind. Lateral lobes deeper than long, not strongly gibbose between the

sulci, smooth, with large, nearly obliterate punctures in the lower third, more distinctly rugulose in metazona. *Mesonotum* subequal in length to metazona, with the median keel replaced by an indistinct smooth line and without the lateral keels. *Metanotum* not twice as long as metazona; its disc distinctly bi-concave, with practically obliterate punctures near the lateral keels; median keel obtuse, tectiform; lateral keels obliterate near the front margin thick and callous in the rest, convergent backwards, incurved at both ends. First tergite of the *abdomen* slightly longer than metazona of pronotum; its disc tectiform, strongly bi-concave laterally and with large punctures especially near the lateral keels; median keel well raised; lateral keels very thick, callous, scarcely convergent, but distinctly incurved apically, behind; sides of the tergite rugulose. The following tergites with some scattered punctures and a lateral line of foveolæ, adjoining the lateral keels, which are low, but perceptible on the second and third tergites and obliterate in the rest; median keel is also lowered and obliterate from the third tergite backwards. *Last tergite* with two small triangular submedian lobes, separated by the width of one lobe. *Supra-anal plate* trapezoidal, distinctly narrowed apically, shorter than broad at the base surface concave at the sides of the median ridge which is moderately raised, thick, sulcate in the distal half; close to the each lateral margin there is an acute, rounded apically, flattened tooth, directed backwards, but slightly projecting sideways; hind margin sinuate on each side of the median lobe which is broadly triangular, short, with the apical angle about 90° and pointed; hind angles of the plate slightly projecting, rounded. *Cerci* strongly compressed laterally, somewhat incurved, with the apex rounded. *Subgenital plate* obtuse.

Coloration above brownish and black, with yellowish and testaceous pattern. Pronotum dull blackish-brown along the middle, with broad and indefinite testaceous fasciæ; lateral lobes ivory-white below, shining black, turning brownish above, in the rest. Mesonotum, metanotum and abdomen black, dull on the meso and metanotum and the first tergite, shining in the rest, with broad testaceous fasciæ along the lateral keels; an indefinite pale testaceous median fascia begins from the third tergite, becoming broader, paler, and more distinct backwards. Pleuræ shining black with an oblique, callous, ivory-white stripe. Hind femora testaceous, without definite fasciæ. Hind tibiæ pale sanguineous.

	♂ (type).
Length of body	12 mm.
,, pronotum	3
,, hind femur	7

Described after a single male from the range Alexandrovsky, distr. Aulie-Ata, 23, vi, 1920.

This is an extremely well-marked species, easily recognisable by the peculiar sculpture of pronotum, metanotum and of the first tergite, but especially by its genitalia, reminding those of *C. zubovskyi*, m.

The species is named after Miss Emilia Miram, assistant in the Orthoptera room of the Petrograd Zoological Museum and author of several valuable papers on Russian Orthoptera.

Conophyma jacobsoni, sp.n.

Related to *C. sokolowi*, Zub., but larger.

♂. *Antennæ* distinctly longer than head and pronotum together. *Head* reclinate. Frontal ridge slightly convex in profile, shallowly sulcate throughout, gradually and feebly widened below the ocellum, obliterate near clypeus. Vertex strongly sloping, about half again as long as broad, slightly narrowed anteriorly, scarcely concave, punctured in the fastigium, with a feeble median carinula and low, disappearing in front, lateral carinulæ. *Pronotum* elongate,

slightly widened behind; disc obtusely tectiform, shallowly and indistinctly punctured and callously rugulose, more distinctly so in metazona; first sulcus completely obsolete; second distinct, but not deep; third fairly broad, but not deep, cutting the median keel; median keel sharp, in profile convex, in the metazona low, but distinct; lateral keels well distinct throughout the prozona, slightly convergent from the anterior margin towards the second sulcus, but distinctly bent outwards just before it, feebly divergent behind it; metazona shorter than one-half of prozona; lateral lobes, slightly longer than deep, feebly gibbulose between the sulci, smooth, with but few minute punctures, more distinctly punctured in metazona. Mesonotum scarcely longer than the metazona of pronotum; median keel very feeble; lateral keels distinct only at the very hind margin, low, slightly more approached to each other than the keels of pronotum. Metanotum not twice as long as metazona, obtusely tectiform, its disc slightly concave laterally, with shallow and broad punctures and indistinct callous rugosities; median keel quite distinct, tectiform, not sharp; lateral keels callous, obtuse, obliterate at the anterior margin; lateral lobes with a large, shallow, oblique impression, punctured behind it. *First tergite* obtusely tectiform, its disc somewhat concave laterally, punctured and rugulose as the metanotum; median keel tectiform, low; lateral keels callous, thick, distinctly displaced outwards from the keels of metanotum, convergent backwards. Second tergite with very feeble median and lateral keels, the following tergites without keels. *Last tergite* with two triangular lobes, which are about as long as broad and separated by an interspace half again as broad as one of the lobes. *Supra-anal plate* trapezoidal, slightly broader than it is long; hind angles obtuse and rounded, hind margin slightly convex, with the median lobe short, rounded, occupying about one-third of the width of hind margin; median ridge broad, convex, scarcely narrowed posteriorly, slightly sulcate at the base. *Cerci* compressed, elongate-triangular in profile, rugulose, extending a little beyond the plate.

Coloration above shining-black with ivory-white pattern, below and on the legs pale yellowish-testaceous. Head dull-black above, with faint, narrow testaceous postocular fasciæ. Pronotum with the lateral ivory-white fasciæ moderately wide; lateral lobes shining black above, ivory-white below. Mesonotum brownish black, with the fasciæ developed in its hind half only, slightly more approached to each other than those of the pronotum, emitting forwards very faint, not callous, pale stripes converging to the metazona. Metanotum with the fasciæ as broad as on pronotum. Pleuræ black, with an oblique ivory-white fascia. Abdomen with the median line (except on the first tergite) and two continuous fasciæ ivory-white. Hind femora without any trace of fasciæ. Hind tibiæ red throughout.

♀ (paratype). Pronotum, metanotum and first tergite distinctly rugosely punctured, with the keels low, not callous, but distinct. Head above and discs of pronotum, mesonotum, metanotum and of first tergite pale greenish-grey, with brown, grey and blackish punctures. The rest of abdomen above castaneous, with the fasciæ testaceous. Bands on the lateral lobes of pronotum, pleuræ and on the side of abdomen, black. Lower valvæ of ovipositor with strong, but short teeth.

	♂ (type)	♀ (paratype)
Length of body	16 mm.	23 mm.
,, pronotum	3·75	4·25
,, hind femur	8	9

Described from 5 ♂♂ (including the type) and 4 ♀♀ from Tchimgan, distr. Tashkent, 21, vi—2, vii, 1920; 1 ♂ and 3 ♀♀ from Ak-Tash, distr. Tashkent, 23, vii, 1920; 1 ♂ and 1 ♀ from Tchervak, distr. Andizhan, 16, vi, 1913.

The series before me shows very little variation in the coloration of males in which the fasciæ are sometimes pale sulphur-yellow, sometimes testaceous; females vary more widely, the black fasciæ on the sides of body tending to disappear. Some females are practically unicolorous brownish, without distinct fasciæ. The shape of the male supra-anal plate is also not quite constant, sometimes being nearly quadrate, but with the hind angles always rounded, hind margin convex and the apical lobe broad, which separates the species from *C. sokolowi*, apart from the different sculpture of pronotum, differently shaped lateral keels of the latter and coloration. Especially noticeable are the unbanded hind femora.

According to Mr. Plotnikov's communication, the species is quite common and numerous in the mountains at Tchimgan, near Tashkent.

I dedicate this species to Mr. G. G. Jacobson, of the Zoological Museum of the Academy of Sciences, Petrograd, the compiler of the best existing work on Palæarctic Orthoptera ‡ which stimulated greatly the interest of Russian entomologists in this group of insects and educated several orthopterists, myself included.

Conophyma plotnikovi, sp. n.

Apparently near to *C. simile*, Zub.

♂. Small. *Antennæ* slightly longer than head and pronotum together. *Head* reclinate. Frontal ridge slightly convex in profile, distinctly sulcate, narrowed at the ocellum, widened and obliterate near clypeus. Vertex sloping, concave, without median carinula, with feeble, convergent forwards lateral carinulæ. *Pronotum* short and broad, cylindrical, scarcely widened behind, its disc slightly convex, but very distinctly gibbulose with shallow round impressions and callous tubercles between the sulci, punctured at the anterior margin, and very coarsely punctured and rugulose in metazona; sulci deep, but only the third one cutting the median keel; median keel thick, smooth, slightly convex in profile, distinctly lowered near the anterior end, distinct in metazona; lateral keels thick and low, but distinct in front of the first sulcus, subparallel for a short space at the front margin, then strongly convergent towards the first sulcus, behind which they are practically obliterate, very irregular and very strongly divergent towards the second sulcus, displaced sideways and quite irregular behind the latter, obliterate in metazona; metazona shorter than one half of prozona, rotundate-truncate behind; lateral lobes about as long as deep, strongly gibbose in the upper half of prozona, densely punctured and rugulose in metazona. *Mesonotum* slightly longer than metazona of pronotum, with fine median keel behind, without lateral keels, with elongate shallow impressions on the sides. *Metanotum* not twice as long as metazona of pronotum, very obtusely tectiform, with the disc slightly concave on each side of the median keel, which is well distinct, but not sharp; lateral keels distinct in its hind two-thirds only, low, callous, irregular; two shallow oval impressions near the lower hind angles (just above the pleural suture). Pleuræ with shallow, broad impressions. *Abdomen* with the three keels on the first tergite only; this tergite shallowly concave on the disc, on each side from the median keel. Last tergite with two widely distant triangular lobes, which are longer than at the base broad. *Supra-anal plate* quadrangular, slightly broader than long, with lateral margins feebly concave; apical margin feebly convex, with a small emargination in the middle, where a short, narrow lobe is projecting; hind angles

‡ Orthoptera and Pseudoneureptera of the Russian Empire (In Russian), Petersburg, 1916.—The Oothoptera part of the book has been done by G. G. Jacobson, that on Pseudoneuroptera by V. L. Bianchi. The work has been based on Tumpel's book, but only modesty of the authors caused them to undertone that, as The contents and scope of their book required an enormous amount of original work.

practically straight, somewhat attenuate (owing to concavity of lateral margins); surface raised along the middle in shape of a low ridge, narrowed posteriorly (where it forms the median lobe), sulcate in the basal half, distinctly separated by oblique sulci from the slightly incrassate lateral margins and from the oval convexities placed at the hind angles. *Cerci* short, compressed, elongate triangular in profile.

Coloration pale buff below, shining black and blackish-castaneous with buff pattern, above. Head above testaceous-brown, marmorated indistinctly with brown. Pronotum with the disc black along the middle, turning castaneous on the median keel and in metazona, with two buff fasciæ, moderately broad and strongly convergent backwards in front of the first sulcus, suddenly dilated and displaced outwardly behind it, gradually narrowed and divergent backwards; lateral lobes with the upper half shining black. Mesonotum testaceous brown, with four large round blackish spots across its anterior half, separated with testaceous-buff color. Metanotum with the disc blackish-brown, fading into testaceous behind; a little more than anterior half of the median keel, triangular spots narrowed backwards on the lateral keels, and short streaks above the pleural sutures, buff. Pleuræ black in a little more than upper half only. First abdominal tergite blackish-testaceous on the disc, fading into testaceous behind, with the median keel buff in more than anterior half, with broad, narrowed posteriorly irregular buff spots on the lateral keels; the rest of abdomen with a broad pale-buff median fascia, and a lateral row of elongate irregular buff spots. Hind femora with the faintest traces of testaceous fasciæ above. Hind tibiæ very pale sanguineous in the apical half.

♀(paratype). Reddish-ochraceous, dull, with some black, or blackish marks distributed, as follows: a small indefinite spot in the middle of prozona, four spots across the mesonotum, middle parts of discs of metanotum and first tergite, large lateral spots on the second tergite with pale centres, a double submedian row of small spots on the other tergites, hind femora with a small basal spot, a black dot on the upper carina before the knee and two fasciæ in the upper areas extended also half-way down the inner and outer surface. Front and middle legs in small blackish spots; lower valvæ of ovipositor with strong teeth.

	♂(type)	♀(paratype)
Length of body	14 mm.	18mm.
,, pronotum	2·5	3
,, hind femur	7·5	8

2 ♂ ♂ and 3 ♀ ♀ from the summit of the Malyi Tchimgan, distr. Tashkent, 10, vii, 1920; 1 ♀ and 1 ♀ from the pass Pessotchny, Tchimgan, distr. Tashkent, 16, vii, 1920.

This species is represented by two very distinct color forms, one marked strikingly in black and buff, as described for the male type, another is protectively colored in reddish-ochraceous with obsolete brown and blackish marks (see description of the female paratype); to the latter belong 1 ♂ and 2 ♀ ♀ from the Lesser Tchimgan. As there are no structural differences between the two forms, I have no doubt that they are con-specific and represent only either individual variations, or, more likely, are connected with different kinds of environment; in the latter case they may be distinguished as two *morphæ* of the species, but direct observations on the spot are necessary to verify this conclusion.

C. plotnikovi differs from *C. simile*, Zub., in the structure of pronotum, in coloration and in the shape of the male supra-anal plate.

The species is named after my friend Mr. V. I. Plotnikov, Director of the Turkestan Entomological Station, who has done much to advance our knowledge of the insect fauna of Turkestan.

Conophyma pylnovi, sp. n.

Resembling *C. plotnikovi* m. in the structure of pronotum, but differing from it strongly by the male genitalia.

♂. *Antennæ* longer than head and pronotum together. *Head* not strongly reclinate. Frontal ridge slightly convex in profile, distinctly widened between the antennæ, feebly sulcate, not reaching the clypeus. Vertex strongly sloping, about half again as long as broad, flat, median carinula slightly perceptible at the very apex, no lateral carinulæ. *Pronotum* very short and thick; its disc practically flat, even slightly concave before the first sulcus and between the second and third sulci, dull, but not rugulose or punctured in prozona, distinctly rugulose in metazona; all sulci deep; the first sulcus straight, cutting the lateral keels deeply, but not the median keel; second slightly sinuate, cutting the lateral keels, and very nearly cutting the median keel; third deep, obtusely angulate, cutting all three keels; median keel in profile slightly convex, distinctly lowered at the second sulcus and interrupted by the third, low, thick, in metazona quite low and irregular; lateral keels before the first sulcus quite distinct, slightly convex, strongly convergent backwards, low, thick and irregular farther backwards, distinctly divergent between the first and second sulcus, less so between the second and third sulcus, hardly perceptible in metazona; lateral lobes slightly deeper than long, strongly gibbose in their upper parts, with the broad foveolæ adjoining the lateral keels marginated below by distinctly raised ridges, the surface obsoletely punctured, and rugullose except in metazona which is coarsely punctured. *Mezonotum* somewhat longer than metazona of pronotum, smooth, with faintly indicated median keel, but without the lateral keels. *Metanotum* not quite twice as long as metazona, very obtusely tectiform, bi-impressed; median keel very low; lateral keels thick and low, not developed in the anterior third. *First tergite* as long as mesonotum, tectiform, bi-impressed, with the median keel thick, but well raised; lateral keels thick, slightly convergent backwards. The following tergites with only a smooth median line instead of the keel, without lateral keels. *Last tergite* with two small, rounded lobes, slightly longer than they are broad, separated from each by an interspace half again as broad as one of the lobes. *Supraanal plate* trapezoidal, slightly longer than broad, with the hind angles rounded; hind margin slightly convex on each side of the median lobe which is short, triangular, not broader than one-fourth of the hind margin; surface practically flat impressed at the hind angles, with the median ridge scarcely raised, feebly sulcate basally and more distinctly so at the apex. *Cerci* compressed, reaching to the apex of the median lobe, strongly narrowed apically.

Coloration dull blackish-brown, variegated with brown and brownish-testaceous above, testaceous below. Pronotum without fasciæ on the disc; lateral lobes blackish-brown above, shining black in the rest, except the hind angles which are reddish-brown. Mesonotum, metanotum and first tergite dull blackish-brown above. Pleuræ shining black. Abdomen shining blackish-brown, with an indefinite median fascia and very irregular, interrupted lateral testaceous fasciæ with blackish dots. Hind femora with scarcely distinct dark fasciæ; sanguineous below. Hind tibiæ sanguineous.

♀ (paratype). Sulci of pronotum not deep, but distinct and all of them cutting the lateral keels. Coloration dark reddish-brown, dull, densely dotted with black, without definite fasciæ. Hind femora more distinctly fasciated than in the male. Lower valvæ of ovipositor with strong, sharp teeth.

	♂ (type)	♀ (paratype)
Length of body	15 mm.	18.5 mm.
,, pronotum	2·75	3·5
,, hind femur	7·5	9·5

Described from one male and one female, taken at Ak-Tash, distr. Tashkent, 23, vii, 1920.

A very distinct species, showing a peculiar structure of pronotum and resembling somewhat in this respect *C. mitchelli*, m., from Kashmir.

The species is named after my much regretted friend, young and very promising Russian orthopterist E. V. Pylnov, who died prematurely from typhus as one of numberless victims of the recent disastrous events in our country.

Conophyma ikonnikovi, sp. n.

Allied to *C. fedtschenkoi*, Zub.

♂. *Antennæ* about as long as head and pronotum together. Head strongly reclinate. Frontal ridge shallowly sulcate, slightly widened between the antennæ, obsolescent near the clypeus. Vertex moderately sloping, nearly twice as long as broad, somewhat narrowed anteriorly, scarcely impressed without median carinula, with lateral carinulæ feeble. *Pronotum* cylindrical, very slightly widened posteriorly; its disc somewhat convex, gibbulose between the sulci, which are all three well developed; median keel well developed throughout, cut by the third sulcus and distinctly lowered at the second sulcus; lateral keels practically obliterate throughout, slightly perceptible only anteriorly where they are distinctly converging backwards, and between the sulci where they are very irregular and diverging backwards; metazona shorter than one-half of prozona, very feebly sinuate-emarginate behind; lateral lobes distinctly longer than deep, gibbose. *Mesonotum* somewhat longer than metazona of pronotum, with the median keel very feeble. *Metanotum* twice as long as metazona of pronotum, obtusely tectiform, with the median keel distinct and the lateral ones very obtuse and irregular, nearly obliterate. *Abdomen* with the median keel well developed on the first tergite only and subobliterate in the rest; lateral keels scarcely perceptible: irregular on the first tergite only. *Last tergite* with a broad, straight emargination behind, bearing in its middle two elongate obtusely conical, thick, slightly incurved lobes separated from each other by the space as broad as one of the lobes at its base. *Supra-anal plate* about as long as it is broad, trapezoidal, broadest behind; lateral margins strongly sinuate at the very base, straight in the rest; hind margin straight with a short rectangular lobe; hind angles a little less than 90°, rounded; surface impressed like a trough, with the sloping sides under the angle of 45°, and the median part (bottom of the trough) somewhat convex, sulcate along the middle in the basal third and, less distinctly, at the apex. *Cerci* quite twice as long as the plate, projecting beyond it by two-thirds of their length, practically straight, slightly compressed laterally at the base, inflated inwardly at the base of the apical third, with the apices pointed and very slightly bent outwards and downwards. *Subgenital plate* short, obtuse conical.

Coloration pale greenish-testaceous below, on the legs, apex of abdomen and face, above shining black, with yellowish-buff pattern. Head blackish above, with the postocular fasciæ scarcely perceptible, brown. Disc of pronotum dull black, in the metazona brownish, with shining yellowish-buff lateral fasciæ, which are obtuse-angulate inflexed at the first sulcus, diverging both forwards and backwards; surface of fasciæ irregularly punctured; lateral lobes shining black in more than upper half, greenish testaceous below, finely transversely rugulose, more densely so in metazona, and with fine scattered punctures. Mesonotum blackish-brown, dull, with the lateral fasciæ obsolete in front, much more approximated to each other than the pronotal fasciæ. Metanotum and the first tergite dull-black, with the lateral fasciæ distinct, still nearer to each other than in mezonotum. Pleuræ shining black, with an oblique yellowish fasciæ on metapleuræ. Abdomen shining black above and on the sides, with the

median line and moderately broad, irregular lateral fasciæ, yellowish-buff. Hind femora with two very faint brownish fasciæ above. Hind tibiæ pale greenish-testaceous.

♀ (paratype). Blackish-brown, variegated and dotted with black, with the typical pattern in pale sulphur-yellow and broader than in the male. Lower valvæ of ovipositor acutely dentate.

	♂ (type.)	♀ (paratype)
Length of body (without cerci)	15.5 mm.	19
,, pronotum	3.5	4
,, hind femur	8.5	10
,, cerci	3	1.5

Two males and two females from Southern Bokhara, 1914.

Differs from *C. fedtschenkoi*, Zub., which has been only briefly diagnosed, in the very remarkable development of male cerci, as well as in other details of the male genitalia and in coloration.

The species is named after my friend Mr. N. F. Ikonnikov, who has done some excellent work on systematics of the *Acrididae* of various parts of Russia.

A list of species of the genus *Comophyma*.

1. *C. semenovi*, Zubovsky, 1898; Ann. Mus. Zool. Acad. St. Petersb, iii, p. 106 (Semiretchye).
   Synonym: *Podisma Almasyi*, Kuthy, 1905; Ann. Mus. Nat. Hungar., iii, p. 218 (Semiretchye).
2. *C. zubovskyi*, Uvarov, 1924: see above (Ferghana).
3. *C. miramæ*, Uvarov, 1924; see above (Alexandravosky range).
4. *C mitchelli*, Uvarov, 1921; Ent. Mon. Mag., 3rd ser., vii, p. 268; also above (Kashmir).
5. *C. sokolowi*, Zubovsky, 1899; Horæ Soc. Entom. Ross., xxxii, p. 588 (Tash kent.)
6. *C. uvarovi*, Semenov, 1915; Revue Russe d' Entom., xv., p. 453 (Kopet Dagh.)
7. *C. jacobsoni*, Uvarov, 1924; see above (Tchimgan, near Tashkent.)
8. *C. simile*, Zubovsky, 1899; Horæ Soc. Entom. Ross., xxxii, p. 591 (Samarkand district).
9. *C. plotnikovi*, Uvarov, 1924; see above (Malyi Tchimgam, near Tashkent.)
10. *C. pylnovi*, Uvarov, 1924; see above (Ak-Tash, distr. Tashkent).
11. *C. weberi*, Zubovsky, 1899; Horæ Soc. Entom. Ross., xxxii, p, 584 (Samarkand distr.)
12. *C. fedtschenkoi*, Zubovsky, 1900; Horæ Soc. Entom. Ross., xxxiv, p. 23 (valley of the upper Zeravshan).
13. *C. ikonnikovi*, Uvarov, 1924; see above (S. Bokhara).

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY.)

BY

T. R. BELL, C.I.E., I.F.S., (Retd.)

(*Continued from page* 305 *of this Volume*).

PART XXXIV.

(With a text figure).

Sub-family (4)—PLASTINGIINÆ.

This sub-family is composed of the genera, eighteen in number :—*Plastingia*, *Suastus*, *Arnetta*, *Zographetus*, *Lotongus*, *Zela*, *Nidari*, *Pirdana*, *Œrane*, *Creteus*, *Pithauria*, *Pithauriopsis*, *Pedestes*, *Suada*, *Isma*, *Scobura*, *Itys* and *Sebastinyma*. Of these the first, *Plastingia*, has eight species in British India and twenty more in Sumatra, Java, Borneo, Celebes and the Philippines. *Suastus* has six in British India and only three in Singapore and Java, the Philippines and Islands between these ; *Arnetta* has three which are all found in India and Burma ; *Zographetus* four in British India and three more outside in the Malayan Islands ; *Lotongus* three, with ten outside ; *Zela* one and another outside ; *Nidari* two, with seven foreign ; *Pirdana* two and five in the Malayan region ; *Œrane* is represented by a single species with two in Malayan countries ; *Creteus* is a genus of a single species ; *Pithauria* has two British Indian only ; *Pithauriopsis* has only one ranging from Assam to Borneo ; *Pedestes* two occurring respectively in N. W. Himalayas, Sikkim and Burma with another pair in Tonkin and Pulo Laut ; *Suada* has one, with three eastern relations ; *Isma* one and four ; *Scobura* one and eight ; *Itys* one and one and, finally, *Sebastonyma* a single species in Sikkim, Assam and Burma.

The four first genera are the only ones out of the eighteen that interest us and out of their twenty-one British Indian species only five come in here, a single *Plastingia*, two *Suastus* with one each of *Arnetta* and *Zographetus*. The early stages of two only are known. These two are *Plastingia submaculata* and *Suastus gremius*. It is a very small basis to found any conclusions upon :—incomplete information about two genera out of a total of eighteen. There is a very cursory reference to the larva and pupa of *Hidari thrax* in *Lepidoptera Indica*, (vol. x, p. 227,) from which we learn that the caterpillar feeds upon Palms—the cell would seem to be made much in the manner of that of *Hyarotis adrastus* (Cramer).

Imago.—The butterflies are of moderate size or smaller with the wings brown or blackish above, generally with subapical dots and a series of disc-spots on

the fore wing; more rarely immaculate. The hind wing is immaculate above but has some black spots (or darker spots) below generally, often on a greyish ground.

Antennæ.—Not long but longer than two-thirds length of the costa of fore wing; the club gradual and bent over.

Palpi.—Various, porrect or otherwise, the third joint long or not.

Hind tibiæ.—Fringed and with two pairs of spurs; naked in *Pithauria Pithauriopsis.*

Fore wing.—Vein 12 ending before end of cell or at end of cell; cell less than two-thirds length of costa; vein 3 ends well before end of cell; vein 2 from middle or before middle; vein 5 very weak; discocellulars straight, outwardly oblique, faint.

Hind wing.—Vein 3 from close to angle of cell, vein 2 from after middle; vein 5 all but absent; discocellulars straight, inwardly oblique, faint.

Egg.—Dome-shaped, twice as broad as high or even much more; with some dozen or more strong meridional ribs from top to bottom; the whole standing upon a narrow, inclined basal ring or base. The surface is moderately shining. The colour is brownish or red with the ribs pure white.

Larva.—Of the ordinary hesperid *shape*, fattest in the middle, broadly rounded at anal end and there flattened; with a large, semi-elliptical *head* and a very distinct neck; the head is not bilobed. *Surface* of body is extremely minutely haired, the hairs hardly visible they are so small and there are some tiny, round shining glassy-looking spots on some of the segments. The *colour* is light green with the hair-dots darker.

Pupa.—Rather stout and with the frons only slightly prominent between the eyes with a more or less spatulate cremaster set round the edge with small hooked shafts. *Spiracles* of segment 2 provided with conspicuous large, more or less ear-shaped or semi-circular expansions. *Surface* set with comparatively long, more or less decumbent hairs, those on head pointing forwards, those on abdomen directed backwards. *Colour* more or less light green with a covering of cereous, white powder; the abdomen often with a yellow shade.

Habits.—The eggs are laid on the tops of the leaves of Palms including *Calamus* or Canes. The egg-larva and eggs in the only two known species are red-brownish or red as are the eggs they come out of. The larvæ make the same style of cell, one as the other, described below and eventually when about to pupate, cut it off the leaf so that it falls to the ground. The butterflies are fast fliers and rest with their wings upright over the back, sitting on leaves at night. They visit flowers and suck at bird-droppings on leaves and damp places in nalla-beds.

Genus 16.—Plastingia.

Imago.—This is very like that of *Suastus gremius* in colouring having the same brown upperside with white spots to the fore wings, with a similar underside having black spots on the hind wings.

Antennæ.—Quite two-thirds the length of costa of fore wing; club slender gradual, rather long, gently curved at end which is pointed.

Palpi.—Prominent, curving round upwards; second joint densely scaled, third joint small, conical, obtuse.

Hind tibiæ.—Slightly fringed on the side and with two pairs of spurs.

Fore wing.—Neuration as in *Suastus gremius.*

Hind wing.—As in *Suastus.*

Egg, larva, pupa, habits.—See below under description of the only species *submaculata*, that is known in the early stages.

204 Plastingia submaculata (*Standinger*).—Male. *Upperside*; dark olive-brown blackish when quite fresh fading to olive-brown. Fore wing with a thick powdering of bright-yellow scales from base above cell and nearly to its end; some yellow, decumbent hairs below the cell also at base as far as inner margin; another streak of bright-ochreous scales just above vain from base to half the length of wing; two small white spots towards end of cell, the lower just above junction of vein 2 with bottom of cell, the upper further out; a 1·5mm.—square white, hyaline spot in interspace 2 below junction of vein 3 with end of cell and another similar, smaller in interspace 3 beyond and well separated from it; no subapical dots; and there is very little sign of fringe of hairs along inner margin. Hind wing without markings but with some decumbent, ochreous hairs from base in cell and extending below to beyond its end. *Cilia* of both wings whitish with the base brown as well as small brown areas at ends of veins. *Underside:* Dark greenish-yellow according to Colonel Swinhoe but really more grey with a slight lilac tinge and a sprinkling of ochreous scales along costa of fore wing and at base of hind wing. Fore wing with the lower half darkish-brown including cell but the whole of the area from the middle of interspace 1 to inner margin from base outwards to outer-margin along vein 12 shining white-ochreous; the white hyaline spots of upperside showing through, a quadrate brown spot bordering the one in interspace 3 exteriorly and, above this, an outwardly-curved series of purple-tinged, brown, smaller spots in interspaces 4 to 8. Hind wing with black spot in middle of discocellulars at origin of vein 5 and an all-round series of black spots beginning with two in interspace 7, one in the middle and one further out forming the uppermost of a curve consisting of one about the middle of interspaces 6, 5, 4, 3 and just below this last in interspace 1 in which there is still another inwards about its middle; besides this the outer margin of the wing is narrowly brown sometimes stretching very slightly inwards in an obscure lunular manner, the anal angle more extensively brown. Antennæ black, the shaft with ochreous dots on inner side, the club with an ochreous medial band above, dull-orange beneath; palpi with the basal joint and underside ochreous, the upperside of second and minute conical, third joint (that is nearly hidden in the heavy covering of hair-like scales) dark-brown; head and body concolourous with wings, the head with ochreous scales, the thorax with ochreous hairs, the blacker abdomen with ochreous segmental bands, beneath the body is greenish-ochreous, the tibiæ and tarsi brown, the segmental bands of abdomen, whiter. The antennæ are strongly hooked, the club gradual and acute, about 9mm. long as compared with a wing-length of 16mm. Female exactly similar to male. Expanse from 35 mm. to nearly 40 mm.

Egg.—It is rather peculiar in *shape*: circular, the sides sloping and straight, the top broadly flattened with a smaller middle again somewhat convex; it is like a very broadly truncated cone with a height under half the diameter; the structure stands upon a 0·075 mm. broad ring or band which has a greater slope than the sides of the egg. The *surface* feebly shining and feebly cross-rayed between 14 or 15 meridional ribs, the number being sometimes 14, at others 15; these ribs are 0·05 mm. broad and about the same height and are flakily rough along their crests, they extend from the very outside circumference of the basal band (although only feebly indicated on the band) to the margin of a circular, smooth, slightly convex apical surface of 0·55 mm. diameter, in the centre of which is the 0.05 mm. wide micropyle; outside this smooth surface, and for a distance of 0·2 mm. from its edge, the surface is very regularly,

transversely rayed between the ribs with little raised, flaky-crested low ribs which are 0·025 mm. apart; this clearly transversely rayed zone is produced outwards along each rib triangularly, for another 0·05 mm. and the top ends of the ribs, on the other hand, reach beyond it towards the apex; the ribs are 0·05 mm. apart at their apical ends and 0·4mm. apart at the base of the egg. *Colour* brownish with the ribs and prominent cross-rays white. B. 2·2mm., H. 0·8 mm.

Larva.—Is of the ordinary hesperid *shape* with a large head compared to the neck and a body which is depressed on the ventral surface but otherwise circular in transverse section, stoutest in the middle, fining gently to each end, the anal segment being a semi-circle, sloping evenly with the rest of the body. The *head* is more or less regularly semi-elliptical in shape, but is higher than broad; the surface of head is reticulate-rugose, the reticulations forming irregular cells of about 0·1 mm. in diameter without hairs of any sort except round the edges of the ligula; the true clypeus is an equilateral triangle with a very acute apex; the false clypeus a very narrow strip outside it, gradually widening convexly to form a narrow arc over the true clypeus, the former reaching to just above the middle of face, the latter to just below; the labrum, glassy-soiled whitish in colour, is transverse, longer than half the true clypeus with its front margin square; the ligula more or less parallel-sided with the frontal sinus deep and triangular, the lobes on each side narrow, round-ended, the whole as long as the labrum and rusty-brown; the basal antennal joint is greenish, the second brown; the mandibles large, light-rusty with a narrow, basal much darker band and entire, dark-rusty-brown ends; the eyes are arranged in a gentle curve as concerns the top four, all equidistant from each other, the sixth 3×as far from the fourth, and below it in a line with it and 3, the 5th behind 6 and 2×the distance from it that 3 is from 4; the colour of the head is a light honey-yellow with a white, subdorsal, narrow band, more or less strongly expressed, this band broadening out and curving round above the mouth opening on each side of the clypeus; after this the labrum and ligula and a space on each side of clypeus above mouth-opening brownish; there may be a dorsal, brown line or even band from hinder margin to apex of clypeus, also the hinder margin of the head may be broadly brown and the neck opening is never without a thin line along it at any time and there is generally a short, brown, carved, dorsolateral line in the middle of the face from above the clypeus-apex down to the level of the clypeus base; the height of the head is 4mm., its breadth 3 mm. The *surface* of the body is transversely lined as usual from hinder margin of each segment forwards, there is a flat, glassy, lateral, tubercular, light-brown spot on the anal segment about 0·01mm. in diameter and several, shining, invaginated, similar tubercles, green in colour, in the dorsolateral region on segments 7-10; there are many, small, green, concave dots or tubercles (?) all over the body, some of which bear little glassy, conical tubercles, each surmounted by an extremely light, fine, erect hair hardly visible even with a lens; some 0.5mm. long, similar, fine, white hairs along the free margin of anal segment. *Spiracles* rather small, oval, flush, yellow; those of segment 12 larger, those of 2 still larger and rounder. *Colour* of larval body is very glaucous, light green, the dots and spots, about from 0.05 mm. to 0.1 mm. apart, darker green; beneath yellowish-green. L: 25mm. when at rest; B: 4mm.

Pupa.—Is rather like that of *Suastus gremius*; the *shape* somewhat stout in the front part where the head is broad with prominent eyes, and slightly bowed, rather square in front and, with segment 2, slightly constricted laterally at hinder margin; the shoulders about the same width as head, then about the same breadth until segment 8 after which the body tapers to the end gradually; the transverse section from segment 3 to segment 12 is circular; the frons is in a plane perpendicular to the longitudinal axis of the pupa, the vertex inclined thereto at an angle of about 30°, with the hinder margin straight; segment 2 a

transverse band, about as long as the vertex of head, with the hinder margin straight and, at the lateral ends, curved strongly forwards to take the upper ends of the ear-shaped spiracle-expansion which is very large; the thorax very little humped, the hinder portion parallel to the longitudinal axis of the pupa, the front portion in a plane very little inclined towards it, the hinder margin a parabolic curve meeting the wings in a very shallow, broadly rounded angle of about 90°; segment 4 rather shorter than segment 2 which is, in its turn, about one-fifth the length of thorax; segment 5 slightly longer than segment 4; segment 6 nearly half as long again; 6 to 11 about co-equal with this last; 12 shorter by about one-third; segment 13 not half 12; the anal segment with the basal half solid, more or less conical, round topped, the diameter at base about equalling the height with the latter half produced out in the same plane as the longitudinal axis of the pupa from its dorsal surface, flat, spatulate, with the suspensory hooklets (here they are simply fine hairs) at the very extremity, the dorsum limited on each side by a prominent ridge which runs backwards, the two converging strongly towards each other towards the hinder margin, the basal, solid portion of the segment with its dorsal surface inclined to the other half very slightly, the ventral portion of the basal half occupied by the scar of the anal prolegs inclined from the perpendicular (to the longitudinal axis) forwards considerably; *head* with the small clypeus triangular, the ligula (?) a small diamond let in between the two halves of the proboscis, this proboscis exceeding the wings and free beyond their ends, though pressed into the surface, as far as the middle of segment 9, slightly thickened before end, the fore and midlegs embraced by the antennæ which are curved in at their ends and reach to about three-quarters the length of wings; the hind legs appearing on each side of the free proboscis-tip, themselves also there free, both between the somewhat produced apices of wings; the antennæ are cross-rayed only on the clubs. *Surface* of pupa rough with transverse rows to each segment of appressed, bristle-like hairs directed regularly backward: some short, erect hairs, fine and longer, on cremaster and all ventral proleg-scars as well as on the head; the segments well-marked. *Spiracles* of segment 2 with a large, ear-shaped (semi-circular) red-brown, slightly raised expansion, its diameter on the common margin of segments 2, 3, its surface shelving to the perforation, near its anterior, lateral corner, with a fringe of stiff bristles lying across the perforation from the portion of the base not occupied by that perforation, this expansion is about as long as segment 2(the length of expansion considered to be transverse to pupal length); the other spiracles very small, shining, raised, roundly oval, darker than the colour of the body. *Colour:* the head green with a shade of brown; the thorax green; the abdomen waxy yellow; the whole covered over with a white, cereous powder. L: 20mm. B: 5mm.

Habits.—This butterfly was discovered in N. Kanara some twenty or more years ago by the writer of these papers sitting on a leaf of *Calamus pseudotenuis*, Becc., a very common species of Cane in the evergreen jungles of the District where it often forms dense thickets that are extremely difficult to get through because of the excessively spiny stems of the plant and its long *flagella* or whip-lash like productions of the stem-sheaths (it is these that are so thorny) that hang down from above in all directions, set at short intervals along their length with a half-ring of three or four very stout, hooked spines that are thick at the base, short and excessively sharp. After that the quest for the larva was a long one and success was a long time in coming. Perseverence, long searchings and a great measure of patience finally brings its reward in everything and so it was here.

The discoveries are chronicled in *Lepidoptera Indica*, vol. X, p. 218 by Colonel Swinhoe published in the year 1912-13. The habits of the butterfly are there given in a condensed form from information gleaned in Kanara. The eggs are laid on the uppersides of leaves, always singly, often on the withered leaves near the ground, as the insect likes dark places for the purpose of oviposition ; although they may be laid on perfectly green, fresh leaves further up where there is plentiful, thick shade from overhead trees. These canes are extensive climbers growing to the height of large trees they find as supports but many seedlings are always to be found which start as ordinary palm-like growths before they begin to climb. The butterfly has never been seen in the open and is impatient of prolonged exposure to sun. It flits about very rapidly in the checkered shade in short flights, settling with closed wings in little spots of sunlight on the uppersides of leaves. It visits flowers sparingly but may be seen sucking the moisture out of bird-droppings that fall on leaves ; but it is at all times a scarce thing to see and its capture is always an event to be remembered. The caterpillars, however, when diligently hunted, are not very difficult to find and the skippers can always be bred from them. Cane withers quickly and, where it has to be brought from a distance, does not last for more than a day or two in a fit condition for food. The larva makes a cell very much like that of *Suastus gremius* but the edge of the cover is always scolloped all round the edge. The original cell, the one made by the egg-caterpillar, is an oblong piece of the edge of the leaf turned over on to the underside and is very tightly closed all round the free margins except at one end next the hinge where the hole of entrance is situated against it. This method of building is kept up to the end except that, of course, finally, the midrib of the leaf is made to serve as hinge ; and, often, this cell is then isolated in the middle of a long length of midrib as the leaf is eaten away completely on both sides ; the side towards the tip of the leaf is often cut off and, in the end, when the time for pupating has arrived, the midrib at the other side is also gnawed through before the final closing of the habitation, with the result that the whole house descends to the ground. Just before the end the lining of silk inside the cell is thickened, both ends are webbed strongly and the larva emits from the body between the prolegs at the sides, a cereous powder which is spread all over the interior both on webbing and lining. The use of this powder is to keep out the damp or wet and it does so very effectively. Canes often grow over nallas and in more or less swampy places so that the cells, when cut loose, drop into water which would in the ordinary course get in and drown the caterpillar. Most of the breeding goes on in the monsoon months and everything, then, in the places where cane grows, is of course extremely wet. The leaves and ground-rubbish get swamped down the hills as often as not and, with

it, the cells that lie amongst it. If one of these is examined it will be found that not a drop of water has got in—they fetch up between stones or amongst heaps of dead leaves left after the flow of water has stopped. One of the most satisfactory ways of collecting specimens is by looking for fallen cells under cane-bushes upon which are the signs of eating. Often they are to be found where they have dropped for, naturally, many escape being flooded away—when they have come from bushes that happen to be situated upon slightly raised ground out of the way of the course of water in the form of moving currents. The style of eating is not at all difficult to recognise for several reasons. To begin with most larvæ make several cells before they are contented, or make several efforts at it, with the consequence that there are generally more than one entire end of leaf upon the ground below—the part cut off beyond the cell. Upon the plant exist the remains of the partially completed ones. Then there are the signs of eating during the caterpiller's whole life—quite a considerable amount; and the remains of the various sized houses it has made as it became larger and larger. One of the best ways to rear larvæ is to tie them out upon cane-bushes under a mosquito net; there they are practically in natural conditions and undisturbed; they make their regulation number of cells and can stick to each as long as they like. In cages in a bungalow the cells naturally wither with the leaf and it is sometimes difficult to keep them, for the larvæ are prone to desert withered habitations and have to make new ones at short intervals. This interferes with their growth and one gets small specimens of the imago. In a cage it is advisable to cut the cells away from the original leaf and pin them on to the new one whenever change of food is necessary as it avoids too frequent disturbance of natural habits. The growth of these larvæ is rather slow and, notwithstanding that Cane is an evergreen plant, towards the end of the monsoon, though there never at any time can be a want of fresh food, they will remain unchanged in the fallen cell for quite long periods before pupating—probably during the quiescent stage of the sap and consequent comparative want of moisture in the leaves. Colonel Swinhoe informs us that the type came from Palawan Island of the Celebes group; that de Nicéville records it from Kanara (the one recorded above), Cachar, the Daunat Range, Burma, Parak and Pulo Laut. And he says "Davidson, Bell and Aitken also record it from Kanara, their specimen, which was submitted to de Nicéville and identified by him, a perfect specimen, has been lent to us for figuring; before seeing de Nicéville's notes in the Journal of the Asiatic Society of Bengal we had come to the conclusion that the two *Pedestes* erected by Elwes and Edwards, *maculicornis* and *fuscicornis*, with recurved terminal crook to their antennæ, were indentical with *Plastingia submaculata*."

Genus 17.—SUASTUS.

Imago.—These are medium-sized butterflies with the coloration always dark-brown on the uppersides of both wings and on the undersides of fore wings; the undersides of the hind wings often washed or covered with grey scales and with black spots between some of the veins. The fore wings generally have subapical hyaline dots and a series of discal hyaline spots.

Antennæ.—Long, nearly two-thirds length of costa of fore wing, the club gradual, the tip shortly bent over.

Palpi.—Upturned, curving over head, second joint densely scaled, the third slender, long and pointed.

Hind tibiæ.—Fringed and with two pairs of spurs.

Fore tibiæ.—With epiphyses.

Fore wing.—Vein 12 ends on costa before end of cell; vein 11 from upper middle of cell and free; vein 5 a little nearer 4 than to 6; vein 3 emitted some distance before end of cell, 2 from well before middle; cell less than two-thirds length of wing; upper discocellular short, distant; middle and lower discocellulars inwardly oblique and in a straight line; costa gently, evenly arched, apex subacute, the outer margin convex; inner margin about as long as outer in male, rather shorter in female.

Hind wing.—Vein 7 emitted slightly before end of cell; 5 not visible, vein 3 from close to end of cell with 2 from one-fourth before end; discocellulars straight, inwardly oblique; costa arched before base, outer margin evenly rounded.

The above description would absolutely suit *Plastingia submaculata* Staud., except that the third joint of the palpus is quite short.

There are two species existing in Bombay, six in British India, the two here being *gremius*, F. and *bipunctus*, Swinh., that are distinguished by the undersides of the hind wings most easily, the former being grey with a number of clearly defined jet-black spots; the latter having that underside slightly ochreous with a single black spot at end of cell.

Egg, larva, pupa and *habits* are only known for *S. gremius* and are all described in detail under that species.

205. Suastus gremius (*F.*).—(Pl. M, figs. 79♂, 79a♀).—Male. *Upperside*: olive-brown. Fore wing with ochreous-white spots, a small one in the middle of the discocellulars, sometimes a minute one above it, three subapical, small spots, the uppermost usually minute; three larger, discal spots in an oblique line, the upper one before the middle of interspace 3, the second somewhat oval and before middle of interspace 2, the lowest about middle of interspace 1; these spots varying a good deal in size. Hind wing somewhat paler than fore wing with a broad, dark margin, being without the long, decument, yellowish hairs that occupy the rest. *Cilia* of both wings brownish-ochreous. *Underside:* grey with a slightly-lilac tinge when fresh. Fore wing with the inner portion below the subcostal vein suffused with blackish leaving the apex broadly grey; the spots showing through from the upperside with the one in interspace 1 blurred, narrower and longer than on upperside. Hind wing clearer grey, sparsely covered with whitish scales, a black spot near upper end of cell with three in an oblique row in interspaces 1, 2, 3 and 6, all ringed with whitish, a white streak along vein 1. Female. Usually paler than the male with the markings similar but the spots on the fore wing much larger, the two upper, discal spots square,

the middle one excavated on the outer side ; two conjoined, large spots at end of cell. Antennæ black, speckled obscurely with white, tip of club dull orange, the underside of it at base and upper end of shaft white; eyes bordered white behind ; body and head above more or less concolorous with wings, the thorax in fresh specimens with a greenish gloss ; the abdomen with obscure, greyish segmental bands ; underneath : the palpi, chest and abdomen and legs grey, the tarsi with an orange-brown tinge. There is only the very slightest fringe of hairs along inner margin of fore wing ; fore wing with ochreous scales at base and broadly along inner margin to the middle on the upperside. Expanse 35-45mm.

The males are almost invariably smaller than the females. In underbred specimens, such, that is, that are starved, the black spots on the underside of hind wing tend to disappear. Amongst many dozens that have been bred in Kanara and elsewhere there was a very large preponderance of females, perhaps four times as many as males.

Egg.—The *shape* is that of a hemisphere more or less, the top somewhat flattened : it stands, besides, upon a narrow, inclined, colouriess rim or foot. *Surface* moderately shining and minutely cellular-pitted as well as extremely finely cross-rayed, the rays being about 0·025mm. apart ; besides, there are thirteen broad, high, meridional ridges from the base to near the apex where they lose themselves in the surface; their greatest breadth is 0·05 mm. which is about equal to the intervals between them at the top where they disappear : they are rounded in transverse section and finely pitted ; the micropyle-surface occupies the apex of the egg and is circular, 0·035 mm. in diameter ; round the base of the egg the ridges are 0·035 mm. apart. *Colour* of the egg is dark red-brown with the meridional rays pure enamel-white; turning black before the larva emerges ; finally whitish. B. 1·5 mm.; H. 0·85mm.

Larva.—The *shape* is that of the *Baoris* group owing to the flat anal segments and the habit of the larva of hunching its body in front and lying closely applied to the resting-surface ; the anal end is broadly rounded, somewhat thickened round the margin and, therefore, depressed just inside the margin, the dorsum being considerably flattened, the dorsal line sloping at an angle of about 20° to the longitudinal axis ; segment 13 is a short, transverse strip ; segment 2 is much narrower than the head as well as thinner all round and is unmarked except for the large, deep-brown spiracles ; the body is stoutest in the middle when stretched and moving but about segment 5 when at rest and hunched up with segments 1-3 contracted, the head laid back. The *head* is more or less oval, higher than broad but, of course more or less truncated across mouth-opening; it is rounded on vertex with the central dorsal line hardly depressed on vertex, the surface is rather distantly pitted ; the clypeus less than one-quarter the height of the face, acutely triangular, slightly longer than broad ; the false clypeus is a narrowish strip outside it, not very distinct, half the height of face, the apex rounded ;the labrum is transverse, red-brown as is the more or less parallel-sided ligula with its deep acutely angled sinus on the front margin ; the mandibles and second, antennal joint are red-brown, the antennal, basal joint light in colour ; the eyes, arranged in a gentle circle of four with the other two far below and behind, are white with the middle two of the curve black; there is a fringe of rather long, porrect, reddish hairs along the edge of the mouth-opening but no others. The colour of the head is whitish remaining pure in a band across face just over the mouth-opening and labrum as well as on the cheeks between a more or less oval patch on each lobe that starts thin on each lobe-vertex and broadens out towards middle, ending at transverse band over labrum and another triangular patch at base of cheeks behind the eyes: both patches being suffused, darkish brown with light spots (not regular) of ground-colour

showing on them ; besides this the hinder margin of head is narrowly darker brown sometimes coalescing with the basal cheek-patch; the central (dorsal) line of head is sometimes ground-colour, sometimes has a dark line down the middle of it as far as apex of false clypeus ; the true clypeus has a fine brown border and there is a chevron-shaped black mark forming the upper half border of the false clypeus over the apex of the true clypeus. The *surface* of the larva is dull, smooth, except for extremely minute, erect, light hairs, visible only along the dorsoventral line where they are a bit longer ; there are six strong, reddish, much longer hairs pointing straight out round the anal margin;the segments are quite distinctly marked with the usual transverse folds on the posterior portions; also the usual hair-tubercles (subdorsal, dorsolateral, supraspiracular, &c.) are present as minute, shining raised ovals which are rather difficult to see; the flat, dorsal surface of the anal segment is minutely roughened-tubercular. *Spiracles* are of ordinary size roundly oval, slightly raised, dark-brown ; those of segments 2 and 12 much larger. *Colour* of body is glaucous-green, spotted all over with small, darker green dots except segments 2, 3 and the anal segment; the anal segment margined round the free margin with whitish and there is a very dark-green, dorsal slightly pulsating, thin band or broad line from segment 4 to segment 13 ; ventrum darkish green. L. 27 mm.; B. 4·5 mm.



Suastus gremius. Cell of pupa on palm leaf.

Pupa.—It is more or less typical in *shape*, slightly bent down at the anal end, the dorsal line from segment 8 to end forming a considerable curve, the ventral line being straight throughout except at segment 13, whence it is also bent: the broadest part of the pupa is at the point of the shoulders whence the breadth decreases very gently as far as the hinder margin of segment 10, thence more rapidly to the extremity of 13 after which follows the still more rapidly decreasing cremaster : this cremaster is more or less triangular in shape and the posterior half is somewhat suddenly narrowed to a conical point, the dorsal surface of the whole cremaster from base to just before the absolute extremity being flat and bordered laterally by a raised ridge ; at the apex of the point—the absolute extremity of the pupa that is—there is a minute truncation and it as well as the lateral surface of the cremaster are clothed with stiff, bristle-like hairs sparsely, the hairs being red, extremely minutely and distantly feathered under a strong lens, reddish in colour and directed backwards: the whole cremaster is red-brown in colour ; segment 13 is, practically speaking, the transverse base of the cremaster and is about half its length, becoming non-existent ventrally segment 12 is about as long as 13 and only little shorter than 11 ; segments 10,9 slightly longer than 11 and very slightly shorter than 6-8 ; segment 5 shorter than 6 and 4 very short—all these comparisons being taken on the dorsal line ; segment 4 in the dorsal line forms part of the dorsal, posterior slope of the thorax and its lateral portions are much broader because of the hinder margin of the thorax meeting the wings in a widely open, rounded angle of about 80° ; the hinder margin of thorax is a gentle curve of less than a quarter circle and a very even curve ; the hinder margins of head and segment 2 (front margin of thorax) are absolutely straight and parallel to each other and throughout at right angles to the longitudinal axis. *Head* is very broad, little less broad than the pupa at shoulders and the front slop of the thorax, the dorsal slope of segment 2 and that of the head-vertex are in absolutely the same plane of about 30°

to the longitudinal axis of the pupa: the head-vertex is more or less flat; the frons, which is in a plane nearly at right angles to the longitudinal axis, is only slightly convex and slightly depressed in the dorsal line; the whole head is slightly constricted behind laterally; segment 2 short: about equal to segment 5 in length, measured on the dorsal line; the thorax is only slightly convex, the apex being close to the front margin whence the dorsal slope to hinder margin is slight and nearly straight. The *surface* of the pupa is dull except on thorax, head and wings which are slightly shining; transversely, irregularly, finely aciculate-rugose on the first three segments, more roughly similarly rugose on the rest; the abdomen and thorax and vertex of head bear a sparse covering of stiff, reddish, simple (under a strong lens extremely minute and distantly feathered) hairs which are directed forwards on the head, segment 2 and thorax and backwards on the other segments; the wings are naked; the proboscis reaches just beyond the hinder margin of segment 8; the bevilled edges of segment 9, 10 (and 8, 11) present nothing peculiar and are all not strongly developed. *Spiracles* of segment 2 rather conspicuous by reason of a strong thickening in the shape of a 1mm. long slightly curved oblong on the front margin of segment 3 which faces slightly forwards and dips into the spiracle-opening, faced, on the depressed portion of the hinder margin of segment 2, by a fringe of stiff, minute hairs which extend back over that opening at the upper end; the oblong is red-brown in colour and tubercular-roughened; the rest of the spiracles are longly oval, not large, slightly raised and very light soiled-yellow in colour. *Colour* of pupa is grass-green on head, segment 2 and thorax and wings; the rest being a very light greenish-yellow. The whole covered over with a white, cereous excreted powder more or less densely. L: 18mm. B: 4mm.

Habits.—The egg is laid on the top surface of the leaf and, generally, near the point or an edge. It is laid single, although, as often as not, two or more are laid on the same plant. The leaves chosen for oviposition are generally such as are neither very young nor too old and tough. In three days' time the young larva eats its way out at the top of the egg making a circular aperture exactly large enough for the big head to come through, when it emerges without ado. It sometimes eats the shell sometimes not, before wandering off down the leaf and, sometimes, on to another. Generally, however, it does not go far but chooses a place at the edge where it commences to eat a short line from the margin inwards for about a distance of its own small length; then another, a short way further on, thus making a short, free, oblong piece which it turns over on to the upper or under surface and fastens down tightly along the long edge, leaving the two short ends free. In this manner it makes a more or less oblong cell in which it takes up its abode and gradually lines thickly and very strongly with a dressing of web—single silks woven in every direction until a very perfect matting or thin cloth is formed. The first stage is passed in this. As it grows, in the second and third stages, it makes a new and larger cell in exactly the same way. In the last but one and the stage before pupation, when it is full grown, it makes the cell much in the same way but uses the whole half-side of a blade or segment of leaf—the term "leaf" is erroneously used above for a segment or blade—for the purpose. At first it ventures only just outside the cell but, later on, as it gets bigger, often wanders

quite a long way to feed. When full-grown and fully fed it makes a cell in a similar fashion but closes it at one end completely and draws the purposely fashioned, jagged pieces of leaf at the other end together loosely; the inside is coated thickly with a carpet of silk, the loosely closed end is spun with a few cross-silks amongst which are incorporated little pellets of the white cereous excretion of the larva; at the closed end of the abode are generally a few pellets of the *excreta* and the discarded skin. The pupa is but very loosely attached by the end of cremaster to the silken carpet, often it is not fastened at all—indeed there are no hooklets existing by which the attachment could be effected in any but a slight way. The egg-larva is generally red, bright red and this red hue subsists up to the end of the second stage and, slightly, into the third; after which a greenish coat is assumed to culminate in the glaucous-green of the mature caterpiller. Prior to fastening up the pupal cell, the larva often still eats a little and, always, gnaws away the blade on each side of the midrib for some way behind as well as the whole portion of the blade towards the tip which then falls to the ground. The midrib still attaching the abode to the plant is then partially eaten through so that, generally, after a bit, the cell, with the pupa in it, falls to the ground where it is often swamped away by rain or blown about by the wind. The mixture of cereous matter with the web in the part of the cell in front of the pupa, the loosely closed end is seemingly designed to prevent the ingress of water which it certainly does most effectually. The rest is too tightly cemented together to let anything in. The genus *Halpe* (at least as composed of the species *hyrtacus*, *astigmata*, *moorei* and *honorei*) adopts a similar method of guarding the pupa against death by drowning for the larvæ of the insects composing it all cut the cells loose from the leaf of the foodplant when about to pupate. The skipper *Suastus gremius* is an insect with a robust thorax and wings well adapted to rapid flight. It *has* a very strong flight and extremely quick as well. It is difficult to follow with the eye when on the wing and never dawdles about or flutters or hovers: it is suddenly there, on a flower or on a leaf and, the next instant, it is gone; the line taken is, as far as can be observed, fairly straight and with very little "skip" in it; although it turns with ease and great suddenness from its course when it so desires. It comes readily to flowers and may also be found, occasionally, sucking moisture on the ground or on the top of a leaf; it is quite commonly found tasting bird-droppings on leaves in the jungles with its long proboscis. It is fond of sunlight though, where possible, the eggs are laid in shaded spots. The male basks with the hind wings depressed horizontally, the fore wings slightly open; but it is not, on the whole, a basking butterfly and is practically never found on the tops of high hills amongst these species that indulge commonly in that habit. The foodplant of the larva consists

of species of palms, and generally, in India, among the indigenous ones, that most affected is the wild date-palm, *Phœnix sylvestris* which is found in many parts of India ; Bengal, Guzerat, Western Peninsula, Coromondel Coast in its different forms : *humilis* from India, China and Cochin China ; *acaulis* in Kanara, North, Central and Western India, Burma ; *robusta* from the Deccan. The distribution of the butterfly is India, Ceylon and Burma.

The larva also feeds upon several of the introduced species of palms, especially commonly on a small, fan-leafed one which is grown in the verandahs of bungalows in Bombay ; also upon the wild *Caryota urens* or Fish-tailed Palm. It is certain to eat others also.

The black spots on the underside of the hind wing of the butterfly may vary in number as, in the dry weather, they seem to be liable to disappear or only exist as small, whitish marks—some, however, are always present. Swinhoe has named what he considers a separate species from Southern India *Suastus bipunctus* from the fact that only two of the black spots are present on the underside of the hind wing. It is quite probable that the form is only one of the dry-weather *gremius*.

The figures of the imago, 79 and 79a of Plate M, are not at all good in the matter of colour although correct in pattern. The female insect, 79a, is the better of the two but the underside—the pair of wings on the right—is too pink and the grey of the hind wing should be quite clear or pure. The male underside, right-hand wings of figure 79, should be similar to the female ; in the picture they are absurdly dark.

206. Suastus bipunctus (*Swinhoe*).—Male and female. *Upperside* : black or very dark blackish-brown. Fore wing with three or four minute, white spots in an oblique line across the disc, varying somewhat in size and number in different examples, one in each of the interspaces 2 and 3 and two towards apex ; in the female the spots are usually larger and the lower spot is quadrate ; but all these spots vary much in size in both sexes in different examples. Hind wing without markings. *Cilia* of both wings blackish-brown. *Underside* : paler than the upperside. Fore wing with the spots as above and a small suffused white space in the middle of interspace 1. Hind wing paler than the forewing, the inner portion suffused with ochreous scales, a dark spot at end of cell and a discal series limiting the ochreous suffusion. Antennæ black with whitish dots on the underside ; palpi, head and body blackish-brown above and below with white hairs on the underside and whitish, segmental bands on the abdomen with a whitish patch at its base ; legs blackish-brown. Expanse 30-35mm.

The habitat is given as Nilgiri Hills and Burma by Colonel Swinhoe from whom the above description has been taken (*Lepidoptera Indica*, vol. X, p. 152). He states that the type is in the B.M. and several examples of both sexes are in his collection from the Nilgiris and in the B. M. from Haundraw, Attaran Valley and the Daunat Range, Burma. A single specimen was caught in Kanara District in the Bombay Presidency but no other has ever been seen. It must be a very rare species in Bombay and nothing is known about the early stages in consequence.

Genus 18.—Arnetta.

Imago.—This genus consists of three species; *vindhiana* from S. India, *atkinsoni* from Sikkim, Assam and Burma; and *binghami* from the Salween Valley and Tavoy in Burma. They are all medium sized butterflies with the appearance of those of the genus *Parnara*, that is olive-brown on the upper-sides with immaculate hind wings and mostly small-spotted fore wings (apical and discal, semihyaline white spots) with the undersides variously suffused in a clouded manner with russet or yellowish-brown and with some obscure whitish dots. *Vindhiana*, the only Indian Plains species is apparently confined to S. India. Swinhoe gives its distribution as follows:—"The type comes from Jubbulpur; Evans records it from the Palni Hills; we took it at Matheran, Lanaoli and Mhow; Betham records it from the Central Provinces; Aitken and Comber from the Konkan; Hampson from Nilgiris and Aitken from Thana near Bombay; the types of *nilgiriana* and *modesta* are from Koonoor." It is quite plentiful, really common, throughout the Surat Dangs and west Khandesh District but has never been seen in the heavier jungle-country south of Bombay in the Presidency, that is in Belgaum, Dharwar or the S. Kanara Districts. In the Surat Dangs a hundred might be caught any morning. They were found there sitting on the ground on dry leaves, blades of grass, &c., and often would get up by the dozen as one walked along under the teak trees. They may be said to live in dry bamboo-growing hilly country. The general flight is very similar to that of *Parnara* as is also the way of sitting; they visit flowers busily and play about much in the same way as the insects of that genus. The foodplants are unknown—if, indeed there is more than one; and this, notwithstanding diligent search in the Dangs extending through weeks.

Antennæ.—Less than two-thirds the length of costa of the fore-wing; club slender, moderately long and with a short, pointed crook.

Palpi.—Palpi porrect, second joint densely scaled, third joint projecting horizontally in front of face, short and obtusely conical.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa opposite end of cell; discocellulare suberect, the lower a little shorter, 5 arising a little below the middle; 3 from one-sixth before lower end of cell; 2 from middle; cell less than two-thirds length of costa; costa gently arched, apex subacute, outer margin convex and about equal to inner margin.

Hind wing.—Vein 7 from close to upper end of cell; discocellulare and vein 5 faint; 3 from close to lower end of cell, 2 a short distance from bass of 3; outer margin evenly rounded.

Egg, larva, pupa.—Unknown. The larva probably feeds upon some coarse grass; but this is only a conjecture.

207. Arnetta vindhiana (*M.*)—Male and female. *Upperside*: Olive-brown with a slight ochreous tint. Fore wing with no fringe of hair on inner margin and none on base of wing or elsewhere; a small, hyaline-white spot at upper end of cell; three subapical, similar dots near bases of interspaces 6, 7, 8 in a nearly straight line downwards and two larger, quadrate spots one immediately below the other and touching, the upper, smaller in base of interspace 3, the other, longer, in the middle of interspace 2. *Cilia* of both wings grey or ochreous-grey with the bases brown. *Underside*: light rusty brownish-grey (Swinhoe calls it "brownish-pinkish-ochreous"). Fore wing: the middle portion from base to near outer margin blackish-brown, spots showing through from upper-side. Hind wing: (the upperside of this is immaculate with longish, brown hairs in cell and on hinder half.) One indistinct, rusty spot at end of cell and one or two more in a straight line above it; an indistinct series of similar, discal spots between the veins well beyond the cell. Antennæ blackish-brown, banded with yellow narrowly on top, completely yellow below and dull

orange-red at tip of club ; palpi, head and body brown above with some ochreous, short hairs ; beneath greyish-white. Expanse 30mm.

All that is known about this species is given above under the genus under "*Imago.*"

Genus 19.—ZOGRAPHETUS.

A genus of four species in British India—there are three more in the Malayan Sub-region. In British India there is *satwa* from the N. W. Himalayas, Sikkim, Assam, Burma ; *flavipennis* from Sikkim, Bhutan, Burma and the Andamans ; and *flavalum* from Sikkim (a unique specimen at the time it was described). The only species that interests us is *Zographetus ogygia* from South India, Burma, Borneo and Sumatra ; the type coming from Sumatra was named by Hewitson. The single specimen that was obtained in S. India came from Kanara and was identified by de Nicéville ; it was caught near the sea-coast in semi-evergreen jungle, about 800′ above sea level during the monsoon. That was many years ago and nothing has ever been seen of it since.

Imago.—The butterflies are rather like *Arnetta* in facies ; are medium-sized and brown on the uppersides with the usual *Parnara*—like hyaline-white spots on the fore wings and occasionally also on the hind wings. Underneath they are all yellow of different shades, rusty or brownish, and have discal, black spots between the veins, variously arranged.

Antennæ.—About two-thirds the length of costa of fore wing, the club moderate, elongate, the point short and crooked.

Palpi.—Slightly upturned, second joint densely scaled, third obtuse-conical.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Males with two pairs of linear, glandular streaks on the upperside ; the upper pair on either side of vein 2, at its bifurcation, the lower two immediately beneath these on either side of vein 1. Vein 12 ends at a little before end of cell on costa ; discocellulars suberect, the lower slightly shorter than the middle one, vein 5 nearer to 4 than to 6 ; vein 3 from near lower end of the cell, 2 close to base of cell ; costa gently arched, apex somewhat produced subacute ; outer margin convex, shorter than hinder margin.

Hind wing.—Vein 7 slightly before one-third before upper end of cell ; 3 from near lower end, 2 from one-fourth before end ; lower margin of cell slightly angled at vein 2 ; outer margin rounded in male, somewhat produced at apex in female.

Egg, larva, pupa.—Unknown.

Habits.—As far as they are known for *ogygia*, these are given above.

208: Zographetus ogygia (*Hewits.*).—Male. *Upperside* : dark-brown. Fore wing with two yellowish-white spots at end of cell, the upper minute ; a larger, subquadrate spot immediately below them in interspace 2 ; a small round spot close outside the junction of the subquadrate spot with the lower cell spot m, interspace 3 ; a small spot above in interspace 6 and two minute dots immediately above it forming the subapical series. Hind wing without markings. *Cilia* white with thin, brown base. *Underside* : paler, of a pinkish-brown colour. Fore wing with its middle narrowly blackish spots as on upperside. Hind wing with a brown spot in cell, another at its end and a discal, curved series between the veins, all very indistinct. Antennæ black, ringed with white, the upper part

of the club white on the underside tip orange-red ; palpi, head and body above and below including the legs, concolourous with the wings.—Female. Like the male but with an additional whitish spot in discal series of fore wing in interspace 1 against the middle of the submedian vein ; and the ground colour of the underside of the hind wing is paler. Expanse 35mm.

Habitat.—Burma. S. India, Borneo, Sumatra.

Distribution.—The type is from Sumatra ; Watson records it from the Chin Hills ; Davidson, Bell and Aitken from Kanara ; it is in the B. M. from Thoungye, Burma; Elwes records it from Pulo Laut and Labuan. (*Lepidoptera Indica*, vol. x, p. 188).

Egg, larva, pupa, habits.—Unknown except as mentioned above.

Sub-family (5)—ERIONOTINÆ.

Imago.—All have the eyes red, a character that lasts for years after death. The subfamily consists of five genera in British India ; *Erionota, Gangara, Pudicitia, Paduka* and *Matapa*. The last consists of medium sized insects, the others comprise some forms that are the largest of the Skippers with others that are well over the medium dimensions. Nearly all, except *Matapa* (with 5 species) and *Paduka* (one species, *lebadea*) males which are immaculate, are marked with exceptionally large, hyaline, discal spots of a generally golden yellow colour (*Erionota attina* only has them grey-white) on the fore wings.

Antennæ.—More than half the length of fore wing, the club gradual, acuminate, the end bent over.

Palpi.— Upturned in front of the face ; second joint densely scaled, pressed close against the face ; the third joint concealed.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ends on costa about end of cell ; 11 free ; the cell comparatively short, 3 from near its lower end, 2 from about its middle.

Hind wing.—Vein 7 from before end of cell, 3 from near end, 2 various ; discocellulars faint, 5 not traceable, outer margin slightly sinuate.

Egg.—Dome-shaped about twice as broad as high with about 40 thin meridional ribs that are difficult to see ; the colour white or pinkish for *Gangara thyrsis* and *Matapa aria*.

Larva.—Somewhat elongated, anal end rounded, head large compared to the neck, heart-shaped or rounded, black or grey (in which case it is spotted-*Paduka*) ; covered (in *Erionota, Gangara*) with a thick coat of cereous excretion which, in the case of *Gangara thyrsis*, takes the form of numerous short threads ; in *Matapa* and, apparently, in *Paduka*, naked, the colour is white or grey ; *Gangara* has red markings under the cereous covering.

Pupa.—Rounded at fore-end but with a more or less conical boss between the eyes in cases (*Paduka* apparently and *Erionota thrax*) ; abdomen elongated with end turned down and a strong cremaster ; the proboscis generally slightly reaching beyond ends of wings free ; in *Gangara thyrsis* of extraordinary length the free portion reaching a length of 30 mm. while the whole length of pupa is only 35mm.

Habits.—The butterflies are all crepuscular ; they fly first thing in the morning or just after sunset in the evening and visit flowers, settling upon them to suck their juices. The flight is rapid and strong and the insects are difficult to follow with the eye on the wing

notwithstanding their large size. They rest in dark places during the day in corners of walls, underneath foliage or in large hollows in tree-trunks and sit with their wings tightly closed over the back. In dark places in the jungles and in groves of palms the butterflies keep on the wing later in the morning and appear earlier in the evening. The eggs are laid on the uppersides of leaves and the food-plants of the larvæ are Palms, Plantains and Bamboos, the last for *Matapa aria*, the first for *Gangara thyrsis*, *Paduka lebadea*; plantains for *Erionota thrax*—belonging to the families *Palmaceæ*, *Gramineæ* and *Scitamineæ*. These larvæ make spiral cells more or less cylindrical in shape in which they eventually pupate, making the first of course small, others to suit their size as they grow. The pupa rattles about violently inside when disturbed or even when the cell is touched; it is strongly attached by the tail and covered with cereous powder. It is doubtful whether any *Matapa* ever occurs in the Plains or away from jungles and hills. *Erionota thrax* and *acroleuca* as well as *Gangara thyrsis* appear, on the other hand, to be found wherever there are Plantains and Palms. It is therefore thought advisable to include the two *Erionota* in the following descriptions although they are not in the original key.

Genus 20.—MATAPA.

Imago.—Five species, all quite immaculate above and below except for an oblique, glandular streak on the disc below the cell of the fore wing in the male, present in all five. They are all medium-sized insects, chocolate-brown or olive-brown in colour on the upper sides of both wings. *M. aria* (M.) is the only one that comes in here.

Antennæ.—More than half the length of costa of fore wing; club somewhat thickened with a rather long, pointed crook.

Palpi.—With second joint densely scaled, pressed against face, upturned; the third concealed.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ends on costa opposite end of cell; discocellulars strongly inwardly-oblique, 5 arising from their junction; 3 from less than one-sixth before end of cell; 2 from a little before middle; lower margin of cell slightly angled at origin of 3; the cell rather less than two-thirds length of costa; costa slightly arched near base, afterwards straight to the slightly produced, sub-acute apex; outer margin slightly convex, about equal in length to the hinder margin in male but shorter than that margin in female which has a comparatively longer wing.

Hind wing.—Vein 7 from more than one-fourth before end of cell with discocellulars faint, vein 5 obsolete, 3 from very close to lower end and almost touching it, 2 from about one-sixth before end, outer margin evenly rounded except between veins 3 and 1 where it is slightly excised.

Egg, larva, pupa, habits.—See below.

209 Matapa aria (*M.*)—Eyes red; Male. *Upperside*: dark chocolate-brown without any markings except the glandular streak on the fore wing which is straight, grey, edged inwardly with dark-brown; the costa above the vein is often strongly light-rusty to about half way to apex on the fore wing and there are some brown decumbent hairs at base of wing and a slight fringe of similar

ones along inner margin. On the hind wing the whole cell and area behind it including the abdominal fold is set with long brown hairs rather thickly. *Cilia* of both wings very light-yellow tinged with orange at anal angle of hind wing and towards apex. *Underside*: Fore wing dark-brown or ferruginous except the middle portion from the base and including the cell to outer margin which is blackish-brown, the inner margin below vein 1 much paler. Hind wing uniformly rusty ferruginous of rather a dark shade. Antennæ black obscurely ringed with greyish above, greyish ringed with black beneath; the club with the end bent over at right angles, the bent-over portion yellow below, dull-orange above. Palpi densely scaled with third joint minute, hidden; separated by the coiled proboscis, brown above ferruginous beneath. Head and abdomen above concolourous with the wings, the collar often ferruginous; thorax and proximal segments of abdomen with long, thick hair; below more or less concolorous with wings, including the legs.—Female. Like the male but paler and more ochreous-brown, the ferruginous of undersides much brighter; the abdomen with ochreous tip. Expanse up to 40mm., the female generally the larger.

Egg.—A low dome in *shape* standing upon a flattened, rather broad, irregularly circular ring which is quite transparent and lies on the surface of the leaf or blade, it is in no way ribbed; the egg is as broad at extreme base as it is for some way up. *Surface* slightly shining with about 40 meridional ribs—it is nearly impossible to count them even with a lens as they are extremely fine and low and only exist from the base up about as far as the periphery of the top third—which are white; the interspaces between them and the top third of the egg are indistinctly and rather roughly or coarsely shallow-cellular, the moderately large, more or less circular, somewhat flattened space round the invisible micropyle being more minutely cellular still. To the unaided eye the whole surface is smooth but is obscured by a thick covering of the scales from the anal end of the butterfly which adhere to the whole surface irregularly in patches of light fawn and dark brown. *Colour*: Somewhat pinkish, soiled and, later on, with some red-orange spots and marks on the upper part. B. 1·8 mm.; H. 0·9 mm.; the transparent, basal rim about 0·3 mm. in width.

Larva.—The body is more or less circular in transverse section—cylindrical in *shape* that is: but it is, of course, somewhat flattened ventrally and is in this case, swollen laterally in segment 12 so that that segment is the thickest part of the body, or looks it; segment 13 sloped dorsally behind segment 12, is convex transversely and about the same length as segment 14 and little shorter than 12; the anal segment is more or less semi-circular and in the same dorsal slope as segment 13—about 30° or more to the longitudinal axis of body; segment 2 has a moderately broad, shining-black collar from spiracle to spiracle interrupted narrowly dorsally as usual, situated just behind the front margin. *Head* is semi-elliptical in shape, only slightly higher than broad (at base: across mouth-opening); the vertex innocent of sinus; the surface shining and shallowly reticulate rugose; the true clypeus triangular, apex acute, one-third the height of face: false clypeus slightly outward-curved as to sides, also triangular with apex acute, about half the height of face; the colour is orange, sometimes with large, black frontal blotch on each lobe reaching from eyes about three-quarters of the way up and conjoined to an apical black blotch on same lobe; the labrum is transverse and not clearly defined, same colour as rest; the lingula is white, translucent circular nearly, with a deep triangular sinus, with a few shining, orange hairs at ends of each lobe; antennal, basal joint is small, sullied, orange, third joint whitish; mandibles dark red-brown; eyes black, four in a slight curve, the three lower co-equal, the top one slightly smaller. *Surface* of larva covered with extremely minute, erect, fine, whitish hairs with a subdorsal and dorsolateral, oval, black dot, both widely separated, as also a supraspiracular ditto to each segment; hairs on segments 13, 14 very much longer and not all of the same length and some somewhat longer

hairs (than the short body-hairs) on the dorsoventral margin and legs ; the segment margins impressed—marked thinly with six parallel, well-separated, thin, depressed lines in front of each. *Spiracles* conspicuous jet black very broadly oval, those of segments 2 and 12 twice as large as the rest, none are small. *Colour* of body is greenish chalky-white with the segment-margins and depressed lines looking conspicuously darker ; ventrum and legs all similarly white. L. 25 mm.; B. over 3 mm.

The 12th segment is not so much broader as higher than the rest of the body; although it is strikingly swollen looking.

Pupa.—The pupa is very similar to that of *Gangara thyrsis* in general *shape* but is without the great length of proboscis that distinguishes that species. It has the thorax very humped and by far the highest point of body at its apex, the portion in segment 4, 5 being lowest, segments 6, 7 being again higher than 4, 5 ; the front slope of thorax, segment 2 and the head-vertex are all in one plane at an angle between 45 and 30° to the longitudinal axis of the body, the hinder slope shorter than the anterior one and ending rather abruptly in a sudden short fall to segment 4, the hinder margin a curve rather longer than a quarter-circle and meeting the wing-lines in an open, rounded angle of about 90°; segment 4 sloping down to segment 5 and only slightly shorter than it, segment 6 double the length of 5; *head* as said, with the vertex dorsal, the frons in a plane perpendicular to the longitudinal axis, both lightly convex, the basis of antennæ slightly prominent, the eyes also very prominent so that the head is slightly constricted behind them, and an unusual, small, rounded tubercle at their interior lower margin, just where the proboscis takes its origin; this proboscis produced free to the end of segment 10 but closely applied to the body ; the part of the body from the hinder margin of segment 10 strongly decurved with segment 11 one-quarter as long again as 12 ; segment 13 a short transverse piece forming the posterior slope of segment 12, or rather the posterior part of the slope of that segment, the anal segment consisting of a short, transverse, thicker base from which the semi-circular, rather thin (ventrodorsally) end piece proceeds backwards, this bearing at its apex a short, oblong projection, the projection being broader than long and being set with a lot of short, orange, hooked shafts at the end by which the pupa attaches itself. *Surface* moderately shining more or less smoothly and covered with a cereous excretion all over, at the most, transversely fine-aciculate, the segments of the body are well-marked, segments 10, 11 being especially tumid-looking; the bevilled margins of segments 8-11 short behind and rather long-sloping in front, not in any way particularly modelled as to surface ; a very slightly roughened, orange more or less oval surface on apex of thorax on each side of the dorsal line and central, nearly touching each other—what for ? *Spiracles* of segment 2 oval, flush, colour of pupa nearly ; rest narrow-oval, dull whitish, not large. *Colour* greenish-white, darker on thorax, sometimes honey yellowish on thorax ; the orange, apical, thoracic, transversely long-oval surface of thorax, the little tubercles at anterior, lower margin of eye and two small tubercles on shoulder (not prominent either) all orange. L. 24 mm.; B. 4·5 mm. at middle of body which equals the H there : H of thorax 5·5 mm.

Habits.—The egg, very large for the butterfly, is laid singly on the top of a bamboo-leaf, anywhere on the surface, chiefly about half way up, rarely near the tip ; the bamboos chosen being generally rather small and on the edge of an opening in the forest, a path for example being a favourite situation and the leaf is generally one from three to six feet from the ground in a shady place under the overhead protection of large trees. The little larva eats its way out through the top, making a large hole of egress because of the large

head ; it does not eat the shell after crawling out of it but walks off, very actively spinning silken steps as it goes, moving the front part of body continuously with the head alternately from one side to the other in the ordinary way used when spinning. Eventually, after wandering about aimlessly to all appearance, it comes to rest at the point where it makes a roomy cell for itself by drawing the edges together from the extreme point backwards. For this purpose, after the first couple of silks have been spun from edge to edge to make a preliminary half-open funnel-shaped cell, it eats away a 4 mm.-broad space from the edge inwards to the midrib and at right angles to the edge and at a distance from the point of anything up to 40mm. It then brings the triangular (more or less) piece of the side thus separated from the main leaf over underneath on to the undersurface of the other side, using the midrib as a hinge and fastens it down all round the edge very firmly by pads and strands of silk ; the inside is lined with a silken carpet and in this large cell the little larva passes its first stage or two. It is bright blood-red when it first emerges, about 4mm. long by 0.75 mm. or less in width with an enormous, black, triangular head which is thick, shining, naked and very slightly bilobed on the rather narrow vertex ; segment 2 is yellowish with the narrow, transverse, chitinized, black collar of the mature larva already existing ; the surface is covered with a few minute, erect hairs and there are some very much larger ones round the anal margin. The little larva—and the big one too, us a matter of fact, behaves in exactly the same way as that of *Gangara thyrsis* ; making, just as that one does, a spiral cell eventually which hangs on to the main part of the leaf by a thin thread of blade left for that purpose. The final cell is thickly lined with silk and the larva leaves it only at night-time or in the dusk of the evening or at or just before dawn in the morning to feed—in dull weather feeding time is prolonged. Pupation takes place in this final cell or one like it in which the silken lining or carpet is made much thicker especially in the transverse lines or steps that always exist inside the houses of these species (*Gangara* and *Matapa*) ; the carpet being thickest at the lower end, *i. e.* the top end really where the head of the pupa is, for the cell hangs down by its supporting thread and the opening, always protected by web spun across, is directed downwards. The pupa is attached strongly to the upper end and hangs head-down and shivers violently when touched producing a loud, rustling noise, exactly in the same manner as does that of *Gangara* although the special adaptation of the proboscis and ventral segments is not present here. The proboscis is closely applied to the ventral segment 9 where there is a depression to receive it but there are no ridges on either surface. The butterfly nearly always emerges towards the small hours of the morning and remains motionless all day until the late afternoon, sometimes taking a preliminary flight after completely hardening.

It is a strong flier, quick and devious, hardly ever flying straight ahead. It is fond of flowers and may be found at them any day in the late afternoons, choosing such as grow close to the ground in very shady places. It often rests on leaves and is easily caught. The wings are held closed over the back and the fore wings do not seem ever to be drawn much into the hinder ones, neither have they ever been observed even slightly opened. This species is very plentiful on the Western Ghats, both above and below, wherever bamboo is found. The larva feeds indifferently on any bamboo—*Bambusa arundinacea*, *Dendrocalamus strictus*, *Oxytenanthera* or *Ochlandra Talboti*, Brandis. The habitat of the insect is India, Ceylon, Burma, Andamans, China, Malay Peninsula and Malay Archipelago. Swinhoe says "the types are marked Bengal; we have it in our collection from the Donat Range, Ataran Valley, Ceylon, Hue, Annam, Brunnei, Borneo, the Philippines, Karwar and many examples from the Khasia Hills of both sexes; Elwes records it from Masuri; Fergusson from Travancore; Betham from the Central Provinces; Aitken and Comber from the Konkan; de Nicéville from Calcutta; J. J. Walker from Hongkong; Wood-Mason and de Nicéville from Cachar and the Andamans." It is also found in the Thana District of Bombay and in Kanara, Belgaum, the western parts of Dharwar and all along the Western Ghats.

Genus 21—GENGARA.

There is only a single species, *thyrsis*, (*F.*). This is figured on Plate N, figures 84 and 84a, representing respectively the male and the female. The figures are rather too dark and, in the male, neither the tufts of hair on the front half of the back of the abdomen nor the tufts on the underside of fore wing in the middle of the hinder margin, extending up to vein 1, are at all evident.

Imago.—Very large, up to 75mm. in expanse, or 3", even occasionally slightly more. Dark glossy-brown on the upperside when fresh, fading with age; the fore wings with three subapical dots and three large, discal ones, all golden-yellow; hind wings immaculate. Underneath it is dark-brown with cloudy powdering of blue-whitish scales on both wings.

Antennæ.—More than half length of costa of fore wing; club gradual, of moderate thickness, the end bent over more or less at a right angle, ending in a fine point.

Palpi.—Upturned, second joint densely clothed, pressed close against the face, reaching just to level of vertex of head; third joint minute, nearly concealed. The palpi are always well-separated by the proboscis.

Hind tibiæ.—Longly fringed and with two pairs of spurs.

Fore wing.—Vein 12 ends on costa before end of cell; cell short and little more than half length of costa, its upper end bent somewhat down; a short internal vein from near base of vein 3; upper discocellular very short, middle and lower strong and in an almost erect, straight line, the lower the shorter; vein 5 therefore nearer to 4 than to 6, strong; 3 about one-sixth from lower end of the cell, 2 from about one-third from base; costa arched at base, then evenly, gently curved to apex; apex blunt, somewhat truncate; wing

long ; outer margin nearly straight from tornal angle to the truncation at apex and shorter than inner margin. In the males on the upperside, there is a glandular streak above the middle of vein 1 and a double streak on each side of basal half of vein 2 ; on the underside there is a patch of erectile, yellow hairs extending from middle of inner margin to vein 1.

Hind wing.—Vein 7 from about one-fourth before and of cell ; upper discocellular faint, erect, shorter than lower which is well developed and outwardly oblique ; 3 from just before end of cell, 2 from before middle ; outer margin sinuous and broadly, shallowly lobed towards anal angle. In the males the lower margin of the cell between veins 3 and 2 as well as the basal halves of these veins are considerably swollen ; on the upperside the wing thickly clothed with long hair from its base concealing the swollen veins.

Abdomen.—In the male with thick dorsal tufts of hair on the two or three proximal segments.

210. Gangara thyrsis, (*F.*)—(Pl. N. figs. 84 ♂, 84 ♀).—Male. *Upperside* dark chocolate-brown. Fore wing with semihyaline, gold-ochreous, quadrate spots ; a very large one filling up the cell near extremity, excavated on its outer side ; another, slightly smaller, filling up the middle of interspace 2 and a much smaller one further out in the middle of interspace 3, slightly irregular in shape ; two small spots before middle of interspaces 7, 8 before apex and close together with another further out in middle of interspace 6. Hind wing without markings. *Cilia* of fore wing brown, becoming whitish towards the hinder margin ; of hind wing whitish throughout, but suffused brown in centre. The fore wing is also provided with long hair on the upperside at base extending outwards along inner margin as a fringe, much longer and thicker in the male than in the female. *Underside:* dark-brown, variegated with a clouding of bluish-grey. Fore wing with some whitish scaling in three patches towards apex ; the hinder marginal space broadly whitish under the tuft of yellow hairs; spots showing through from upper side. Hind wing with the whitish scaling in four more or less distinct, parallel bands transversely across the wing, leaving the abdominal fold mostly unmarked. Antennæ black fading to brown, the club and upper part of shaft beneath greyish, the turned-over part dull-orange. The eyes bright red—Female. Like the male but without glandular streaks or sex-tufts ; the dorsal tufts of hair on abdomen also much smaller ; the truncation of apex of fore wing slightly less defined. Expanse of female up to 80 mm ; of male somewhat less.

Egg.—A nearly perfect hemisphere in *shape*, standing on a narrow inclined (outwards) band that is hardly as broad as the distance between two ribs. *Surface* shining, very minutely punctured rough, generally covered with blackish, dust-like, very fine hairs only visible under a lens ; sculptured with 40 very thin, low, indistinct meridional ribs that go on to the basal band, none of these ribs reaching the actual apex of dome. *Colour.* livid white B: 2.25mm ; H: 1.25mm.

Larva.—Subcylindrical in *shape*, fattest about segment 5 when at rest and slightly hunched; after which the diameter decreases little to the anal end which is still high at 12, sloping afterwards to the broadly-rounded end of segment 14 ; prolegs short : *head* more or less triangular in shape, the face convex, broadest at base, the apex narrowly rounded ; the surface of the head is cellular-rough, the cells flat-bottomed with very thin walls that are also very low ; on the cheeks above the eyes and upwards to vertex there are little tubercular points, longest on lower cheeks but never even then as high as a diameter of one of cells of the roughness ; there are many soft, light-coloured, decumbent hairs all over, all pointing downwards but these are not easily visible ; true clypeus long-triangular twice as high as broad, the sides slightly concave-curved in about the middle, the apex acute with a slight medial ridge from it to base in dorsal line ; false

clypeus, if present, not visible; labrum short, lozenge-shaped, transverse, whitish; yellow ligula rather large and circular with the frontal sinus triangular and deep, brown-shining; both antennal joints brown; eyes arranged with the three uppermost, numbers 1, 2, 3, equidistant from each other in a slight curve, number 4 twice as far from 3 as 3 is from 2, number 5 the same distance from 4 and behind it, 6 forming the apex of an equilateral triangle with 4 and 5; colour of head dark-chocolate brown but always covered with a thick coating of white powder which completely conceals the surface. The height of the head is 6mm. and the breadth at base is about 5mm. *Surface* of body slightly haired with short, erect hairs that are longest along the dorsoventral margin; this surface exuding a cereous white secretion all over that forms long threads of a flaky looking consistence that completely hide the surface of the body; this excretion is easily removed by the touch and is not formed if the caterpillar is in bad health; it forms in bunches of threads everywhere except on ventrum and is densest, thickest on segments 3 to 5 and 12 to 14. *Spiracles* not possible to see because of the dense coating of white powder. *Colour* of body rose-brown, even reddish dorsally except on segments 2, 3 where it is sea-green like the ventrum and spiracular region. L: 45mm; B: 7mm at thickest part.

Pupa.—This is rather abnormal in *shape*: the front rather exceptionally humped at thorax and stout, or appearing such because the abdomen is rather elongated; the thorax is quite evenly rounded; the head without protuberances, the dorsal constriction behind thorax slight, the shoulders very slightly convex prominent with the lateral outline behind them as far as 8 very shallowly concave; the *head* is somewhat narrow with prominent eyes, narrowing very slightly backwards; the vertex is inclined at about 45° or less to the longitudinal axis of body, the frons, about as long as vertex, is perpendicular to the axis and rather convex, the convexity somewhat flattened, low; the clypeus is semicircular, the eye-crescent linear; the fore legs reach middle of wings, the mid legs reach three quarters the length of wings; the antennæ are somewhat longer than mid legs and have the clubs prominent and cross-rayed; the proboscis is extremely long, free beyond the ends of wings and there curled into a spiral of one and a half convolutions reaching sometimes, even thus curled, the end of the body, the free portion, if stretched out, sometimes reaching 30mm. in length; the whole proboscis, in one case, reached, measured from base to tip, 47mm; the free portion of this proboscis runs in a groove in the middle of ventrum of segment 9 and on each side of this groove are two transverse, short ridges abutting immediately against the proboscis; a similar arrangement is situated on segment 10; the proboscis-sheath is transversely ridged completely round and very closely throughout the free portion, these ridges being quite sharply prominent where the proboscis passes between the large ridges of the ventrum of abdomen in the groove and, when the body is suddenly bent down, as it is when the pupa is touched, a hissing sound is produced by the arrangement; the proboscis is more or less rigid from end of wings to the end of segment 10, fitting closely into the grooves of 9 and 10 after which it sweeps out into the curve and is much more pliable; segment 12 is also abnormal:—it is as long as 11 and the dorsoventral edge beyond the spiracle is produced outwards and backwards into a strong, conical tooth that really includes segment 13 which is a very short transverse piece in a plane nearly at right angles to the longitudinal axis of pupa; the pupa is as broad at the hinder margin of 12, therefore, because of these teeth, as anywhere else; segment 14 is all cremaster, about as broad as one-third of 13, oblong or slightly oval-truncate, as long as 12+13, down-curved, deep at base coming to an edge at hinder margin, concave dorsally, the concavity bounded by well-defined, sharp edges, the sides perpendicular to dorsal portion; the ventral aspect flat also, the hinder margin somewhat concave, emarginate and set with a bunch of closely-packed hooked shattlets that are very short and dark-rusty in colour; segment 2 is a transverse piece, straight on both margins, rather longer than the vertex of head with a dorsal inclination to axis

of about 40°; thorax about 3 × the length of segment 2, evenly rounded, not very prominently humped, the apex about half way between front and hinder margin (a little nearer the hinder), the hinder slope rather less than the front slope, the hinder margin equilaterally triangular with apex rounded, the sides meeting wings in an angle of about 45°, this angle deep although rather widely rounded; the dorsal outline after thorax and the ventral outline as far as segment 11 are practically straight; the segments are all well marked. *Surface* dull except on head, thorax and wings where it is shining, slightly transverse-aciculate; segment 10 with two thin, brown ridges parallel to each other and to front margin near that margin with another, shorter, near middle of segment; the former two straight dorsally but curving back laterally and then forwards in front of spiracle; segment 11 similarly ridged but without the one in middle of segment; segments 12 and 13 with each a ridge close to front margin; all three segments (10, 11, 12) with hinder margin slightly raised, dirty, wrinkled, segment 13 with it clearly ridged; veins of wings slightly but obscurely prominent. *Spiracles* of segment 2 longly-oval, light-brown; others narrow, three times as long as broad, light-yellow, each about one-sixth of a segment-length. *Colour* soiled light brownish-yellow except on head, thorax and wing which are clear, watery light-green. L: 35 mm; of which cremaster is about 3mm.; B: 8mm. at shoulders, 6 mm. at head, 7·5mm. at middle.

The whole pupa is covered with a thick coating of white, cereous powder that is also spread over the inside of the cell.

Habits.—The egg is laid on the upper surface of a leaf; the little larva, emerging, makes a shelter by turning over a triangular portion from edge of leaf and makes a more or less tubular cell of it, generally at the tip. Later on it uses the whole leaf-breadth and makes a spirally-coiled cylinder inside which it pupates. The pupa is strongly attached by the tail and shakes itself violently up and down as well as sideways when disturbed producing a rattling noise against the cell-surface, augmented by the hollowness of cell, besides hissing as stated above. The vibrations of the "rattling" are very rapid. The larva lies inside the cell with its head turned on its side when at rest; moves sluggishly at all times and grows rather slowly. The butterfly flies very fast and is on the wing at dusk and at the first dawn, visiting flowers busily upon which it settles to suck the juices. It rests in dark places during the bright daylight. The larva feeds upon *Palmaceæ* and has been found on Canes, Cocoanut palms, Fish-tailed palms and others. It exists wherever its food is found. The habitat of the butterfly is India, Ceylon, Burma, the Andamans, Malay Peninsula and the Malay Archipelago. It is a common species everywhere it exists.

In the pictures of this insect in Swinhoe's *Lepidoptera Indica*, vol. X, pl. 735, figs 1, 1a and 1b. there is no sign of any spot on the upperside of fore wing in the middle of inter space 1, whereas, in very many of the specimens bred in the N. Kanara District of the Bombay Presidency, there is such a spot, similar in colour to the others, varying in size from a mere dot to an obliquely-placed oval of 2mm. in length by about half the width, slanting outwards, situated just above and touching vein 1 in the direction of a line passing along the outer margin of the upper large, discal spot and along the inner margin of the lower spot.

The larval cell is made by cutting or eating a piece out of one-half of the leaf from the edge to the midrib and at an angle of 45 degrees to the midrib from above downwards, then in a concave curve outwards to or nearly to a point on the same edge at right angles to the point where the slanting line hits the midrib; the very edge of the concavity is then brought up against the underside of the leaf by degrees by starting weaving ropes across the corner where the slanting line meets the concave edge, continuing outwards with the effect of bending the leaf until the cell-cylinder has its longitudinal axis at right angles or more to the basal portion of leaf. The lower end of the cylinder is left open, the inside is covered with a thin carpet of web; until, before changing to the pupa, the larva more or less closes it by spinning more silk-ropes across the entrance; it also coats the inside with powder. Sometimes, after the cylinder is made, the midrib is nearly gnawed through and the leaf is eaten through all round the cover (so to speak) so that the whole cell hangs just by the midrib which connection occasionally separates with the result that the house falls to the ground.

There is another genus *Erionota* with two species, *thrax*, (L.) and *acroleuca*, (Wood-Mason and de Nicéville) which may be considered to be butterflies of the Plains as they have been found at Kolar (*acroleuca*) and the other in the Dun—this latter being hardly,however, plain country. The genus has much the same characters as *Gangara* but the males have no sexual marks to distinguish them from the females. The larva appears to be similar to that of *Gangara* in that it is white, is covered with a waxy powder and makes a spiral cell. The food of the caterpillar of *thrax* is said to be plantain leaves, the wild or cultivated *Musa*, botanically belonging to the same family, *Scitamineæ*, as the Gingers.

The following is taken direct out of Swinhoe's *Lepidoptera Indica*, vol. X, pp. 157 to 159 :—

Erionota thrax. (*L.*)—Male. *Upperside*: chocolate-brown with an ochreous tint. Fore wing with three large, semihyaline, ochreous spots of which one is semiquadrate with its outer edge excavated, filling up the outer part of cell but not reaching its end; another, longer, quadrate spot filling up the middle of interspace 2, sometimes with even sides, sometimes one or other or both sides excavated; much smaller spot of irregular shape before the middle of interspace 2. Hind wing without markings. *Cilia* of both wings grey. *Underside*: pale chocolate-brown, spots of fore wing as above, the inner part of the wing suffused with blackish-brown; the hind wing generally uniformly coloured, sometimes with some indistinct, brownish suffusion on its inner portion.—Female. Like the male but larger. Antennæ black, the club greyish white on the underside; head and body above and below and legs concolorous with wings. Expanse up to 80mm.

Larva.—White covered with a waxy powder and has a black, heart-shaped head. It lives in a shelter made of a portion of a rolled-up leaf. To make this shelter it has to cut into the edge of the enormous leaves of the wild or cultivated *Musa* or plantains, to obtain a suitable segment to be rolled up.





1a.

1.





1b.



1c.





2a.





2.

2b.

2c.



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1. Natrix nigriventer. 2. Natrix gilhodesi.

TWO NEW BURMESE SNAKES.

BY

F. WALL, C.M.G., K.H.S., COLONEL, I.M.S.

(*With a Plate.*)

In a small collection of snakes sent to me from Huton, Bhamo District (30 miles north-east of Bhamo ; circa 4,500 feet ; Lat. circa 97° 33 ; Long. circa 24°·24), I find two species that are new to Science. I propose to call one of these after the Revd. Father Gilhodes, to whom my thanks are due for the specimens, all of which were collected in June 1924.

Natrix gilhodesi spec. nov.

No less than six specimens of this well defined species came to hand. That selected as the type may be described as follows.

Length— ♂ 518 mm. (1 foot 8½ inches) ; tail 175 mm. (7 inches).

Lepidosis—Rostral : Depth about three-fourths its breadth ; hardly visible from above; the rostro-internasal, and rostro-nasal sutures subequal, and longer than the rostro-labials. *Internasals* : Two; truncate anteriorly ; the suture between them slightly less than that between the praefrontals. *Praefrontals*; Two ; the suture between them hardly half the length of the frontal. *Supraoculars* : Length rather less than the praefrontal and internasal taken together, three-fifths the parietals. Breadth about two-fifths the frontal along a line connecting the centres of the eyes. *Frontal* : Length rather greater than its distance to the end of the snout, two-thirds the parietals. *Nasals* : Divided. *Loreal* : Three-fifths the length of the nasals. *Praeocular* : One. *Postoculars :* Three. *Temporals* : 2+1+2. (In all other specimens 1+1+2.) *Supralabials* : 9 ; the 1st and 2nd touching the nasals ; 4th, 5th and 6th the eye ; 7th and 8th the anterior temporal. *Infralabials* : 7 ; the 5th, 6th and 7th touching the posterior sublinguals. 7th about three-fifths the length of, and rather broader than the posterior sublinguals. *Sublinguals* : Two pairs ; the posterior rather the longer and separated by 1+1+2 scales, succeeded by a narrow 1st ventral. *Costals* : In 19 rows two heads-lengths behind the head, 19 at midbody, 17 two heads-lengths before the vent. The reduction of rows from 19 to 17 takes place about three or four heads-lengths behind midbody, and is due to the fusion of the 3rd and 4th rows above the ventrals. Keeled to the penultimate row at midbody. Slightly emarginate apically. No lateral facets. Vertebrals. Breadth about two-thirds their length, three-fifths the ultimate row. Ultimate row. Breadth about two-thirds their length. *Ventrals* : 157. *Anal* : Divided. *Subcaudals* : 110, divided.

Colouration—Dorsally dark brown, with an ill-defined, reddish stripe on the 5th and 6th rows above the ventrals where the rows are 19, and on the 4th and 5th where 17. This begins near the neck and ends at the vent. Ventrally whitish, the edges of the ventrals brown as on dorsum. Top of head dark brown leaving an interrupted white moustachial stripe., which is continued interruptedly to the side of the neck. In general appearance it reminds me forcibly of *Natrix khasiensis*.

Dentition—Maxillary 26, anododont, syncranterian, coryphodont; the last three teeth distinctly enlarged and subequal. *Palatine* : 15 on left side 16 on right; anododont, isodont. *Pterygoid* : 27 left, 15 right; anododont feebly kumatodont. *Mandibular* : 30 on left side, 29 right ; anododont, feebly kumatodont.

Remarks.—The other five specimens agree except in the following points :— The ventrals vary from 147 to 157, and the subcaudals from 97 to 110. In all

the temporals are 1+1+2. In one specimen there are dubiously two praeoculars. One has only two postoculars on both sides and another on one side only. The 4th and 5th supralabials are confluent in one example, making the total 8, of which the 4th and 5th only touch the eye.

The greatest length is that of a ♀ *viz.* 530 mm. (1 foot 9 inches) ; the tail 17 mm. (7 inches). The colour in one has a marked ruddy tinge dorsally. One measuring 478 mm.(1 foot $6\frac{7}{8}$ inches) was egg-bound, and contained one elongate egg 31×6 mm. ($1\frac{1}{4}\times\frac{1}{4}$ of an inch).

Natrix (?) *nigriventer* spec. nov.

This species is represented by a single specimen which is probably juvenile Being unique and small I have preferred not to risk damage to it by an investigation of the maxillary teeth, but place it provisionally in the genus *Natrix*. It was captured in June 1924 at Huton, Bhamo Dist. *Length*. 318 mm. ($12\frac{1}{2}$ inches); tail 112 mm. (4 inches).

Lepidosis.—Rostral: Depth about three-fifths its breadth ; hardly visible from above ; the rostro-nasal and rostro-labial sutures equal, and rather greater than the rostro-internasals. *Internasals*: Two; truncate anteriorly. The suture between them equal to that between the praefrontals. *Praefrontals*: Two. *Supraoculars*: Length a shade less than the praefrontals and internasals taken together, rather less than the frontal, three-fifths the parietals. Breadth about two-fifths the frontal along a line connecting the centres of the eyes. *Frontal*: A little longer than its distance to the end of the snout, two-thirds the parietals. *Nasals*: Divided. *Loreal*: About three-fourths the length of the nasals. *Praeoculars*: Two. *Postoculars*: Three. *Temporals*: 1+1+2. *Supralabials*. 9; the 1st and 2nd touching the nasals; 4th, 5th and 6th the eye ; 7th and 8th the anterior temporal. *Infralabials*: 7 on the right side; 8 on the left, the last about half as long and about as broad as the posterior sublinguals. *Sublinguals*: The posterior pair rather longer than the anterior, and in contact with the 5th, 6th and 7th on the right side, the 6th, 7th and 8th on the left. Entirely separated by 1+3 small scales which are succeeded by a pair before the 1st ventral. *Costals*: In 17 rows in the whole body length; keeled to penultimate row at midbody ; emarginate apically ; with no.(?) lateral facets. Vertebrals. About three-fifths their length, three-fifths the breadth of the ultimate row. Ultimate row. Breadth of scales subequal to their length. *Ventrals*: 157. *Anal*: Divided. *Subcaudals*: 127. Divided. *Colouration*: Dorsally blackish-brown. A dull ochraceous stripe on the 5th row above the ventrals, interrupted to form a macular chain in the neck and forebody, and continuing on to the base of the tail. A largish, ochraceous spot behind the 9th supralabial not meeting its fellow over the nape. Ventrally uniform blackish-brown with throat and chin dirty yellowish mesially. Head blackish above with obscure lighter vermiculations. Upper and lower labials with blackish posterior margins. A dull ochraceous oblique streak on the posterior temporal, and upper half of last labial.

NOTES ON CHAROPHYTES FROM GONDA, U. P.

BY

G. O. ALLEN, I.C.S.

(*With 5 plates.*)

With such a brief acquaintance with this group of plants I have only ventured to publish these notes in the Journal from the fact that nothing of the sort has previously appeared therein. The occasion may perhaps be opportune owing to the recent publication by Mr. James Groves, F.L.S., the well known expert on this group, of a paper " Notes on Indian Charophyta " in the Linnean Society's Journal (Botany vol. xlvi, April 1924). This will be of the greatest value to any who have studied these plants at all out here and will no doubt stimulate fresh interest in them. The key to the Indian species will also prove of much assistance, particularly in a country where botanical literature is often not readily available.

In the Introduction to "British Charophyta" by Groves and Bullock-Webster there is a remark that " it may be safely conjectured that the majority of well informed people are not even aware of their existence." If this is the case in England it applies with still greater force, I imagine, to India where comparatively few have any out-door tastes other than games and sport. It will be obvious that the following notes are meant as an elementary introduction for those who are more or less unacquainted with the subject and as a record of a few personal observations.

It will be as well to commence by touching briefly on the general features of these plants, generalisations being meant to apply to species found in India. They comprise a small group of cryptogams of entirely aquatic habits and can be fairly easily recognised at sight by their green colour (though this is sometimes rather obscured by incrustation of lime) and the whorled arrangement of the branchlets. Their structure is so unique as to separate them off clearly from all other groups of plants and botanists have now elevated them, though so inferior numerically, to equal rank along with the four great divisions of the vegetable kingdom.

Beautiful as many of these plants are to the naked eye it is not until they are seen under the microscope as well that their full charms are revealed. It is this combination of field work with plenty of scope for examination at home that makes their study so attractive. Judging from the paucity of published records these plants seem to have attracted singularly little attention as yet from botanists in India with the result that there is a wide field for interesting " finds ". Of several recorded species further material is badly needed for expert examination. The total number of species recorded in the world is estimated to be not much over 200. This neglect in India may doubtless be partly attributed to their having, so far as I am aware, no economic value as yet and partly also to the scarcity of literature on the subject (most of which is unfortunately in German) and the consequent difficulty in identifying the different species. The work referred to above, British Charophyta, (by the Ray Society) will be found extremely useful even for Indian workers, the Introduction being particularly instructive. It also contains a full glossary of terms used in connection with this group. I may mention here that I shall be glad to receive specimens from any locality and send others in exchange and at the same time render any little assistance that I can.

Among the most striking characteristics of this group are the simplicity of their general structure and the large size of their cells, which incidentally show cyclosis extremely well, combined with the extremely complicated structure of

the reproductive organs. It is this latter peculiarity which is the main ground for their separation from the Algae,the division to which they are otherwise most allied. A remarkable fact about the oogonium (the female organ) differing as it does from that of any other plant is that it has persisted in its present form from at least Oolitic, if not Carboniferous times. Owing to the affinity of these plants for lime numerous fossil fruits and also parts of stems of various species of *Chara* and also of a *Nitella* have been found in a wonderfully good state of preservation, considering the frail nature of the plant in the living state. The study of fossil Charophytes is only in its infancy. Use has been made of them for zonal work.

Charophytes are partial to still or very slowly running clean and usually shallow water. They are always entirely submerged except where by accident they may find themselves in a rapidly drying pool but they do not flourish out of their element. Where they occur they often form the chief feature of the aquatic vegetation of the spot. They are partial to sunlight. The Charas in particular often grow in great dense masses. Charophytes however are not adapted to put up much of a fight against more aggressive types of water plants though the incrustation of lime which is a common feature in some genera is considered to be an effort on the part of the plant to strengthen its position in life. The large shallow open jhils of Northern India appear to be well adapted to the needs of these plants while flooded rice fields appear particularly favourable surroundings for the smaller species. The more vigorous growers often suffer from overcrowding, finer specimens being obtained where the plants have more room to spread themselves.

A few hints on collecting may not be out of place, Charophytes prefer to grow as a rule in soft mud. Wading is the best means of gathering them, a method often quite feasible in Indian waters. Where the water is deep the grapple and line may have to be resorted to but this is apt to cause much damage to the material collected and entails much patience in disentangling the frailer species. Good specimens in fruit should be carefully selected and dug up entire by hand. They should then be washed gently in order to remove the larger portions of extraneous attachments, the fine mud from the rooting portion being easily separated by gentle hand pressure while the plant is floating in the water. They should not be jumbled up anyhow but the more delicate kinds brought home in glass tubes filled with water and the larger ones either in an earthenware pot with a large mouth or in a vasculum of the ordinary type. In the hot weather they shrivel up extremely quickly if not kept in water. The assistance of a companion often comes in handy for carrying the pot as both hands are generally wanted for the preliminary process of cleaning and gathering and when wading there is nowhere to put anything down. The importance of obtaining some ripe fruit cannot be insisted on too strongly as it is sometimes practically impossible to determine a species with any certainty without an examination under the microscope of the ripe oospore the membrane of which often bears a characteristic design. In the case of dicecious species specimens of both sexes should of course be taken. On getting home it is as well to go through ones gatherings carefully as a delicate species whose presence is unsuspected may sometimes lurk among the stouter kinds.

Specimens which it is desired to mount dry should be dealt with as soon as possible. The gathering should be placed in a white basin and the selected portions there freed as far as possible from Algae and other forms of "rubbish." The very robust species can then be arranged on mounting paper and the surplus water allowed to drain off. It is not always desirable to separate each stem, often a most tedious task : a loose clump arranged in as natural a position as possible generally best illustrates the manner of growth. They should be covered with a piece of clean linen or calico to prevent the plant adhering to the drying paper. A few sheets of newspaper serve the purpose of drying paper

Fig. 1.

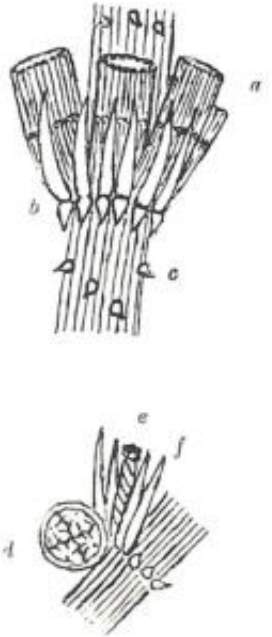


Fig. 2.

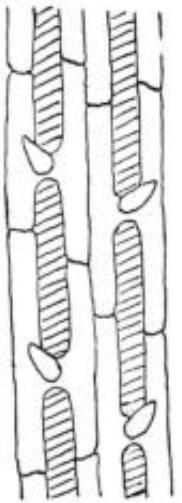


Fig. 3.

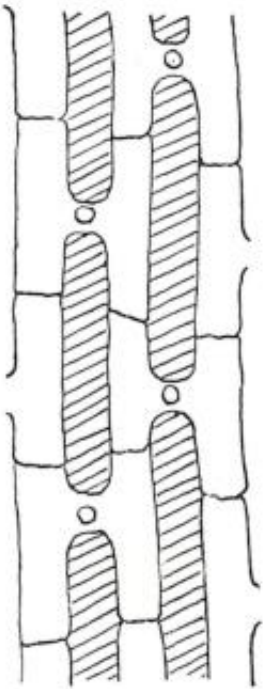


Fig. 1. *Chara brachypus*—*a*. branchlet ; *b* stipulode ; *c* spine ; *d*. antheridium ; *e*. young oogonium ; *f*. bract cell. (Note.—*Lowest branchlet segment very short ; a characteristic feature of this species*).

Fig. 2. *Triplostichous* stem-cortex—Primary series bearing spines shown shaded.

Fig. 3. *Diplostichous* stem-cortex—Primary series bearing nodes (no spines shown) indicated by shading.

extremely well. Some weight should be placed on the plants according to the nature of their build. Some of the stouter Charas require very considerable pressure, the delicate Nitellas only a little. The secret of success is to remove the linen at latest the next day. The old newspaper is then replaced by dry pieces, the plant being left as it is on the white paper mount. Even with the robust forms a little manipulation with the needle either before pressing or an hour or two later when the plants are half dry will often improve the arrangement but in the majority of cases and especially with the delicate forms such as Nitellas a different procedure has to be adopted. After being cleaned in the same way the specimens must be floated on to the mounting sheet which should be supported on a sheet of perforated zinc, a most valuable aid in getting the plants to assume a natural position. A small oblong zinc tank with sloping sides about three inches high and just large enough to enable the perforated zinc to be easily removed considerably adds to ones comfort. The water should not be deeper than is really necessary. This process is occasionally rather a tedious task but the beautiful results that mayoften be obtained in this way fully repay the trouble bestowed. The rest of the procedure is the same as already described.

A few Nitellas have a mucilaginous jelly-like coating over them, particularly over the younger shoots and even the Charas sometimes have sticky globules of Algae firmly adhering to them. In such cases a piece of oil cloth must be substituted for the linen. This jelly coating presumably serves to protect the young parts and reproductive organs in some way. When one comes to mount for example a specimen of *N. hyalina* one finds it a mass of particles of dirt which it is very difficult to detach.

After the drying is completed with several changes of newspaper the plants can be secured to the mounting sheet by little pieces of transparent gummed paper. Nitellas are often sufficiently fastened by the pressure during drying and require nothing further. A safer method, though it takes much more time, is to paint over the plant with gum and then turn the whole sheet over on top of the final mounting paper and detach the original sheet, damping the back of the latter in places if found necessary for its removal. I have not personally tried this method but beautiful mounts are thus obtainable and unless very carefully stored and handled specimens only fastened with gummed paper are likely to get damaged. Each sheet should have a label attached and a number assigned for each separate gathering.

What is not required for mounting dry can either be grown in glass jars for purposes of observation or to obtain ripe fruit or if already in this condition some may be kept in tubes of weak formalin for mounting portions as microscopical slides or as a reserve for distributing or exchanging specimens. Immature specimens as well should be mounted dry and some kept in fluid.

Lime incrustation sometimes assumes a curious form. In some Charophytes especially Nitellas and the ecorticate Charas, though I have found it also in *C. zeylanica* a corticate species, the incrustation is annular. This takes somewhat different forms : in some the bands are wide, in others mere rings.

Ordinarily a 2 per cent. solution of formalin is quite strong enough for preserving Charophytes satisfactorily. This is readily made by mixing one part of the usual 40 per cent. formalin with 19 parts of water.

In mounting for the miscroscope it will often be necessary to soak the selected portion for a few minutes in dilute nitric or hydrochloric acid to remove the lime. This destroys of course the beautiful green colour of the plant but it is often impossible to make anything of the structure without the specimen being subjected to this process. After the acid has been washed away with water the specimen must be carefully cleaned with a camel's hair brush to remove the Algae and multifarious small animals that often infest these plants. When the portion being mounted has ripe fruit on it the greatest care has to be

taken not to dislodge it as the ripe oogonia are only loosely attached at this stage. Plants in this condition are frequently very dirty but it is often better not to attempt too much cleaning rather than risk spoiling the specimen. Very delicate attention with a fine brush and the needle is all that can be done. (It is desirable of course to mount specimens in different stages : for it is often much easier to make out the structure with young shoots.) The specimen can then be mounted straight away in formalin or more satisfactorily in dilute or pure glycerine. A mixture of equal parts of glycerine and water is often employed. With the more delicate species much care has to be exercised in adding the glycerine to avoid the cells collapsing. This is a matter of experience. It is safer as a rule to let the object soak for twenty-four hours at a time in successively stronger solutions of glycerine. This may be effected by mounting in formation and putting a drop or two of glycerine on the slip on either side and leaving it to find its way gradually under the cover glass : when this soaks in as the formalin dries up more glycerine can be added in the same way. A mixture of one part rectified spirit, two glycerine and three water often works well as a start. The mounts can then be sealed in the usual way with gold size, either a built up cell being employed or in the case of stout specimens vulcanite or rubber ones. It is not of course necessary to seal up the mounts if they are not likely to be constantly removed from place to place. The specimens may be simply kept soaked in glycerine with a cover glass lightly placed on top. This enables them to be freely examined at any time though dust cannot be easily removed from the cover glass.

Before commencing to describe the different parts of a charophyte I insert here a simple guide to the genera found in India as reference will be made to it in what follows :

NITELLEÆ—Coronula of ten cells in two tiers ; branchlets usually furcate : ecorticate.

1. *Nitella*—Antheridia apical in the furcations (several species).
2. *Tolypella*—Antheridia lateral at branchlet nodes (three species).

CHAREÆ—Coronula of five cells in one tier.

3. *Nitellopsis*—No stipulodes : branchlets of two or three very long segments : very long bract cells (one or two to the branchlet) : ecorticate : (one species).
4. *Lychnothamnus*—Long stipulodes : stem corticate, branchlets ecorticate : gametangia side by side, one oogonium between two antheridia : (one species).
5. *Chara*—Stipulodes always present, sometimes rudimentary : branchlet, never furcate : stem and branchlets either corticate or ecorticates oogonium above the antheridium : (many species).

It will be seen from the above that Charophytes are divided into two families the *Nitelleæ* and the *Chareæ* which are distinguished by the nature of the coronula (a little structure crowning the oogonium) though the two chief genera, *Nitella* and *Chara*, will be readily recognised by other characteristics. The other three genera differ so markedly from *Nitella* and *Chara* that it will be as well for the most part to describe them separately. Up to the present sixteen species of *Nitella* have been recorded from India, fifteen of *Chara* and three of *Tolypella* while the other two genera comprise but one species each.

The most important parts of the plant to be studied, under the microscope in particular, are the stem, the branches, the stipulodes, the branchlets and the reproductive organs.

Branches.

There will be no difficulty in recognising the fact that the stem consists of nodes and internodes. At the nodes are produced the branches, usually one at a node

in *Chara*, two in *Nitella* and several in *Tolypella* : they resemble the stem and are of unlimited growth. It is at the nodes also that the whorls of branchlets are given off and at the base of these latter the stipulodes if present are found. The reproductive organs are borne on the branchlets.

Stipulodes.

The stipulodes may be considered first. They are one celled organs, varying much in size from mere rudiments to a substantial length, though always much shorter than the branchlets, and form a single or double circle which will easily be made out under the microscope. It is important to note that stipulodes are only found in *Lychnothamnus barbatus* and all species of the genus Chara. It will be seen that for the purposes of classification the primary division of this genus is into those species with one and those with two circles of stipulodes. Where there is a double row the upper one points upwards and the lower one downwards. Normally the number of stipulodes where the circle consists of two rows is in each row double the number of branchlets while if there is only a single row the number may be the same as or double the number of branchlets. It may not be always easy at first to make out the number but for purposes of identification it is ordinarily sufficient simply to determine whether the row is a double or a single one. (See plate I Fig. 1.)

Stem.

In treating of the stem we come to one of the most characteristic features of a charophyte, namely the cortex. This calls for close study as much of the classification of the genus *Chara* is based on it and the details of structure are some what difficult to make out at first. It occurs in the branchlet as well but I am only referring just now to the stem cortex. A stem cortex is found in *Lychnothamnus* and all the species of *Chara* (except the three largest in which the stem and branchlets are entirely ecorticate).

The cortex is a sheath of cells covering the internodes of the stem. This sheath consists of a number of longitudinal rows of cells lying alongside one another and normally entirely hiding the original stem thus giving it a regularly striped appearance. These rows of cortical cells are produced in a remarkable manner. At each stem whorl two circles of cortex cells start growing one upwards and the other downwards, the cortex of each internode being therefore the joint production of cells which starting from the nodes immediately above and below grow in opposite directions till they meet about the middle of the internode. The primary rows (figs. 2 and 3) of cortical cells themselves consist of alternating nodes and internodes. These internodes go on increasing in length while the nodes do not. The latter however increase laterally (it is this structure that calls for careful examination) but these outgrowths on either side of the node become at once elongated and take their place alongside the original row (the primary cortical series) to form the secondary cortical series. If the species under observation be one that bears spines the primary series will be at once distinguished as the spines are produced at the cortex nodes which as already stated occur in the primary series only.

These secondary cells vary in length in different species. Where they are about the same length as the internodes of the primary series it follows that they occupy the whole of the rows immediately on either side of the primary row and consequently between any pair of adjacent primary rows there will be two rows of secondary cells, one arising from each of the respective primary rows. This kind of cortex is called Triplostichous because for every branchlet there are three rows of cortical cells, the centre one being the primary row and the two others, one on either side of it, the secondary rows. This may sound rather complicated but a reference to the diagrammatic figure (see Plate I fig. 2) will I hope, help to make the structure clear.

In another type of stem cortex the secondary cells are only about half the length of the internodes of the primary row and hence there is room for the secondary cells to accommodate themselves in one row between two primary rows, this one secondary row being built up of cells arising partly from the primary row on one side of it and partly from the primary row on the other side of it. This kind of cortex is called Diplostichous since for every branchlet there are two rows of corticate cells, one primary and one secondary. This type is easier to make out than the former one as there is more space round the stem for the rows which are consequently rather wider. (see Plate 1 fig. 3.)

So long as the ends of these secondary cells are squarish they fit on top of one another like stones in a column and recognising whether the cortex is triplostichous or diplostichous presents no serious difficulties. An intermediate arrangement however occurs when the ends of the secondary cells taper and overlap the ones above and below them. Under these circumstances a transverse section of the stem would sometimes show two secondary rows and sometimes only one between an adjacent pair of primary rows. This condition is known as sub-triplostichous. It is not very common but judging from my own experience it is the most difficult to make out. In one species of *Chara*,—*C. canescens*, recorded from Quetta there is no secondary cortex: the same applies to *Lychnothamnus barbatus*. The cortex is then known as Haplostichous. This is of course the easiest type of all to distinguish. Usually the cortical cells are contiguous: in *L. barbatus* there are spaces between them.

In examining the structure of the cortex cutting transverse sections will afford both interest and assistance, particularly in determining the relative sizes of the cells in the two series. In some species they are of equal size: in others either may be the larger. This question of relative size is of importance for purposes of classification. If the primary cells are the more prominent (they may be distinguished as stated above by the spines if they happen to be present or by the nodes) the condition is known as Tylacanthous the spines appearing to be situated on ridges. If the reverse, it is called Aulacanthous the spines appearing to lie in furrows. It is not always easy by any means to make out the relative size of these cells of the two series from every portion of the stem. The specimen has often to be searched under the microscope until a suitable portion is found that will settle the point. A young portion of the stem shows this best.

The stem of a Charophyte is often subject to torsion: the cortex where present follows the twist of the stem, which always ascends from left to right and thus in the opposite direction to the spiral in the oogonium. Spines are a second form of outgrowth from the cortical cell nodes. They vary considerably in size and generelly single. Those arising nearest the stem nodes are usually larger and tend to point towards the middle of the internode *i.e.*, those on the descending cortex point downwards and those on the ascending upwards. As a rule stipulodes spines and bract cells in any species agree in being well developed or otherwise. A remarkable exception is N. obtusa which has extremely long single bracts but no stipulodes and naturally no spines, the stem being ecorticate.

In this connection a passing reference may be made to the rooting system. When the oospore begins to germinate there are formed the pro-embryo from the node of which the stem starts and the primary root. The latter elongates and forms nodes at which rhizoids are produced. Rhizoids are also formed at the lowest nodes of the stem. The rooting part of the plant appears white as it contains no chlorophyll. Its only purpose is to attach the plant to the mud.

Bulbils may also be briefly noticed. They are reserves of starch formed at the lower stem nodes and root nodes. They consist as a rule of a large spherical

cell proceeding from a root node only or a roundish mass of small cells at the stem nodes. They have only been recorded in the case of a few species but may often have been overlooked. Personally I have only noticed stem bulbils *viz.*, on *C. zeylanica*.

Branchlets.

Branchlets as already mentioned arise at the stem nodes in whorls and are one of the most obvious features of a Charophyte. The branchlets it will be remembered bear the reproductive organs. In the *Nitelleæ* and in *Nitellopsis* the number is usually six while in the rest it varies from seven to sixteen. All the branchlets in any whorl are as a rule similar (the genus *Tolypella* and *N. hyalina* form exceptions). In the older parts of the plant they decay just as the leaves of a land plant do. In the youngest parts they tend to curve inwards or be closely addressed to the stem whilst as they grow they open out, the ends pointing upwards though not necessarily in a stiff and regular manner. It will be sufficient to pay particular attention at first to the differences between the branchlets in the genera *Chara* and *Nitella*. *Nitellopsis* and the species of *Tolypella* present considerable modifications and the first finds are more likely to consist of a *Chara* or a *Nitella*.

The branchlet in *Chara* (as also incidentally in *L. barbatus*) consists of three or more nodes and internodes after the manner of the stem though the growth is in this case limited and at each node there is a whorl of one-celled bract cells. These latter are usually shorter on the outer side of the branchlet and vary a good deal in shape and size in the different species.

In *Nitella* the antheridium or male reproductive organ is terminally situated instead of laterally as in *Chara* with the result that at the node a furcation into two or more lateral members occurs, though it by no means follows that there is always an antheridium at every furcation. These lateral members may furcate again at their nodes and further lateral members be formed. An original branchlet may thus divide up into a number of forks. This furcation is characteristic of a *Nitella* and will at once serve to distinguish it from a *Chara* and all other genera. A pine tree with its branchlets and tufts of slender needles and dotted about with cones sometimes reminds me of a gigantic *Nitella*. The ultimate rays of the final furcation are called dactyls. These dactyls may be one celled (as in *N. acuminata* and *N. mirabilis*) or more usually two celled or occasionally three.

The nature of the furcation is of importance for purposes of classification. Species differ in the number of furcations, in the number of rays given off at these points and in the nodes where reproductive organs are found as well as in the shape and structure of the dactyls. The branchlets at each stem whorl are similar in every species except *N. hyalina* which may be at once identified by there being two different kinds, a long and a short (actually arranged in one circle of long branchlets and two of short). In *Nitellopsis* the branchlet has generally only one node and instead of a whorl of short bract cells there are produced one or two long though still one celled bract cells on the inner side of the branchlet.

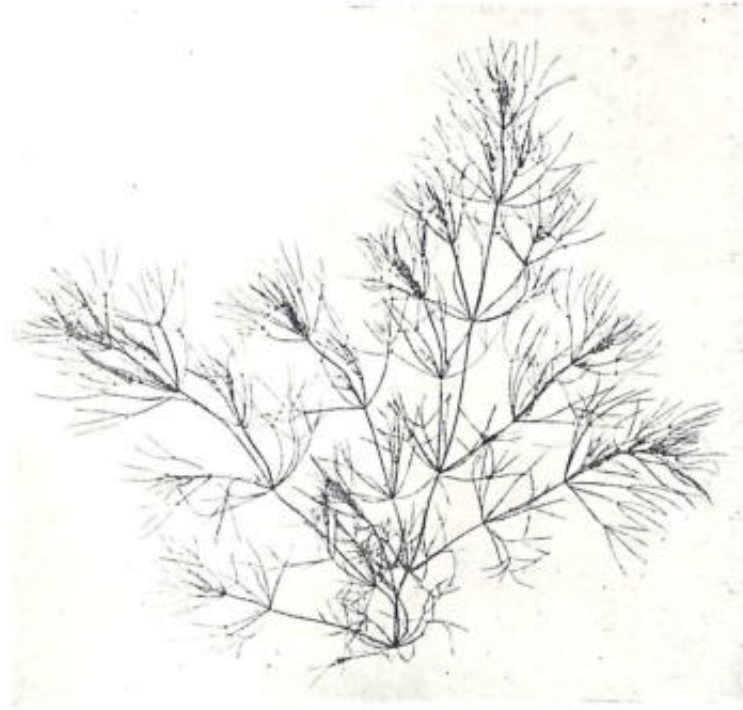
In *Tolypella* there are sterile branchlets as well. These are simple *i.e.*, no furcations of any kind. The fertile branchlets consist of one or two cells followed by a node and then by several elongated cells. At the node of the branchlet instead of one celled bracts being produced there occur members made up of a string of cells. This all makes the branchlet of *Tolypella* a more complicated affair.

Branchlet Cortex.

In nearly all the species of Chara the branchlets are also corticate though the cortex is simpler than that of the stem. There is no division into primary and



Nitella acuminata Braun.



Nitella mirabilis Nordstedt.

Specimens collected in shallow ponds at Saharanpur, U. P.
(Rather less than half natural size.)

CHAROPHYTES FROM GONDA DISTRICT, U. P.



Chara Brunii Gmel.
(Rather less than half natural size.)

the North of Oudh, the latitude and longitude being about 26 N. and 82 E. respectively. This area lies between the Ghogra river and the outer Himalayas, Nepal forming the Northern boundary. The district is fringed along this latter border with forests but it is of the less picturesque portions that I write. Over 6 per cent.of the whole being under water the district is well suited for the study of aquatic vegetation and from my brief experience a particularly favourable one for Charophytes.

Though strictly outside the scope of my subject, I may be excused if I mention my first experiences. In 1920 I had the good fortune, whilst on leave, to meet Mr. Groves and finding he had been studying Charophytes for a great number of years I suggested that perhaps I might be able to send him some material on my return to India. It was not till I happened to pay a brief visit to Sirinagar a year later about the end of September 1921 that finding these plants numerous in the Dhal Lake I collected a few and despatched them to Mr. Groves on the off chance of their proving of interest to him. In due course I was delighted to find that my first gathering included (in addition to *L. barbatus* and *C. fragilis* specimens both ♂ and ♀ of *N. obtusa* in excellent condition. Prior to this the plant had only been put down with an element of doubt as Asiatic on the strength of a specimen without gametangia of either kind that had been collected in Upper Burma twenty nine years before. My specimens thus definitely settled the species as Asiatic, previous records with the exception of the Burma one having come from Europe only. This early success stimulated me to further efforts on my return to Gonda. During the cold weather of 1921-22 I found several species in this district, my special prize being *N. mirabilis*. This plant had not been recorded from India before : in fact it had only been mentioned in MS. by Dr. Nortsted from a specimen found in China in 1908. It is a most beautiful plant, the remarkable feature being the clusters of long stalked gametangia. My collecting ended with the approach of the hot weather about March and I commenced again towards the end of the rains in September and continued throughout the cold weather of 1922-23 till I left India on leave in March. I found several fresh species that I had not come across the previous year this being partly due to my starting collecting rather earlier. My most important " finds " were *C. wallichii, Tolypella prolifera* and *N. batrachosperma*. *C. wallichii* had only been recorded once before namely by Dr. Wallich in 1809 and then only the male plant. I found both sexes and the ♀ has now been described by Mr. Groves in his recent paper. *T. prolifera* had not been recorded from India before, the only other Asiatic record being from China.

The delicate little *N. batrachosperma* had also not been recorded from India before.

The full list of species that I found in Gonda is as follows: *N. mirabilis, N. acuminata, N. mucronata, N. batrachosperma, N. hyalina, T. prolifera, L. barbatus, C. wallichii, C. corallina, C. braunii, C. gymnopitys, C. hydropitys, C. contraria, C. fragilis, C. brachypus*, and *C. zeylanica*.

I have included *C. gymnopitys* though it cannot be said with certainty whether it was this species or *C. flaccida* owing to the specimens that I gathered having no ripe fruit on them. Under *C. flaccida* there is a passage in the Notes on Indian Charophyta as follows " The golden brown ripe oospores afford the only character that I know of to distinguish this from the next species and in many specimens which have passed through our hands the fruit was immature." The " next species " referred to is *C. gymnopitys* in which the ripe oospores are black. My impression is that my specimens were more probably *C. gymnopitys*.

That I should have been able to add a few new records for India and gather sixteen species in so short a time in Gonda goes to show what a little explored field there is here calling for study. The main structures can be readily made out under a low power and there is also plenty of field work to be done as

many points about these plants can only be satisfactorily settled by a study of them on the spot.

My collecting was nearly all done in flooded rice fields and a shallow *jhil* (a depression below an old river bank) within a mile of my bungalow with occasional visits to the river Tehri which winds about not far away. This fascinating stream takes its rise in the neighbouring district of Bahraich and is fed by the waters of the great Baghel Tal at Pyagpur. It flows deep and sluggish in a well defined narrow bed fringed by swampy ground and has numerous more or less stagnant backwaters that are utilised as rice fields in the rainy season. It was these swamps and offshoots that I found so rich in Charophytes. The moist area of the district also contains numerous horse shoe shaped *jhils* that mark the old beds of meandering streams but I did not find any opportunity to search them : in fact I found my available time fully occupied by frequent visits to two or three spots near at hand. And there was nearly always something fresh to note : for one peculiar feature that I noticed was the rapid way the different species succeeded one another. One or two continued throughout the cold weather but several disappeared after a short time although flourishing freely for a while. These rapid changes may perhaps be attributed to differences in temperature (for the cold weather sometimes sets in quite suddenly) or to some of the earlier localities getting dried up. The only species I found in the cold weather of 1921-22 that I failed to find the following cold season was. *C. Braunii* but Charophytes are often very capricious in their appearance. Very roughly the periods during which I found the different species to last are as follows :—

(The numbers prefixed are taken from the key to the species in " Notes on Indian Charophyta " by Mr. Groves.)

Stagnant water is the natural habitat for Charophytes. I think the only species I found growing in water that had an appreciable current was *C. wallichii* a powerfully built plant. One or two species seemed to be confined to particular spots. For instance *T. prolifera*, I only came across in a shallow pool near the *jhil* and it was in evidence for a very short time. *N. mirabilis* too, I found growing in abundance only at the shallow end of this *jhil*. *N. hyalina* was the most widespread of all any shallow water appearing to suit it. *C. hydropitys* and *C. gymnopitys* both of small stature seemed particularly partial to cut rice fields where they might be found in water about a foot deep. As these spots dried up I failed to come across them anywhere else. *C. wallichii* soon disappeared in Gonda as I specially searched for it when I heard it had not been recorded for 113 years I found it however growing in a *jhil* at Lucknow at the beginning of January. *N. batrachosperma* too I only came across at one spot in the *jhil*.

I have included four plates from photographs kindly taken for me at the Forest Research Institute Dehra Dun. They are of dried specimens actually gathered at Saharanpur U. P. but these species are similar to those found at Gonda. Plates illustrating other species are to be found as follows :—

N. mirabilis—Plate 35 in Notes on Indian Charophyta Journ. Linn. Soc. Botany Vol. xlvi. *N. mucronata*, *N. batrachosperma*, *N. hyalina* and *T. prolifera* in British Charophyta : *C. Braunii* in " Journal of Botany " for January 1884.

There should be no great difficulty in identifying these Gonda species with the help of the key in the "Notes." I append a few notes that may be of some assistance.

N. acuminata and *N. mirabilis* are the only two *Nitella* with the ultimate rays (dactyls) always one-celled.

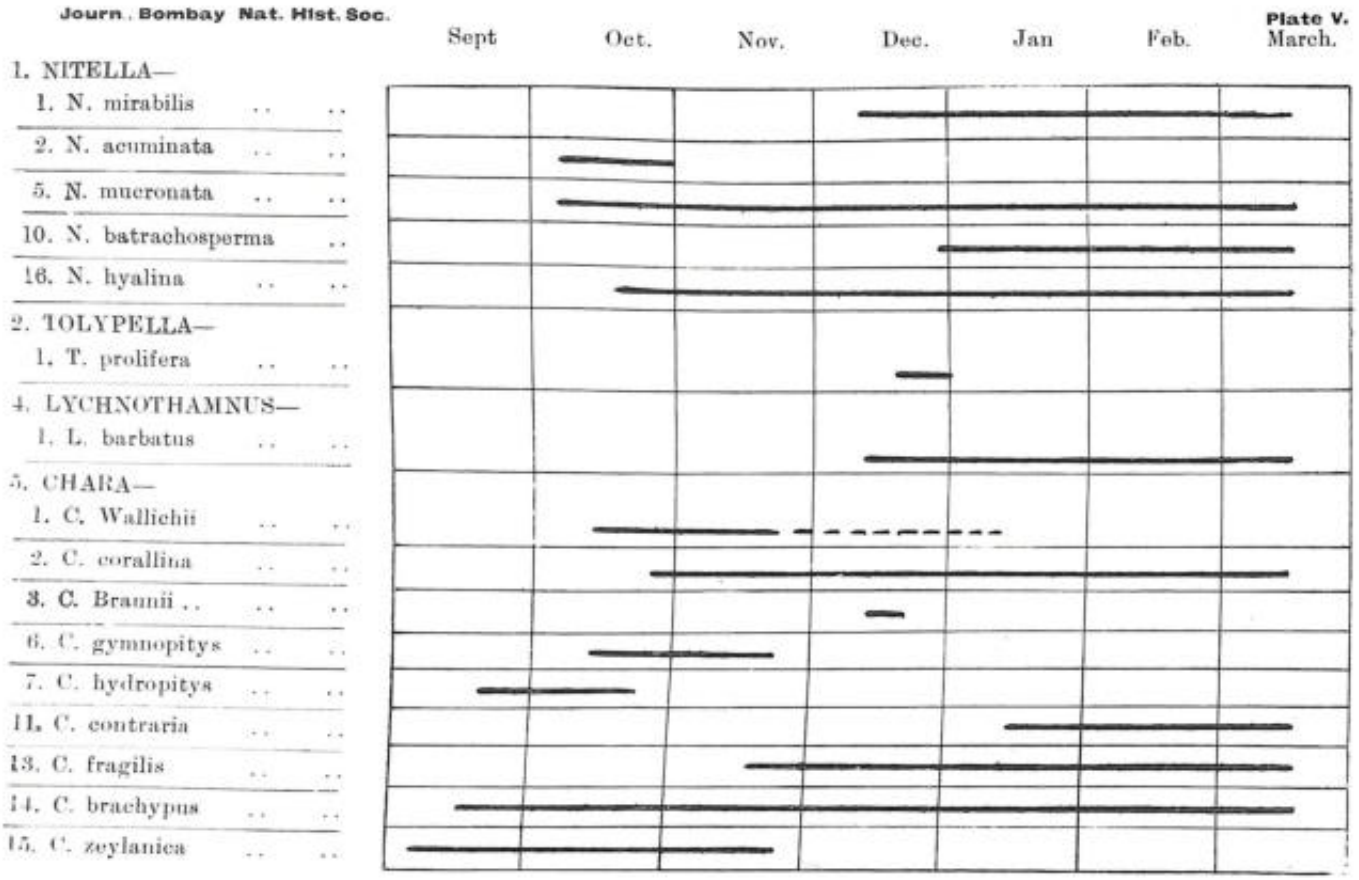
N. mucronata has the last cell but one of the dactyl rounded off and the ultimate cell perched on it : a common plant.

N. batrachosperma is a very delicate little plant growing in small clumps in shallow water in very finely divided mud. Although from its name one would

CHAROPHYTES FROM GONDA DISTRICT, U. P.



Chara Wallichii Braun.
(Rather less than half natural size.)


Sept
Oct.
Nov.
Dec.
Jan
Feb.
March.
1. NITELLA—
1. N. mirabilis .. ..
2. N. acuminata .. ..
5. N. mucronata .. ..
10. N. batrachosperma ..
16. N. hyalina .. ..
2. TOLYPELLA—
1. T. prolifera .. ..
4. LYCHNOTHAMNUS—
1. L. barbatus .. ..
5. CHARA—
1. C. Wallichii .. ..
2. C. corallina .. ..
3. C. Braunii .. .. ..
6. C. gymnopitys .. ..
7. C. hydropitys .. ..
11. C. contraria .. ..
13. C. fragilis .. ..
14. C. brachypus .. ..
15. C. zeylanica .. ..

expect this plant to be enveloped in mucous I found none at all. *N. hyalina* is easily distinguished by its whorls of different lengths. An abundant plant in the shallower water. Always thickly coated in mucus except quite the oldest parts.

T. prolifera with its long sterile branchlets bears little resemblance to any of the other genera.

L. barbatus is appropriately named as the long stipulodes and bracts give it a bearded appearance. Though it is not very easy to make out the gametangia at first through the mass of bracts the one oogonium between two antheridia distinguishes it from all other Indian Charophytes. *C. Wallichii*, *C. corallina* and *C. Braunii* are alike in being entirely ecorticate and they are all large plants. The first is dioecious while the other two are monoecious. *C. Braunii* is readily distinguishable from *C. corallina* by the reproductive organs being produced only at the nodes of the branchlets whereas in the latter they are produced at the base of the whorl as well. C. *corallina* is a very brittle plant.

C. hydropitys and *C. gymnopitys* are both much smaller plants than the last three. The former has the lowest branchlet segment ecorticate, the rest of the branchlet being corticate. This fact will separate it from all others except C. zeylanica which does not resemble it in other respects. *C. gymnopitys* has the branchlets entirely ecorticate. The remaining four all bear a general resemblance and are much larger than the last two but not so stout in build as the ecorticate Charas. *C. contraria* is distinguished from the other three by the rows of stem cortical cells being only double the number of the branchlets (diplostichous) whereas the others all have three to the branchlet (triplostichous).

This plant most nearly resembles *C. vulgaris*, a very common species though I did not happen to find it at Gonda. *C. fragilis* is likely to be confused with *C. brachypus* but the former has the stipulodes small and blunt and almost rudimentary while the spine cells and bract cells are not acute. *C. brachypus* has the stipulodes sharp and well developed and the spines and bract cells acute. Another distinguishing point about *C. brachypus* is the fact that the lowest branchlet segment in addition to being rather short is colourless or nearly so. *C. zeylanica* is readily distinguished from the two foregoing by the lowest branchlet segment being ecorticate. This plant seems to prefer the rainy season as I found it abundant in great masses at the end of the rains but no sign of it later.

In spite of the very great assistance I have derived from " British Charophyta " and much instructive correspondence with Mr. Groves I fear there are likely to be some inaccuracies in the above though I hope but few.

BIRDS NESTING WITH A CAMERA IN INDIA.

PART IV.

THE DAL LAKE AND HOKRA.

BY

CAPT. R. S. P. BATES.

(*Continued from page* 313 *of this volume.*)

(*With* 6 *plates.*)

Alas! I lack descriptive powers and am by no means of a literary turn of mind. However, as this is primarily an article on birds and their habits, I presume such qualities are not here essential. Even so, it would give me a great deal of satisfaction to be able to describe adequately my thoughts and feelings on the first, no, not only on that first occasion, but whenever I find myself on the clear placid waters of the Dal Lake. Those lotus covered reaches, interspersed with patches of tall and swaying reeds; their background of slender poplars, surrounding the chalet-like cottages; the whole dominated by the towering forest-clad heights culminating in snow-capped Haramouk, fill the heart of the most casual visitor with admiration for their beauty, grandeur and peacefulness. But in me the emotions are additionally intensified by the pulsating life all around one: the strange cat-like mewing of the Pheasant-tailed Jacanas; the chizacking noisy Reed-Warblers, and the plaintive bubbling voice of the Little Grebe from the rushes hard by; the wheeling graceful terns and the slow beat of a Heron's wings, as it majestically sails over the green-carpeted water towards its haven in the giant trees of the Shalimar Bagh. All these combined with that subtle atmosphere of peace and rest, which the Kashmir lakes seem to engender, serve to make one feel at peace with all men, and nature too. Those motionless fishermen, still as statues, standing or kneeling in the prows of their quaint *shikaras* with uplifted trident ready to make a lightening and unerring thrust into the limpid depths at any unsuspecting fish that may venture within their range—what patience they possess; they too add to the calm tranquillity of the whole and seem the very personification of the spirit of Kashmir.

Immediately on passing through the Dal gate certain birds claim one's instant attention. Of these first and foremost comes the beautiful little Central Asian King-fisher (*Alcedo atthis pallasii*), which, practically indentical with that seen more or less sparingly in England, is excessively common throughout the happy valley, and almost before one is through the gate, is certain to be seen sitting on the prow of a house-boat, on a drooping reed, or on a branch of one of the small willows with which the canal banks are lined, every now and then bobbing its head in a most curious manner, as if possessed of terrible indigestion, and no wonder if this really is so, seeing that they insist on swallowing at a gulp fish half as long as themselves.

The Indian Great Reed-Warbler (*Acrocephalus stentoreus brunnescens*) is to be heard rather than seen, as its loud hoarse chattering, proceeding from every reed-bed, is a striking feature of these jhils. The bird itself is rather a retiring creature, though less so than most species of Reed-Warblers, and spends much of its time creeping up and down the rushes in search of insects, occasionally ascending into a tree for the same purpose or to give vent to quite a pleasing little song.

As soon as the reeds have attained to a convenient height, building operations are begun—this is usually about the end of May. The nest, a very deep cup to prevent the eggs being tipped out when the reeds are swaying excessively, is suspended between 3 or 4 reeds about two to four feet above the water. The



THE INDIAN GREAT REED-WARBLER.
Acrocephalus stentoreus brunnescens.



THE PADDY-FIELD WARBLER.
Acrocephalus agricolus.



THE COMMON COOT.
Fulica atra atra.



THE CENTRAL ASIAN KINGFISHER.
Alcedo atthis pallasii.



THE PHEASANT-TAILED JACANA.
Hydrophasianus chirurgus.

eggs, up to 4 in number, are pale green or grey fairly thickly spotted and blotched with varying shades of grey, red and purple, and are about ·9″ by ·6″ in length and breadth respectively.

I have said above that this bird is rather timid. I have found however that birds of the same species often vary enormously in temperament and this Reed-Warbler is no exception. I was once inspecting the contents of a nest—3 eggs—and actually had my fingers resting on one side of it, when the owner, swearing loudly, pitched on the opposite rim and looked down into its nest as if to see what damage I was doing. Of course, as is generally the case, the reflex was not handy and a perfect opportunity was missed. Usually they are content to creep up unseen and only betray their presence by clamouring loudly a few yards off in the reeds.

The familiar Eastern Swallow too is always to be seen either skimming over the surface of the water or feeding a row of hungry fledglings seated on a horizontal and swaying reed. A Water hen or a Dabchick will probably swim out from the cover, and then, seemingly surprised at its own unwonted boldness, hurriedly sneak back again, bubbling with satisfaction at having been so brave as to show itself to the outside world.

The Little Bittern (*Ixobrychus minutus minutus*) may here often be observed seated on a bent reed or paddling amongst the lotus. Why this bird should prefer to gaze fixedly skywards when apparently fishing for its daily bread is to me a mystery. There he will sit, long neck and dagger-like bill forming a straight line, looking a perfect moonstruck lunatic.

The Central Asian Kingfisher breeds from April to about July in the bank of the canals and rivers and in the sides of the katcha wells, digging a hole from 2 to 4 feet deep with a round chamber at its end, in which it deposits from 5 to 7 glossy white eggs, rounded ovals in shape and about ·8″ in length by ·68″ in breadth. A Kingfisher's nest containing young ones is as unsanitary as a Kashmir village in wet weather, and this, I might explain, is saying a great deal. The passage is floored with a slimy mass of disgorged fish bones, the odour from which is very far from pleasant: yet the youngsters emerge from their dark and odiferous cavern as gorgeously arrayed and apparently as spotlessly clean as their parents.

The Eastern Swallow (*Hirundo rustica gutturalis*) is an early breeder. By half way through June young birds are to be seen everywhere, though still under their parents' care. Their saucer-shaped mud nests, which are softly lined with feathers, are attached to the rafters and beams of the dwelling houses, with the inmates of which they live on the best of terms. The post-office in Srinagar is an excellent example of their partiality for and fearlessness towards human beings, as there they nest in numbers within the rooms crowded with clerks, flitting in and out of the windows close to one's head while one is being attended to. One nest I noticed was within about eighteen inches of a babu's ear and contained young ones, which the parents were feeding every few moments most unconcernedly. On Lake Gagrabal, whose water by the way is most extraordinarily clear, I noticed many Hodgson's Striated Swallows (*Hirundo daurica nepalensis*), *i.e.*, the Red-rumped Swallow of Jerdon. These differ in habits from the Eastern Swallow, in that they build a closed nest with a tubular entrance either in a building or on rocks and cliffs.

The Little Bittern builds from about the end of May a nest of rushes about eight inches to a foot in diameter either on or just above the water. This is anchored amongst the reeds, a few of which are often bent over the nest into a sort of lattice-work roof. The eggs 3 to 5 in number are white rather oval thick shelled and chalky 1·3″ long and 1″ broad.

Having practically come to the end of my leave, and especially wanting photos of a Little Bittern's nest, I decided to spend a morning searching the reed-beds of

the Dal Lake. The day very nearly started with tragedy. Water was plentiful that year with the result that the current through the gate was like that of a mill-race. A heavy *dunga*, a country boat, was vainly attempting to force its way through, the crew chanting rythmically as some pushed with long poles and others pulled on the chains on the gate wall. The occupants of a *shikara*, three well-made Kashmiris, also desirous of getting into the lake, were taking advantage of the *dunga* by pulling themselves along its side. We followed suit. The gap between the *dunga* side and the wall was not much more than a yard in breadth. The leading *shikara* was well in this gap when the current caught the *dunga's* prow and swept it across with considerable force, thus pinning the frail boat. Something had to happen and it did very quickly. The *shikara* was crunched up like a piece of match-wood, and its crumpled remains forced under water the crew jumping into the *dunga* in the nick of time, so saving themselves a nasty wetting and possibly worse.

This part of the proceedings was merely highly amusing, as evidenced by the glee of the crowd that invariably collects on the road over the gate when a boat is going through, even when the water level is normal. We of course enjoyed the play as much as those above, but it was now our own turn to come into the lime light, and our untimely mirth was cut short by the waterlogged remnants of the shikara, which suddenly came up underneath us. My ½-plate camera took a great objection to the awful list of our boat and fell overboard, but as luck would have it I was just in time to grab the strap and pull it inboard before it had had time to get thoroughly wet.

Straight opposite the gate and not 200 yards from it, where the main canal forks, one arm leading direct to that portion of the lake known as the Lokut Dal, the other winding through orchards and vegetable gardens and the picturesque village of Renawari with its massive moghal bridge to the Bod Dal and the Nasim and Shalimar baghs, is a triangular patch of reeds. This I considered too small and too public to yield anything, nevertheless I sent in a man to have a look round having first explained my usual scale of rewards. The promise of a few annas is a great incentive to a Kashmiri. In a few moments he returned with a Moorhen's egg, anxious to know whether this counted, as I had only mentioned large white eggs and small spotted ones. To encourage him I said it did, and duly paid the reward. He was soon back again with a Little Grebe's (*Podiceps ruficollis albipennis*). This time I personally went to investigate, thereby somewhat upsetting the equilibrium of a dear old lady in a passing shikara, as I lowered myself into about 4 feet of water with all my clothes on. The result is shown in the full page illustration.

That meagre patch of reeds yielded no less than the nests of 3 pairs of Little Grebes, 3 of Little Bitterns, 1 of Indian Great Reed-Warblers, as yet empty, and 2 of Moorhens. In a patch on the opposite side of the canal I obtained the photograph of the Reed-Warbler's nest, which is also reproduced here.

Having exhausted the neighbourhood, I was about to move on to the lake itself to look for Pheasant-tailed Jacanas, when another of my minions, whose luck had been out, informed me that he had found a new nest, the reward for which would surely be a large one. What I found was a Reed-Warbler's nest completely filled by, and nearly collapsing under, the weight of two Little Bittern's eggs, which the scoundrel had filched from a nest close by. Curiously enough another man had tried to play practically the same trick on me a couple of weeks previously by putting a Bittern's egg into a crow's nest.

Passing along these canals, which wind for the most part through orchards before finally debouching into the lake, one is likely to notice the following birds in addition to those so far mentioned—the Indian Oriole and Tickell's Ouzel, the Common Indian Bee-Eater, Rufous-backed Shrike, Hodgson's Pied Wagtail, Kashmir Jackdaw, Indian House Crow, Common Pariah Kite, Himalayan Starling, Common Myna, and the Cashmere House Sparrow. In the evenings and early mornings chiefly the European Bee-Eater, a strong and graceful flier,

may be seen floating overhead, drawing attention to itself by its pleasant whistling note, and last but not least that graceful poem, the Indian Paradise Flycatcher (*Terpsephone paradisi paradisi*) will be espied flitting amongst the fruit trees like an undulating mass of snow-white cotton-wool. The head and perky crest of the adult male are a beautiful metallic glossed green or rather greenish black, almost the entire remaining plumage is pure white, and the two centre tail-feathers are prolonged into slender appendages some 12 to 14 inches long. At rest, these hang down in a graceful curve: In flight, they wave behind, making the bird appear to ripple through the air.

Before attaining to this amazing perfection, the bird undergoes many changes. On leaving the nest one might quite well take it for a bulbul of some sort, as I for one did, when I first made its acquaintance in Rajputana soon after my arrival in India, even though armed with that admirable little book for beginners, Douglas Dewar's "Bird Calendar for Northern India." At this stage the plumage with the exception of the head and crest, which are glossy black from the outset, is largely chestnut, and the centre tail feathers are not elongated. The female never doffs this garb, and the male not until his second autumn moult, and it is not until he is some four years old that his metamorphosis is complete.

The nest of the Paradise Flycatcher is nearly as beautiful as the bird, being a neatly woven fairly thin-walled cup of grass plastered with cobwebs and lichen and lined with hairs. It is placed either in a slender fork or on top of a more or less horizontal branch, usually no great height up and more often than not in a fruit tree. The eggs up to 4 in number are a beautiful pink, sometimes quite salmon, spotted and speckled with red, rather resembling those of our common Swallow.

All the above-mentioned with the exception perhaps of the European Bee-Eaters will be found breeding about the end of May. The Indian Orioles will be building their basket-like nests in the fruit trees or chenars or even the willows lining the canal banks. The nest is a most interesting structure, and is built as follows. A strip of fresh bark is wound round one limb of a forked branch and carried thence to the other limb. A rough equilateral triangle with about a six inch side is thus formed. Other strips are then wound on until a cradle is obtained and in this the grass nest is woven. The eggs two or three in number are fairly large about 1·1″ by ·8″ rather blunt ovals, and are white with a number of either dark red or black spots distributed over the surface. The Oriole, although its nest is generally in a well protected situation, or even in an inaccessible one—I have spotted nests in the topmost and slenderest branches of giant chenar trees—is a very light sitter; such a light sitter indeed that one will hardly ever be permitted a glimpse of her at home. The Orioles too possess some fine liquid notes, which one cannot fail to remark. A description of the bird is unnecessary, the only other bird, which at all resembles it, and one which I have seen pretty frequently in Srinagar itself, being the Black and Yellow Grosbeak (*Perrisospiza icteroides icteroides*), which of course is a finch, black-headed and much smaller.

The Rufous-backed Shrike (*Lanius schach erythronotus*) literally forces itself on one's attention from the moment the happy valley is entered. Every few yards a nest will be noticed built against the trunk of one of the poplars, which so closely line the main-road, and usually about 10 or 12 feet up amongst the cluster of fine twigs and smaller branches which commence about that height from the ground. How many hundreds of these nests, old and new, there must be between Baramullah and Srinagar it is impossible to say. Some day perhaps an enthusiast who is really hard up for a job, will count them and publish the result of his census in the Strand Magazine or the Daily Mail, in the space usually reserved for telling us the height of a pyramid built of the Maconachie rations consumed by the British Army during the war and other such world-shaking

information. At any rate the Rufous-backed Shrike may be put down as one of the commonest birds of the valley, and besides frequenting these poplars is to be found in every orchard and garden and round every village. It is a veritable bird of prey, although its victims are nothing more formidable than grasshoppers and beetles, and occasionally, I believe, though I have never witnessed it myself, a young bird. They are certainly very fierce, and up to mobbing birds much bigger than they themselves. They perch a few feet from the ground in a tree or bush and sail down at an angle on to their prey. The extent of their breeding season is considerable and commences about the beginning of May. The nest is rather bulky and often loosely constructed, containing a considerable amount of rubbish such as dirty rags, bits of paper, leaves, etc. The eggs 3, 4 or 5 are somewhat larger than one would expect measuring about ·9″ by ·7″, and are rather pretty, being greenish white with fairly large spots and sometimes blotches of different shades of red and brown.

The Common Indian Bee-Eater (*Merops orientalis orientalis*) is very common throughout the length and breadth of India, and must be familiar to any one long before they reach Kashmir, as one cannot help seeing hundreds during any railway journey sitting on the telegraph wires quite unperturbed by the passage of the train. The side of any bank, ditch or sandy mound affords a position for the entrance to the narrow tunnel which the birds dig for their home. This is sometimes as much as five feet long and terminates in a rounded chamber in which the 5 white eggs are deposited. These measure about ·8″ by ·7″.

Hodgson's Pied Wagtail (*Motacilla alba hodgsoni*) is quite a confiding bird and often utilizes the roofs of the house-boats, or the inside of a rolled-up ' chick ' for its nesting site. On one occasion I picked up my boat at Baramullah, and was joined, as we left, by a pair of these wagtails, which at once commenced building inside a chick intended for the verandah. As the boat was on the move they occasionally got left quite a distance behind, as they had perforce to visit the river banks to collect material. At Bandipur they left me, as I am sorry to say the boatman, against orders of course, let down the chick and destroyed the nest, which was already of quite decent proportions.

From the beginning of May they breed freely wherever found, other and more usual situations being in cavities in the river and canal banks, under stones and in the masonry of bridges, or in the roots of bushes close to the water's edge, etc., and by half way through the month I have found many nests containing young ones. The latest date on which I have found a nest with eggs (near Pahlgam in the Liddar Valley) was July 8th and these, 5 in number, were quite fresh.

The Indian Hoopoes (*Upupa epops orientalis*) are early breeders in Kashmir, and by the beginning of June have practically finished operations for the year. Holes at the bases of the walls of the dwelling houses are their favourite abodes, though hollows in trees are also patronised. Like the Kingfishers too by no manner of means can they be congratulated on their sanitation.

Tickell's Ouzel (*Planesticus unicolor*) is a common bird in the gardens of Srinagar and round about the villages. The nests are like those of the Blackbird at home, and built in a fork of a bush or tree at anything from 6 feet or so upwards. They are not conspicuous birds but have a very pretty song and occupy the same position in Kashmir as the Blackbird does at home. Their eggs too are like those of the Blackbird resembling them very closely indeed though the markings are perhaps redder, and they are to be obtained from about the end or possibly half way through May.

The Kashmir Jackdaw (*Corvus monedula soemmeringii*) is another very common bird in the Happy Valley, and very much outnumbers the Indian House Crow. Every Chenar of decent proportions holds its quota, as the many holes in these magnificent trees afford the most excellent sites for the nests of this species, one tree often containing many pairs. The Jackdaws are also well



THE WHITE-EYED POCHARD.

Nyroca rufa rufa.



HODGSON'S YELLOW-HEADED WAGTAIL.

Motacilla citreola citreoloides.



THE EASTERN BAILLON'S CRAKE.
Porzana pusilla pusilla.



THE NORTHERN RUDDY CRAKE.
Amaurornis fuscus bakeri.

ahead of the House Crows in domestic duties and have young out by the end of May, when the latter are but just commencing to build.

In Srinagar a favourite situation for the nests of the Crows is upon the wooden stanchions holding up the projecting upper stories and balconies of the houses overhanging the river. Midway through May I noticed a good many nests being built on the low trees of the small island one passes immediately on entering the Bod Dal, but at the beginning of June they appeared to have got no further on, and I conclude that their eggs must be taken by the natives.

The Common Pariah Kite of Kashmir, besides being considerably larger than his plain's brother, has very much more pronounced whitish patches on the underside of the wing. Their large untidy stick nests may be noticed high up in the chenars round about the villages and by May those eggs which are still to be found are almost certain to be well incubated. These kites are arrant baby-snatchers, and the shouts of the Kashmiri womenfolk are continually to be heard during the hours of daylight, as they attempt to keep them off their chickens and ducklings, often unsuccessfully I fear.

On emerging from the canal into the Bod Dal, one passes through floating gardens and large patches of green and swaying reeds until confronted by a small island bearing an enormous half dead chenar, in the upper branches of which is generally a Kite's nest. In May the lotus has hardly made its appearance except in the shallower reaches, and as one slides peacefully past the isle a wide stretch of deep blue water suddenly meets the eye, over which may be seen a few Whiskered Terns (*Chlidonias leucopareia indica*) gracefully dipping to the water, while uttering their harsh and rasping call. An occasional Night Heron (*Nycticorax nycticorax nycticorax*) perched on a bent reed or an awkward Little Bittern may be remarked close to the reed-beds one has just passed through, and an Eastern Marsh Harrier (*Circus spilonotus*) will probably be descried gliding over the tops of the reeds, every now and then descending into them after its prey. But the strangest bird and the one that will arrest the attention immediately is the Pheasant-tailed Jaçana (*Hydrophasianus chirurgus*). The weird cat-like cries of these peculiar birds alone cannot fail to strike one, but the more one discovers about them the more one's wonder grows. Surely they were once common or garden chickens, which in some remote age forgot themselves and took to the water, thereby perhaps giving rise to the term water-fowl as opposed to the fowls of the air, and the barn-door fowl. Who knows! The male in breeding plumage with his long black tail-feathers certainly resembles a quaintly coloured cockrel, an unhappily coloured cockrel, the mixture and arrangement of its black white and yellow plumage being decidedly trying in my opinion.

Many of these birds may be seen, most of them fairly close to the shore or reed patches, but some in the very centre of the lake, apparently walking on the surface of the water. In reality these last are on the weeds which are now just reaching the surface, and the ease with which they progress without sinking is due to the exceptionally long toes with which they are provided, the centre toe of a Pheasant-tailed Jaçana being as much as three inches in length and the hind toe, the greater part of which is claw, two. The nest of this bird is a mere pad of weeds or rushes varying considerably in scantiness, as evidenced by the photograph reproduced here, in which I failed to discover any materials at all. This nest was on a thick layer of soggy weed, so the owner probably thought and rightly so that materials were unnecessary. A more usual situation is out amongst the lotus leaves, but on this occasion, a backward year, the lotus had hardly made its appearance when I left Kashmir half way through June. The photo was actually taken on June 7th. The eggs are as strange as the bird, being flat topped and tappered to a pretty sharp point at the small end. In colour they vary considerably and I have seen green eggs, clay coloured eggs and bronze eggs, and one clutch I took looked just as if they had been painted with gold size and absolutely sparkled. I am afraid I ravished this, the only nest I found that day, as I had discovered that they knock the much vaunted

Plover's egg into fiddlesticks. The white is beautifully clear and the yolk literally melts in the mouth like butter. In fact I can thoroughly recommend them to the epicure. They are quite a respectable mouthful too, measuring about 1·5″ by 1·1″.

While crossing the lake to where I found this Pheasant-tailed Jaçana's nest, which by the way was not far distant from the entrance of the canal to the Shalimar Bagh, I was very much surprised to come upon an Indian Little Grebe finishing off a nest in the very centre of the lake, literally miles from the shore or any of the reed beds and absolutely unconcealed in any way, a most strange situation for so shy a bird, though last year on the Ulsoor Tank in the middle of Bangalore I noticed two nests in the open water only a few yards from the bank, alongside which runs a busy thoroughfare. I suppose the lake must have been fairly shallow at this point as the weeds were just appearing on the surface over a considerable area, and it was in this patch that the nest was being built.

The Indian Whiskered Terns (*Chlidonias leucopareia indica*), which make their nests, untidy pads of weeds and rushes, in colonies on the surface of all the jhils of the valley, have a very hard time of it in the Dal Lake I am afraid, and few, if any, can ever succeed in raising a family. I particularly wanted a photograph, but the nearest I came to finding a nest with the requisite number of eggs in it, was seeing a fisherman collect literally every single egg he could from the colony I was heading for, and make off before I could get close enough to tell him what I thought of his ancestors, himself and all his offspring. One solitary egg was all he had left behind him, and there must have been at least twenty nests. I must admit that these eggs too are undoubtedly good eating, and I have on occasions abetted these egg thieves by buying their ill-gotten spoils from them.

A common bird about the main portions of the lake is Hodgson's Yellow-headed Wagtail (*Motacilla citreola citreoloides*) though I have not actually found their nests in the Dal, but both this bird and the Paddy-Field Warbler (*Acrocephalus agricolus*), which one may also come across in certain parts of the lake, breed very freely on Hokra and other jhils of a similar type, and in consequence I will describe what I found on a couple of visits to that jhil on June 18th and 21st, 1921, in company with Captain Livesey, who kindly obtained a permit for me along with his own.

I appear to have forgotten all about the spry little Kashmir Grey Tit (*Parus major kashmiriensis*), a bird rather resembling the Great Tit of the British Isles, both in appearance and habits. I was struck by the numbers of this species exploring the leafy pall of the magnificent chenars in the Nasim Bagh. On the 19th May I took one of their nests in a hole in the bank of a canal leading into the Anchar Lake. I was looking for Kingfisher's nests and seeing a likely looking excavation gently pushed a stick down it. I was startled by a violent hiss, which was repeated every time the stick was moved. I thought it must be emitted by a snake, so out of mere curiosity set to work to open up the place, digging downwards from a point which I judged to be directly over the end of the hole. When I got into it, I was more than surprised to see a very angry looking Grey Tit, with large lumps of fallen earth almost burying it, sitting tightly on a large pad of wool which completely filled the floor of the chamber I had laid bare. The defensive attitude of these birds on the nest is somewhat strange. The tail is spread wide into a sort of fan and the head sunk into the soft wad of the nest so that the bill is almost invisible and a pair of very beady black eyes just peep over the rim. The bravery of this particular little heroine was such that she actually allowed me to remove the debris from the nest and her back, only hissing loudly when my fingers came close to her head. She allowed me to fix up the camera with its staring lens but a couple of feet or so from her, and would, I am sure, have let me get all the photos I wanted, had not



THE INDIAN LITTLE GREBE.
Podiceps ruficollis albipennis.



THE LITTLE BITTERN.

Ixobrychus minutus minutus.

a sudden gust of wind blown the focussing cloth right off the camera on to her long-suffering head. This proved too much for her nerves and she fluttered out of the hole disclosing seven red-spotted egg, which, on immersion in the canal, proved to be quite fresh.

Hokra Jhil is within a few hundred yards of the main Baramullah-Srinagar road opposite Shaltin, but one would certainly never suspect its presence, even if told where it lay, as a low bund lies between, and it is surrounded by ricefields and nearer at hand by a considerable strip of low lying more or less wet spongy ground, covered with soft grass of varying length interspersed with a few scraggy little bushes, mere prickly stalks a few inches to a few feet in height. It is on this wet ground that from about the commencement of June, Hodgson's Yellow-headed Wagtails may be found breeding in their hundreds. The nest is rarely if ever on really dry ground and its base in fact is often wet. It is generally a well built cup of grass placed in the centre of a tuft or at the foot of a bush or even in soft grass of a length barely sufficient to hide the nest and may contain from 3 to 5 eggs. These vary very considerably but all are of a most decidedly greenish tinge, mottled or streaked with greyish or reddish brown, many of them rather resembling those of the Grey Wagtail (*Motacilla cinerea melanope*), than which however they are slightly bigger and more oval in shape. On June 21st I found one nest containing a pair of well-developed young ones, but all the other nests, and we hit upon a good many, still held eggs, a number not even their full quota. A very noticeable feature about the nesting females of this species was the considerable variation of the brightness of their colouration, many of them evidently breeding while still in different stages of immature plumage. The nest illustrated here was in a patch of reeds, which had been cut down to their roots. The ground was so waterlogged that the base of the nest was soaking wet and even the lining quite damp. It was dangerous stuff to walk on and swayed perilously, evidently being but a layer of tangled roots floating over deep water.

In places the soft grass attains a length of three or even four or more feet, and in this and in the slender reeds, which in places grow amongst it, the Paddy-field Warblers conceal their nests. These are neat little cups of grass and moss suspended in exactly the same manner as those of the Indian Great Reed-Warbler and are generally very well hidden, as the tangle of soft grass, in which they are usually placed pretty low down, affords complete concealment from view. They are not really shy and by patiently watching them from a short distance away, one should be able to mark down the position of a nest to within a few feet, after which a thorough search will do the rest. The eggs of this little warbler are by no means unlike those of the Indian Great Reed-Warbler, but are smaller, generally more elongate, and less thickly marked.

On June 18th we were only able to find a couple of nests both of which were still being built, but on the 21st we found another containing 3 eggs, the photograph of which is reproduced here. The Paddy-field Warbler is very much smaller and also quieter than its strident voiced cousin ; the tail is more graduated and the throat of a deeper rufous tinge.

The Indian Great Reed-Warblers were of course breeding as profusely here as elsewhere in the valley, and their harsh grating voices were to be heard emanating from all the coarser reed patches, and other nesting birds, which I have already mentioned as inhabiting the Dal, were Moorhens, Little Grebes, Little Bitterns, Pheasant-tailed Jaçanas and Whiskered Terns. Coots also were common. The Coot's nest in the illustration was not actually taken at Hokra, but I include it here as it is interesting on account of the young one, which appeared to me to be in quite a fit state to take to the water. In fact, after procuring the photograph, I put it into that element and it swam off quite strongly into the reeds, where it probably joined its brothers and sisters already

in hiding. These youngsters are as a rule capable of swimming practically from the moment they are hatched, and at the approach of danger immediately leave the nest and hide in the surrounding cover. Why this one had not done so I cannot imagine. It will be noticed that another is on the point of emerging from the egg. The hard whitish nob on the tip of the upper mandible can be seen quite plainly.

Hokra, being a state "*rukh*" and so undisturbed by the spring influx of tourists, is a sanctuary where the shyer and more seclusion-loving waterfowl betake themselves, or rather remain, after the spring migration has taken place, and White-eyed Pochard (*Nyroca rufa rufa*) and Mallard (*Anas platyrhyncha platyrhyncha*) breed in considerable numbers. I also remember seeing many Teal and a few Widgeon (*Mareca penelope*).

A White-eyed Pochards' nest containing ten eggs, fairly well advanced in incubation, and surrounded by a goodly quantity of down, was discovered in the centre of a very tangled mass of reeds. The eggs were a very pale *cafe-au-lait* and had a decidedly satiny surface,so, nestling amongst their dark-hued padding, they made a most pleasing picture.

Quite close in a most awkward spot to reach, owing to the amount of water and thickness of the reeds, was a Mallard's nest. This contained a large number of ducklings when first discovered, but all but two of them and one which still had a considerable portion of the shell attached to its rear end, escaped into the surrounding reeds while I was struggling to reach the nest. Two chipped eggs also remained. The photo I obtained did not come up to expectations and is not worth reproducing here, that is useless it were intended to show how perfectly the colouration of a duckling can blend with its normal background of reeds, as, though the image is perfectly sharp and the head alone the size of a pea, it is most difficult to pick it out.

One of our chief reasons in obtaining permission to visit Hokra was that we hoped to find the Snipe with eggs, but though we put up a considerable number we were unsuccessful in our search. The Common Fantail Snipe (*Gallinago gallinago gallinago*), and also that fraud, so far as shooting is concerned, the Painted Snipe (*Rostratulla benghalensis benghalensis*) are both to be found breeding around these more sequestered and marshly jhils with their surrounding area of spongy ground, which the Fantails seem especially to seek after in Kashmir, but I think one should look for their nests earlier than towards the end of June, even though they do appear to nest rather later here than is usually the case with this species.

On the 18th before we had progressed a hundred yards round the edge of the jhil, an Eastern Baillon's Crake (*Porzana pusilla pusilla*) was flushed off its nest of five eggs. These tiny little rails are very common in Kashmir, and as they sit very close and often fly straight off the nest, their abodes are not over difficult to find. How these minute birds, the smallest of all our rails, manage to cover their numerous eggs is beyond me. They lay anything from 5 up to 9 and these are decidedly large in proportion to the size of the bird, whose body really cannot be much larger than that of a sparrow. Yet the average egg measures about 1·2" by ·85". The nest is composed of a small collection of grass or reeds and is often placed in soft marsh grass, in the grass on the side of a bank, or at the foot of a bush, and resting on more or less solid ground, and possibly more frequently anchored over water amongst reeds, a number of which are bent over the eggs into a canopy. In fact the situations are much the same as those chosen by the Northern *Ruddy* Crake (*Amaurornis fuscus bakeri*) with the exception perhaps of the first named and the fact that whereas the former has a predelection for the vicinity of jhils, the latter appears to shun them.

The latter also breeds commonly in the Valley, and on both occasions eggs were brought to us. One enterprising youth brought the female bird also, which he had managed to catch on the nest, quite how I don't know. She had an egg

in the oviduct which could be easily felt and as easily seen, as they too are decidedly large in proportion to the size of the bird. We let her go, but rather than exercise her wings, she dropped straight on to the water and went swimming off up a side ditch, sneaking along its edge and swimming with the same jerky motions as the Moorhen. The Ruddy Crake does not seem to like the large reed-covered jhils, but shows a great preference for the rice-fields and the ditches which supply them. Their nests are to be found on the banks, which divide the fields, in tangled undergrowth in their vicinity and also attached to the rice stalks or reeds, a number of which are bent over the nest to form a partial roof, giving to the nest a most pleasing appearance. June is really a bit too early to expect to find full clutches, as they are rather late breeders, and it was only well on in July, just before I went down from Kashmir, that I found nests with their full compliment of eggs.

(*To be continued*).

THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By Colonel W. H. Evans, D.S.O., F.Z.S., F.E.S.

(*Continued from page* 351 *of this Volume.*)

Part VII.

(*With one Plate.*)

H. 30. Nacaduba.—The Lineblues. (Plate 27.)

Dark blue with borders linear in ♂; above and below brown with a number of parallel whitish lines. ♀ ♀ discally pale blue or white with broad dark borders.

1a (a). Unf no pale basal lines, only a pair end cell and a discal pair in addition to the marginal markings.

1 (2a). Unh prominent round black spot at apex. ♂ upf purple blue with a more or less prominent diffused discal white patch on F. ♀ white. Below white, the 2 submarginal rows of dark linear spots prominent, other markings pale brown and obsolescent.

* *angusta kerriana, Dist.* (32-35). The White Lineblue. Karens—S. Burma R.

2a (1). Unh no prominent apical black spot. Below brown with white lines discal markings prominent, submarginal not more prominent. ♀ ♀ pale blue or violet.

2b (5). Unf outer discal line does not meet inner submarginal line at v3. Above lines from below not showing through by transparency.

2 (3a). Unf inner submarginal line broad, diffused and continuous, all markings broad and yellowish. Unh inner submarginal line consists of broad, straight strigæ. Above ♂ dark purple brown, paler in a side light, border narrow, but not thread-like. ♀ variable, purple blue, paling outwardly. Wings broad, rounded.

α. Below markings narrower and paler; unf inner submarginal line becomes obsolete towards apex.

pactolus ceylonicus, Fruh. (34-38.). The Large 4 Lineblue. Ceylon. R.

β. Below markings wider and inner submarginal line unf even.

* *pactolus continentalis, Fruh.* Sikkim-Burma. NR.

γ. Below darker, markings broad and sharp; unf inner submarginal line not broader than the rest.

pactolus andamanicus, Fruh. Andamans. NR.

δ. Smaller. Above more plumbeous. Below markings narrow pale and rather obscure.

pactolus macropthalma, Fd. (32-35). Nicobars. NR.

3a (2). Unf and unh inner submarginal line consists of narrow, separate lunules; all markings narrow, more discontinuous and whiter. Wings produced at apex F and tornus H.

3 (4). ♂ above rather plumbeous blue, violet in a side light. Unf the upper edges of the inner submarginal and outer discal lines are close together.

hermus nabo, Fruh. (30-35). The Pale 4 Lineblue. Ceylon S. India. Sikkim-Burma. NR.

H.30. Nacaduba.—(*contd.*)

v sidoma, Fruh. unh the upper discal area darkened, obscuring the lines. NR.

(3). ♂ above dark shining violet, no plumbeous tinge. Unf upper edges of the inner submarginal and outer discal lines separate.

**vajuva, Fruh.* (30-35) The Violet 4 Lineblue. Sikkim-Burma. NR.

5 (2b). Unf outer discal line meets inner submarginal line at v3, appearing as a continuous line from costa to dorsum. Below submarginal lines appear to enclose 2 rows of prominent dark spots; pale brown, markings rather broad, white and continuous. ♂ above pale blue, lines from below showing through by transparency. Much smaller; wings broad and very rounded.

* *pavana, Hors.* (26-28). The Small 4 Lineblue. Tavoy—S. Burma. Andamans. R.

6a (1a). Unf an additional pair of lines in cell near base.

6 (7a). Uph and unh 2 prominent black spots at tornus, prominently orange crowned below. Below pale grey, markings wide, submarginal lines highly lunulate. Unf basal pair of lines usually to v1. ♂ above rather pale blue. Tailed.

**ancyra, Fd.* (27-29). Felder's Lineblue. Karens—S. Burma. Nicobars. R

7a (6). ♂ uph no tornal black spots or only showing through by transparency; ♀ a single spot. Unh usually only black spot in 2 prominent, the orange crown faint and narrow.

7 (8a). ♂ apex F produced and pointed, termen straight from apex. ♂ ♀ H produced and termen straight. Tailed. Below lines pale brown and no darkening of the ground between lines; unf basal pair to v1.

α. ♂ above dark shining violet blue. ♀ plain brown, no blue; prominent black spot at tornus H and obscure submarginal white spots above. Below rather pale ochreous brown.

viola viola, M. (22-25). The Pointed Lineblue. Ceylon S. India. R.

β. As last, but below plain brown, no ochreous tinge. ♀ smalt blue, broad borders or plain brown.

* *viola merguiana, M.* Sikkim—Burma. Andamans. NR.

8a (7). ♂ apex F may be produced, but the termen is rounded at least at the apex.

8b (15a). H always tailed.

8c (12a). Unf discal lines on either side of v3 more or less straight and the spaces between not darker than the ground (except sometimes in the DSF of No. 8).

8d (10a). Wings produced, termen F straight or nearly so.

8 (9). ♂ above rather pale violet blue, markings from below showing through by transparency (except in Nicobar specimens); discs not clothed with short fine hairs (visible with a hand lens). Below all markings prominent, white. Unf markings regular, continuous and straight, submarginal lines not lunular. Unh markings very broken the usual dorsal Y, formed by the discal lines and the lines end cell, barely traceable due to the inner discal line in 3 meeting the outer line end cell; discal line in 4 separate from the line end cell. ♀ above bases pale metallic blue, disc F whitish, but never any white spots on the inner edge of the dark border in 1-3; below markings much broader and in DSF often filled in darker, forming bands.

α. Below ♂ markings broad, a distinct central whitish line showing between each pair of lines.

H. 30. Nacaduba—(*contd.*)

**atrata prominens*, *M.* (28-32). The Transparent 6 Lineblue. Ceylon. C.

β. Below markings narrower.

atrata euplea, Fruh. S. India. Sikkim—Burma. Andamans, Nicobars. C.

9 (8). ♂ above dark opaque shining violet blue; discs clothed with short white hairs. Below all markings much duller and narrow, more bent on F, but on H the dorsal Y is much easier to trace. ♀ disc upf metallic blue, no white, but traces of whitish spots in 1-3.

akaba gythion, Fruh. (27-31). The Opaque 6 Lineblue. Ceylon. S. India. Sikkim-Burma. Andamans. C.

10a (8d). Wings rounded, termen F highly convex; discs above covered with fine white hairs.

10 (11). ♂ above pale violet blue, all markings show through by transparency and ground colour darkens towards termen. Below markings very broad and white; unf submarginal markings highly lunulate. ♀ bases pale milky blue, discs white, whitish spots in 1-3 F. Occurs in a dwarf form, as well as the normal form.

sinhala, Ormiston. (18-30). The Ceylon 6 Lineblue. Ceylon. C.

11 (10). ♂ above dark violet blue, opaque. Below markings very dull and narrow; submarginal markings F lunulate; H dorsal Y prominent and inner discal line joins outer line end cell at their lower ends. ♀ disc upf and base H violet blue.

berenice ceylonica. Fruh. (22-30). The Rounded 6 Lineblue. Ceylon, NR.

β. Darker.

berenice plumbeomicans, WM.. (22-30). Tavoy—S. Burma. Andamans. R.

γ. ♂ above much darker purple brown. Below markings very dull and tornal ocellus H unusually large.

berenice nicobaricus, WM. (24-30). Nicobars. R.

12a (8c). Unf discal lines on either side of v3 very irregular, especially the outer upper discal line and spaces between usually filled in as dark bands.

12 (13a). Below rather dark brown, bands F broad and nearly black; H. basal bands black, discal band and band end cell coalesced to form a large black discal area. ♂ above pale shining violet blue, with a broader border, 1mm, than any other *Nacaduba*. ♂ upf lower discal area and base H pale metallic blue.

**aluta coelestis, DeN.* (23-25). The Banded Lineblue. Kumaon—N. Burma Andamans. R.

13a (12). Below bands narrow, only a little darker than the ground. ♂ above dark purple blue or purple brown with very narrow border. Below pale to dark brown with or without an ochreous tinge of varying intensity. ♀ plain brown, sometimes with a bluish lower discal patch F.

13 (14). Unf basal band confined to cell; discal band not below v2 or sometimes there is a dot in 1.

bhutea, DeN. (25-28). The Bhutya Lineblue. Sikkim—Assam. NR.

14 (13). Unf discal band continued at full width to v1 and basal band reaches v1 except in faintly marked specimens. Below very variable; may be dark brown with white lines to yellow or grey with dark bands.

**nora, Fd.* (18-25.) The Common Lineblue. Ceylon India, Burma. Andamans C.

15a (8b). H tailless. 15b (18) Unf base not darkened.

15c (17). ♂ above dark purple. Below bands darker than the ground; unh tornal spot in 2 large, much larger than the spot in 1.

H. 30. Nacaduba—(*contd.*)

15 (16). Cilia uniform brown throughout. Very like No. 13.

α. Seasonal forms very alike; below brown, bands only slightly darker than the ground, very irregular on F. ♀ brown, base F blue or violet blue more or less. Unf basal band to v1.

dubiosa indica, Evans. (22-26). The Tailless Lineblue. Ceylon, India, C.

β. WSF as last. DSF ♀ below pale ochreous with dark bands and on H prominent marginal spots increasing in size to costa, spot at apex being as large as the tornal spot in 2; unf basal band not to v1; above plain dark brown, traces of blue scales at base F.

dubiosa sivoka, Evans; (22-26). Sikkim—Burma. C.

γ As last, but DSF ♀ below bright yellow and marginal spots H absent.
dubiosa fulva, Evans. (22-26). Andamans. C.
(*dubiosa*, Snell, is from N. Australia and is the oldest name for what is usually called the tailless form of *ardates*, *M.*=*nora*).

16 (15). F cilia white at apex. Unf basal band not below mv. Below as No. 14α.

α. Small and faintly marked below.
noreia noreia, Fd. (22-25). The White-tipped Lineblue. Ceylon, N. Burma. R.
β. Larger and more prominently marked below.
noreia hampsoni, DeN. (26-28). S. India—Mussoorie. R.

17 (15c). ♂ above rather pale dull violet blue, border linear. Below pale brown, bands not darker than the ground, white lines faint; F basal lines confined to cell; discal band does not extend below v2 or there is a much narrower spot in 1 set against the outer edge of the spot in 2; H tornal spots in 1a and 2 small and equal. ♀ plain brown, may have whitish discal area F.

**dana, DeN.* (24-28). The Dingy Lineblue. Ceylon. S. India. Kumaon—Burma, Andamans. N.R.

18 (15b) Unf basal ¼ black. Otherwise very like *bhuteani, DeN.* (26). De Niceville's lineblue. Karens—S. Burma. R.

H. 31. Jamides. The Ceruleans (Plate 27).

Above from milky white to deep metallic blue. Below brown with parallel white lines, filled in between as bands in the DSF forms of some species. Unf no basal lines. ♀ with broad dark border and apex F and marginal spots H.

1a (7a). Unf upper outer discal line to v3; lower outer discal line more or less joins inner upper discal line.

1b (3a). Unf upper discal lines bent in at v6. Unh discal lines broken at every vein.

1 (2). Below ochreous brown or brown, inner submarginal line not lunulate, markings dull and narrow. ♂ above brilliant dark metallic blue, border and apex F broadly black, H border narrow; borders narrower in DSF. ♀ non-metallic blue.

α. ♂ upf costa black.

bochus bochus Cr. (25-34). The Dark Cerulean. Ceylon, India, Burma, Andamans. C.

β. ♂ upf costa blue, at least at base.

bochus nicobaricus, WM. Nicobars. NR.

2 (1). Below dark grey, inner, submarginal line highly lunulate; markings white and prominent. ♂ above rather dark shining blue, border 1mm, even width. ♀ pale blue.

coruscans, M. (27-35). The Ceylon Cerulean. Ceylon. R.

H.31. Jamides—(*contd.*)

3a (1b). Unf upper discal lines not bent in at v6, but may be broken at vs. 4 and 6 ; unh markings more continuous.

3b (5a). Unf no white dashes on costa internal to the discal lines.

3 (4). Unh orange crown to tornal spot narrow, half the width of the spot. Below grey markings wide. ♂ above very pale shining metallic blue, border a thread ; ♀ nearly white.

lacteata, DeN. (28-40). The Milky Cerulean. Ceylon. R.

4 (3). Unh orange crown to tornal spot very large, twice the width of the spot, Below dark grey, markings narrow, prominent, very straight and regular. ♂ rather pale shining blue, border a thread. ♀ pale blue ; uph marginal spots very prominent and inner dark border to them very lunulate.

philatus subdita, M. (28-35). The Burmese Cerulean. S. Burma. NR.

5a (3b). Unf always 2 or 3 white costal dashes internal to the discal lines above lines end cell. Seasonal forms well marked. WSF with white lines on a dark grey or brown ground as usual. DSF filled in dark between pairs of lines, forming, broad bands, which on H may be darkened over making them indistinct, while on F the disc between the bands is more or less white. ♂ above very pale blueish white ; ♀ similar with broad dark border and apex F.

5 (6). ♂ upf border a thread and not dilated at apex ; more metallic and shining. A forest insect, not found in the open as next.

cleodus pura, M. (27-38). The White Cerulean. Assam-Burma. R.

6 (5). ♂ upf border a thread at tornus, gradually widening to 1mm. at apex.

α. ♂ above bluer and darker ; uph with submarginal spots.

celeno tissama, Fruh. (27-35). The Common Cerulean. Ceylon. C.

β. Above whiter ; uph no submarginal spots.

* *celeno celeno, Cr.* (27-40). India, Burma. C.

γ. Above as last ; uph with submarginal spots. No DSF.

celeno blairana, Evans. (27-35). Andamans. C.

δ. ♂ above with an inner fuscous border.

celeno kinkurka, Fd. (27-32). Kar Nicobar.

η. ♂ above entirely overlaid fuscous scales, leaving only a narrow pale submarginal fascia. Larger.

celeno nicevillei, Evans. (30-37). Great Nicobar and Kondul. NR.

7a (1a). Upf upper outer discal line ends at v4 ; lower discal lines join the lines at end cell ; upper discal lines angled or broken in at v6 ; inner upper discal line to v3. ♀ pale blue.

7 (8a). ♂ uph a complete submarginal row of flat spots separated from the marginal line by a white line bordering each spot. Apex F more or less produced, more so in DSF than WSF.

α. As next, but uph border more marked.

elpis meilichius, Fruh. (30-40). The Metallic Cerulean. Ceylon. C.

β. ♂ uph border broad, 1mm, slightly increasing to apex and slightly diffuse more especially at apex ; rather narrower and less diffuse in DSF. Above pale shining blue, transparent in WSF, milkier and opaque in DSF. Below WSF grey to brown ; DSF pale ochreous brown.

**elpis eurysaces, Fruh.* (30-44). S. India. Sikkim-Burma. Andamans. C.

H. 31. Jamides—(*contd.*)

γ. ♂ upf dark terminal line preceded by fuscous strigæ outwardly resting on an obsolete whitish line. ♂ above slightly shining bluish white.

elpis kondulana, Fd. (40). Nicobars. R.

8a (7). ♂ uph no submarginal markings except at tornus, where there may be traces of spots in 1a-2, border a thread. Below pale greyish brown to brown markings very narrow and sharp.

8 (9a). ♂ upf border a thread, slightly thicker than the border H. Above pale shining blue, darkening towards costa and apex F, where it is opaque, elsewhere transparent. Wings rounded, termen F more or less convex.

kankena pseudelpis But. (28-36). The Glistening Cerulean. Sikkim-Burma, NR

β. Smaller. Darker metallic blue, opaque.

kankena kankena, Fd. (28-32). Nicobars. NR.

9a (8). ♂ upf border 1mm increasing to 2mm. at apex.

9 (10). Above brilliant shining sky blue, darker than in the last two and everywhere opaque. Below darker than in last. Wings rounded and termen convex.

cærulea, Druce (32-35). Assam-Burma. The Royal Cerulean. R.

10 (9). Upf border diffused. Above dusky purple blue. Wings produced and termen straight.

lugine purpura, Evans. (35). The Dusky Cerulean. S. Burma. R.

H, 32. Azanus.—The Babul Blues. (Plate 27).

Small blues with catenulated spots below. Unh prominent black tornal spots in 1a and 2; basal and costal spots also black.

1a (4). Unf no spot in cell.

1 (2-3). ♂ above bright lilac blue, the scales modified in the centre of the disc F, where the blue colour appears darker, borders broad increasing at apex F and H. Below markings well developed. ♀ brown, no blue at base. Unh a basal costal brown streak.

**ubaldus, Cr.* (20-25). The Bright Babul Blue. Ceylon, India, N. Burma. C.

2 (1-3). ♂ duller violet blue, more uniform, area with modified scales present, but inconspicuous. ♀ blue at bases. Below usually markings faint.

uranus, But. (20-25). The Dull Babul Blue. India. C.

3 (1-2). As No. 2, but with broad dusky borders and darker below. Unh, no basal costal streak.

urios, Ril. (28). The Siam Babul Blue. Burma. VR.

4 (1a). Unf a spot in cell; unh prominent upper basal streak. ♂ as last above, but no modified scales. ♀ blue at bases, prominent spot end cell and whitish beyond it.

jesous gamra, Led. (21-26). The African Babul Blue. Ceylon, India, Burma. R.

H, 33. Lycænesthes.—The Ciliate Blues. (Plate 27).

Above uniform blue, no border; ♀ brown with blue bases and dark marginal spots H. Below with broad catenulated bands. Unh prominent orange crowned black marginal spot in 2.

1 (2). Unh spot base 7 large, of the ground colour; discal band more or less continuous. Unf discal band continuous or broken at v2. ♂ above dark purple blue. H. rounded.

a. Paler and markings below more regular.

H. 33. Lycænesthes—*(contd.)*

emolus emolus, God. (28-35). The Ciliate Blue. S. India. Sikkim—Burma. C.

β. Darker, smaller. Unf discal spot in 1 inclined inwards, pointing to spot end cell.

emolus andamanicus, Fruh. (25-28). Andamans. NR.

2 (1). Unh spot near base 7 small and black; discal band broken at v6. Unf discal band broken at v3. ♂ above much paler and bluer. H produced.

α. Below paler and edges of discal bands very irregular.

lycaenina lycaenina, Fd. (24-29). The Pointed Ciliate Blue. Ceylon. S. India. R.

β. Below darker; edges of discal bands much more regular.

**lycaenina lycambes, Hew.* Sikkim-Burma. Andamans. NR.

H. 34. Niphanda.—The Pointed Pierrot. (Plate 27).

Above ♂ dark purple blue, markings from below show through faintly on F. ♀ disc whitish, prominent discal markings. Unf prominent dark streak from base along upper edge cell; spot mid cell continued to dorsum; lower part of discal band in 1 and 2 much shifted in. Unh spot base 7 and discal spots in 6 and 7 very prominently black, contrasting with rest.

α. Small, apex F and tornus H not much produced. ♂ above the blue shading to a broad fuscous margin, H with marginal spots. ♀ above no blue, white areas F and H often extensive. Unf streak from mid cell to v1 of nearly even width, upper end slightly tapered.

**fusca cymbia, DeN.* (26-30). The Pointed Pierrot. Sikkim—Dawnas R.

β. Larger; tornus H and apex F very produced. ♂ above much clearer blue and border reduced to a fine line. ♀ light blue, white beyond cell F and H. Unf streak from mid cell with lower part much enlarged. Unh spots on dorsum prominently black.

fusca tessellata, M. (30-38). Java—S. Burma. R.

H. 35. Heodes.—The Coppers. (Plate 27).

Mostly copper coloured above and spotted as *Lycaena* below.

1a (6a). H termen excavated between vs 1 and 2.

1b (3a). Unf lower discal spots 1-3 not in line, spot in 2 shifted prominently out, ground colour orange with a brown border. Upf copper red, broad border, spotted as unf. Uph dark brown with submarginal red band. Unh grey brown with reddish margin. Tailless.

1 (2). Unh spots prominent, discal series resting outwardly on a white band and the red submarginal band is bordered on both sides by black spots. Unf brown margin even and submarginal black spots complete. ♂ upf unsullied copper; ♀ basal half dark brown; uph with faint purple suffusion.

**pavana, Koll.* (37-40). The white-bordered Copper. Kashmir-Kumaon. C.

2 (1). Unh spots minute, no white band or submarginal spots; unf apex broad grey brown. Uph often with small bluish discal spots. ♂ upf more or less suffused dark scales. Very variable.

α. Small, pale. Brown suffusion usually scanty.

phlæas stygianus, But. (26-30). The Common Copper. Baluchistan—Chitral and Ladak. C.

β. Larger. Upf brown suffusion intense, leaving only the base metallic copper.

phlæas indicus, Evans (28-34). Outer Himalayas, Kashmir-Kumaon. C.

**γ.* Large, pale but bright. Brown suffusion scanty: upf veins black.

H.35. Heodes.—(*contd.*)

***phlæas flavens, Ford* (30-34). Interior Himalayas to Sikkim, S.E. Thibet. C.

3a (1b). Unf lower discal spots in 1-3 in line.

3 (4a). Unh reddish brown with 2 narrow discal pale lines, pale line end cell and 2 or 3 basal black spots; markings very obscure. Above ♂ shining purple with dark border and prominent spot end cell, marginal orange lunules at dorsum F and along margin H. ♀ above dark brown, outer area F orange with blue-edged black spots. Unf orange with blue edged black spots. Tailless.

***tseng mandersi, El.* (31-35). The Chinese Copper. Shan States. VR.

4a (3). Unh white, prominently spotted.

4 (5). Unf spot in 2 in line with spots in 1 and 4; white, more or less overlaid yellow. ♂ above brilliant golden copper, unspotted and border 1mm., widening at apex and macular on H. ♀ yellow, fully spotted, base F and entirely on H suffused dark scales. Tailless.

***solskyi aditya, M.* (32-36). The Golden Copper. Chitral—Ladak. R.

5 (4). Unf spot in 2 in line with spot in 1 and spot end cell. Below both wings white with a somewhat diffused submarginal reddish band. Tailed. ♂ above purple brown basal two thirds purple glossed, spots from below show faintly on F and end cell H; ♀ dark brown, upf outwardly more or less orange and with orange marginal spots H.

phoenicurus, Led. (28-35). The Baluchi Copper. Baluchistan. R.

6a (1a). H termen evenly rounded.

6 (7). Unh white with prominent and regular spots and a red submarginal band spotted on either side. ♂ ♀ above purple brown, basally purple glossed, upf with a spot end and mid cell. Unf orange discal spots small, regular, becoming obsolete posteriorly; submarginal spots small.

α. Tailed. Paler above and below.

casyapa susanus, Swin. (29-35). The Purple Copper. Baluchistan. R.

β. Tailless. Darker above and below.

***casyapa evansii, DeN.* Chitral. R.

7 (6). Unh entirely verdigris green, spotless or with very tiny basal and discal spots. Unf orange with green border; in ♂ the orange area partly or wholly suffused green; discal spots in pairs in echelon, but upper pair shifted right in. Above ♂ bright copper, border, 1½mm., inwardly suffused purple; upf fully spotted and uph prominent spot end cell and discal row. ♀ dark brown, upf more or less orange outwardly. Tailless.

kasyapa, M. (30-36). The Green Copper. Chitral—Mussoorie. NR.

v. zariaspa, M. (27-32). ♂ above much duskier and entirely suffused purple; upf spots smaller and regular, the lower discal spots not elongated as in typical form and never a spot base 2. ♀ darker, less orange F. Below much bluer. NR.

H. 36. Heliophorus.—The Sapphires. (Plate 26).

Below ochreous with a broad red border H. H usually tailed at v2 or at least toothed.

1 (2a). Unh prominent costal and dorsal black spots near base. ♂ above dark shining violet with a broad border F and red submarginal band H. ♀ dark brown, the red submarginal fascia continued on F. Below pale ochreous to ochreous brown, a prominent white line inside the red submarginal area. Tailed

H. 36. Heliophorus—(*contd.*)

**sena, Koll.* (28-33). The Sorrel Sapphire. Chitral—Kumaon. C.

2a (1). Unh no prominent basal spots (may be minute ones in No. 2). ♀ above dark brown with a broad orange upper discal fascia on F and a red submarginal band on H.

2 (3a). Below no markings beyond sometimes a few dots between the base and the red marginal area, which is very dark and continued on to apex F. ♂ above dark shining purple. Tailed.

a. Very variable. ♂ upf border broad, over 1½mm.; often with an orange area beyond the cell; uph purple much restricted and red margin very prominent. ♂ F apex sharp and termen straight.

epicles indicus, Fruh. (28-34). The Purple Sapphire. Kumaon—Dawnas, Middle Andamans. C.

β. ♂ upf border narrow, 1mm. and uph orange markings reduced. ♀ upf orange band wider. ♂ apex F more rounded.

epicles kohimensis, Tyt. Nagas. NR.

3a (2). Below with a dark discal line and a line end cells, usually obsolete on H, but at least line end cell on F is traceable; red margin not continued to F and tornal spot F prominent.

3 (4a). H no tail, only a tooth at v2. ♂ above deep rich, non-metallic blue, border broad, but varies with season. Unf discal line straight and macular, if present. ♀ unf a large irrorated orange discal patch.

tamu, Koll. (30-35). The Blue Sapphire. Chitral—Kumaon. NR.

4a (3). H with long tail; ♀ unf no orange patch.

4 (5-7). ♂ above brilliant metallic green: inner edge dark border F straight.

a. ♂ metallic green with no bronzy tint.

androcles coruscans, M. (30-35). The Green Sapphire. Kashmir-Kumaon. N.R.

β. ♂ with a more bronzy tinge.

androcles androcles, Hew. Assam. N. Burma. N.R.

5 (4, 6, 7). ♂ brilliant metallic blue: inner edge dark border F curved.

* *moorei moorei, Hew.* (30-35). The Azure Sapphire. Chumbi, Bhutan. NR.

β. Duller.

moorei birmana, Fruh. (32-36). Manipur—N. Burma at high elevations N.R.

6 (4, 5, 7). ♂ above powdered dark metallic green scales.

a. Upf green colouring as extensive as in No 4.

viridipunctata viridipunctata, DeN. (34-40). The Powdery Green Sapphire. Kumaon—Sikkim. NR.

β. Upf green colour much restricted.

viridipunctata kala, Tyt. Nagas. NR.

7 (4-6). ♂ above iridescent golden bronzy.

brahma, M. (32-38). The Golden Sapphire. Kumaon—N. Burma. NR

H. 37. Neolycæna.—The Persian Hairstreak.

Above dark brown, cilia chequered. Below brown. Unh with irregular white discal and postdiscal streaks; 2 rows of black su marginal dots, white margined inside and yellowish between the rows. Very like an ordinary *Lycaena* in general appearance.

sinensis, Alph. (32-34). The Persian Hairstreak. Baluchistan. VR.

H.38. Callophrys.—The Tailless Hairstreaks.

1 (2,3). Below dull green with a row of small obsolescent discal white spots on H. Above plain dark brown.

rubi, L. (28-32). The Green Hairstreak. Baluchistan—Chitral. R.

2 (1, 3.) Below bright ferruginous, base, H darker; a narrow irregular dark discal line. Above rather pale blue with a broad dark border and apex F.

leechii, DeN. (30). The Ferruginous Hairstreak. Assam. VR.

3 (1, 2). Below dark brown with dark lines across base H, ends cells and 2 across disc, also submarginal diffused line H. Above plumbeous blue.

chalybeia, Leech. (28-32). The Plumbeous Hairstreak. N. Burma. VR.

H.39. Strymon.—The White-line Hairstreaks. (Plate 26).

Above dark shining brown. Below pale to dark brown, a narrow discal white line across both wings, inwardly black edged; a more or less obsolete series of black submarginal spots, inwardly white edged and a subterminal white line; H tornal lobe and spot in 2 black, prominently crowned orange.

1 (2). H single tail at v3. Unh discal line regular; submarginal spots H. obsolete on H and on F only in 2 and 3.

**sassanides, Koll.* (28-35). The White Line Hairstreak. Baluchistan—Chitral—Mussoorie. NR.

2 (1). H tailed at vs 2 and 3. Unh white discal line distorted to a W near dorsum.

mackwoodi, Evans. (34). Mackwood's Hairstreak. Manipur, N. Shan States. VR.

H.40. Listeria.—Lister's Hairstreak. (Plate 26).

♂ above bright blue, very broad black apex F; ♀ duller. Unf smoky brown, outer ½ broadly paler and bearing an obscure wide fascia; a pale spot end cell. Unh basal ½ black, rest reddish brown, very obscurely marked.

**dudgeoni, DeN.* (26-28). Lister's Hairstreak. Mussoorie—Sikkim. VR.

H.41. Euaspa.—The Water Hairstreak. (Plate 26).

♂ ♀ above rather pale blue, broad black apex F and an upper white discal patch F and H. Below dark chocolate brown, broad whitish border and marginal white ringed spots, orange circled at tornus H. Lobe small.

**milionia, Hew.* (30-34). The Water Hairstreak. Murree—Kumaon. NR.

H.42. Thecla—The Hairstreaks. (Plate 26).

Mostly metallic green above in ♂. ♀ blue purple or brown with 2 orange or white discal spots on F. Below usually with dark edged white lines and more or less prominent tornal orange and black spots H. All tailed except No. 17.

1a (5, 6a, 12a). ♀ upf basally purple with 2 orange discal spots, end cell and mid 3; uph plain dark brown.

1b (3a). ♂ above dark powdery green, or dull purple; upf black border 3mm., vs black. ♀ purple colour confined to base, orange spots small. Below brown to ferruginous with broad dark bands consisting of a bar end cell, discal band, marginal and submarginal bands; discal bands more or less edged outwardly by a silver line.

1 (2). Unh discal band very broad, coalesced to bar end cell, outwardly silver edged, straight to v2, then zigzagged to dorsum; innner submarginal band lunulate; prominent orange crowned tornal spots. Below rather pale brown, bands dark brown. Unf discal band straight and increasing to costa. Above dark powdery green. Wings produced. ♀ purple absent.

icana, M. (40-45). The Dull-green Hairstreak. Kulu—Kumaon. R.

2 (1). Unh discal band narrow and quite separate from the bar end cell; inner submarginal band lunulate. Below markings ferruginous; unf discal band of even width. Above purple. Wings rounded.

H. 42. Thecla—(*contd*).

α. Below ochreous brown, discal band outwardly silver edged and on F angled at v3; on H straight to v2, thence zigzagged to dorsum; tornal spots traceable, but very obscure.

**bieti dohertyi* DeN. (40-45). The Indian-purple Hairstreak. Kulu-Garhwal. R.

β. As last, but upf base only violet and uph all dark brown.

bieti mandara, Doh. (40). Kumaon. VR.

γ. ♂ above as α, but darker purple. Below very dark brown, silver edging to discal band obsolete; discal band on F evenly curved and on H only slightly zigzagged at lower end; all markings very deep ferruginous and tornal spots H absent.

bieti irma, Evans. (38). Bhutan. R.

3a (1b). ♂ not dull or purple green. Unh tornal orange spots prominent. Wings rounded.

3 (4). ♂ marked like ♀; upf peacock purple with broad dark brown apex and termen and 2 small yellow discal spots. ♀ duller, orange spots much larger, coalesced. Unf dark brown, powdery purplish white discal band, inwardly silver edged and a submarginal white line; in ♀ orange discal spots show as above. Unh dark brown base, broad irregular discal band, and broad submarginal band powdery purplish white.

**pavo, DeN.* (35-38). The Peacock Hairstreak. Bhutan—Nagas. VR.

4 (3). ♂ above metallic green. ♀ as ♂ of last. ♂ below silver white, no submarginal markings, dark bar end cells, narrow brown discal band often obsolete on F, and irregular dark brown central markings on H, often obsolete. ♀ unf pale brown, dark discal and submarginal markings, separated by a broad silver band; unh as ♂ but markings broader and silver ground, especially towards base, tending to become pale brown.

α. ♂ upf black margin 2mm. to 5mm. at apex.

**ataxus ataxus, Db.* (40-46). The Wonderful Hairstreak. Murree-Kumaon. R.

β. ♂ upf borders much narrower.

ataxus zulla, Tyt. Nagas. VR.

5 (1a. 6a. 12a.). ♀ above metallic sky blue, very faint traces of orange discal spots upf and borders broad. ♂ above bronzy metallic green with a violet sheen, border, 1½mm to 5mm at apex; uph a terminal blue line dorsum-v3. Below dark brown with silver white lines; unf line end cell, discal line and 2 submarginal lines; unh line through mid cell to v8, discal line very zigzag at lower end, submarginal and diffused marginal lines, tornal orange spots prominent.

suroia, Tyt. (40-42). Manipur. The Cerulean Hairstreak. Manipur. R.

6a (1a-5-12a). ♂ upf dark brown, upf with a large coalesced orange discal spots in mid 3 and end cell, spot in 3 often continued into 2. Below pale to dark brown; unf silver or pale edged dark bar end cell, dark discal band, outwardly silver or pale edged, 2 whitish submarginal lines; unh similarly marked and margin powdered whitish scales, tornal spots prominent and area between discal and submarginal lines often pale brown or white powdered.

6b (9a). Unh basal line mid 7 present, though often obscure.

6 (7a). Unh basal line in 7 crosses cell, but cell portion may be obsolete especially in ♀; upper end bar end cell nearer basal than discal line. ♀ unf orange spots show prominently and in ♂ there are some obscure orange scales in middle of cell bar. Below dark brown, area between discal and submarginal lines prominently silver powdered. ♂ above metallic green, border 1½ mm.

H. 42. Thecla—(*contd.*)

vittata, Tyt. (41-44). Tytler's Hairstreak. Manipur—Nagas. R.

7a (6). Unh basal line does not enter cell; upper end cell bar much closer to discal line. ♀ unf no traces of orange spots.

7 (8). Above ♂ metallic green; border 1-2mm., sharp defined.

α. Unh basal area pale, same shade as area between discal and submarginal lines.

duma duma, Hew. (42-48). The Metallic Green Hairstreak. Sikkim—Nagas. NR.

β. Unh basal area dark, same shade as between marginal pale area and submarginal line.

* *duma dumoides, Tyt.* (44-48). Manipur. NR.

v. intermedia, Tyt. (38-44). Smaller and ♂ border F narrower.

8 (7). Above ♂ powdered dark green scales, border 4mm., meeting black apex at v4 (Manipur, at v6 in Sikkim). Below uniform very dark brown, silver discal line prominent, remaining markings obscure and pale postdiscal areas absent.

zoa, DeN. (42-46). The powdered Green Hairstreak. Sikkim—Manipur. R.

9a (6b). Unh basal silver line absent.

9 (10a). Above ♂ powdered dark green scales, border 4mm., meeting black apex at v6. Very like No. 8, but paler below and smaller.

doni, Tyt. (36). The Suroifui Hairstreak. Manipur. VR.

10a (9). Above metallic green with sharp defined border.

10 (11). Below uniform brown, areas between discal and submarginal lines not conspicuously paler. ♀ above as *ataxus*.

letha, Wat. (40). Watson's Hairstreak. Assam. Chin Hills. VR.

11 (10). Below silvery fawn colour, area between submarginal and discal lines conspicuously paler, nearly white, silver lines absent. Uph ♂ terminal metallic blue scales dorsum-v3.

kabrua, Tyt. (36-40). The Kabru Hairstreak. Manipur, Nagas. R.

12a (1a-5-6a). ♀ above more or less rather pale blue with 2 large whitish spots end cell and mid 3. Below grey brown to silvery bluish marked as in last group.

12b (18). ♂ metallic green with well defined black border.

12c (17). H tailed.

12d (15-16). Unh discal band straight and continuous from v2 to costa.

12 (13-14). Below grey brown, not silvery. ♂ above border even and broad, 2mm., F and H. ♀ only traces of blue on F and H all dark brown. Below markings very even; H tornal orange spots prominent.

birupa, M. (38-40). The Fawn Hairstreak. Simla—Kumaon. NR.

13 (12-14). Below greyish white, not silvery. ♂ above border F as last, H narrower and irrorated bluish scales. ♀ blue colour extensive F and H. Unh markings pale and diffuse, no tornal orange spots H.

jakamensis, Tyt. (40-42). The Jakama Hairstreak. Manipur, Nagas. R.

14 (12-13). Below bluish silvery. ♂ F border narrower, even.

α. Larger. ♂ border H as broad as on F and no blue scales on it. ♀ H blue colour much restricted.

H. 42. Thecla—(*contd.*)

* *syla syla, Koll.* (42-45). The Silver Hairstreak. Safed Koh. Chitral—Kumaon. C.

β. Smaller. ♂ border H narrower than on F and irrorated blue scales. Below markings narrower, tornal orange spots H obscure. ♀ uph blue colour extensive, usually to termen.

syla assamica, Tyt. (36-38). Sikkim—Manipur. R.

15 (12d-16). Unh discal line very irregular, much bowed out opposite end cell. ♂ above margin very narrow. ♀ and below as No. 14 *β*.

kirbariensis, Tyt. (36-38). The Kirbari Hairstreak. Manipur, Nagas. R.

16 (12d-15). Unh discal line broken into semi-detached streaks, bowed in opposite end cell. Unf discal line also of detached streaks. ♂ ♀ above as No. 15, but uph with a blue terminal line on either side of tail.

paona, Tyt. (46-47). The Paona Hairstreak. Manipur. VR.

17 (12c). Tailless. ♂ ♀ above as No. 15, border in ♂ broader. Below as No. 16, markings smaller and often obscure ; no tornal orange markings.

khasia, DeN. (36-38). The Tailless Metallic Green Hairstreak. Assam—Manipur and Nagas. R.

18 (12b). ♂ as ♀. Tailed. Above blue colour extensive ; H margin narrow, containing a narrow pale blue line running along entire termen. Below white, not silvery ; F discal band black, also submarginal band, which ends in 2 very large spots in 1 and 2 ; other markings pale brown ; H tornal orange spots prominent.

* *ziha, DeN.* (35-38). The White-spotted Hairstreak. Murree—Kumaon. R.

H. 43. A Chaetoprocta.—The Walnut Blue. (Plate 26).

Above ♂ ♀ dark shining purple, border and apex broadly black, broader in ♀. Below white, marked as in H. 42-14 ; bands on H and end cell F pale and obscure ; discal band F black also marginal spots F, that in 1 being very large. ♀ with a prominent tuft of closely set yellow hairs at end of abdomen. Lobe fairly well developed and H angled at v3.

* *odata, Hew.* (32-36). The Walnut Blue. Chitral—Kumaon. C.

H. 43 B. Amblopala. The Chinese Hairstreak.

Above ♂ ♀ metallic blue with broad dark brown borders and an orange discal spot in 4-5 F. Unf pale brown, apex and margin chestnut, a silver bar end cell and a silver discal line. Unh chestnut, a central silver Y band from mid costa to tornus.

avidiena, Hew. (32). The Chinese Hairstreak. Naga Hills. VR.

H. 44. Curetis. The Sunbeams. (Plate 27).

♂ golden red above : ♀ with red or white discal areas. Below silvery white with obscure bands.

1a (4a). Below not covered with minute black dots. Unf discal and submarginal bands parallel. Unh discal band far from end cell. ♂ upf black border not or only very slightly continued along the dorsum. H only slightly produced and termen rounded.

1b (3). ♀ above with broad white discal patches.

1 (2). ♂ above copper of a pale tint : upf dark border very narrow, often reduced to a thread at dorsum and angled at the apex more or less. Below postdiscal line on both wings fairly straight and regular.

H. 44. Curetis—*(contd.)*

phædrus, F. (40-48). The Malabar Sunbeam. Ceylon. S. India—Bengal. NR.

2 (1). ♂ above darker: upf dark border broader and more even. Below postdiscal line separately curved in each space and varies in distance from base; unh line on either side of v5 markedly nearer the margin.

thetis, Dry. (40-48). The Common Sunbeam. India, Burma. NR.

3 (1b). ♀ with orange or obscure whitish discal areas. ♂ above with broad, evenly curved, dark border. Unf postdiscal lunules in 5 and 7 well beyond the others and not in line with rest as in No. 2.

α. ♀ with orange areas. Always larger than β.

saronis gloriosa.M.(44-48). The Burmese Sunbeam. Cachar—Burma. NR.

β. As last, but smaller.

saronis saronis, M. (40-44). Andamans. NR.

γ. ♂ as last. ♀ with obscure whitish discal areas.

saronis nicobarica, Swin. (40-44). Nicobars. NR.

4a (1a). Below covered with minute black dots. ♂ upf border continues along dorsum.

4 (5a). F termen convex and H termen rounded. ♂ uph base and tornus broadly darkened. ♀ with broad orange areas, which are darker and more restricted than usual: on H bar end cell not showing and the red area usually does not reach the costa. Below discal and submarginal bands nearly parallel.

sperthis, Fd. (30-40). The Rounded Sunbeam. Mergui. R.

5a (4). F termen straight or concave and H tornus produced. Unf discal and submarginal bands convergent to apex.

5 (6). ♀ with orange discal areas. Unh portion of discal band in 6 and 7 variable, but not in line with bar end cell.

α. ♂ above very variable and difficult to distinguish from No. 6: darker and usually no tooth end cell upf: uph base darkened, leaving a red discal area, which narrowly reaches the costa, as a rule.

bulis bulis, Db. (35-45). The Bright Sunbeam. Mussoorie—N. Burma. R.

β. ♂ much brighter: uph all red with a prominent black streak from the base over the mv: ends veins black.

* *bulis malayica, Fd.* (40-45). Karens—S. Burma. NR.

6 (5). ♀ with white discal areas of variable extent. Unh the portion of the discal band in 6 and 7 in line with the bar end cell, seen best by transparency from above. ♂ above paler red than usual and usually a tooth end cell upf. F apex very produced and may be falcate: tornus produced and termen straight or concave. H tornus much produced and termen produced in middle, being sharply angled at v4.

acuta dentata, M. (40-50). The Angled Sunbeam. S. India. Central Provinces. Mussoorie—Burma. C.

H. 45. Iraota.—The Silverstreak Blue: (Plate 27).

Above bright shining blue with broad borders. Below dark ferruginous; unf a silver streak and discal spots; unh usually a broad irregular basal silver streak, obscure zigzag discal markings and usually ochreous towards termen.

1 (2). ♂ tail only at v1; ♀ also tail at v2; margin more or less crenulate. Unh silver streak never to margin and sometimes completely absent. ♀ purple with broad borders.

H. 45. Iraota—(*contd.*)

α. ♂ above green rather than blue; unh silver streak, when present, clouded ferruginous.

timoleon nicevillei, But. (40-48). The Silverstreak Blue. Ceylon. R.

β. ♂ above blue. Unh silverstreak, if present, clear.

* *timoleon timoleon, Stoll.* S. India—Mussoorie—Burma. NR.

2 (1). ♂ tail at vs 1 and 2; ♀ with an extra tail at v3. ♂ above deeper blue; ♀ entirely dark brown. Below silver markings more extensive and wider; F discal spot in 4 elongate, nearly to termen; H a basal streak along costa and usually the broad irregular streak reaches termen and throws down a bar across end cell; discal zigzag silver markings prominent, margin broadly pale ochreous.

rochana boswelliana, Dist. (40-48). The Scarce Silverstreak Blue. Manipur—Burma. R.

H. 46. Horsfieldia.—The Leaf Blue. (Plate 27).

Above blue or purple with dark borders. Below dark ferruginous in ♂, rather pale brown in ♀, with a prominent black discal line across both wings, more or less irrorated with dark scales, presenting a leaflike appearance as in *Kallima*.

1 (2). ♂ above purple with border of even width.

α. Smaller and darker. ♀ in 2 forms, typically smalt blue to purple.

anita naradoides, M. (42-52). The Purple Leaf Blue. Ceylon. NR.

♀v. *darana, M.* Above plain brown. R.

β. Larger. ♀ above smalt blue. ♂ above border narrower.

**anita anita, Hew.* (50-55). S. India. Sikkim—Burma. NR.

γ. ♂ bluer above and darker below. ♀ blue area larger and extending to H.

anita andamanica. Ril. (50-55). Andamans. NR.

2 (1). ♂ above rich deep blue; ♀ purple blue, always more extensive, especially on H. ♂ above border narrows to dorsum.

narada taooana, M. (50-55). The Blue Leaf Blue. Dawnas—S. Burma. R.

H. 47. Thaduka.—The Many-tailed Oakblue. (Plate 27).

α. ♂ ♀ above pale silvery blue, black border=⅓ the wing F and H. Below base F and all H very dark brown, outer half F pale brown, with a discal band of black spots; H spotting very obscure; a prominent white spot mid cell F and usually some metallic green spots at bases F and H and above the tails.

**multicaudata kanara, Evans.* (35-45). The Many-tailed Oakblue. S. India. R.

β. Above darker, Unf cell spots and unh spot base 7 dark.

multicaudata multicaudata, M. S. Burma. R.

H. 48. Mahathala.—The Falcate Oakblues (Plate 27).

1 (2). H margin smooth. ♂ above rich deep blue with narrow borders: ♀ purple with broad borders. Below rufous brown, markings obscure: F white lines across cell and a broad continuous dark discal band; H a pale fascia from mid dorsum to apex and a similar submarginal fascia, obscure spots at base.

**ameria, Hew.* (38-42). The Falcate Oakblue. Bengal—Burma. R.

2 (1). H margin crenulate. ♂ ♀ above blue with broad borders and black veins; costa upf chequered black and white. Below pale to dark brown; H



H. **Lycaenidae.** H. 49. *Amblypodia.*

H. 48. Mahathala—(*contd.*)

with obscure confused markings as in H. 47; F with 6 white bars across the cell, a highly waved postdiscal line and a square large pale patch mid 1, with 2 smaller square spots in 2 and 3; H some tornal metallic green scales.

**atkinsoni*, *Hew.* (35-40). The Crenulate Oakblue. Manipur—S. Burma. R.

H. 49. Amblypodia.—The Oakblues. (Plate 28).

Above all shades of blue and purple and even metallic green. Below normally with the same pattern. Unf 3 spots in the cell, including the spot at the end of the cell; often with a costal spot in 10 over the spot end cell and more rarely with one or more spots nearer the base in 11 and at the bases of 10 and 11; a more or less continuous discal band, which may be broken at v4 and may or may not be continued to v1; a spot at base 2 and a dark area at base 1; a submarginal dark line. Unh a more or less prominent spot or half spot at base 8; a basal row of 4 spots (7, cell, 1 and dorsum); a central row of 3 spots (7, cell and 2); a continuous band made up of spots from the costa to dorsum, the shape of which varies in different groups, more especially as to the shape and position of the two uppermost spots (in 7 and 6), whether the dislocation at v2 is partial or complete and whether the band runs continuously to the dorsum or not; more or less prominent tornal green or blue metallic scales and a single broad or 2 narrow submarginal lines. May be tailed at v2 and lobed at the tornus H.

1a (72a). Unf with 3 normal dark cell spots.

1b (16a). Unh with the discal spots in 7, 6 and 5 with their centres in line, more or less rounded; spots in 7 and 6 in echelon, inner edge of spot in 6 more or less in line with the outer edge of the spot in 7 (see also Nos. 27 and 28). Tailed or tailless.

Anthelus Group.

1c (11a). Tailed.

1d (4a). Unf cell spots abnormal, not confined to cell; discal band broken at v4. Unh tornal green scales diffused, lobed. H produced.

1 (2-3). Unf spot end cell extended to costa and 3 prominent whitish costal spots, including upper spot of discal band; unh discal band completely broken at v2 and continuous to dorsum. Below chocolate with on H a broad white band from base cell to apex and below this band the ground colour is much paler. Above ♂ ♀ pale blue, border F ½mm. at tornus to 5 at apex, H no border.

**subfasciata*, *M.* (40-46). The White-banded Oakblue. Dawnas—S. Burma. NR.

2 (1-3). Unf basal and central spot extended to v12 and 2 prominent costal spots; unh an additional costal spot at base 8, discal band partially broken at v2 and discontinuous to dorsum. Below ochreous brown, spots on F and about costa H very dark. ♂ above metallic blue changing to purple, border F ½mm. at tornus to 3 at apex; ♀ paler metallic blue, borders broad; tornus H fuscous.

a. Above paler. Below pale ochreous. Unh other than costal spots obscure.

**anthelus anthelus*, *Db.* (50-60). The Multi-spotted Oakblue. Dawnas. NR.

β. Above and below much darker. Unh all markings prominent.

anthelus anthea, *Evans.* Tavoy—S. Burma. NR.

3 (1-2). Unf central cell spot only extended to v12 and a single costal spot in 10 over spot end cell; unh discal band completely broken at v2 and continuous to dorsum. Below pale ochreous brown, spots large, rounded and only slightly darker than the ground, apex and outer part of H may be whitish. ♂ above pale metallic blue changing to violet, no border; ♀ more violet, border broad and a spot at end cell F.

anarte, *Hew.* (62-65). The Magnificent Oakblue. Manipur—S. Burma. VR.

H. 49. Amblypodia—(*contd.*)

4a (1d). Unf cell spots normal and at most a single costal spot.

4 (5a). Below rosy purple. Unf discal band continuous or slightly broken at v2, no costal spot. Unh discal band partially broken at v2 and continuous to dorsum, tornal green scales diffused. ♂ above dark purple blue, border F ½mm.; uph costa broadly fuscous: ♀ with broad borders.

suffusa, Tyt. (40-50). Tytler's Rosy Oakblue. Manipur-Dawnas. R.

5a (4). Below brown or ochreous brown.

5b (10). ♂ upf no discal area of modified scales. Unf discal band completely broken at v4; unh discal band partially dislocated at v2 and more or less continuous to dorsum.

5c (9). Unf no costal spot in 10 over spot end cell.

5d (8). Unf discal spots separated by white irides. Below pale brown with large prominent spots. Unh tornal green scales diffused; lobed.

5a (7). Above ♂ pale violet blue, border a thread, a black spot end cell surrounded by a white area. ♀ paler, becoming whitish outwardly, spot end cell and a spot beyond conjoined to the costal border. Unf discal spots in 2 and 3 elongated towards the spot end cell.

5 (6). Unf discal spots well separated.

α. Pale and large. Below markings small in DSF, being very black on F and about costa H.

camdeo camdeo, M. (52-56). The Lilac Oakblue. Sikkim—N. Burma. R.

β. Smaller and darker. ♀ more uniform violet blue.

**camdeo varro, Fruh.* (42-50). Karens—S. Burma. VR.

6 (5). Unf discal spots large with irides conjoined.

dispar, Riley. (44-52). The Siam Oakblue. Assam—Dawnas. VR.

7 (5a). ♂ above pale silvery metallic blue, border O to 1mm. at apex.

♀ bluish white, border broad and a spot end cell. Unf spots in 2 and 3 rounded; unh whitish below costa inside the discal band.

**karennia Evans.* (48). The Karen Oakblue. Karens. VR.

8 (5d). Unf discal spots not separated by white irides, upper spot of discal band shifted in. Below rather dark brown, all white edgings prominent. ♂ pale silvery violet blue, no border, a more or less prominent discal white spot upf. ♀ darker and border broad: spot end cell, not joined to costal border.

opalina, M. (48). The Opal Oakblue. Assam—Tavoy. VR.

9 (5d). Unf costal spot in 10 over cell spot in continuation of upper spot of discal band, no spot in 1. Below hair brown, irides pale brown, not prominent; ♂ above metallic violet blue, no border; ♀ violet blue, borders broad, no spot end cell. Unh tornal green scales sharp defined.

agnis, Fd. (56-58). The Large Metallic Oakblue. Dawnas—S. Burma. R.

10 (5b). ♂ upf with a discal area of modified scales. Unf discal band variable, may be broken at v4, only sinuous, or spot in 4 may be shifted out; usually costal spot in 10. Below hair brown, markings dull; unh discal band completely dislocated at v2 and continuous to dorsum; tornal green scales sharply defined, lobed. ♂ above metallic violet blue, becoming violet outwardly; ♀ with broad borders, no spot end cell, but with ill-defined spots beyond conjoined to the costal border.

α. Paler and more silvery, border F in a thread.

H. 49. Amblypodia—(*contd.*)

atosia aricia, Stg. (42-46). The Tailed Disc Oakblue. Pegu Yoma—Karens. R.

β. Darker, border F in ♂ ¼mm.

* *atosia atosia, Hew.* Dawnas—S. Burma. C.

11a (1c). Tailless. Below hair brown, markings dull; unf no spot in 1 and costal spot obscure or absent: unh lobed and tornal green or blue scales sharply defined. ♂ border broad, no spot end cell, but may be spots beyond joined to the costal border. Wings rounded and costa F highly arched.

11b (13a). Unh discal band completely dislocated at v2 and continuous to dorsum. Below more or less obscurely purple washed.

11 (12). Unf costal spot in 10, discal band broken at v4 and usually spot in 4 shifted out. ♂ ♀ above as in No. 10, but border F in ♂ up to 1mm. (Paler and bluer than typical *epimuta* from Java).

epimuta elsiei, Evans. (37-43). The Tailless Disc Oakblue. Tavoy—S. Burma. NR.

12 (11). Unf costal spot in 10 obscure or absent, discal band bent at v4 and spot in 2 shifted out; darker below. ♂ above shining metallic blue, completely overlaid violet on F, border F 1¼mm.

* *metamuta, Hew.* (36-40). The Bicolor Oakblue. Karens—S. Burma. R.

13a (11b). Unh discal band partially dislocated at v2, more or less continuous to dorsum. Unf no costal spot in 10; discal band bent at v4.

13 (14-15). ♂ above pale metallic blue shading to violet, border F ½mm. Small.

payaiensis, Ollen. (38-40). The Pale Arched Oakblue. Dawnas—S. Burma. R.

14 (13-15). ♂ above darker and much larger.

* *moolaiana, M.* (42-50). The Large Arched Oakblue. Karens—S. Burma. R.

15 (13-14). ♂ above dark uniform violet blue, ♀ uph, border broad. Below darker and markings more prominent.

15a (15b). Border F 1 mm.

agesilaus, Stg. (43). The Dark Arched Oakblue. Mergui. VR.

15b (15a). Border F a thread.

amphimuta, Fd. (43). The Malay Arched Oakblue. Mergui. VR.

16a (1b). Unh discal spots in 7, 6 and 5 with centres not in line, 7 and 6 more or less quadrate, conjoined. (See Nos. 27 and 28).

16b (65-a). Unf no spot base 11 between basal and central cell spots.

16c (36a). Unh discal band completely dislocated at v2 and usually continuous to dorsum. Always tailed and F termen never concave just below the apex; lobed.

16d (21a). Unf discal band completely broken at v4, spot in 4 being shifted out of line with the rest; usually a well defined costal spot in 10 and often spot in 11 and at base of 7 and 10. Unh tornal green scales prominent, though sometimes diffuse.

Atrax Group.

16 (17a). Below dark chocolate, all markings broken up and consisting of small white lines and dashes. Unh discal spot in 6 large, overlapping spot in 5 and end cell, outwardly concave. ♂ above pale metallic silvery blue shading to violet at apex F, border ½mm.; ♀ pale blue with broad borders F.

H 49. Amblypodia.—(*contd.*)

* *albopunctata, Hew.* (34-38). The White Spotted Oakblue. Karens—S. Burma. NR.

17a (16). Below grey brown to ochreous or purple brown with a purple to pinkish wash. Unh discal spots in 7 and 6 conjoined and placed between spot end cell and spot in 5.

17 (18-20). ♂ above dark shining purple blue, border F 1½mm. to 3 at apex ; ♀ shining blue, border F 2mm. to 5 at apex, costal border 1mm. leaving blue over cell, a black area beyond cell conjoined to black apex. Below very distinct, dark purple brown with prominent white edged broad markings, more irregular than usual ; F costal spots prominent ; 2 zigzag submarginal lines. Wings rounded.

* *alitaeus mirabella, Doh.* (36-38). The Purple Brokenband Oakblue. Tavoy—S. Burma. R.

18 (17-19-20). ♂ above dark shining purple blue, border 1½mm. to 3 at apex ; ♀ shining blue, border 3mm., all costa and apex black to v4, a small spot mid 3. Below grey brown to purple brown, markings prominent but much more regular and narrower ; unh discal band usually discontinuous at dorsum. Apex F produced and termen straight.

atrax, Hew. (32-38). The Dark Brokenband Oakblue. Shan States—S. Burma. NR.

19 (17-18-20). ♂ above shining violet blue, or silvery blue, overlaid violet : border F 1mm.—1½ at apex. ♀ pale blue, border 1½mm.—5 at apex, ½mm. on costa, leaving blue above the cell, the black apex angled at v4. Below rather pale ochreous or grey brown with slight pinkish wash. Very variable above and below.

* *ariana, Evans.* (35-42). The Pale Brokenband Oakblue. Dawnas—S. Burma. R.

20 (17-19). ♂ above purple, border ¾mm.; ♀ as last. Below ochreous brown to slightly purple brown. Wings much more rounded than in the rest of the group and unh tornal green scales much more sharply defined.

rafflesii, DeN. (37-40). Raffles' Oakblue. Mergui—S. Burma. R.

21a (16d). Unf discal band not much dislocated at v4, spot in 4 never pushed out and never more than a single costal spot (in 10 over the end cell spot).

21b (25a). Of large size, over 45mm. Unh discal band in 2-5 straight, confluent and directed to the tornal lobe ; tornal green scales prominent and usually diffuse ; discal spot in 6 with its outer edge oblique and well inside the inner edge of the spot in 5.

silhetensis Group.

21c (24). Below ochreous brown.

21d (23). Unf discal band dislocated at v4, lower part shifted in ; always a costal spot in 10. Unh discal band slightly dislocated at v4.

21 (22). Unf costal spot in 10 never so wide as the spot end cell ; upper part of discal band straight or uppermost spot shifted in. Termen F straight.

α. ♂ above violet blue, border F 2mm. Below greyish ochreous ; bands and spots large and prominent ; unh tornal green scales faint or absent.

* *silhetensis silhetensis, Hew.* (50-56). The Sylhet Oakblue. Sikkim—N. Burma. R.

β. ♂ above shining purple blue, border F ½mm. Below clear ochreous brown, spots usually small and sharply defined.

H. 49. Amblypodia—(*contd.*)

silhetensis arama, DeN. (50-56). Karens—S. Burma. R.

22 (21). Unf costal spot in 10 very large, as wide as the spot end cell; upper part of discal band arched. ♂ above shining purple blue, border F ⅜mm. ♀ border broad, and may be a spot end cell and a black patch beyond. Unh tornal green scales prominent.

* *adorea, DeN.* (46-50). The Singapore Oakblue. Dawnas—S. Burma. R.

23 (21d). Unf discal band not dislocated at all at v4, may be slightly sinuous there; costal spot in 10 present or absent. Below variable, may be slightly purple washed. ♂ above shining purple blue, border 1½mm.—5 at apex; ♀ paler, bluer, border 2½—7mm.

* *adatha regia, Evans.* (48-50). The large Mergui Oakblue. Mergui. R.

24 (21c). Below rosy purple to purple brown; unf costal spot in 10 present or absent. ♂ above shining purple blue, border F 1mm. ♀ paler, border 3mm., a dark patch beyond end cell.

apha, DeN. (46-50). The Vinous Oakblue. Dawnas—S. Burma. VR.

25a (21b). Not larger than 45mm. Unh discal band in 2-5 more irregular and discal spot in 6 with its outer edge more or less joining inner edge of spot in 5.

Phaenops Group.

25b (29a-31a). Below dull ochreous hair brown. Rather large and wings produced. Unf discal band sinous, no spot in 10.

25 (26a). Below rather dark brown, markings very wide and prominently outlined white. Unh central row spot enlarged; discal spot in 6 very large, overlaps spot in 5 and usually not up to the spot end cell; tornal green scales diffused. ♂ above shining violet blue, border 1mm. to 2 at apex, veins black, especially on H.

arata, Tyt. (44). Tytler's Dull Oakblue. Manipur. VR.

26a (25). Below markings dull and narrow.

26 (27a). Unh discal spot in 6 midway between the spot end cell and the spot in 5 or nearer the former; tornal green scales sharply defined, prominent. ♂ above very deep purple blue, border ½mm.; ♀ paler and borders very broad.

agrata, DeN. (44). DeNiceville's Dull Oakblue. Manipur—Burma. R.

27a (26). Unh discal spot in 6 much nearer the discal spot in 5; spots in 7, 6 and 5 in echelon with their centres more or less in line. Below markings very obscure.

27 (28). Unh no tornal green scales. ♂ above bright violet blue, border 1½mm; ♀ as next.

aenea, Hew. (46). Hewitson's Dull Oakblue. Sikkim—Assam. R.

28 (27). Unh with more or less prominent metallic green scales at tornus. ♂ above dark purple blue, border ½mm; ♀ purple blue costal and terminal border F 4mm. and on H blue only about cell.

khamti, Doh. (46). Doherty's Dull Oakblue. Sikkim—N. Burma. NR.

29a (25b-31a). Below rather dark ochreous hair brown with prominent markings and tornal green scales H; rarely a very faint purple wash. Unf usually a spot in 10, discal band variable, may be straight, sinuous or slightly broken at v4; unh discal spot in 6 overlapping spot end cell or intermediate between it and the spot in 5. ♀ purple with broad borders.

H. 49. Amblypodia—(*contd.*)

29 (30). ♂ above bright shining deep blue, border F 1mm. ♀ purple colour extending into the black apex, thereby forming a black patch end cell.

* *phœnops aroa, Hew.* (34-40). The Bright Oakblue. Karens—S. Burma. NR.

30 (29). ♂ above dark purple blue, border F 1mm. ♀ purple colour not extending into the black apex. Wings much more rounded.

pryeri, But. (38-42). The Roundwinged Bright Oakblue. Dawnas—S. Burma. R.

31a (25b-29a). Below with a more or less well developed rosy, pinkish to purple gloss. Unf a more or less prominent costal spot in 10.

31b (33a). Unh discal spot in 6 more or less overlapping the spot end cell and the centres of spots in 7 and 6 in line with spot end cell.

31 (32). Unh discal spot in 5 well separated from the spot end cell. Below variable, the rosy pink gloss variable in shade and intensity.

α. Unf discal band usually broad, curved, sinuous, upper portion oblique: unh tornal green scales prominent. ♂ above bright deep blue, border F 1½—2mm. ♀ shining blue with broad borders. Very variable.

* *alea alea, Hew.* (34-40). The Rosy Oakblue Karens—S. Burma. NR.

β. Unf discal band straight and narrow. Unh tornal green scales faint. ♂ above bright deep blue, border 1½mm. ♀ shining blue.

alea constanceæ, DeN. (40). Andamans. VR.

32 (31). Unh discal spot in 5 conjoined to spot end cell or only separated by a double white bar; discal band very irregular. Unf discal band continuous, straight or slightly curved. Below purple brown with a purple glaze; unh tornal green scales rather faint. ♂ above dark shining violet blue; ♀ paler purple blue, border broad and with more or less of a spot end cell.

α. Below uniform. Unh inner submarginal line prominently zigzag. ♂ border F 1mm.

agaba aurelia, Evans. (36-44). The Purple-glazed Oakblue. Manipur—N. Burma. R.

β. Below patchy, apex and costa F and H except termen, as well as all the markings with a whitish glaze. Unh inner submarginal line obscured. ♂ border F ¾mm.

* *agaba agaba, Hew.* Karens—S. Burma. NR.

33a (31b). Unh discal spot in 6 with its inner edge clear of the outer edge of the spot end cell. Unf discal band unbroken and on H discal band in 2-5 very compact. Unh tornal green scales usually faint and diffused.

33 (34-35). Below rather pale purple brown with a purple wash. Unf no spot in 10. Unh basal and central spots unusually small and bar end cell very narrow. ♂ above dark shining violet blue, border 1mm.; ♀ paler purple, a spot end cell F and on H the purple colour confined to the cell.

canaraica, M. (44-45). The Kanara Oakblue. S. India. R.

34 (33-35). Below pale grey brown, more or less washed pinkish. Unf with a costal spot in 10, discal band very straight. Unh discal band almost continuous from 2-7. ♂ above dusky purple, border F 2mm. to 4 at apex, H blue to just beyond end cell. ♀ border 3mm. to 6 at apex and on H blue colour absent or with traces at base.

* *hewitsoni, BB.* (34-40). The Indian Oakblue. S. India—Dun—Dawnas. C.

H.49. Amblypodia—(*contd.*)

35 (33-34). Below pale silky ochreous brown. Unf with costal spot in 10 discal band very straight and a prominent oblique spot in 1. Unh discal band almost continuous from 2-7. ♂ above dusky purple, ♀ blue ; border F 3mm. to 6 at apex, a spot end cell and a whitish streak beyond ; on H blue to just beyond cell. Wings produced.

* *alemon, DeN.* (35-44). The Silky Oakblue. Manipur—Dawnas. C.

36a (16c). Unh discal band never dislocated at v2. (except No. 56).

36b (50a-54a). Tailed and F termen never concave just below the apex.

Centaurus Group.

36c (44a). Unh discal spot in 6 overlapping spot end cell and the spot in 5, its outer edge concave.

36d (39a). Unf discal band continuous, not broken at v4 ; spot in 10 over end cell obscure or absent.

36 (37a). Unf an oblique discal spot in 1 ; unh tornal green scales faint or absent, no lobe or tornal black spots. Below dark ochreous brown, markings obscure ; unf markings in cell defined by vertical silver lines, discal band sinuous ; unh markings faint, discal spot in 5 close to spot end cell. ♂ above dark violet blue ; ♀ paler with broad borders. F apex produced and termen straight.

α. ♂ border F 1mm. ♂ ♀ paler basally.

centarurus pirama, M. (53-62). The Centaur Oakblue. Ceylon, S. India. NR.

β. ♂ border ¾mm. ♂ ♀ uniform above.

centaurus pirithous, M. Kumaon—Assam. NR.

γ. ♂ border ½mm. ♂ ♀ uniform above.

* *centaurus centaurus, F.* Burma. NR.

δ. ♂ border ¼mm. Bases conspicuously paler, especially in ♀.

centaurus coruscans, WM. Andamans. NR.

37a (36). Unf no discal spot in 1 or only a faint one in continuation of the discal band. Wings rounded.

37 (38). Below purple brown. Unh discal spot in 5 well separated from the spot end cell, tornal green scales more or less prominent and with a small lobe. Below purple brown with a conspicuous glaze. Above ♂ dark shining blue, border F 1½mm. increasing to 3 at tornus and apex and on H ; ♀ paler, border 4mm. and a black spot end cell.

paralea, Evans. (40-45). The Glazed Oakblue. Manipur—Shan States. R.

38 (37). Below ochreous brown with prominent markings ; unf with a costal spot in 10 and discal band sinuous ; unh sharply defined tornal green scales and lobe, discal spot in 5 well separated from the spot end cell. Above ♂ shining purple blue, border F 1mm.

cooperi, Evans. (42-44). Cooper's Oakblue. Mergui. VR.

39a (36d). Unf discal band conspicuously broken at v4, lower part shifted in and upper part oblique. Unh lobe well developed and always with more or less diffuse tornal green scales.

39 (40a). Unf dark area under cell produced along 1 to the discal band ; no costal spot in 10. Unh discal band very sinuous, spot in 5 at right angles to the spot in 4. Below grey brown to dark ochreous brown, markings prominent. Above ♂ dark shining blue ; ♀ brighter and paler with broad borders and a spot end cell.

H. 49. Amblypodia—(*contd.*)

a. ♂ above border F 1mm.

amantes amantes, Hew. (45-57). The Large Oakblue. Ceylon, S. India—Dun—Sikkim. NR.

β. ♂ border upf 4mm.

* *amantes amatrix, DeN.* Manipur—Dawnas. NR.

40a (39). Unf dark area under cell quite separate from the discal band; usually prominent costal spot in 10. Unh discal spots square, moderately regular, in a stepped line.

40b (42a). ♂ above purple; ♀ uph no blue and on F the broad dark border continued a little along the dorsum.

40 (41). Unh the central cell spot joined to the central costal spot. Below rather pale brown, apex F whitish; H centre of disc and margin shining yellow. ♂ above dark purple, border F 2mm. and a spot end cell; ♀ rather pale purple.

**singla, DeN.* (44-48). The Yellowdisc Oakblue. Sikkim—Karens. NR.

41 (40). Unh central cell spot never joined to central costal spot. Below ochreous brown to brown with a silky gloss; F apex whitish; H prominently, but sparsely sprinkled white scales, margin and markings more or less shining yellow. ♂ above very dark purple, very nearly black, border F 1mm., 2 on H; ♀ as last.

**bazalus, Haw.* (44-48). The Powdered Oakblue. Sikkim—Karens. NR.

42a (40b). ♂ above green. ♀ with more or less blue colouring on H. Unh bar end cell well separated from the spot in 5.

42 (43). ♂ above bright metallic brassy green, border F under 3mm. Unbar end cell narrow. ♀ purple blue with broad borders.

a. Wings rounded. ♂ upf border from 2mm at apex to 4 at tornus; H green to just beyond the cell. Below uniform rather pale brown with a silky gloss; H tornal green scales diffused. ♀ borders very broad and continued along dorsum.

**eumolphus eumolphus, Cr.* (44-50). The Green Oakblue. Sikkim—Karens. NR.

β. Apex F produced. ♂ upf border 1mm at apex to 3 at tornus, green area more extensive on H. Below as last, but apical area F and H broadly pale, whitish. ♀ border narrower, not continued along dorsum F.

eumolphus hellenore, Doh. Assam—Tavoy. NR.

γ Wings rounded. ♂ above as last. Below uniform ochreous brown, no silky gloss; H tornal green scales sharply defined, brilliant.

eumolphus maxwelli, Dist. Mergui. VR.

43 (42). ♂ above metallic peacock green, border F 6mm. at tornus to 9 at apex. ♀ bright shining blue, border narrower than in ♂ 4mm. and a black spot end cell. Below very dark ochreous brown, ♀ ferruginous brown, markings wider than usual, tornal green scales sharply defined, brilliant.

horsfieldii eurysthenes, Fruh. (40-46). The Peacock Oakblue. Dawnas—S. Burma. R.

44a (36c). Unh discal spot in 5 outwardly rounded, not overlapping both spot end cell and the spot in 5, usually central, just filling the gap. Unf no spot in 10. Lobed.

44b (46a). Unh more or less overlaid white scales.

44 (45). Below entirely overlaid white scales except for the markings on F and about costa H, which are dark chocolate; unf discal band slightly broken at v4; unh tornal green scales sharply defined. ♂ above dark shining purple border ½mm. ♀ entirely dark brown.

H. 49. Amblypodia—(*contd.*)

ormistoni, Riley. (46). Ormiston's Oakblue. Ceylon. VR.

45 (44). Below apex F and H inside the wavy submarginal line and below v8 overlaid white scales, remainder dark chocolate. Unf discal band completely broken at v4 and the discal spot in 3 joining spot end cell; markings prominently outlined white. Unh discal spot in 7 larger than the spot in 6, both prominently chocolate as also are the central and basal spots in 7, which are close together and conjoined to the chocolate area in 8; tornal green scales obscure. ♂ above purple, border F 2mm to 3 at apex and tornus. ♀ purple, paler, border 4mm, running along dorsum and very broad at apex; H only cell purple.

**bazaloides, Hew.* (44-47). The Tamil Oakblue. S. India, Assam—N. Burma. R.

46a (44b). Unh not overlaid white scales.

46b (49). Below ochreous hair brown; unh tornal green scales prominent, discal band continuous to dorsum.

46c (48). Unf discal band slightly broken at v4.

46 (47). Unf base 1 under cell entirely filled dark brown up to origin of v2. Below markings very large. ♂ apex F pointed; above very deep purple blue, border F ½mm and veins brownish. ♀ bright purple blue, border F 1-5mm at apex, black spot end cell.

corinda acestes, DeN. (50-55). The Ultramarine Oakblue. Mergui. VR.

47 (46). Unf no prominent dark basal area under cell. Below dark ochreous brown. ♂ above shining purple blue, border F 1½mm., veins outwardly narrowly black.

vihara, Fd. (52). Felder's Oakblue. Mergui. VR.

48 (46c). Unf discal band unbroken but bent at an angle of 140 degrees at v4. Below rather pale ochreous brown. ♂ ♀ alike rather pale blue, border H and at tornus F 2mm to 6 at apex.

woodii, Ollenbach. (40-50). Wood's Oakblue. Tavoy—S. Burma. R.

49 (46b). Below pale grey brown turning whitish at apex F and H. Unf spot base 3 joining spot end cell and the spot base 2; discal band broad, continuous, directed to tornus, spot in 3 slightly elongated inwards; dark broad submarginal spots in 2 and 3; all markings black, except upper part of discal band, which is whitish. Unh all markings pale, black edged, more markedly so near costa, discal spot in 3 shifted in, joining spot end cell; no tornal green scales. Above pale silvery blue, border F 4mm.; ♀ with black spot end cell.

alesia, Fd. (42-44). The Pallid Oakblue. Dawnas—S. Burma, Andamans. R.

50a (36b. 54a). F termen pointed and sharply concave below the point. Unh discal band discontinuous to dorsum, tornal green scales absent or faint. Tailed or tailless; small lobe.

Rama Group.

50b (53). Tailed.

50c (52). Below markings regular. Unf discal band continuous, slightly broken at v4, at most a single costal spot in 10. Unh discal band not broken at v2.

50 (54). Below pale silky ochreous brown, markings prominent on F, faint on H; unh discal spot in 6 between spots end cell and in 5, not overlapping either. Above ♂ ♀ alike, pale blue, border F 4mm. to 6 at apex, slightly continued along dorsum, a spot end cell and whitish beyond; H border 4mm. vs blackish. Termen F crenulate

H. 49 Amblypodia—(*contd.*)

**dodonaea, M.* (38-44). The Pale Himalayan Oakblue. Chitral—Kumaon. C.

51 (50). Below purple brown with a silky gloss. Unh discal spot in 6 large, overlapping spot end cell and spot in 5 and outwardly concave. Above ♂ dark violet blue; ♀ purple with broad borders and a spot end cell F.

α. ♂ above border 1½-2mm. and extending slightly along dorsum; on H 3mm. ♀ border 4-7mm. and on H blue to just beyond cell. Below markings dull and faint.

rama rama, Koll. (38-40). The Dark Himalyan Oakblue. Kashmir—Sikkim. C.

β. ♂ border F 1mm. and on H just under 1mm; ♀ purple more extensive. Below markings darker and better defined.

**rama ramosa, Evans.* (34-40). Manipur—Dawnas. NR.

52 (50c). Below ochreous with dark irregular markings. Unf 2 costal spots, discal band very irregular and broken. Unh markings rather obscure, discal band completely broken at v2. Wings very produced especially at tornus H. ♂ ♀ above shining purple, border F 4mm. to 7 at apex and a spot end cell; H only purple at base.

comica, DeN. (42). The Comic Oakblue. Manipur—Shan St. VR.

53 (50b). Tailless. Below ochreous brown, markings inconspicuous and as in No. 51; unf cell spots may be obsolete. Wings rounded ♂ above dark violet blue, border F 2mm.; H blue to just beyond cell. ♀ purple with broad borders, a spot end cell F and on H cell only purple.

**paramuta, DeN.* (30-35). The Hooked Oakblue. Sikkim—Karens. NR.

54a (36b-50a). Tailless and F not concave below apex. Unh discal band discontinuous to dorsum; unf no costal spot in 10.

Agelastus Group.

54b (59a). Below rough looking, ochreous brown to grey brown. Unf discal band straight, not sharply angled at v4, usually a spot base 3.

54 (55a). Unh central cell spot large, its iris touching the iris of the spot end cell. Below ochreous brown, all markings large and prominent, ringed pale yellow and with pale yellow patches at apex F and on H; unh inner submarginal line zigzag, small black lobe and faint tornal green scales. Above ♂ purple with broad borders F and H: ♀ rather pale blue, border F 3mm. to 5 at apex.

**alaconia oberthuri, Fd.* (38-40). The Patchy Oakblue. Karens—S. Burma. R.

55a (54). Unh central cell spot small, well separated from spot end cell. Unf often a broad dark area under cell; discal band variable, often very broad.

55 (56a). Unh with tornal green scales. Below ochreous brown. Below markings may be wide and confluent, pale edgings dull. ♂ above shining purple, border F 2mm to 5 at apex; ♀ brilliant shining blue, border as in ♂.

**agelastus, Hew.* (39-42). The Green-edged Tailless Oakblue. Shan States—S. Burma. NR.

56a (55). Unh no tornal green scales.

56 (57-58). ♂ above violet blue, ♀ pale blue, rather dusky, border F 3mm to 6 at apex. Below uniform ochreous brown, markings well defined: may be a purplish wash.

asopia, Hew. (42-46). The Plain Tailless Oakblue. Manipur—S. Burma. NR.

57 (56-58). ♂ shining purple, ♀ pale blue, border F and H 4mm., even. Below paler, greyish ochreous brown, darker at base H, markings prominent. Wings very rounded and smaller.

H- 49 Amblypodia—(*contd.*)

zeta, M. (30-36). The Andamans Tailless Oakblue. Andamans. R.

58 (57-56). ♂ above shining purple, ♀ pale purple, rather dusky; ♂ border 2mm., ♂ 4mm.; ♀ H blue colour confined to cell. Below over laid pinkish grey on costa and apex F and on all H, markings prominent.

æta, DeN. (38). The Dawna Tailless Oakblue. Dawnas. R.

59a (54b). Below smooth looking; unf discal band bent at v4, no spot base 3.

59b (63a). Below uniform.

59 (60a). Unf spot mid cell very large, reaches mv. Below purple brown all markings very large and basal spots H crowded together; no tornal green scales. ♂ above light dull purple blue, border F 2mm. to 6 at apex.

belphœbe, Doh. (40). The Large-spotted Oakblue. Tavoy (Doh). VR.

60a (59). Unf spot mid cell does not reach mv; unf discal band prominently bent at v4.

60 (61a). Below dark ochreous hair brown, with narrow, dull, regular markings, tornal green scales sharply defined, brilliant. ♂ above dark shining purple blue, border F ½mm., ♀ blue, border 4-6mm.

* *antimuta, Fd.* (30-36). The Small Tailless Oakblue. Karens—S. Burma. NR.

61a (60). Below glazed purple brown, markings prominent, but edging dull; unh no tornal green scales and discal spot in 6 more or less excavate outwardly. Tornus H angled and slightly lobed.

61 (62). ♂ above rich shining dark purple, no border. ♀ rather pale blue, border F 3mm. to 6 at apex, narrow on costa and no spot end cell or beyond.

* *arvina, Hew.* (38-42). The Purplebrown Tailless Oakblue. Dawnas—S. Burma. R.

62 (61). ♂ above rather pale shining blue, border F 1mm. to 4 at apex and a black patch beyond cell, joined to the costal border; ♀ border 3mm. to 7 at apex and the black area beyond cell coalesced to apex.

adala, DeN. (38). The Ladylike Tailless Oakblue. Dawnas—S. Burma. VR.

63a (59b). Below not uniform. Unh no tornal green scales or lobe.

63 (64). Unh centre of wing broad yellow, base, margin and all F washed purple over purple brown; unh markings obscure. ♂ border F 2mm. to 3 at apex; ♀ paler, border 3-6mm.

a. ♂ above dark shining violet blue.

* *perimuta perimuta, M.* (30-37). The Yellowdisc Tailless Oakblue. Sikkim—Tavoy. NR.

β. ♂ above bright shining metallic blue.

perimuta regia, Evans. (36-38). Mergui—S. Burma. NR.

64 (63). Unh centre of wing and apex whitish violet, rest rather pale purple brown, washed pale purple; unf discal band unusually broad and running to tornus; unh markings well defined. ♂ ♀ above shining metallic blue, purple in a side light, border 2mm. to 5 at apex; H only indications of blue in cell.

* *duessa, Doh.* (32-38). The Violetdisc Oakblue. Dawnas—S. Burma. R.

65a (16b). Unf with a costal spot base 11 between basal and central cell spots; also costal spots over central and end cell spots. Unh basal and central spots crowded together, irides touching, a prominent spot base 8, discal band completely dislocated at v2 and discontinuous to dorsum.

H. 43 Amblypodia—(*contd.*)

Ganesa Group.

65b (71). Unf discal band continued full width to v2 and often extending into 1, usually broken more or less at v4 ; inner cell spots reaching niv.

65 (66a). Tailless. ♂ ♀ above rather pale blue, border F 3mm. to 6 at apex, a prominent spot end cell on either side of which there is a whitish patch. Unh no tornal green scales. Apex F acute and inner margin much produced ; H costa concave, apex pointed, termen straight to v6.

α. Below creamy white, markings F prominently dark brown, but somewhat overlaid whitish ; nearly invisible on H.

* *ganesa ganesa, M.* (32-37). The Tailless Bushblue. Chitral—Kumaon. C.

β. Below bases rather pale purple brown ; markings F more prominent, not overlaid whitish ; H markings prominent.

ganesa watsoni, Evans. Assam—Shan States. R.

66a (65). Tailed. Below rather pale to dark chocolate brown with white patches ; spots large, prominent, white edged.

66b (69a). Unf discal band more or less broken, but never so that the inner edge of the spot in 4 is in line with the outer edge of the spot in 3.

66c (68). Unf discal spots not so regular as in 68.

66 (67). Unh no prominent white patch mid costa and uph blue colour confined to cell. Unh no tornal green scales. H costa straight and apex sharp.

α. ♂ above dull violet blue, border 3mm. to 5 at apex, prominent spot end cell and a whitish patch beyond. ♀ duller, white area F extending to inside cell.

paraganesa paraganesa, DeN. (30-34). The Dusky Bushblue. Kumaon—Bhutan. NR.

β. ♂ above entirely dark brown except for a few scattered blue scales at base F. ♀ blue scaling as extensive as in ♂ of last.

paraganesa zephyretta, Doh. Assam—Shan States. R.

67 (66). Unh prominent white patch mid costa, as prominent or more so than the apical patches F and H.

α. Very much as β, but ♂ above purple instead of blue.

ammonides ariel, Doh. (29-31). The Malayan Bushblue. Assam—N. Burma. VR.

β. ♂ above pale metallic blue, border 2mm. F and H, to 5 at apex F. ♀ paler and duller. Below dark purple brown rendering white patches very prominent. Wings very rounded. No tornal green scales.

ammonides ammonides, Doh. (29-31). Dawnas—S. Burma. R.

68 (66c). Unf inner edges of spots in 5 and 6 in line and regular, also inner edge spot in 4 against middle of spot in 3. ♂ above rather dull violet blue, border F 1-2½ mm. to 3-4 at apex, extending along the costa. ♀ rather pale blue, border 2½-5mm., a white patch on either side of the black spot end cell ; 1mm. on H and veins widely blackened just before the border. Below rather dark purple brown, white patches more or less prominent and may obscure the markings : unh with tornal green scales.

birmana, M (30-39). The Burmese Bushblue. Manipur—Shan States. NR.

69a (66b). Unf discal band completely dislocated at v4, so that the inner edge of the spot in 4 is in line with the outer edge of the spot in 3. ♀ as No. 75 but paler and the white patch on F is larger and extends well into the cell.

H. 49. Amblypodia.—*(contd.)*

♂ above pale violet blue. Unh tornal green scales more or less prominent. Below much as No. 68. F dorsum produced. Uph cilia nearly uniform.

69 (70). ♂ border less than 1mm. on F and H. Below uniform pale brown all over, white patches obscure.

aberrans, DeN. (32-38). The Pale Bushblue. Manipur—Shan States. R.

70 (69). ♂ above border 1mm. to 2 at apex, F, continued slightly inwards along the veins. Below bases pale brown, rest whitish. Uph cilia chequered white at end of each vein.

* *ellisi, Evans* (37-42). Ellis' Bush-blue. Manipur—Shan States. R.

71 (65b). Unf discal band continued full width to v3 only, a small spot against the outer edge in 2 ; band irregular, semi-broken at v5, inner spots in cell small, not extending to mv. Below dark purple brown, washed purple, outer half F and margin H pale brown. H apex very dark and usually a prominent quadrate white patch mid costa ; discal band attenuate towards dorsum ; with tornal green scales. Very short tail at v3 and usual tail at v2. Lobed.

α. ♂ above shining violet blue, border 2mm. to 5 at apex, 2 on H. Wings very rounded. Unf discal band unbroken.

abseus mackwoodi, Ril. (32-35). The Aberrant Bushblue. Ceylon. R.

β. ♂ above dull purple, border 4mm. to 7 at apex, 5 on H. ♀ pale blue, border 3-6mm. and a spot end cell.

**abseus indicus, Riley.* Sikkim—Tavoy. NR.

γ. ♂ above brilliant deep purple blue, border 2mm. to 4 at apex, 2 on H. ♀ pale metallic violet blue, border as ♂.

abseus abseus, M. Tavoy—S. Burma. R.

72a (1a). Unf cell spots abnormal.

72b (80). Unf very dark brown, cell usually containing a pale spot near end and sometimes a second spot nearer base, no dark spots: discal band continuous, bent at v4, flanked by a pale area on either side, no costal spots ; pale areas vary from purple brown to violet or whitish. Unh with a dark basal area or basal spots absorbed into a dark sub-basal band.

Apidanus Group.

72c (75a). Unh discal spots in 7 and 6 from a dark bar coalesced to the dark spot end cell, all inner edges in line. H lobe prominent and with tornal green scales.

72d (74). H with a well defined tail at v2. Below markings large, well defined on a violet brown ground. Apex F and tornus H produced.

72 (73). Unh a large basally bifid black spot mid costa not reaching the black area, which extends from base to mid cell and from costa to dorsum. ♂ above deep rich purple blue, no border. ♀ bright purple, borders broad and continued along dorsum F.

**diardi, Hew.* (40-54). The Bifid Bushblue. Sikkim—Dawnas. NR.

73 (72). Unh spot mid costa continued as a broad band across cell to base dorsum, above it there is a pale area from the base along the costa. ♂ ♀ above as last.

fulgida Hew. (36-46). The Shining Plushblue. Sikkim—Shan States. NR.

74 (72d). Tailless. Wings produced in ♂, rounded in ♀. ♂ above most brilliant dark purple blue, no border. ♀ pale blue shading to purple, borders broad. Unf lower outer area pale brown, discal band abbreviated

H.49. Amblypodia.—*(contd.)*

Unh almost entirely dark brown with a whitish violet fascia from mid termen to mid dorsum, a small apical patch and another mid costa, which sometimes extends to the dorsum; markings as last, but nearly invisible, basal third all black.

**anniella artegal, Doh.* (34-44). The Brilliant Plushblue. Shan States—S. Burma. R.

75a (72c). Unh discal spots in 7 and 6 much more macular and irregular, inner edge of spot in 6 in line with outer edge of spot end cell. Wings rounded.

75b (78a). Tailed and lobed.

75 (76a). Unh basal area very broadly dark brown, unmarked; central area broadly pale brown, followed by a dark oblique submarginal area and about tornus pale again; metallic green scales at tornus well developed.

a. ♂ above purple blue, border F 1mm. to 2 at apex, 1½ on H. ♀ pale blue, borders broad.

**apidanus ahamus, Doh.* (34-40). The Plain Plushblue. Cachar—Karens. R.

β. ♂ above darker, border less than 1mm. ♀ as last.

apidanus apidanus, Cr. Dawnas—S. Burma. R.

76a (75). Unh basal area variegated; extreme base at costa pale, discal markings shining purple brown on a dark area, central and tornal areas pale.

76 (77). Unh no metallic tornal green scales, lobe small; sub-basal dark band extends to mid cell. ♂ above bright purple blue, border 2 mm to 3 at apex, 3 on H. ♀ rather pale purple, borders broader.

adriana, D N. (38-44). The Variegated Plushblue. Sikkim—Shan States. NR.

77 (76). Unh with tornal green scales, lobe prominent; sub-basal dark band to dorsum. Above as last.

asoka, DeN. (40-44). The Spangled Plushblue. Sikkim—Shan States. NR.

78a (75b). No lobe or tail. F slightly concave below the sharply pointed apex. ♂ above shining deep rich ultramarine blue. ♀ purple with very broad borders.

78 (79). Unh broad basal dark area crossed near base by a pale band from base to costa, pale area beyond the dark basal area narrow, tornal green scales prominent. Unf obscure short reddish streak along costa from base. ♂ above border a thread, 1mm. at apex; H toothed at each vein especially at v2, margin F rather crenulate.

chinensis, Fd. (43-46). The Chinese Plushblue. Sikkim—Assam. NR.

79 (78). Unh no pale band on the dark basal area; pale discal area much broader.

a. Unh no tornal green scales, all markings obscure. Unf pale cell spots prominent. Margins not so crenulate as last. ♂ above border from 1mm. to 2 at apex. Blue colour deeper than in last.

areste areste, Hew. (40-46). The Tailless Plushblue. Sikkim-Assam. R

β. Unh with tornal green scales; all markings more prominent. Margins more crenulate. Unf pale cell spots obscure. ♂ border narrower.

areste arestina, Evans. (41-46). N. Shan States. R.

H. 49 Amblypodia—(*contd.*)

80 (72b). Below pale ochreous brown devoid of markings except for a narrow obscure dark brown postdiscal and marginal fascia and some very obscure basal spots H. ♂ above bright shining violet blue, becoming purple outwardly. ♀ paler and bluer. Apex F pointed; H rounded, no tail or lobe or tornal green scales unh.

"α." ♂ above border under 1mm. ♀ border 2-6 F and 1 on H.

* *fulla ignara, Riley.* (36-38). The Spotless Oakblue. Sikkim-Burma. R.

β. ♂ above border 1-2½ at apex; ♀ paler than last.

fulla andamanica, WM. (38-39). Andamans. R.

The following are new names:—

Nacaduba dubiosa indica and *fulva* (H. 30·15); *Jamides celeno blairana* and *nicevillei* (H. 31·6); *lugine purpura* (H. 31·10). *Thecla bieti irma.* (H42·2); *Thaduka multicaudata kanara* (H. 47); *Amblypodia karennia* (H. 49.7); *anthelus anthea* (H. 49·2); *epimuta elsiea* (H.49·11); *ariana* (H. 49·19); *agaba aurelia* (H. 49·32); *parelea* (H. 49·37); *cooperi* (H. 49·38); *perimuta regia* (H. 49·63); *areste arestina* (H. 49·79); *Heodes phlaeas indicus* (H. 35·2).

(*To be continued.*)

NOTES AND DESCRIPTIONS OF INDIAN FISHES.

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Part III.

(*Continued from page* 321 *of this volume.*)

The specimens sent from the Madras Fisheries Department in August 1922 embrace nineteen species, two of which appear to be new. A set of the duplicates have since been returned to the Madras Fisheries Department for their use as records. According to the labels given, the localities are Tuticorin and Madras. It is with pleasure that I acknowledge my indebtedness to Mr. James Hornell, F.L.S., F.R.A.I., late Director of Fisheries, Madras, for the opportunity to study this interesting collection.

Exocœtidæ.

Parexocoetus mento (Valenciennes).

Head 4; depth 4 ; D.i, 10, i; A.i, 10,i; P. i, 11; V.i, 5; scales 39 from gill-opening above to caudal base and 2 more on latter; 5 scales above lateral line, 2 below; 25 predorsal scales; snout $3\frac{3}{4}$ in head measured from upper jaw tip; eye 3; maxillary $3\frac{1}{2}$; interorbital 3.

Body elongately fusiform, deepest about ventral origin, well compressed. Caudal peduncle compressed, least depth $\frac{2}{3}$ its length on $3\frac{2}{3}$ in total head length. Head width 2 in its length. Snout conic, rather wide, length $\frac{3}{4}$ its width. *Eye*—large, slightly impinging on upper profile, hind pupil edge midway in head length; diameter greater than snout, $1\frac{1}{3}$ in interorbital. Mouth small, lower jaw well protruded. Maxillary short, reaches opposite middle of nostril, largely concealed; expansion $2\frac{3}{4}$ in eye. Narrow band of fine teeth in jaws, on vomer and palatines, and patch on tongue. Nasal aperture small, triangular, close before eye. Interorbital level. *Gill-rakers*—7 + 18, lanceolate, $1\frac{1}{4}$ in gill-filaments or $2\frac{3}{4}$ in eye. *Scales*—with 4 to 6 imperfect basal radiating striæ, edge lobate; circuli moderate, complete. Lateral line not extending far as end of anal base, tubes simple, slender. *Fins*—Third dorsal ray reaches caudal base, equals total head length; second anal ray $2\frac{1}{4}$ in head; upper caudal lobe $\frac{8}{9}$? of lower which $3\frac{2}{3}$ in combined head and trunk; pectoral reaches about opposite base of fifth dorsal ray, 2 in combined head and trunk; second and remaining pectoral rays all branched; ventral inserted midway between mandible tip and caudal base, fin reaching $\frac{8}{10}$ to anal or $1\frac{1}{2}$ in head.

Colour—Back olivaceous neutral tint, sides and lower surface whitish. Side of head, including lower sides of preorbital whitish. Edges of jaws brown. Dorsal neutral-dusky, blackish terminally. Caudal with each lobe dusky medianly, edges whitish. Anal whitish, middle of fin dusky. Pectoral neutral-dusky above, lower half whitish. Ventral white. One example, 115 mm. Madras.

Cypselurus unicolor (Valenciennes).

Head 4; depth $5\frac{1}{3}$; D.i, 10, i; A. i, 11, i; P. i, 15 ; V. i, 5; scales 49 from gill-opening above to caudal base and 4 more on latter; 6 scales above lateral line, 3 below to anal origin; 35 predorsal scales; snout $3\frac{1}{3}$ in head measured from upper jaw tip; eye $3\frac{1}{4}$; maxillary 4; interorbital $2\frac{2}{3}$.

Body elongately fusiform, deepest at ventral origin, but slightly compressed. Caudal peduncle compressed, least depth $1\frac{1}{3}$ its length or $3\frac{1}{3}$ in total head length. Head width $1\frac{2}{3}$ in its length. Snout broad, obtuse, length $\frac{2}{3}$ its width. *Eye*—large, slightly impinging on upper profile, hind pupil edge midway in head length

diameter greater than snout, 1⅓ in interorbital. Mouth small, lower jaw slightly protruded. Maxillary short, reaches opposite middle of nostril; expansion 4 in eye. Teeth fine, obsolete, short narrow band of very minute ones anteriorly; apparently none on palate or tongue. Nasal aperture small, triangular, close before eye. Interorbital broadly and slightly concave. *Gill-rakers*—7 + 24 lanceolate, 1 $_{1}^{1}$ in gill-filaments or 2 in eye. *Scales*—adherent, narrowly, imbricated; basal radiating striae 3, edge lobate; circuli fine, concentric. Lateral line not extending beyond depressed dorsal, not reaching caudal base; preventral tubes finely venulose. *Fins*—First branched dorsal ray 3⅔ in total head length; first branched anal ray 4⅔, fin origin opposite that of dorsal; caudal widely forked, upper lobe 1⅓ of lower, which 3½ in combined head and trunk; pectoral reaches scale beyond base of last dorsal ray, second and following rays branched; ventral origin slightly nearer caudal base than hind eye edge, reaches middle of depressed anal, 3¼ in combined head and trunk.

Colour—Back neutral-olivaceous, sides and under surface whitish. Gray dots sprinkled all along side. Lower side of head, including preorbital, whitish. Dorsal and caudal dull gray-brown. Pectoral with membrane dusky-neutral, above and below pale to whitish. Anal white. Ventral pale, front edge whitish. One example, 197 mm. Madras.

Agrees in many ways with the figure by Jordan and Seale of their *Cypsilurus unicolor* except that is shown as more slender and with little longer ventr l. The flying-fishes of this group (*Exonautes*) are often with some form of external parasite. The above example has a long dark *Penella*, a lernean opepod, protruding from along the anal base.

SCORPÆNIDÆ.

Apistus carinatus (Schneider).

Head 2½ to 2⅔; depth 3½ to 3⅔; D. xiv, I. 8, i; A. iii, 7, i; P. 12 + i; scales 43 to 48 in lateral line to caudal base and 3 more on latter; 7 scales above lateral line and 14 or 15 below to anal origin; 4 predorsal scales; snout 3 to 4 in head measured from upper jaw tip; eye 4$_{10}^{1}$ to 4½; maxillary 2 to 2⅛; interorbital 10½ to 11½.

Body elongately ovoid, compressed, deepest at ventral origin. Caudal peduncle well compressed, length ⅓ its least depth which 3⅞ to 4 in total head length. Head width half its length. Snout conic, length ⅔ its width. *Eys*—impinging on upper profile, hind edge midway in total head length; diameter 1 to 1⅛ in snout. Mouth large, mandible protruded. Maxillary reaches opposite hind pupil edge; expansion 1⅔ to 2 in eye. Bands of minute, villiform teeth in jaws, on vomer and palatines. Symphyseal barbel 3$_{10}^{1}$ to 3½ in total head length; lateral mandibular 3½ to 4$_{10}^{1}$. Nostrils near together on side of snout; front one at first ⅔, hind one lower and at last ⅘. Interorbital slightly concave. Antero-supraorbital slightly raised, with 5 or 6 strong keels on front face. Strong median spine from preopercle at end of suborbital stay and 2 broader, shorter points below. Preorbital with 2 short points on lower edge forward and strong spine behind parallel with upper maxillary edge ⅔ of eye. Opercle with 2 spines and like most of surface of cheek with broken striae or short keels. Low keel ending in short spines behind, above opercle, followed by suprascapular spine. Parietal keel double each side and also postocular. *Gill-rakers*—ii, 4+11, ii, lanceolate, 1⅓ in eye, twice gill-filaments. *Scales*—with 8 to 12 broad radiating striæ; 5 apical pointed lobes, each with keeled midrib, edges of lobes minutely and sparsely dentate; circuli fine. Small patch of scales on cheek behind maxillary, head otherwise naked. *Fins*—Tenth dorsal spine 1⅞ to 2$_{10}^{1}$ in total head length; first soft dorsal ray 1⅓ to 1⅔; third anal spine 2⅛ to 2⅔; second anal ray 1⅔ to 2; caudal rounded behind, 1⅛ to 1⅓; ventral 1⅔ to 1⅞. Pectoral reaches far as base of last dorsal ray or caudal base, 1⅔ to 1⅞ in combined head and trunk.

[1] Bull. Bur. Fisher, fr. S., 25, 1905 (1906), p 209, fig. 12.

Colour—Pale brownish, whitish below. Dorsals pale, with black blotch larger than eye on posterior spines marginally. Front dorsal spines with dusky blotches terminally. Soft dorsal and caudal pale, with 2 dusky cross-bands. Anal grayish, with deeper blotches. Pectoral blackish, pale basally. Ventral whitish, dusky on inner rays terminally. Two examples, 82 to 90 mm. Madras.

Choridactylus multibarbis Richardson.

Head $3\frac{1}{3}$; depth $2\frac{2}{3}$; D. xiii, 9; A. ii, 8; P. i, 6, ii+ii; snout $2\frac{1}{3}$ in head; eye 4; maxillary $2\frac{2}{3}$; mouth width 4; interorbital 3.

Body well compressed, back elevated close behind head where greatest body depth, sloping down gradually behind. Caudal peduncle well compressed, least depth $3\frac{1}{3}$ in head. Head width $1\frac{1}{6}$ in its length. Snout broad, depressed, very steeply abrupt, about wide as long. *Eye*—elevated, greatly impinging on upper profile, hind edge midway in head length; fringed flap above long as pupil; diameter 2 in snout, $1\frac{1}{3}$ in interorbital. Mouth moderate, wide, mandible slightly shorter than upper jaw. Maxillary little inclined, reaches opposite eye center; expansion 2 in eye. Two fleshy mandibular barbels each side, front one longer, equals eye. Narrow band of villiform teeth in each jaw; palate edentulous. Nostrils in 2 short tubes, separated, near middle of snout, anterior slightly longer. Interorbital deeply concave. Supraorbital with broad antero and postero-marginal spines. Postocular spines 2, followed by larger suprascapular. Strong preorbital spine nearly long as eye, with 2 small shorter ones in front basally. Preopercle with strong spine, long as eye. *Gill-rakers*—3+8, short knobs, barely $\frac{1}{4}$ of gill-filaments, which $1\frac{2}{3}$ in eye. Head with numerous small variable fleshy excrescences; minute short filaments on dorsals and caudal, outer face of pectoral and base of ventral. Row of 14 fleshy points along lateral line. *Fins*—Third dorsal spine $1\frac{2}{3}$ in head; fourth dorsal ray $1\frac{2}{3}$; fifth anal ray $1\frac{1}{3}$; caudal rounded behind, $1\frac{1}{3}$; ventral 1. Pectoral $2\frac{1}{3}$ in combined head and trunk.

Colour—Pale purplish-brown generally. White blotch from behind third dorsal spine down opposite pectoral. Another at front of soft dorsal and down on trunk above anal, followed by 3 below, of which last largest. Caudal dusky basally and terminally, medianly white. Pectoral largely dusky marginally, pale medianly. Ventral and anal neutral black, margin of latter narrowly pale. Under surface of head, breast and abdomen whitish. Sides of abdomen finely spotted whitish. One example, 78 mm. Madras.

Minous monodactylus (Schneider).

Head $2\frac{1}{3}$ to $2\frac{2}{3}$; depth $2\frac{2}{3}$; D. ix or X, ii; A. ii, 9; snout $2\frac{2}{3}$ to $2\frac{3}{4}$ in head measured from upper jaw tip; eye $4\frac{1}{3}$ to $4\frac{2}{3}$; maxillary $2\frac{1}{10}$ to $2\frac{1}{4}$; interorbital $4\frac{1}{3}$ to $4\frac{1}{2}$.

Body elongately ovoid, well compressed, deepest at pectoral base. Caudal peduncle well compressed, least depth $4\frac{1}{3}$ to $4\frac{1}{2}$ in total head length. Head width $1\frac{1}{8}$ to $1\frac{1}{4}$ in its length. Snout obtuse, broad, length $\frac{3}{4}$ to $\frac{4}{5}$ its width. *Eye*—midway in head length, $1\frac{1}{3}$ to $1\frac{1}{4}$ in snout, equals interorbital. Mouth broad, mandible projecting. Maxillary reaches eye; expansion $10\frac{2}{3}$ in eye. Teeth in villiform bands in jaws and patch each side of vomer, none on palatines or tongue. Front nostril in short tube at first $\frac{2}{3}$ in snout; hind nostril smaller, about last fourth in snout. Interorbital deeply concave. Supraorbital ridge serrate, with broad serrated spine behind. Pair of large rugose parietal spines each side, large suprascapular further back, which preceded by row of 3 large rugose postoculars. Preorbital with long spines nearly equal to eye; small short one in front basally. Preopercle with spine equal to eye and 4 strong broad ones around edge of flange. *Gill-rakers*—5+12, larger clavate, $\frac{1}{3}$ of gill-filaments, which $1\frac{2}{3}$ in eye. Skin smooth; row of short supraorbital filaments, few fleshy papillæ on maxillary expansion; preopercle flange with few flaps and few

along mandible. *Fins*—First dorsal spine $2\frac{2}{3}$ to $2\frac{3}{4}$ in head; first dorsal ray $2\frac{1}{3}$ to $2\frac{2}{3}$; third anal ray $3\frac{1}{3}$ to $3\frac{2}{3}$; caudal rounded behind, $1\frac{1}{4}$ to $1\frac{2}{3}$; pectoral $1\frac{1}{4}$ to $1\frac{1}{3}$, filaments $1\frac{2}{3}$ to $1\frac{4}{5}$; ventral $1\frac{2}{3}$ to $1\frac{4}{5}$.

Colour—Back purplish-gray, with pale line above lateral line longitudinally and another close below similar. Lower surface whitish. Dorsals dusky marginally, with blackish marginal blotch at front of soft fin. Longitudinal whitish line on spinous dorsal medianly, also on soft dorsal. Anal neutral-black. Caudal whitish, with 3 transverse dusky cross-bands, median closer to outer, though fin edge narrowly whitish. Pectoral dusky-brown terminally, lower ray whitish. Ventral dusky-brown terminally, basally whitish. Five from Tuticorin, 80 to 94 mm.

Cocotropus echinatus (Cantor).

Head $2\frac{2}{3}$ to 3; depth $2\frac{4}{5}$ to $2\frac{2}{3}$; D. xiv, 10 or 11; A. ii, 8; snout 3 to $3\frac{1}{3}$ in head measured from upper jaw tip; eye $3\frac{2}{3}$ to $3\frac{4}{5}$; maxillary $2\frac{4}{5}$ to $3\frac{1}{3}$; interorbital 4 to $4\frac{1}{3}$.

Body compressed, elongate, deepest at pectoral base and tapering down behind. Least depth of caudal peduncle $2\frac{4}{5}$ to 3 in total head length. Head width $1\frac{1}{4}$ to $1\frac{1}{3}$ in head. Snout obtuse, slightly broader than long. *Eye*—elevated, hind pupil edge midway in head length; diameter $1\frac{1}{3}$ to $1\frac{1}{2}$ in snout. Mouth low, mandible protruding. Maxillary reaches opposite eye; expansion 2 in eye. Minute villiform teeth in bands in jaws, patch each side of vomer, none on palatines or tongue. Front nostril larger, in short tube at last $\frac{2}{3}$ in snout; hind nostril smaller, similar, close before upper front eye edge. Interorbital convex, with 2 median parallel ridges from occiput to snout tip. Preorbital with strong bifid spine. Preopercle with 4 strong spines, upper largest. Opercle with 3 spines. *Gill-rakers*—5 low short knobs on lower branch of first arch, greatly shorter than gill-filaments, which $1\frac{1}{2}$ in eye. Lateral line of 11 long slender tubes to caudal base; 1 more on latter. Trunk with minute scattered papillæ, most abundant and crowded on lower surface. *Fins*—First dorsal spine $1\frac{2}{3}$ to $1\frac{3}{4}$ in head; first dorsal ray $2\frac{1}{3}$ to $2\frac{2}{3}$; first anal ray $3\frac{1}{3}$ to $3\frac{1}{2}$; caudal rounded behind, $1\frac{1}{4}$ to $1\frac{2}{3}$; pectoral $1\frac{1}{4}$ to $1\frac{1}{3}$; ventral $1\frac{2}{3}$ to $1\frac{4}{5}$.

Colour—Back purplish-brown generally, becoming white below. Fins all brownish, obscurely spotted or mottled with darker. Three examples, 38 to 51 mm. Madras.

Day describes fine brown radiating lines from the eye which are not clearly evident in my examples.

GOBIIDÆ.

Butis coperatus (Cantor).

Head $2\frac{2}{3}$ to $2\frac{7}{8}$; depth $3\frac{2}{3}$ to 4; D. vi—i, 8 or 9; A. i, 8; scales 22 to 25 from gill-opening above to caudal base medianly and 3 or 4 more on latter; 9 scales transversely between soft dorsal and anal origins; 12 or 13 predoral, scales; snout $3\frac{2}{3}$ to 4 in head measured from upper jaw tip; eye $3\frac{1}{4}$ to $4\frac{1}{10}$; maxillary $2\frac{1}{4}$ to $2\frac{1}{2}$; interorbital $5\frac{1}{3}$ to $5\frac{3}{4}$.

Body compressed, elongate, deepest at pectoral base. Caudal peduncle well compressed, least depth $2\frac{1}{3}$ to $2\frac{1}{2}$ in its length or $3\frac{1}{3}$ to $3\frac{1}{2}$ in total head length. Head width $1\frac{2}{3}$ to 2 in its length. Snout convex, length $\frac{3}{4}$ its width. *Eye*—large, slightly impinging on upper profile, hind edge midway in head length, long as mouth. Mouth large, lower jaw protruding. Maxillary reaches opposite middle of eye; width $\frac{1}{4}$ to $\frac{1}{3}$ of eye. Teeth in outer row large, uniform; inner band villiform in both jaws; palate and tongue edentulous, latter truncate in front. Front nostril in short tube at last third in snout; hind nostril simple pore close before eye. Interorbital deeply concave. Supraorbital, frontal and upper

preorbital edges with rather firm short points. *Gill-rakers*—5+4 slender, lanceolate, little longer than gill-filaments on $1\frac{2}{3}$ in eye. *Scales*—with 13 to 21 basal parallel striæ; row of 15 to 21 + 18 to 21 apical denticles; circuli moderate. Predorsal scales only encroach on hind portion of interorbital. Cheek scaly above, 8 rows across, lower half naked. *Fins*—Dorsal spines flexible, third $2\frac{1}{8}$ to $2\frac{3}{4}$ in head; first ray $1\frac{2}{3}$ to $1\frac{4}{7}$; eighth ray 2; seventh anal ray $1\frac{9}{17}$ to $2\frac{1}{8}$; caudal ends in narrow point behind, $1\frac{1}{10}$; pectoral $1\frac{1}{3}$ to $1\frac{1}{2}$; ventral $1\frac{1}{3}$ to $1\frac{2}{3}$. Anal papilla large.

Colour—Brown generally. Each row of scales longitudinally with pale median line. Trunk with 8 transverse darker brown cross-bands. Dorsals neutral-dusky, soft dorsal with 2 rows of pale spots basally. Anal dusky. Caudal pale, dusky basally. Pectoral pale with black round spot at bases of lower rays. Ventral dusky-black. Side of head with 4 transverse or vertical deep brown bands. One from Tuticorin 37mm., and 7 from Madras 35 to 55 mm.

Butis butis (Buchanan-Hamilton).

Head $2\frac{2}{3}$; depth $5\frac{1}{3}$; D. vi—i, 9; A. i, 8; scales 21 from gill-opening above to middle of caudal base and 2 more on latter; 7 scales transversely at soft dorsal and anal origin; 17 predorsal scales; snout $3\frac{1}{3}$ in head measured from upper jaw tip; eye $4\frac{1}{10}$; maxillary 2; interorbital 2 in eye.

Body elongate, fusiform, midway in spinous dorsal length. Caudal peduncle compressed, least depth half its length or 4 in total head length. Head width half its length. Snout conic, length $\frac{2}{3}$ its width. *Eye*—high, superior, hind edge midway in head length. Mouth large, mandible well protruded. Maxillary reaches opposite hind pupil edge, narrow. Teeth in 2 rows in each jaw, conic some uneven or others larger; palate and tongue toothless, latter emarginate in front. Nostril close before eye. Interorbital narrow, level. *Gill-rakers*—2+5, short dimentary points, longest barely $\frac{1}{3}$ of gill-filaments, which about 2 in eye. *Scales*—with 8 to 11 radiating basal striae; apical denticles in row of 14 + 16 to 19; circuli fine. Scales become smaller on predorsal anteriorly, sides and front of head. *Fins*—Third dorsal spine 2 in total head length; second dorsal ray $1\frac{2}{3}$; seventh anal ray $2\frac{1}{2}$; caudal rounded, $1\frac{1}{3}$; pectoral $1\frac{2}{3}$; ventral $1\frac{1}{2}$.

Colour—Brownish, scarcely paler below. Spinous dorsal blackish. Caudal with blackish basal blotch, median rays dusky to ends. Other fins pale with dark blotch at base of each ventral. Pectoral base with median pale spot, dark spot above and below. One from Tuticorin 40 mm.

Boleophthalmus boddaerti (Pallas).

Head $3\frac{1}{3}$; depth $5\frac{1}{3}$; D. v—25, i, A. i, 24; scales 60 from gill-opening above to caudal base medianly and 5 more on latter; 18 scales transversely from soft dorsal origin to that of anal; 26 predorsal scales to eye; snout $3\frac{2}{3}$ in head measured from upper jaw tip; eye 7; maxillary $2\frac{1}{3}$; mouth width $2\frac{1}{3}$.

Body long, compressed, deepest at soft dorsal origin. Caudal peduncle compressed, least depth 3 in total head length. Head width 3 in its length. Snout broad, profile steeply oblique, length $\frac{2}{3}$ its width opposite end of maxillaries. *Eye*—elevated half diameter above upper profile, center at first third of head diameter 2 in snout. Mouth large, little inclined, lower jaw slightly included Maxillary reaches opposite hind eye edge, width $\frac{2}{3}$ of eye. Upper lip with broad cutaneous flap over front side of each maxillary. Teeth in jaws uniserial; upper with 6 flattened partially enlarged incisors in front, others conic; lower with lateral teeth compressed, bifid, small and small pair of wide-set canines anteriorly well inside; no teeth on palate or on thick rounded fleshy tongue Interorbital narrow, with deep concave median depression. *Gill-rakers*—6 + 7, short flexible points, $\frac{1}{3}$ of gill-filaments, which $1\frac{2}{3}$ in snout. *Scales*—small, thickly cover most of head, pectoral and caudal base; 20 or 21 waved radiating basal striae; 3 to 6 short apical radiating striae; circuli fine.

Fins—Dorsal spines filamentous terminally, median long as head; twenty-second ray 2; twenty-third anal ray $4\frac{2}{3}$; caudal ends in median point behind, 1; pectoral $1\frac{2}{3}$; ventral $1\frac{1}{3}$.

Purplish-gray above, pale to whitish below or on under surface of head and abdomen. Spinous dorsal neutral-black, with scattered pale dots. Soft dorsal and caudal dusky, dark terminally. Pectoral and anal dark grey, former with upper edge narrowly dusky. Ventral disk whitish, with outer rays grayish. Sides of head all finely dotted with dusky. Traces of about 7 slightly oblique deeper brown cross-bands. One from Madras, 112 mm.

Ctenogobius horai new species.

Head $3\frac{1}{3}$; depth $5\frac{1}{4}$; D. vi—i, 9, i; A. i, 9; scales 27 from gill-opening above to caudal base medianly and 3 more on latter; 8 scales transversely from soft dorsal to anal origin; snout 4 in head; eye 3; maxillary $2\frac{1}{3}$; interorbital $2\frac{1}{2}$ in eye.

Body well compressed, elongate and tapering slightly back from spinous dorsal origin, where greatest depth. Caudal peduncle well compressed, least depth 2 in its length or $2\frac{1}{3}$ in total head length.

Head moderate, cheeks little swollen, width $1\frac{1}{2}$ in its length. Snout obtuse, convex over surface and in profile, length $\frac{3}{5}$ its width. *Eye*—large, slightly impinging on upper profile, center at first third in head; diameter greater than snout. Mouth moderate, closed mandible even with upper jaw tip. Mandible shallow. Maxillary reaches opposite first third of eye, rather slender. Teeth minute, slightly even, conic, in very narrow bands or rows in each jaw; 1 or 2 close-set recurved canines each side of mandible. Tongue little rounded convexly in front. Front nostril small pore at first $\frac{2}{3}$ in snout length; hind nostril simple pore little nearer front nostril than eye. Interorbital very narrow, with slight median groove. Preopercle edge entire, without fringe or spine. Gill-opening restricted, only extends opposite last fourth in head. *Gill-rakers*—2 + 5, short points, scarcely $\frac{1}{3}$ of gill-filaments, which $1\frac{1}{4}$ in eye. Isthmus broad. *Scales*—absent from predorsal, apparently from prepectoral and chest. Scales on trunk very caducous, most all fallen. Row of fine papillae from behind eye and along its lower edge; 2 rows horizontally across cheek and another below extended forward on mandible below, also vertical row down opercle anteriorly.

Fins—Spinous dorsal origin little behind that of pectoral, spines rather flexible and fin rounded, none produced as filaments; third spine $1\frac{2}{3}$ in head. Soft dorsal origin little nearer caudal base than snout tip, rays graduated posteriorly, where ending in point not quite reaching caudal base; eighth ray slightly less than head. Anal origin little behind that of soft dorsal, fin similar; eighth ray $1\frac{1}{4}$ in head. Caudal ends in median point behind, $2\frac{3}{4}$ in combined head and trunk. Pectoral with upper rays not silky or detached, reaches anal, $3\frac{1}{3}$ in head. Ventral reaches vent, which short space before anal; equals head.

Colour—in alcohol pale brownish generally. About 13 transverse whitish lines on trunk, darker interspaces greatly wider. Vertical fins and ventral dusky, at least terminally. Spinous dorsal with black blotch behind middle. Caudal with traces of transverse darker bands. Pectoral pale.

Length 30 mm. One example from Tuticorin. This species is unique among those of its genus in the transverse light lines on its trunk.

Named for Dr. Sunder Lal Hora, the accomplished Ichthyologist of the Indian Museum.

Ctenogobius tuticorinensis new species.

Head 3; depth 4; D. vi—i, 9, i; A. i, 8, i; scales 28 from gill-opening above to caudal base and 3 more on latter; 11 scales transversely from soft dorsal origin to that of anal; 9 scales along side of predorsal to gill-opening; snout $3\frac{2}{3}$ in head measured from upper jaw tip; eye 3; maxillary 3; interorbital $3\frac{2}{3}$ in eye.

Body elongate, compressed, deepest at spinous dorsal origin and tapering back moderately. Caudal peduncle well compressed, least depth $1\frac{2}{3}$ in its length or 3 in total head length. Head large, robust, width $1\frac{1}{2}$ its length, cheeks but little swollen. Snout convex, obtuse, length $\frac{2}{3}$ to $\frac{2}{3}$ its width. *Eye*—large, slightly impinging on upper profile, much greater than snout. Mouth large, mandible slightly protrudes. Maxillary about reaches opposite front of pupil, narrow. Teeth small, conic, in 2 rather wide-set rows in each jaw, outer little enlarged, at least anteriorly; outermost mandibular slightly recurved canine; no teeth on palate or tongue which latter convexly rounded in front. Nostrils well separated; front one at last $\frac{2}{3}$ in snout; hind one close before eye. Interorbital very narrow, concave. Preopercle edge entire, without fringe or spine. Gill-opening extends forward about last fifth in snout. *Gill-rakers*—4 + 6. lanceolate, $\frac{2}{3}$ of gill-filaments, which $2\frac{2}{3}$ in eye. Isthmus wide. Head scaleless, also predorsal. Caudal base scaly, also chest and belly. *Scales*—with 12 to 15 basal radiating striae; apical denticles 11 or 12 + 12 to 14, in one row; circuli fine basally. Cheek with 3 rows of fine papillae horizontally, now along preopercle edge and mandible; 4 longitudinal predorsal rows.

Fins—Spinous dorsal origin about over first third of depressed pectoral, fin rounded, spines rather flexible; third spine $1\frac{2}{3}$ in total head length. Soft dorsal orgin midway between hind eye edge and caudal base, rays graduated down to last, first longest or $1\frac{1}{2}$ in head. Anal origin opposite that of soft dorsal, seventh ray longest, $1\frac{3}{4}$ in head. Caudal with median rays longest, rounded, slightly shorter than head. Pectoral without upper rays silky or free, reaches vent; $1\frac{2}{3}$ in head. Ventral reaches vent, which shortly before anal, $1\frac{1}{4}$ in head.

Colour—in alcohol pale brownish generally. Sides and back with variegated waved deeper brown blotches, bars or short lines, on back as 2 pairs of predorsal transverse bands, then 4 broader deeper saddles. Alternating on side 4 deep. blotches of dusky brown, little below median axis forward, where first on opercle. Fins all pale generally. Spinous dorsal with 2 dusky-black horizontal bands. upper terminal. Soft dorsal with few rather large dusky blotches, also 2 or 3 series on caudal. Anal with basal and submarginal horizontal blackish line. Dark band from lower front eye edge to middle of maxillary. Length 48 mm. One from Tuticorin.

Among the species of *Ctenogobius* this may be known by its large eyes and contrasted dark blotches on the trunk.

Also 7 other examples, same data, which show the following: Head 3 to 3; depth $4\frac{1}{4}$ to $4\frac{2}{3}$; D. vi or vii—*i*, 9, i or 10, *i*; A. *i*, 8, i; scales 29 or 30 from gill-opening above to caudal base medianly, with 3 or 4 more on latter; 12 scales transversely between soft and dorsal and anal origins; 8 to 10 predorsal scales laterally to gill-opening; snout $3\frac{1}{2}$ to $3\frac{3}{4}$ in head measured from upper jaw tip; eye $2\frac{2}{3}$ to 3; maxillary $2\frac{2}{3}$ to $2\frac{1}{3}$; interorbital $2\frac{1}{4}$ to $3\frac{1}{2}$ in eye. Length 27 to 48 mm.

Ctenogobius cyanomos (Bleeker).

Head $3\frac{2}{3}$ to $3\frac{1}{2}$; depth $4\frac{1}{2}$ to $5\frac{1}{4}$; D. vi—i, 10, i; A. i, 8, i or 9, i; scales 27 to 30 from gill-opening above to caudal base medianly and 3 to 7 more on latter; 9 or 10 scales transversely from soft dorsal to anal origin; 10 to 18 predorsal scales; snout $3\frac{1}{2}$ to $3\frac{3}{4}$ in head; eye $3\frac{2}{3}$ to $4\frac{2}{3}$, maxillary $2\frac{1}{2}$ to $2\frac{3}{4}$; interorbital 8 to 10, or $1\frac{2}{3}$ to $2\frac{1}{3}$ in eye.

Body elongate, well compressed, deepest at soft dorsal origin. Caudal peduncle well compressed, least depth $1\frac{1}{2}$ its length or $2\frac{2}{3}$ to $2\frac{2}{3}$ in head. Head width 1 to $1\frac{2}{3}$ its length. Snout obtusely convex, length $\frac{2}{3}$ its width. *Eye*—large, very slightly impinging on upper profile, hind edge midway in total head length, diameter equals snout. Mouth large, little inclined, lower jaw shorter. Maxillary reaches first third in eye, rather slender. Teeth in villiform bands in jaws, with outer enlarged chiefly anteriorly, in mandible as single enlarged canine

each side; no teeth on palate or tongue, latter rounded in front. Nostril at last fourth in snout. Interorbital narrow, level. *Gill-rakers*—3 + 5, lanceolate, ½ of gill-filaments, 2 in eye. *Scales*—with 7 to 19 radiating basal striæ; apical denticles in row of 15 to 24 + 17 to 19; circuli moderate. Predorsal scales extend only about half way to eyes, variously completed and head otherwise naked; chest, belly and prepectoral base scaly. *Fins*—Second dorsal spine 2 to $2\frac{1}{10}$ in head, spines flexible; ninth dorsal ray $1\frac{2}{3}$ to $1\frac{2}{5}$; eight anal ray 2 to $2\frac{1}{10}$; caudal rounded behind, 1 to $1\frac{1}{10}$; pectoral rays all firm, none silky, $1\frac{1}{2}$ to $1\frac{1}{3}$; ventral $1\frac{1}{2}$ to $1\frac{1}{3}$.

Colour—Pale brown generally, edges of scales on back all slightly deeper brown. About a dozen narrow saddle-like blotches of deep brown down middle of back. Row of about 6 median deep brown blotches along side, last at caudal base. Dark line from behind eye to deep brown suprascapular blotch. Fins all pale. Spinous dorsal with deep brown blotch medianly, little back. Caudal with many transverse dusky or brownish streaks. One from Madras 61 mm., and 15 from Tuticorin 41 to 68 mm.

This species may be known by the combination of the uniform pale or white ventrals, included mandible and row of dark median rounded lateral spots.

My largest example has the third dorsal spine prolonged in a filament nearly long as head. Day's figure shows it greatly longer or estimated to reach base of last dorsal ray. None of my examples carry the pair of symphyseal mandibular barbels as Day describes and figures. He gives the jaws of equal length, though in my examples, the lower is usually a little shorter. All my examples also differ in that a median lateral row of darker spots is present, most distinct in the smaller ones, though at least present in all and possibly intensified to a more or less extent through formaline or other preservative fluids. The largest examples have the outer submarginal portion of the ventrals broadly blackish, much paler in smaller examples. The largest specimens also show a dark slaty line, variously distinct, from the lower front eye edge to the hind end of maxillary. All most all have about 6 dark brown median predorsal blotches to the eyes, the anterior 3 or 4 of which are usually paired.

Ctenogobius viridipunctatus (Valenciennes).

Head $3\frac{1}{4}$ to $3\frac{2}{5}$; depth 4 to $4\frac{1}{2}$; D. v or vi—i, 10, i; A. i, 9, i; scales 35 or 36 from gill-opening above to caudal base medianly and 4 more on latter; 11 scales transversely between soft dorsal and anal origin; 30 to 32 predorsal scales; snout $3\frac{1}{3}$ to 4 in head measured from upper jaw tip; eye 4 to $4\frac{1}{3}$; maxillary $2\frac{1}{3}$ to $2\frac{2}{3}$; interorbital $1\frac{1}{3}$ to $2\frac{1}{3}$ in eye.

Body compressed, deepest at middle of spinous dorsal. Caudal peduncle compressed, least depth $1\frac{1}{4}$ to $1\frac{1}{3}$ in its length or $2\frac{1}{3}$ to $2\frac{2}{3}$ in total head length. Head width $1\frac{2}{3}$ to $1\frac{3}{4}$ its length. Snout obtuse, length $\frac{2}{3}$ to $\frac{3}{4}$ its width. *Eye*—center at first $\frac{2}{3}$ in head length, at first third in younger examples; diameter equals or slightly less than snout. Mouth large, mandible slightly protruded. Maxillary oblique, reaches $\frac{2}{3}$ to $\frac{1}{2}$ in eye, narrow. Teeth biserial, usually outer row more or less larger; wide-set pair of upper canines and pair close-set or single each side of mandible, little recurved; no teeth on palate or tongue, latter convex in front. Front nostril lower, in cutaneous tube about midway in snout; hind nostril simple pore, about last fourth in snout. Interorbital narrow, concave. *Gill-rakers* 3 + 12, lanceolate, ½ of gill-filaments, which half of eye. *Scales*—with 12 to 18 basal radiating striæ; apical denticles 26 to 33 + 22 to 32; circuli fine. Predorsal with finely crowded scales and caudal base finely scaled. Cheeks with 3 rows of fine papillæ horizontally, uppermost along lower eye edge and intermediate spaces with many short vertical series; row along preopercle edge out over mandible. *Fins*—Second dorsal spine $2\frac{1}{10}$ to $2\frac{1}{8}$ in head; seventh dorsal ray $1\frac{4}{5}$ to $1\frac{5}{8}$; eighth anal ray $1\frac{3}{4}$ to 2; caudal with median rays longest, rounded behind, 1 to $1\frac{1}{10}$; pectoral without free silky rays above, $1\frac{1}{3}$ to $1\frac{2}{3}$; ventral $1\frac{1}{3}$ to $1\frac{1}{2}$.

Colour—Brown above, pale to whitish below. Upper surface with 6 transverse predorsal deep brown bars and as many obscure saddles for rest of extent of back. Alternating along side 6 median lateral deep brown blotches, with small dark spot at caudal base medianly. Dusky streak from eye to suprascapula, ending in black blotch. Another from lower eye edge to middle of pectoral base, also dark blotch on cheek below and on preorbital. Dark blotch on opercle above and upper prepectoral. Dorsal grayish, spinous fin with broad dusky base. Soft dorsal with submarginal dark line and another median longitudinally. Anal grayish, with median longitudinal dusky line. Caudal variegated dusky, darker behind, upper edge pale. Pectoral pale. Ventral dusky. Six from Tuticorin 50 to 78 mm.

Ctenogobius griseus (Day).

Head 3¼; depth 4; D. vi—i, 10, i; A.i, 9, i; scales 33 from gill-opening above to caudal base medianly and 5 more on latter; 11 scales transversely from soft dorsal origin to that of anal; 30 predorsal scales; snout 4 in head measured from upper jaw tip; eye 5⅓; maxillary 2⅔; interorbital 5½.

Body elongately ovoid, well compressed, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth 1⅓ its length or 2⅔ in total head length. Head width 1⅔ its length. Snout convex over surface and in profile, length ⅔ its width. *Eye*—small, center in first third of total head length; diameter 1⅓ in snout. Mouth oblique, mandible protruding. Maxillary reaches eye center, slender. Teeth fine, in narrow bands in jaws, outer row in each little enlarged; mandible with slightly larger recurved lateral canine each side; no teeth on palate or tongue, latter rounded convexly in front. Nostrils not very distinct, front one about last ⅔ in snout. Interorbital slightly concave. *Gill-rakers*—5+12, lanceolate, slightly less than gill-filaments, which 1⅔ in eye. Scales with 11 or 12 basal radiating striæ; apical denticles in row of 16 to 20+16 to 18; circuli fine. *Scales*—finely crowded on predorsal, also on caudal base, few on opercle. Cheek with 3 horizontal rows of fine papillæ, row below eye and back to suprascapula; 4 short rows parallel and longitudinal on occiput; row along preopercle edge and mandible. *Fins*—Third dorsal spine 2⅔ in head; ninth dorsal ray 2; eighth anal ray 2; caudal with median rays longest, 1⅔; pectoral 1⅓, ventral 1½.

Colour—Brown generally, lower surface of head and abdomen but little paler. Few scattered deep brown dots on side of abdomen. Fins grayish-dusky, all darker or blackish terminally. Ventral largely dusky-black. One from Tuticorin, 60 mm.

Differs a little from Day's figure in a more abrupt snout. His account gives slightly more scales.

Ctenogobius masoni (Day).

Head 3⅓; depth 4⅓; D. vi—i, 10, i; A i, 9, i; scales 26 from gill-opening above opercle to caudal base and 5 more on latter; 9 scales transversely between soft dorsal and anal origins; 26 predorsal scales; snout 4 in head measured from upperjaw tip; eye 6; maxillary 2⅓; interorbital 6⅓.

Body elongate, well compressed, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth 1⅓ in its length or 2⅔ in total head length. Head width 1⅓ in its length. Snout conic, convex over surface, length ⅔ its width. *Eye*—elevated, impinging on upper profile, center at first third in head. Mouth large, oblique, mandible protruding. Maxillary reaches opposite hind eye edge. Teeth in 3 or 4 rather irregular rows in jaws anteriorly, fewer laterally, conic, small; 4 small canines above anteriorly; small recurved canine each side below; no teeth on palate or tongue, front of latter obtuse. Front nostril about midway in snout, hind one close before eye. Interorbital very slightly convex, supraorbital ridges entire. *Gill-rakers*—2+7, feeble short points, greatly less than gill-filaments, which 1⅔ in eye. *Scales*—with 13 to 18 basal

radiating striae; apical denticles 17 to 20+17 to 20, in one row; circuli fine. Scales smaller and crowded on predorsal. Large scales well over caudal basally. Head naked, except scales on occiput and few on opercle above. Prepectoral scales small. Cheek with 4 horizontal rows of fine close-set papillae. *Fins*—Second dorsal spine $1\frac{3}{10}$ in total head length, spines flexible; first dorsal ray 2; eighth anal ray $1\frac{2}{3}$; caudal (damaged) long as head at least, apparently rounded; pectoral $1\frac{1}{4}$, none of rays above silky or detached; ventral $1\frac{1}{4}$.

Colour—Dull uniform brownish generally. Fins all dusky-neutral terminally. One from Madras, 60 mm.

Parachæturichthys polynema (Bleeker).

Head $3\frac{2}{5}$ to $3\frac{3}{4}$; depth $4\frac{2}{3}$ to 5; D. vi—i, 10, i; A. i, 9, i; scales 30 or 31 from gill-opening above to caudal base medianly and 4 or 5 more on latter; 9 or 10 scales between soft dorsal and anal origins; 16 or 17 predorsal scales; snout $3\frac{2}{5}$ to 4 in head measured from upper jaw tip; eye $4\frac{2}{3}$ to 5; maxillary $2\frac{1}{2}$ to $2\frac{3}{4}$; interorbital 5 to $5\frac{1}{2}$.

Body elongate, well compressed, deepest about middle of spinous dorsal. Caudal peduncle compressed, least depth $1\frac{1}{2}$ its length or $2\frac{1}{2}$ in total head length. Head width $1\frac{1}{4}$ to $1\frac{1}{3}$ in its length. Snout broadly convex, length $\frac{2}{3}$ to $\frac{3}{4}$ its width. *Eye*—superior, center near first $\frac{2}{3}$ in total head length; diameter $1\frac{1}{6}$ to $1\frac{1}{3}$ in snout Mouth large, broad, mandible slightly protruding. Maxillary reaches little beyond front of eye, not quite to pupil, narrow. Teeth fine, conic, in narrow bands in jaws, outer row little enlarged, with 10 or more in front of each jaw more or less conspicuous, especially outermost of mandible; palate and tongue toothless, latter broadly rounded in front. Row of 7 short filaments along each mandibular ramus below. Nostrils well separated; front one about midway in snout; hind one close above upper front eye edge. Interorbital slightly convex. *Gill-rakers*—5 + 8, clavate, about half of gill-filaments, which $1\frac{3}{4}$ in eye. *Scales*—with 10 to 12 basal radiating striae; apical denticles 37 to 43 by 41 + 43, in one row; circuli very fine. Head largely scaly, except muzzle. Cheeks with 5 horizontal rows of papillae, row from below eye and behind to suprascapula, another along preopercle edge and mandible. *Fins*—Third dorsal spine 2 in head; eighth dorsal ray $1\frac{1}{2}$ to $1\frac{1}{3}$; seventh anal ray $1\frac{1}{3}$ to $1\frac{1}{2}$; ventral $1\frac{1}{2}$. Caudal ending in long median point behind, $2\frac{1}{6}$ to $2\frac{1}{3}$ in combined head and trunk; pectoral $3\frac{1}{3}$ to $3\frac{1}{2}$.

Colour—Body olivaceous above, paler or whitish on under surface of head and abdomen, with 4 obscure deeper blotches along back. Fins neutral-dusky, especially marginally. At bases of uppermost caudal rays black ocellus, little larger than eye and bordered with whitish. Three from Madras, 135 to 140 mm.

Odontogobius bynœnsis (Richardson).

Head $3\frac{1}{4}$; depth $4\frac{1}{3}$; D. vi—i, 13, i; A. i, 12, i; scales 50 from gill-opening above to caudal base medianly and 5 more on latter; 15 scales between soft dorsal and anal origins; snout $4\frac{1}{10}$ in head; eye $3\frac{1}{3}$; maxillary $3\frac{1}{2}$; interorbital 5.

Body moderately elongate, well compressed, deepest at middle of pectoral. Caudal peduncle well compressed, least depth equals its length or 2 in head. Head width $1\frac{3}{4}$ its length. Snout widely convex, length about $\frac{3}{4}$ its width. *Eye*—large, close to upper profile, hind edge midway in head. Mouth small, mandible slightly included. Maxillary slender, reaches opposite front pupil edge; width $1\frac{1}{3}$ of eye. Teeth in about 2 rows, at least in mandible, finely conic; mandible with recurved tooth each side medianly; no teeth on palate or tongue, which rounded and fleshy in front. Nostrils small; front one about midway in snout length; hind one close before eye. Interorbital depressed, slightly concave, narrow. *Gill-rakers*—0+8, lanceolate, $\frac{1}{3}$ of gill-filaments, which $1\frac{1}{2}$ in eye. *Scales*—

with 7 to 9 basal radiating striæ ; apical denticles 10 or 11 + 10 to 14, in one row ; circuli fine. Head naked, except predorsal, from which all small scales now fallen ; breast and belly firmly scaled. *Fins*—Fourth dorsal spine $1\frac{1}{2}$ in head ; twelfth dorsal ray 2 ; eleventh anal ray $1\frac{3}{5}$; caudal apparently rounded behind, $1\frac{1}{5}$; pectoral 1 ; ventrals not cup-like, united, $1\frac{1}{4}$.

Colour—Brown above, paler below. Dorsals, anal and ventral dusky terminally. Pectoral and caudal pale, later with small round jet-black spot at base of upper median rays. Dusky streak from each side of snout tip to eye, then from back of last to suprascapula. Traces of dark blotch in prepectoral, before pectoral base. Back with about 7 obsolete vertical transverse dark bars. One from Tuticorin, 40 mm.

My example smaller than Day's figure, showing lower jaw shorter than upper, slightly fewer soft dorsal and anal rays and larger eye.

Oxyurichthys tentacularis (Valenciennes).

Head $3\frac{4}{5}$ to 4 ; depth $5\frac{1}{3}$ to $5\frac{2}{3}$; D. vi—i, 12, i ; A. i., 13, i ; scales 48 to 50 from above gill-opening to caudal base and 5 more on latter ; 14 to 16 scales between soft dorsal and anal origins ; 16 to 18 predorsal scales ; snout $3\frac{1}{3}$ to $3\frac{1}{2}$ in head measured from upper jaw tip ; eye $3\frac{1}{4}$ to 4 ; maxillary 2 to $2\frac{1}{4}$; interorbital $1\frac{2}{3}$ to 2 in eye.

Body elongate, compressed, deepest at spinous dorsal origin, rather slender. Caudal peduncle compressed, least depth 1 to $1\frac{2}{3}$ in its length or $2\frac{1}{3}$ to $2\frac{1}{2}$ in total head length. Head width $1\frac{4}{5}$ to $1\frac{7}{8}$ its length. Snout conic, length $\frac{2}{3}$ to $\frac{4}{5}$ its width. *Eye*—elevated, hind edge midway in head length ; diameter $1\frac{1}{4}$ in snout, slightly longer than snout in young. Mouth large, oblique, lower jaw protruding. Maxillary to first third in eye, to eye center in young. Teeth curved uniserial above ; lower ones biserial, rows widely spaced ; no canines ; no teeth on palate or tongue, latter pointed in front. Nostrils well separated ; front one small pore at first fourth in snout ; hind one much larger, higher, midway in snout. Interorbital narrowly concave. Fleshy pointed tentacle $\frac{2}{3}$ of eye at its upper hind edge, absent in small examples. *Gill-rakers*—3 + 8, lanceolate, $\frac{1}{3}$ of gill-filaments, which $1\frac{2}{3}$ in eye. *Scales*—with 29 to 36 basal radiating striæ ; apical denticles 12 to 17 + 13 to 15 ; circuli fine. Body scales small anteriorly, become larger posteriorly. Rows of fine papillæ across occiput close behind eyes, with 3 parallel rows each side, uppermost along each side of median low predorsal keel, lowest till above pectoral base and median about opposite half extent of opercle ; several short branches extend down from infraorbital ; on preorbitals extend down then bend suddenly back opposite front part of eye horizontally across cheek. *Fins*—Dorsal spines filamentous, third longest, $3\frac{1}{2}$ in combined head and trunk ; tenth dorsal ray $1\frac{1}{3}$ to $1\frac{1}{2}$ in total head length ; eleventh anal ray $1\frac{1}{3}$ to $1\frac{1}{2}$; ventral 1. Caudal ends in long slender point, $1\frac{3}{4}$ to $2\frac{1}{4}$ in combined head and trunk ; pectoral $2\frac{1}{3}$ to $3\frac{2}{5}$, long, pointed.

Colour—Brown, but little paler below. About 9 pairs of close-set saddles on back, first 2 pairs on predorsal. On side row of 6 rounded dark blotches and last as small round spot size of pupil at middle of caudal base, these blotches more or less joined forward with alternate dorsal saddles. Dorsals, anal and caudal pale, spotted with neutral dusky. Dusky bar across pectoral base. Dark brown infraorbital blotch. Pectoral brown. Ventral dusky. Twenty from Tuticorin 47 to 110 mm.

MONACANTHIDÆ.

Monacanthus setifer Bennett.

Head $2\frac{7}{8}$; depth at base of pubic spine $1\frac{1}{10}$; D. i—27 to 29 ; A. 28 or 29, P. 11 or 12 ; snout $1\frac{1}{3}$ to 1^{5} in head ; eye 3 to $3\frac{1}{10}$; interorbital $3\frac{2}{3}$ to 4.

Body well compressed, rather elongately ovoid. Caudal peduncle well compressed, without spines or armature, length $\frac{3}{4}$ to $\frac{4}{5}$ its least depth, which $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Head width $2\frac{1}{3}$ to $2\frac{1}{2}$ in its length. Snout compressed, profile straight, width at front of eyes $2\frac{1}{4}$ to $2\frac{2}{3}$ in its length. *Eye*—high, hind edge opposite that of gill-opening; diameter $2\frac{1}{2}$ to $2\frac{1}{3}$ in snout. Mouth small, terminal, lips about even in front and cover teeth. Latter moderate, larger ones with slightly emarginate edges. Nostrils small, together, nearly level with upper rim of eye, front one little less than half of eye-diameter before front eye edge. Interorbital convex. Gill-opening $1\frac{1}{2}$ to $1\frac{1}{3}$ in eye. Body finely velvety to touch, little more granular around eye and on interorbital. *Fins*—Dorsal spine $1\frac{1}{2}$ to $1\frac{1}{4}$ in head, front edge and surface minutely asperous, hind edge each side with 11 antrorse serrae, some of lower bifid; sixth dorsal ray $2\frac{1}{3}$ to $2\frac{1}{2}$; sixth anal ray $2\frac{1}{2}$ to $2\frac{2}{3}$; caudal rounded behind, $1\frac{1}{3}$ to $1\frac{1}{2}$; pectoral $2\frac{1}{3}$ to $2\frac{1}{4}$. Ventral ends in short movable spine with coronet of 5 denticles, 2 to $2\frac{3}{4}$ in eye; its basal process with 4 denticles across front and 2 each side. Ventral flap moderate, not extending out beyond spine and roughened each side.

Colour—Grayish, with few obscure darker cloudings, usually as 2 blotches of darker on each rayed dorsal and anal and annectant region of trunk. Ventral flap little dusky. Fins all pale. Caudal with 2 darker transverse bands. Three from Madras, 68 to 77 mm.

AN ENCOUNTER WITH A FIGHTING TIGER.

By

Lt.-Col. R. W. Burton, I. A. (*Ret.*)

(with a photo.)

The shooting of a tiger is mostly a somewhat uneventful affair, of interest only to the sportsman himself and those who may be with him at the time. The present writer was fortunate early, last year, in bagging a tiger under, what may be correctly described, as somewhat exciting circumstances, which may be of interest to others besides himself, and the following account is taken from the shikar diary written up shortly after the occurrence. It is reproduced with the necessary polishing up and with a photograph.

In the month of February the fire lines of the Forest Reserves in the Sal forests in the Terai are burnt by the Forest Department, these operations include miles of grass land, covering certain areas which have also to be burnt as a protection to the adjacent jungles.

On the 24th February 1924 the shooting camp was comfortably settled for a few days at a Forest Rest House situated in one of these extensive open spaces which had recently been burnt. In this space, which is about 5 miles long, and averages a mile to two miles in width, is the Railway Station—the Forest Rest House being a mile to the east of it. The Railway runs through the clearing longitudinally, and two hundred yards north of the line, and about half a mile from both the Railway Station and the Rest House, is a patch of jungle more or less circular in shape and some 200 to 250 yards in diameter. Fire had been through the whole of this forest patch when the grassy plain was burnt some ten days previously, but some few patches of long grass remained unburnt, or partly burnt, and there were also evergreen trees and bushes here and there.

It was about seven o'clock when the elephant took me up the 85 feet fire line to the north to visit a buffalo which had been tied out on a cart track running through the forest, and this done, the heavy jungle to the west was searched for an hour or more with a view to finding some bears which were said to have been seen there the previous day. At about 9-30 the elephant emerged from the Sal forest into the burnt maidan, and it was decided to take this small patch of jungle on the way back to the Rest House.

When crossing the open space two pigs were seen going away from the patch of jungle and I remarked to the mahout that there might possibly be a panther there as it seemed curious that pig should be moving in the open at this time of the day. So we went quietly backwards and forwards on the alert for any movement. Almost on the east edge there was a small sambur stag which stared at the elephant with mild enquiring gaze and without alarm.

Quietly we turned and paced slowly on. Suddenly, where a moment before there was nothing, I saw a tiger about twenty-five yards away, which when sighted, was about to enter a small patch of very tall and dense grass which had mostly escaped burning. There was not much time to think; the first thought was that the tiger was not likely to remain long in such cover and, once lost sight of, would probably be well on the way to the main forest and give no chance. By the time the rifle was raised, a fraction of a second, all that was visible was the hind quarters, all forward of the loins being hidden by the grass. The tiger stopped for a moment, and I fired quickly seeing that my solid soft lead bullet (·500 black powder 5 drams) would probably rake forward and possibly kill the beast right away. At the shot the tiger gave a couple of grunts and disappeared. Circling the long grass we went into the open country, towards the main forest, in

case the tiger should have gone on. There being no sign of him, and no tracks, we retraced our steps and began to search. Not finding the beast, it was necessary to circle back to find the place where the shot was fired and in doing so the cause of the tiger's presence in such a spot was discovered. The carcase of a sambur stag was at the edge of the thick grass into which the tiger had disappeared.

Marking the line which the animal would have taken in his rush when wounded we got round the grass and soon located our quarry by his deep rumbling growls which changed into the well known coughing grunts as he charged at the elephant from underneath some thick evergreen creepers and trees.

The old elephant, with visible marks on several parts of her wrinkled hide of previous encounters with wounded felines turned and bolted, with the tiger at her heels, giving me no chance of doing anything but cling on with my left hand to a rope and fire two ineffectual shots over her tail with my right. The *shikari* clung with both hands and well drawn up feet. Having put the elephant to flight the tiger drew up, with lashing tail, and it was seen that his off hind leg was badly damaged. Then he turned off into some partly burnt grass and was lost to sight. We could see that he was a large and massive tiger with fine ruff, and broad chest. His bow-legged appearance as he came on behind us was very marked. Also we saw that he had fine teeth and was exceedingly angry. So ended the first round.

The ancient mahout pulled up the equally ancient elephant within about fifty yards, and after a short rest we started to again draw the foe. Advancing slowly the obedient elephant pushed down several small trees to clear the arena. As each tree crashed, growls were elicited from amongst the grass, which could be seen shaking violently as the tiger tore at it in his rage. As we got within,what our opponent evidently considered the "ring" limit, out he came a second time and the performance was repeated. Again the elephant bolted; again the tiger pursued ; again my puny right arm let off two ineffectual shots. Let the reader sit on the edge of a sofa, without any rest for the feet and try to fire a heavy rifle with one hand. He will find that the weight of the rifle will release the trigger as the barrels are dropped to take aim.

On this occasion the tiger retired further into the grass, and there being no movement it could not be known exactly where he was. Two shots fired into the cover had no result, so the elephant again advanced, pushing down trees as before, and now, being herself somewhat excited, there was some difficulty in restraining her from advancing to do battle on her own account. Such a proceeding would very probably have had disastrous results, as she might have been pulled down on to her knees and one can imagine that any one or more of us might have been shaken off. The mahout was, however, equal to the occasion, and kept the elephant under control. I now told him that the only way would be for me to get into a tree and for the elephant to then draw the tiger and so give me a chance. It was obviously hopeless to attempt anything off the elephant.

Here it may be explained that there was only a pad on the elephant and no rests for the feet and those who have ridden on a pad elephant can realize that it is not easy to shoot off a pad at any time, when it is further explained that the writer is unable, owing to an injury of long standing, to sit astride, with one leg on each side of the mahouts back, as is usually done, then it can be well imagined what a hopeless affair it was to attempt to kill this rampaging tiger off old " Kandan Piari " running away with the action of a boat in a choppy sea.

But let us resume the stirring tale. The violent exertions of the elephant had caused the ropes securing the pad to get considerably loosened and the pad was

slipping over to the right. It was necessary therefore for me to sit with my legs dangling over the left side : ready to pivot back to the right on the tiger sounding " active front" as firing the rifle at all with my left hand was quite impossible. I practised this manœuvre several times. This was necessary as my knees do not bend very much and my heels had to clear the mahout's head !

Before attempting any climbing into a tree, we had first to again locate the tiger so an advance was made from another direction, some more trees being pushed down, and we soon found ourselves within the tiger's fighting limits, and he came with the same horrid demonstrations and again the same proceedings on our part, except that this time the mahout pulled up too quick, or else the enemy had more pace, as he got home, as we found later, with the paw on the elephants near hind leg. I thought this had happened as I was unable to get off my usual second ineffectual shot because the furious beast was out of sight under the elephant's rump ! but I got off the second shot, both hands holding the rifle for the first time, as the tiger halted for a second before subsiding under the low hanging branches of an evergreen tree, and thought I might perhaps have hit him by a lucky fluke.

We now had the tiger in a better position as there was a small tree, close to a large one with a straight trunk, in which, if the tiger would allow me to take my stand, I could be ready for him when once more drawn by the now highly excited elephant.

The third round was over and the points were in our adversary's favour. Nine shots had been fired, the first only being a hit. Six ineffectual shots had been loosed off during the attacks and two into the grass to elicit indications of his whereabouts. Three cartridges only now remained.

Slowly the elephant was taken up to the desired tree and, naturally thinking it was to be pushed down, she was with difficulty restrained from demolishing it. There were several pushes and resulting anxious cracks on the part of the tree. We were on the very border of the " ring " and all this time the tiger kept up a continuous rumble. It was necessary to kneel on the pad, prepared to return instantly to the sitting position, should the charge be made. Several times it seemed to be imminent. At last there seemed to be a favourable moment and into the tree I got. Taking out of my pocket the length of cord always carried for such purposes, I quickly passed it round a branch of the tree and my waist : took the rifle and made ready. The movement of the elephant leaving the tree almost brought out the tiger. Seeing the leaves moving I very nearly got a shot but the chance was momentary and instantly gone. The distance was a short thirty yards.

The final round was now about to commence. It was after eleven o'clock and the first insulting challenge had been delivered at 9-40 a.m.

Once again the old elephant demonstrated, there was more pushing down of small trees, and after some little delay out came the tiger. I expected him across my left front but he took a short cut, as the elephant bore to my right, and my position was very awkward for firing. Both my shots missed ! The first ? I can't say why ! A branch of the tree arrested my arm as I pulled the trigger for the second barrel. The shots, however, seemed to have the effect of stopping the charge, a longer one than the previous three, and the tiger retreated some thirty yards as on the former occasions, and sat himself down not thirty feet away.

The opening of my rifle and the inserting of the twelfth and last cartridge attracted his attention. Looking up he peered malignantly at me round the trunk of a sapling. This prevented my aiming at his head. Just as well perhaps, head shots often go wrong. Ability to fire from either shoulder here came in, as on some previous occasions, as a very useful accomplishment. Leaning

much to my right the strain taken by the waist cord and getting the butt of the rifle against the biceps of my left arm it was possible to get the sights on to his back, behind the shoulder and to left of the spine. To the shot the tiger subsided—he had been supporting himself on his forepaws his head fell back and his gallant fight was over.—

Eleven thirty a.m.—one hour and fifty minutes. No less gallant and beyond all praise was the conduct of old Ghulab the mahout who kept his head and managed his elephant admirably, throughout. Not once did he suggest a retreat, or urge, as he might have done, that he could not risk his elephant, and the old elephant—Kandan Piari—what of her! Had she been permitted she would have been on top of the enemy. Twice before had she been mauled by a tiger. The shikari behaved well also though all he had to do was to cling on: he did that without unnecessary fuss!



The fight is over: now for the measurements. Laid on his back—nose pressed down and knives stuck into the ground at nose—root of tail—tip of tail gave a straight line measurement of nine feet one inch, the curve measurement being nine feet seven inches. The tail was two feet nine inches. The girth fifty-five inches. A massive tiger and beautifully marked.

The initial shot, and the last shot, were the only ones that hit the beast. The first shot fired when only hind quarters and a bit of the flank visible, could not, short of killing the animal outright, have been better placed. It entered at centre of buttock and smashed the thigh bone to pieces a few inches below the hip socket. It was found mushroomed perfectly, against the skin inside the stifle, and, had the penetration been sufficient, would have travelled forward and traversed the stomach to the vital parts of the chest. A·470 high velocity bullet would probably have done this and deprived our readers of this exciting tale. Had the hindleg not been broken we might have fared less fortunately than we did.

I wanted the carcase of the sambur left alone as quite possibly a prowling panther might have been found near it on some other day: but some Thadus, members of that curious tribe which inhabit the Terai forests, skinned and cut it up and brought the malodorous remains for me to see!

The stag had been killed about four days previously and had not been eaten at all: after killing, the tiger had gone for a walk and killed another sambur elsewhere. His stomach contained skin and hair of sambur showing this to have been the case. His return to inspect the first kill was his undoing.

The morning after this exciting day I asked the old mahout if he and his elephant had slept well. He replied that he had slept but little! I own that I was so excited as not to be able to get to sleep until near midnight. Such incidents as this live in one's memory. They come but seldom: but all sportsmen who persistently adventure in pursuit of dangerous game have experienced incidents of the nature here recited and the best one can wish them is "Good hunting" and many more like them—all with equally satisfactory results.

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

Part XXI.

(*With one Plate and* 1 *Text-figure.*)

(*Continued from page* 405 *of Vol. XXX.*)

Genus—GOMPHUS Leach.

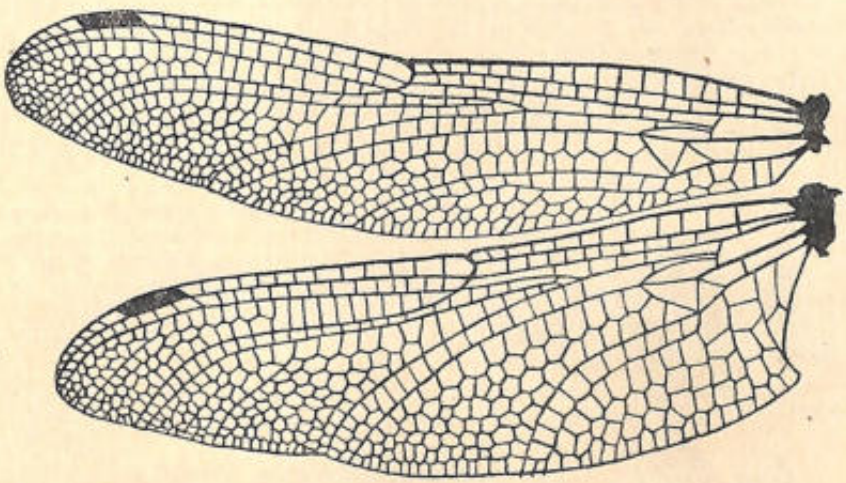


Fig. I—Wings of *Gomphus personatus* Selys. Male.

Gomphus. Leach, Edinb. Encycl., ix., p. 137 (1815); Selys, Bull. Acad. Belg., xxi., (2) p. 44 (1854); id. Mon. Gomph., p. 115 (1857); Will. Proc. U.S.Nat. Hist. Mus., xxxiii, p. 364 (1908); Selys, Mon. Lib. Eur., pp. 77-80 (1840); id. Revue des Odonates, pp. 81 and 82 (1850).

Aeshna. Fabr. Syst. Ent. p. 424 (1775); Latr. Gen. Crust. Ins., iii., p. 286 (1802); Kirby Cat. Odon., p. 64 (1890).

Diastatomma pars. Burm. Handb. Ent., ii p. 831 (1839); Charp. Lib. Eur., p. 15 (1840).

I have based the characters of this genus on a comparative examination of the following species, for the American examples of which I am indebted to Mr. E. B. Williamson of Bluffton, Indiana: *Gomphus personatus* Selys, *G. nilgiricus* Laid., *G. o'doneli* Fras., *G. nevadensis* Kenn., *G. ventricosus* Walsh, *G. fraternus* Say, *G. vastus* Walsh, *G. grasinellus* Walsh, *G. olivaceus* Selys, *G. sobrinus* Selys, and *G. donneri* Kenn.

The first three species are the sole representatives in India of this large genus, the other eight species mentioned are all from America. *G. personatus* and *nilgiricus*, by reason of the preponderance of the coal black ground-colour, stand rather apart from American examples of the genus, but *o'doneli* agrees with the latter, not only by the large extent of its yellow markings, but also by its robust, stocky build. *Gomphus promelas* Selys and *G. ceylanicus* Selys belong to Laidlaw's genus *Heliogomphus*, the former being synonymous with

Heliogomphus pruinans Fras. *Gomphus o'doneli* is from Bengal, *G. personatus* from Assam and Upper Burma, whilst *G. nilgiricus* is from the Western Ghats of India. With the exception of the three Indian species and a few neotropic in distribution, the majority of the species are palæarctic and nearctic, and are found widely distributed throughout Europe and North America.

CHARACTERS OF THE GENUS.

Moderately large to large insects, with body colouring of black marked with yellow. Wings hyaline, reticulation close, base of hind wing of male rather deeply excavate, tornus prominent. Arc usually between antenodals 1 and 2, occasionally opposite 2, more rarely a little distal of 2; two rows of postanal cells in forewing, 4 to 6 in the hind, the first postanal cell of hindwing entire, small and *extending basad for only about half the length of the base of subtrigone*; 1 to 2 rows of cells between *Mi* and *Mia*; pterostigma rather small, braced less than one-fourth the length of distance between the node and outer end of pterostigma, only a single cubital nervure in all wings; 2 rows of discoidal cells in forewing widening to at least 3 rows at level of node; 2 transverse nervures between *Mi-iii* and *Miv* in forewing, only 1 in the hind; all trigones, subtrigones and hypertrigones entire; *Cui* and *Cuii* in hindwing nearly parallel as far as hinder margin of wing.

Legs variable in length in the species, but hind femora always extending beyond hinder border of thorax and often as far as apical border of segment 1, less rarely overlapping segment 2, hind femora closely and minutely spined.

Body markings usually constant, but *personatus* shows considerable and wide variations.

Anal appendages of male equal, or subequal, both superior and branches of inferior widely and equally divaricate, simple, unbranched.

Genitalia variable in the species. Vulvar scale usually small and deeply cleft (but in *nilgiricus* it departs from type and is long and markedly projecting).

Genotype—*Gomphus vulgatissimus*. (Lin.)

Gomphus personatus Selys, Bull. Acad. Belg., (2) xxxvi, p. 197 (1873), ibid. (2) xlvi, p. 454 (1878), Will. Proc. U.S. Nat. Hist. Mus., Vol. XXXI, p. 305 (1908), Laid., Rec. Ind. Mus., Vol. XXIV, pp. 396-398 (1922).

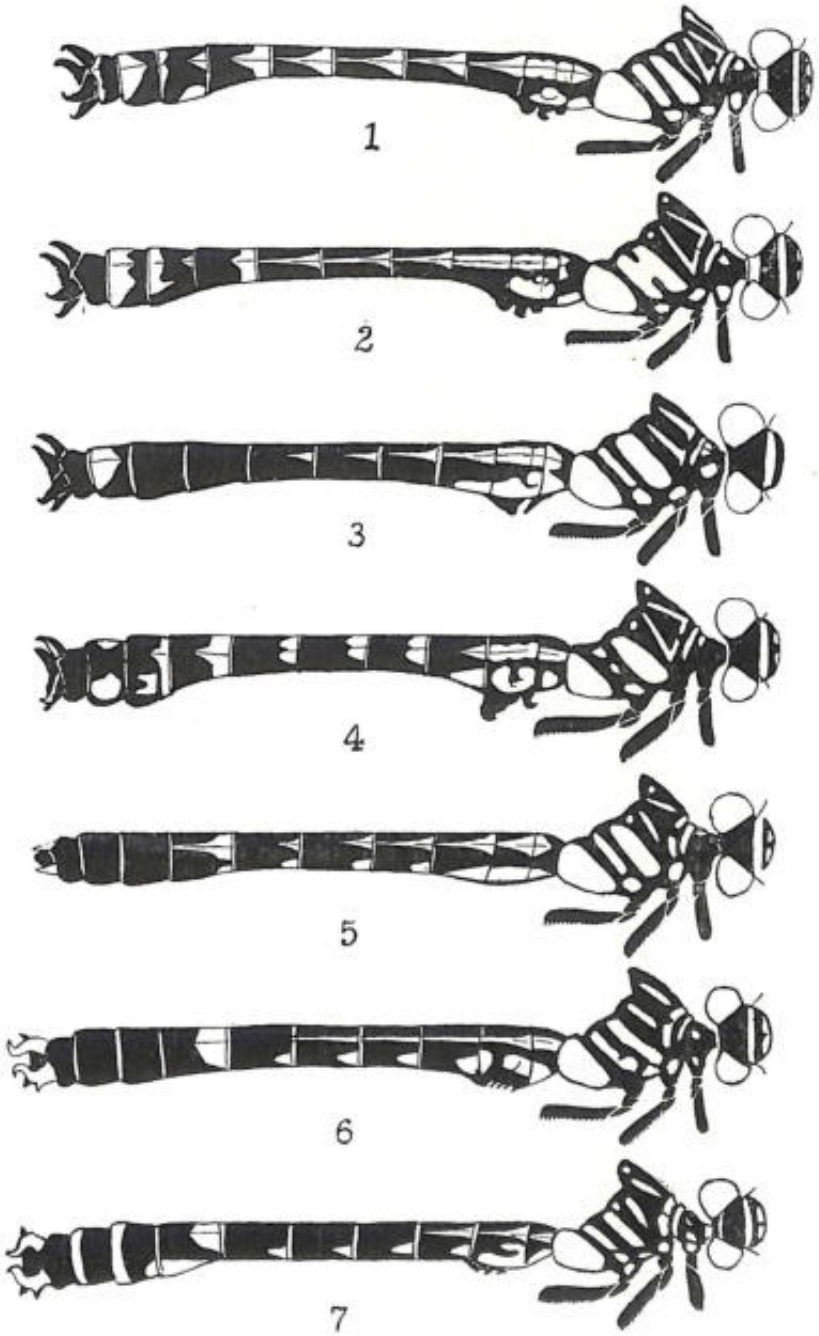
Gomphus xanthenatus. Will. l.c.p. 305-308 fig. 32 (1908).

Male: Abd. 42-45 mm. Hindwing 37-39 mm.

Head: labium with middle lobe blackish, lateral lobes yellow, labrum glossy black marked at the base with two oblong bright yellow spots, bases of mandibles yellow, ante-and post-clypeus black, the latter with a large lateral spot of yellow against the eye and a variable small medial spot of the same colour, frons bright greenish yellow except the lower part in front and its base above which is marked with a fine crenulate black basal line. Rest of head black but the occiput variably bright to dull yellow at its centre, black laterally, fringed with black hairs, very long in the male but shorter in the female. Occiput of male straight, in the female a little sinuous and usually with one or two small spines on either side, and with the yellow much more extensive than in the male.

Prothorax black marked with bright citron yellow, a broad anterior collar, a small medial spot and a much larger lateral one on the posterior lobe.

Thorax black marked variably with citron yellow as follows:—a mesothoracic collar slightly broken at its middle by the black middorsal carina, and confluent at its outer end with straight antehumeral stripes which run from the antealar sinus parallel with the dorsal carina, thus forming an inverted figure seven on each side, a variable humeral marking represented, in a slight majority of specimens, by a small upper spot, but in others by a sinuous stripe which expands



INDIAN DRAGONFLIES.

For explanation see on the reverse.)

INDIAN DRAGONFLIES.

Explanation of the Plate.

1. Gomphus personatus ♂ from Maymyo.
2. Gomphus personatus ♂ from Shillong.
3. Gomphus nilgiricus ♂
4. Gomphus o'doneli ♂
5. Heliogomphus ceylonicus ♀
6. Heliogomphus promelas ♂
7. Heliogomphus nietneri ♂

The size of the figures is purely arbitrary, measurements are given in the text. Fig. 5 is constructed from the Selysian description, the other figures are drawn from life.

into an upper spot and which may be broken at its middle. In Shillong specimens both forms are met with; in a pair taken by Col. F. Wall at Maymyo, Upper Burma, the stripe is well formed, in Williamson's variety *xanthenatus* from Burma, the stripe is absent in three specimens, incomplete and broken in a fourth. Laterally more or less broadly yellow marked with two narrow black lines on the lateral sutures.

In Williamson's *xanthenatus* these two lines are more or less confluent and almost obliterate the included yellow; in the pair from Maymyo, the lines are well separated throughout their entire length by the yellow; in Shillong specimens the line on the anterior suture is invariably broadly broken, being represented by a small upper section and a longer lower which begins at the spiracle. The line on the posterior suture is much finer and the lateral yellow correspondingly much more extensive.

Legs black, anterior femora with a yellow stripe on the inner side, hind femora with a row of short, robust, moderately widely-spaced, gradually lengthening spines.

Wings hyaline, very palely and evenly enfumed; pterostigma dark brown between black nervures; costa reddish brown; 2 rows of cells between *Mi* and *Mia* at level of outer end of stigma, but 4 rows at the apex of wing; a basal incomplete antenodal nervure frequently present, in the Burmese pair from Maymyo it is present in three wings of the male but entirely absent in the female, in Williamson's Burmese specimens, it is present in all wings of two specimens, in the front wings only of another specimen and entirely absent in a fourth specimen. In Shillong material it is more rarely present and in four consecutive specimens examined, it was present in only one of the forewings of two specimens, absent in all other fourteen wings.

Anal triangle of 3 to 5 cells; 4 to 5 rows of postanal cells in the hindwing; 3 rows of cells at level of node in the discoidal field;

nodal index $\frac{14\text{-}18|17\text{-}15}{13\text{-}11|11\text{-}13}$, $\frac{12\text{-}14|15\text{-}12}{14\text{-}10|11\text{-}13}$; membrane obsolete.

Abdomen tumid at base and from segment 7 to 10, thin and cylindrical between these two parts, black marked with bright citron yellow as follows:—a broad continuous stripe on the sides of segments 1 to 3, tapering apical-wards on the latter segment and very short in the male, and not quite extending to apex of segment in the female, a large apico-dorsal spot on 1, a trilobed stripe on dorsum of 2 extending the whole length of segment, a fine dorsal carinal stripe on 3 tapering apicad and with a slightly crenate edge, segments 4 to 6 with small baso-lateral spots and larger baso-dorsal triangular spots which taper along the carinal ridge for a variable distance, on segment 7 these spots are confluent to form a basal annule which extends for a short distance apicad along the carina, markings on segment 8 extremely variable, usually a narrow apical ring which expands on the sides into a triangular point directed basad, a small triangular baso-dorsal spot, and a largish ventro-lateral elongate spot. Variations of this pattern exist as a complete absence of the apical ring, or two irregularly shaped lateral spots at the apex, the ventral spot may be very minute or entirely absent, the carinal spot may extend as far as the apical border and show a medial expansion, in short there seems to be no limit to the number of variations which these three markings may not assume. Segment 9 with a broad apical ring of variable thickness and extending nearer the base on dorsum than on the sides. In some specimens it extends as far as base of segment, in others it is quite fine and its basal border is serrated, usually however it covers about half the segment. Segment 10 entirely unmarked or more rarely with a fine broken apical ring.

Anal appendages as long as segment 10, of equal length and equally divaricate, black. The superior tapering to a point, curling evenly down nearly to apex which is directed abruptly straight back; inferior deeply cleft into two branches which lie parallel to the superiors, hollowed out above, curling evenly upward.

Genitalia: lamina cowl-shaped, projecting slightly; hamules very robust and projecting almost perpendicularly from the genital sac, their apices turning rather abruptly forward, black: lobe matt black, very large and tumid, projecting as a massive funnel-shaped organ.

Female. Abdomen 42 to 45 mm. Hindwing 38 to 42 mm.

Almost exactly similar to the male except in those points already mentioned above. The abdominal markings more extensive, thus the carinal stripe forms an almost complete stripe from segment 1 to 6 and is often confluent with the baso-lateral spots. Segment 8 has a fine apical ring and less rarely a small triangular baso-dorsal point. The apical border of segment 10, the anal appendages and a conical prominence between them yellow. In some, the anal appendages are black and marked with yellow on the dorsum only.

Vulvar scale not quite half the length of segment 9, bifid for about half its length, narrow and subtriangular.

Distribution. The type comes from the Khasia Hills, Assam and was described by Selys from a specimen with a complete humeral stripe. The above descriptions have been made from a large number of specimens collected by Mr. Bainbrigge Fletcher in the Khasia Hills, Assam (Shillong, during May and June), and from a pair collected at Maymyo, Upper Burma, by Col. F. Wall, in June, whilst Mr. Williamson's specimens come from the Toungoo and Karen districts of Burma. In regard to these latter specimens, it will be seen that they grade almost imperceptibly through the Maymyo specimens into the Shillong ones, the only real point of difference being the lateral sutural black lines which are complete in Burmese material, but invariably broken in Assam specimens.

I do not think that this slight difference is sufficient to constitute even a local race, so that they are here treated as mere varieties.

Gomphus nilgiricus Laid., Rec. Ind. Mus., l.c. pp. 397, 398, 419 and 420, fig. 16 and pl. xi, fig. 5 (1922); Fras., Rec. Ind. Mus., Vol. XXVI, pp. 476-477 (1924).

Male: Abdomen 46mm. Hindwing 35mm.

Head: labium pale brownish yellow; labrum, bases of mandibles and anteclypeus dark brown: postclypeus and front of frons black, upper part of frons bright greenish yellow, rest of head black.

Occiput black, slightly raised in the middle.

Prothorax black marked with citron yellow as follows:—an anterior collar, a transversely oval spot on the dorsum of hinder lobe and a small paired spot just in front of and confluent with latter.

Thorax matt black marked with greenish yellow as follows:—straight antehumeral stripes running parallel with the mid-dorsal carina, gradually broadening below where they are confluent with a widely interrupted mesothoracic collar. Laterally broadly greenish yellow marked with two moderately broad black stripes on the lateral sutures, often confluent with one another so as to split up the intervening yellow into two or three spots.

Legs black, robust, hind femora extending well on to the second abdominal segment, minutely and densely spined.

Wings hyaline, pterostigma braced, over 4 to 5 cells, dark brown between black nervures; nodal index $\frac{13\text{-}13}{15\text{-}9}\Big|\frac{15\text{-}12}{10\text{-}13}$; membrane obsolete; 1 to 2 rows of cells between *Mi* and *Mia* at the outer end of pterostigma; 2 transverse nervures between *Mi-iii* and *Miv* in the forewing, only 1 in the hind; 5 to 6

rows of postanal cells in the hindwing, the first entire, extending basad for a little more than half the length of base of subtrigone; a basal incomplete antenodal nervure variably present (present in both forewings of one male, in both forewings of two females, in all wings of two males, but apparently more often present in the forewing than hind); 2 to 3 rows of discoidal cells at level of node, usually 3; only 1 cubital nervure in all wings.

Abdomen tumid at base, moderately and squarely dilated from segment 7 to 10, slender and cylindrical between these parts, black marked with bright primrose yellow as follows:—the sides of segments 1 and 2 at and below level of oreillets, the latter margined with black, a dorsal spot on segment 1 widening apically, a trilobed band on mid-dorsum of segment 2, extending the whole length of segment, a mid-dorsal line on 3 tapering rapidly from its base and not quite reaching apical border of segment, a triangular basal spot on the sides of this segment, paired basal, dorsal spots on segments 4 to 7 and confluent with one another at the base, segments 8 and 10 unmarked but 9 with its apical half yellow, the border of this wide annule markedly crenate or serrate and resembling a similar marking seen in *personatus*.

Anal appendages black, about as long as segment 10, the superiors and branches of inferiors widely and equally divaricate, the superior tapering to a fine point, curved evenly down but the apex turned rather abruptly back and up; inferior with its branches first directed down and then curling up, of the same length as superiors.

Genitalia: lamina depressed, broad and shallowly arched; hamules very robust, broad at base, tapering to a point, projecting markedly from the genital sac with a slight posterior slope, black; lobe large and prominent, funnel-shaped, black.

Female: Abdomen 43 mm. Hindwing 38-40 mm.

Closely similar to the male save for sexual differences. Abdomen thick and robust, cylindrical throughout.

Wings rather broader, pterostigma pale brown, over 4 to 6 cells; nodal index considerably higher. Abdominal markings broader, the dorsal basal spots entirely confluent and continued along the mid-dorsal carina as fine lines. The basal lateral spot on segment 3 much larger, confluent with the lateral yellow on the two previous segments and continued nearly to apical end of segment. Segments 8 and 10 are unmarked as in the male, but 9 bears a similar broad apical ring. Unlike *personatus*, the markings of this insect are remarkably free from variation.

Vulvar scale of great length, projecting from the abdomen at an angle of about 45 degrees, consisting of two closely apposed scales, which taper from a moderately broad base to a fine point.

Anal appendages small, conical, black, the conical protuberance between them yellow.

Distribution.—A rare insect found sparcely throughout the Western Ghats of India. A few specimens have been taken on streams flowing down the Mettapalayam and Gudalur ghats, Nilgiris, I have taken 5 males at the head of the Sampaji river and on a small stream above the Hatti river, Coorg. Major Frere found it in larger numbers on the Bear and Cinchona streams, Kodai-kanal, Palnai Hills. The larva, which burrows in sand, is of the long, cylindrical, torpedo type. The female deposits her eggs by stabbing them into wet sand in the beds of rocky mountain streams. The range of this species seems to be confined to altitudes between 3,000 and 7,000 ft. The males are usually found settled on rocks in midstream or on cane fronds overhanging streams. It is the only Gomphine so far taken in the Palnai Hills, which may explain its greater prevalence there. In the Nilgiris and Coorg, it is faced with the formidable competition of *Lamellogomphus*, *Megalogomphus*, *Heliogomphus* and *Burmagomphus*.

Gomphus o'doneli Fras., Rec. Ind. Mus., Vol. XXIV, pp. 420-421 (1922).

Male: Abdomen 42 mm. Hindwing 30 mm.

Head: labium pale yellow, the middle lobe bordered with black; labrum glossy black with two small basal yellow spots; rest of face and head black except for a narrow transverse stripe of yellow on crest of frons. Occiput emarginate, fringed thickly with black hairs.

Prothorax black, the posterior lobe, a small spot on either side of it, a duplicated spot just in front of it and an anterior collar yellow.

Thorax black marked with yellow as follows:—oblique ante humeral stripes which are confluent with a slightly interrupted mesothoracic collar, a small upper humeral spot. Laterally the greater part of the sides yellow marked by a broad medial band of black which is itself marked by three small yellow spots. Most probably this black band originates from the fusion of two black stripes on the lateral sutures.

Legs short, robust, entirely black. Hind femora coated with small spine and with a single larger spine at the distal end.

Wings hyaline; pterostigma dark brown, braced, rather small; membrane almost obsolete, dark brown; 2 nervures between *Mi-iii* and *Miv* in the forewing, only 1 in the hind; only 1 row of cells between *Mi* and *Mia* at level of distal end of pterostigma; *Cui* and *Cuii* nearly parallel in the hindwing; nodal index $\frac{9\text{-}16}{11\text{-}10}$ $\frac{14\text{-}9}{11\text{-}10}$; 3 rows of discoidal cells at level of node in forewing; 3 to 4 rows of postanal cells in hindwing, the first postanal (the vestigial anal loop) very small, entire, extending inwards towards base of wing for only half the length of the base of subtrigone; no incomplete basal antenodal nervure in either sex.

Abdomen tumid at base, the base of segment 7 and 8 and 9 broadly dilated although not winged, segments 3 to 7 narrow and cylindrical.

Black marked with yellow as follows:—a triangular dorsal spot at apex of segment 1 and a broad lateral spot on each side, segment 2 with a trilobed dorsal stripe, the oreillet and a large lateral spot beyond it, 3 with the dorsum narrowly at the base and a large lateral basal spot, 4 to 6 with dorsal basal spots rather widely confluent across the carina, 7 with a broad basal annule prolonged apicad along the dorsal carina, 8 with a small spot on the middorsal carina at the base and another larger angulated spot on the middle of each side, 9 with the whole of the ventro-lateral border broadly yellow, 10 unmarked.

Anal appendages black, widely and equally divaricate, the superiors slightly longer than branches of inferior and about equal in length to segment 10, very robust, very thick at base, at first directed obliquely out, the apex then sharply angulated back so that the outer border presents a prominent angle, the apex itself rapidly tapering to a sharp point. Inferior deeply and broadly cleft into two strongly divaricate branches, short, broad and with the apex ending in a minute upturned spine.

Genitalia: lamina depressed, broad; hamules very robust, projecting almost perpendicularly from the genital sac, ending in a robust, slightly forwardly directed spine; lobe of great size, bulbous, funnel-shaped, black.

Female. Abdomen 42 mm. Hindwing 32 mm.

This sex which has not been described before, resembles the male in its robust stature and general colouring. The abdomen is a little thicker at the middle segments but is not of that even width generally seen in female gomphines. Differs from the male in the following respects:—In addition to the two small basal spots on labrum, there is another smaller but brighter spot on the outer side of each; the anteclypeus is very dark brown and there are two small median

yellow spots on the lower border of postclypeus and a very obscure spot on the same structure at the border of eyes. The occiput is fringed with short black hairs, simple, its extreme edge brown, but behind, as seen by tilting the head forward, the occiput is bright yellow.

Prothorax and thorax similar but the mesothoracic collar barely interrupted and the upper humeral spot nearly obsolete. Legs black, the hind femora with a row of gradually lengthening, closely-set, very robust spines, the distal one of great length.

Wings similar to the male, nodal index not differing noticeably.

Abdomen with the basal spots so confluent as to form rather broad basal rings from segment 3 to 7, the mid-dorsal stripe on segment 2 tapering apicad more than in the male, the lateral spot on segment 8 not angulate but quadrat and extending to base of segment, an additional small baso-dorsal spot one segment 9 and the lower part of the sides of 10, as well as 9, yellow.

Anal appendages very small, pointed, yellow. Vulvar scale rudimentary merely a small broad short projection of the apical border of segment 8 but slightly overlapping 9; the expanded borders of the segments here functionate for the vulvar scale.

Distribution.—A single pair only of this rare species is known, which were collected by Mr. H. V. O'Donel at Hasimara Tea Estate, Duars, Bengal. In general facies they recall strongly species of the genus from North America and cannot be readily confused with either *personatus* or *nilgiricus*.

(Since the above was written, Mr. O'Donel has taken another male at Hasimara.)

(To be continued.)

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS.

By

Herbert Stevens, M.B.O.U.

Part VI.

(*With 2 plates.*)

(*Continued from page 379 of this Volume.*)

344. Elwes's Horned Lark. Otocorys alpestris elwesi. Blanf.

Recorded for Sikkim at nearly 18,000′ at which elevation Blanford met with this Lark. (Kongra Lama Pass between 15-16,000′. Donkia Pass, 18,000′.)

345. The Long-billed Calandra Lark. Melanocorypha maxima. Gould.

Recorded for the higher parts of Sikkim. Observed up to 15,200′ in Tibet. (Walton.)

346. The Tibet Skylark. Alauda arvensis leiopus Hume.

I have not been fortunate to meet with any species of Skylark in these hills, though I have a distinct impression of a crested Lark without any pronounced form and colour characters, seen in the winter of early March 1920 at 8,800′ in Lachung; this records might also in the circumstances refer to Galerida sp ? as it was not secured. Mr. N. B. Kinnear regards *Alauda inopinata* Bianchi as a purely Tibetan species; until specimens actually turn up from the Sikkim Himalayas for identification and comparison the status of any species of *Alauda* must remain very obscure. *A. inopinata* was obtained at Khamba Dzong at 15,000′ in June and July by the Mount Everest Expedition.

347. The Small Kashmir Skylark. Alauda gulgula guttata. Brooks.

Evidently obtained by Mandelli in June from somewhere in the far interior as Kinnear refers to four skins in the National Collection, one of which is from Sikkim.

348. The Rufous Short-toed Lark. Calandrella brachydactyla dukhunensis. (Sykes.)

I saw undoubted birds of a species of *Calandrella* or *Mirafra* and took their eggs at about 7,500′ in the Mai Khola in East Nepal, unfortunately I failed to secure any specimens. Blanford records it as common in all the higher valleys of Northern Sikkim above 12,000 especially abundant at Yumthang, 12,000′, Momay Samdong, 15,000′ and Phalung, 16,000′. "At the latter place early in October, the Short-toed Larks were in flocks of several hundreds just as they are found in March in the plains of India". These records refer to *Alauda brachydactyla* but might well include the next species. Obtained by the Mount Everest Expedition up to 17,000′.

Brook's Short-toed Lark. Calandrella acutirostris tibetana Brooks.

Obtained by the Mount Everest Expedition at 14,000′.

Possibly may occur in the extreme north which remark also applies to *Galerida cristata leautungensis* (Swinh.).

349. The Western White-eye. Zosterops palpebrosa elwesi. Stuart Baker.

Commonly and generally *distributed up to 5,000'* at all events. Occurs at Gopaldhara, 4,700', during the cold-weather months ♂ 31-12-11. In all likelihood reaches an elevation of 7,000' as recorded for the Himalayas.

350. The Himalayan Yellow-backed Sunbird. Æthopyga siparaja seheriæ (Tick.).

Recorded for the "Himalayas up to 7,000' in summer". This elevation is entirely erroneous for the Sikkim Himalayas. *Confined to low elevations only* Entirely absent from the valleys of the foot-hills in the west which do not support a plains-fauna. Nurbong at 2,000', 21-2-14, conspicuous by their numbers. Obtained in the Tista Valley up to an elevation of 3, 600'. (G. E. Shaw).

351. The Fire-tailed Yellow-backed Sunbird. Æthopyga ignicauda ignicauda (Hodgs.).

Irregularly distributed *from 2,000' and undoubtedly lower on occasions, up to over 10,000' in winter and higher in summer* Phalut, 11,800', August. *This Sunbird ascends the highest of the several species represented in the Sikkim, "Himalayas."* "Observed by Blanford at 11,000'". Kalo Pokhari, Nepal-Sikkim Frontier, 10,160' These sunbirds were often seen in parties during brief, sunny spells of weather haunting the birch and rhododendron trees, when in flower in late March and early April, all vegetation and the surroundings being enveloped in a coating of snow at this time. A drop in the temperature or the wafting up of the clouds would force them into the valley below. Nurbong, 2,000', an immature male observed on the 20th of February and a similar male in March 1914. Eighteen specimens examined. Gopaldhara, 4,720', ♂ 16-11-20 (a), juvenile no moult, breast suffused with orange-red, remainder of lower plumage greenish-yellow, rump yellow, upper tail-coverts crimson; in all other respects similar to the adult female. 4,700' ♂ 28-12-11, (b), juvenile, similar to (a) with the exception that the red on the breast is wanting, the tail is margined externally with rufous, a few feathers on the upper surface showing signs of the change into the adult plumage. 4,720', ♂ 16-11-20, (c), similar to (a) excepting the tail is margined externally with rufous, and one middle feather is 63 mm. longer than the next pair; evidently an abnormality for this juvenile stage of plumage. Kalo Pokhari, 10,000', ♀ 18-3-12, partial moult on crown. 8,500', ♂, 28-3-12, partial moult on crown and throat.

Kalo Pokhari, 10,000', ♂ 18-3-12, partial moult, middle pair of tail feathers shorter than the remainder, measuring 30 mm. in total length. 8,500', ♂ 19-3-12, in moult. Darjeeling, 6,500', ♂ 13-304, partial moult. Gopaldhara, 6,000', ♂ 10-3-18, in moult; ♂ 10-3-18, in moult; ♂ 10-3-18, in moult. These five specimens agree with the first specimen in respect to the middle pair of the tail feathers, which measure in the order taken, 24, 32, 24, 30 and 39 mm. respectively.

Kalo Pokhari, 10,160', ♂ 17-3-12. adult, middle pair of the tail feathers longer than the next pair by 24 mm. ♂ 20-3-12; ♂ 22-3-12; ♂ 2-4-12; ♂ 3-4-12. These four adult specimens agree with the first specimen in having the middle pair of tail feathers longer than the next pair in the order taken by 19, 25, 16 and 26 mm. respectively. Five others collected, but not available for comparison: these did not vary in any appreciable extent from the average. Thus the elongated middle pair of tail feathers of the adult male; the measurement of which is given by Oates as exceeding the next pair in length by 2.7" = 69mm. takes several months to reach their extreme length which is probably not attained before July and may not always be reached within the year, and this is further

confirmed by an adult ♂ 11-8-05 showing a measurement of 61 mm. in this respect.

Blanford's record refers to the Cho La Range, 11,000′, August.

352. Mrs. Gould's Sunbird. Æthopyga gouldiæ gouldiæ (Vig.).

Uncommon. Found at *all elevations of from* 4,000′-10,000′ according to season. Once observed on the Mirik Ridge above Namsoo at an elevation of 4,000′, exact date overlooked, probably late March or early April. Kalo Pokhari, 10,160′, ♂ ♀ 17-3-12 ; ♂ ♂ 22-3-12. With the exception of one other female these specimens constituted the sum total of this Sunbird's appearance on the Ridge, which occurred during a few days of tropical heat ; they had come up from the densely wooded valley below, on the Sikkim side of the Frontier. Gopaldhara, 4,720′, ♂ 15-3-16,* ♂ 16-11-20, only this single male secured ; as I failed to discern the female which was in all likelihood mixed up with the numerous immature males and females of *Æ. ignicauda*. 3 ♂ ♂, ♀ 2-11-21. First arrivals, which appeared immediately the cherry blossom opened.

This Sunbird was much in evidence at this time, dwindling down gradually until the 13th of this month when the flowers had mostly set and the last bird had disappeared : two males are in partial moult not having yet attained the full adult plumage.

353. The Black-breasted Sunbird. Æthopyga saturata (Hodgs.).

Generally distributed. Occurs up to *an elevation of 6,000′* at all events in "the rains". During "the cold weather" it keeps to the warmer bottoms of the valleys. Gopaldhara, 4,720′ Only a few birds of this species are to be seen in this "Sunbirds' paradise" when the cherry trees are in blossom in November, as there is no appreciable augmentation of their numbers as is so noticeable with *Æ. ignicauda* and in some measure *Æ. gouldiæ* at this favourable time ; yet they frequent scattered cherry trees at lower limits to some extent along with *Æ. nipalensis*. During late April, I have seen odd birds probing the flowers of the cardamom at ground level.

354. The Nepal Yellow-backed Sunbird. Æthopyga nipalensis nipalensis. (Hodgs.).

Found at *all elevations of from 3,500′-10,000′* both in the Interior of Sikkim and on the Outer Ranges. Only recorded up to 6,000′ for the Himalayas. Gopaldhara, 3,500′, ♂ 17-1-19, the tail in this male has not acquired its full length. 4,700′, ♂ 24-12-11 , the head, throat, breast and back are undergoing moult into the adult stage of plumage. Sonada, 6,500′, ♂ 6-2-17, adult. Lepcha Jagat, near Ghoom, ♂ 28-5-16*. Common around Singhik at an elevation of 4,800′ during the second week of March, 1920. Kalo Pokhari, Nepal-Sikkim Frontier, 7,000′-10,000′. A series of 10 ♂ ♂, 4 ♀ ♀ collected during March and April 1912 ; all of which are fully adult. Oates remarks the female is undistinguishable from the female of *Æ. seheriæ*. A comparison of a series of both species shows *Æ. nipalensis* to have the *back a more defined yellowish-green, the throat to breast to be darker than in any specimens* of *Æ. seheriæ*. also some females of *Æ. seheriæ* have *the mantle feathers tinged in places with red*. All these characters are easily discernable in well-prepared skins.

355. The Purple Sunbird. Cyrtostomus asiaticus asiaticus (Lath.).

A plains-species. Recorded as found up-to 5,000′ (Himalayas). This elevation is certainly not applicable to the typical form for Sikkim. It occurs in the

Eastern Dooars at Kumargram on the borders of Assam; where it does not encroach on the heavily forested region at the base of the hills. Specimens collected hereabouts in the plains in January 1922, have the back and upper tail-coverts of a steely-blue in comparison with the purple tone of specimens from farther west (Behar).

356. The Larger Streaked Spider-hunter. Arachnothera magna magna (Hodgs.).

Commonly occurs in the Rungbong Valley up to *an elevation of* at least 5,000′, wherever it can find the clumps of plantain trees in the folds of whose leaves it constructs its nest. Obtained around Mangpu at an elevation of 3,600′, (G.E. Shaw.) and at Turzum, 5,200′, 17-4-21. (O. Lindgren). Gopaldhara, 4,720′, 21-5-23* seen to take a spider out of a bed of Nicotiana flowers and demolish it on the ground.

357. The Sikkim Yellow-vented Flower-pecker. Dicæum chrysorrhœum intensum Stuart Baker.

A Plains-Flower-pecker obtained at elevations of 500′ at Golar Ghat, Mahanuddi River, ♂ 29-12-20, up to 2,500′, ♂ 23-2-21 in the Tista Valley. (G.E. Shaw).

358. The Fire-breasted Flower-pecker. Dicæum ignipectum (Hodgs.).

Generally distributed from 3,500-10,000′. Only recorded up to 7,000′ for the Himalayas. Partial to forest; during "the cold weather" it may be found in sparsely wooded tracts. Commonly occurs around Gopaldhara, 3,500′, ♂ 31-1-19; 5,000′, ♀ ♀ 5-1-12; ♂ 19-1-19; 4,900′, ♀ 21-12-19, obtained amongst the tangled growth of a lofty tree. 5,500′, ♂ 21-12-19, shot whilst pecking away at the berries of a forest-tree,—name unknown. 5,800′, ♀ 17-2-18; 5,000′, ♀ 2-3-18.; ♂ 16-3-16. 6,000′, ♂ 10-3-18. In March 1919, females were much more in evidence than males; all were gaily chattering from the topmost branches in an incessant volume of song for such a small bird. Equally plentiful at elevations of 4,600′-4,800′ around Singhik on the 23-2—12-3-20.

359. The Plain-coloured Flower-pecker. Dicæum minullum olivaceum Wald.

In all probability occurs at the *base of the hills in the Terai*. Easily overlooked. Found in fair numbers in the densely forested area at the foot of the hills of Bhotan on the Raidak River in the Eastern Dooars, at the end of January 1922. Very noisy as they poured out their lively trill from the tops of the lofty trees. Specimens collected 25-1-22, showed the birds to be about to nest.

Soft parts: Iris brown; bill plumbeous-grey, upper mandible and tip of lower mandible blackish-plumbeous; tarsus plumbeous horny; soles grey. *Dicæum cruentatum cruentatum* (*L.*) is only likely to be found at *plains-levels*.

360. The Thick-billed Flower-pecker. Piprisoma squalidum squalidum. Burton.

Recorded for the "Himalayas at low elevations from the Sutlej Valley to Sikkim." I have seen no specimens collected nearer to these hills than Tirhut in Behar. C.M. Inglis.

361. The Yellow-bellied Flower-pecker. Pachyglossa melanoxantha. Hodgs.

Evidently rare and extremely local. Obtained near Sonada at 6,500′, ♂ in May 1920 and ♂ 27-3-21. I am under the impression several scattered males, the females possibly overlooked, came under my observation in December 1911, when working the Semana-Mirik Ridge above Gopaldhara at an elevation of from 5,500′-6,000′. At the time I took them for *Chalcoparia singalensis*, a bird

which could not possibly occur hereabouts; as no specimens were secured this record lacks substantiation. Mr. G.E. Shaw's specimens are the only ones I have seen.

362. The Ruby-cheek. Chalcoparia singalensis singalensis (Gmel.).

This species is gregarious in the cold-season when it occurs at this period in parties. Obtained at Bhotan Ghat on the Raidak River Eastern Dooars, in January 1922, ♂ ♀ 22-1-22. There was quite a crunching noise audible, caused by this small party of birds, out of which one pair was secured, as they *probed vigorously with their bills*, sometimes *hanging on with their feet to the dry leaves* reminding me more of *the actions of White-eyes without their delicate movements.*

Soft parts: Iris red-brown; bill black; tarsus yellowish-plumbeous, soles similar.

363. The Blue-naped Pitta. Pitta nipalensis nipalensis (Hodgs.).

Occurs sparingly around Gopaldhara upto 5,000′ or thereabouts, and up to 3,700′ at all events at Mangpu, (G. E. Shaw), at this same locality Gammie obtained it breeding twice at 5,000′ in June.

♂ Juvenile, 16-6-16, agrees with Oates's description in so far as that goes. Forehead to nape, feathers centred with pink, shading into pale ochreous, giving it a streaky appearance; upper portion of orbital ring fulvous; upper plumage black with broad fulvous spots, very prominent on the wing-coverts; primary-coverts black; wing and tail ochreous-green, the tips of the tail with ochreous centres; chin and throat, pink merging into fulvous and black of the posterior and upper portions of the ear-coverts and sharply defined from the black, fulvous-tipped feathers of the breast; belly, entirely pink with faint dusky edges; under tail-coverts with broad-white tips, tinged with ochreous and pink.

Soft parts: Juvenile. Iris hazel-brown; bill orange lobster-red; upper mandible dusky in centre; tarsus pale dusky lobster-red.

364. The Indian Pitta. Pitta brachyura (L.).

I have observed this beautiful Pitta on one occasion 11-6-19° only, at a *low elevation* in the Great Rangit Valley. The B. M. Coll. also contains a single specimen collected by Mandelli from the Lower Hills in April 1874. The nearest locality where it commonly occurs is Behar and it is well represented by Hodgson's specimens in the National Collection.

365. The Green-breasted Pitta Pitta cucullata cucullata. Hartl.

Probably *confined to the Terai and Foot-hills only*, in a similar lay of land and heavy forest to that, in which it occurred on the North frontier of Assam. Jerdon records obtaining one specimen breeding at 1,200′ in the Gt. Rangit Valley. There are numerous specimens of this species from the lower hills in the B. M. Collection.

366. Hodgson's Broadbill. Serilophus lunatus rubropygius (Hodgs.).

Recorded for the "Himalayas below about 5,000′." Evidently *does not occur much beyond the plains-level* as I have nothing to record in support of this statement excepting negative evidence. Gammie is mentioned by Hume, as having obtained it breeding at Mangpus around an elevation of 3,000′ on one occasion. Mr. G. E. Shaw has so far not obtained it from this same locality so it appears to be confined to lower limits generally.



H. S. Photo.

ABOVE KARPONANG. March, 1917.

Haunts of *Conostoma aemodius, Sathora fulvifrons, Pterruthius xanthochloris, Lăiscopus himalayanus, Carpodacus thura, Lophophorus impejanus, Ithagenes cruentus*, &c., &c.



H. S. Photo.

LACHUNG VALLEY ABOVE KEDOM.

Looking north. 11th March, 1920.

A *Palæarctic Avi-fauna* below the region of the Pines. *Suthora unicolor, Aegithaliscus iouschistos, Yuhina occipitalis, Proparus chrysotis*, &c., &c., in the valley-bottom.

367. The Long-tailed Broadbill. Psarisomus dalhousiæ (Jameson).

This beautiful Broadbill is generally distributed up to *an elevation of 5,000′* in the Rungbong Valley; it appears only sporadically, and these movements are difficult to follow. Recorded up to 6,000′. Gopaldhara, 4,720′, 13-1-18,* calling adjacent to the bungalow and heard for some time previously, again on the 28-3-15.* 5,000′ upwards, calling in the forest, 22-4-16* and also heard at a similar elevation 14-20-5-15. Sepoydoorah to Tindharia, 2,500′, 13-3-14,* much in evidence. Gammie obtained it breeding at 2,500′ in April in the Tista Valley.

368. The Assam Black-naped Green Woodpecker. Picus canus gyldenstolpei Stuart Baker. "Larchi Paharis.

Used without distinction for all Woodpeckers.

In the vicinity of Gopaldhara occurs up to an elevation of 5,500′ or somewhat higher. Found in open, sparcely forested tracts, as well as the defined forested areas.

The young ♂ (Assam) 7-8-04, has the crown merely tipped with fulvous, and with the exception of the head, the whole of the upper and lower plumage, especially the upper tail-coverts and tail are in moult; in this last condition resembles an adult ♂ 31-7-04.

369. The Small Himalayan Yellow-naped Woodpecker. Picus chlorophus chlorophus. Vieill.

Commonly occurs at plains levels. In the Rungbong Valley is found up to an elevation of 5,000′ at all events. Recorded upto about 10,000′. I have nothing to mention in support of this statement. Nine examined: Some females show a tendency to resemble the male in having a "few" feathers of the forehead over the black stripe and in front of the eye coloured red.

370. The Large Yellow-naped Woodpecker. Chrysophlegma flavinucha flavinucha (Gould).

Recorded for the Himalayas chiefly between 2,000′ and 7,000′. I have noted this Woodpecker at all elevations from 600′ upto 5,500,′ and it possibly exceeds these limits to some slight extent. Whilst it occurs commonly at plains-levels, the recorded limit is likely to be rarely reached.

371. The Northern Pale-headed Woodpecker. Gecinulus grantia grantia McClell.

Recorded chiefly between 2,000′ and 5,000′. Evidently locally distributed. Occurs in the Tista Valley, and obtained below Mangpu at 3,500′. (G. E. Shaw). My only information respecting this Woodpecker was obtained in the Plains of Upper Assam.

372. Rufous-bellied Red Woodpecker. Dryobates hyperythrus hyperythrus (Vig.).

Occurs along the Singile La Ridge from Tonglo to Phalut at 10,000′—12,000′ during June to August. In the winter it is decidedly rare at these high elevations. I cannot follow Blanford's statement: "the commonest Woodpecker in the pine forests of Sikkim at 9,000′-12,000′" which would very aptly apply to *D. darjellensis*, and as I note the Lepcha name is given for the latter and not for *D. hyperythrus* I surmise the letterpress has been somehow transposed.

Three examined: Tonglo, 9,000′, East Nepal, ♂ 3-2-12. Nepal-Sikkim Frontier, ♂ 30-6-04. (C. M. Inglis). Phalut, 11,600′, ♂ 9-8-05. (C. M. Inglis). The two last specimens evidently obtained in the Pine forests. I am wrong in my surmise but allow the original note to stand and quote Blanford's remarks "The change from the fauna of outer Sikkim where Woodpeckers abound as

they do throughout Malayasia, is strikingly exemplified by this family. It is doubtful if *P. hyperythrus* has been obtained in the neighbourhood of Darjeeling; specimens reported to have been brought thence were probably shot in the interior." He speaks of it as rare in the Pine forests where two specimens were obtained at 9,000′, Lachen and 10,000′, Lachung. It has of course, *a decided Palæarctic status.*

373. The Darjeeling Pied Woodpecker. Dryobates darjellensis (Blyth).

Recorded for the Himalayas in Nepal and Sikkim from about 3,000′-12,000′ elevation. This distribution is totally incorrect, although it has been obtained below the Sonada to Kurseong Ridge at *6,000′*; this elevation may well be considered the extreme, lowest limit, as it does *not appear to be found much below 8,000′ in winter.* Obtained on Tonglo at 10,000′, 10-2-12. Commonly occurred around Kalo Pokhari during April 1912, at a similar elevation. Obtained south of Lachung at 8,600′, 26-2-20. Observed at close quarters south of Senchal at 8,200′, ♂ 24-3-15*. Obtained above Mangpu at 6,000′. (G. E. Shaw). Mai "Khola", East Nepal. Several clutches of two and three eggs. 28×20 average, taken in April and May at elevations of from over 8,000′-10,000′. Ten specimens examined.

♂ Wing 126-129, av. 127·3. ♀ wing 123-127, av. 124·4.

There is some individual variation in the depth of tone and in the intensity of the black streaks on the underside in adults.

Two immature ♂ ♂ obtained on Tonglo at 10,000′, 6-7-04, (C. M. Inglis.), and between Dentam and Chiabanjan 7-8-05, have the whole crown tipped with crimson-red and orange-red respectively; this coloration is evidently a distinct, characteristic phase of the immature male and substantiates Scully's description to which Blanford merely makes passing mention. Wing in both examples 122.

374. The Lesser Pied Woodpecker. Dryobates cathpharius cathpharius (Blyth).

Recorded with a range similar to *D. darjellensis* (Blanford). I have failed to meet with this Woodpecker at such high elevations as the former. The zonal distribution of this species is mainly between *5,000′-6,000′*, and though these limits are exceeded in both directions, there is only a remote chance of meeting with it at 3,000′. Occurs in the Rungbong Valley from 4,500′-7,000′ and also occurs in East Nepal at similar elevations; 7,000′, ♀ 22-5-12. Obtained around Mangpu from 5,600′-6,000′, (G. E. Shaw). Observed near Kedom at 7,000′, in March in the Lachung Valley and at Mangam below Ringim Gompa at 4,300′, in February, in the interior of Sikkim. Even in the winter, I have always found *D. darjellensis* above the highest limit of *D. cathpharius.*

Eight specimens examined:

♂ Wing 99-102, av. 100·5; ♂ juv. wing 95. ♀ wing 96-101, av. 98·6.

Soft parts: Iris red-brown; bill plumbeous-horny; tarsus "greenish"—plumbeous, claws, similar only horny.

375. The Fulvous-breasted Pied Woodpecker. Dryobates macei macei (Vieill.).

Occurs in the Rungbong Valley up to an elevation of about 3,500′, and is found chiefly in the bottom of the valley and not in the thick forest which is above the limit of its range; so far it has not been obtained above 2,400′ in the Tista Valley (G. E. Shaw), where it might be expected to reach a higher limit than in the minor valleys to the west.

There appears to be *well-defined limits in the distribution of each of the members of this genus*, particularly where competitive forms have to maintain their status in a limited forested area, as is the case where cultivation has altered the face of the country through depletion of the forests.

Three specimens examined: Rungbong Valley, Darjeeling, (December) ♂ wing 108; ♀ ♀ wing 105-109, av. 107, compared with five Assam skins, ♂ ♂ wing 102·5-104, av. 103·3; ♀ wing 103. This disparity in size is significant and almost points to the formation of a race, distinct from the plains bird.

376. The Darjeeling Pigmy Woodpecker. Iyngipicus semicoronatus (Malh).

Recorded for Sikkim at elevations above about 3,500′.

Occurs in the Rungbong Valley at elevations of from about 3,400′-4,500′. In the Tista Valley occurs as low as 1,100′ to 3,800′, (G. E. Shaw). Observed and obtained in pairs, four to five miles out from the Hills in *the plains* of the Eastern Dooars, between Jainti and Hathipotha and on the Raidak River in January 1922. Found in light, tree-growth outside the limits of the heavy forest. Gopaldhara, 3,500′, 10-5-20. Three to four, or probably, two to three males and an odd female, the males vieing with each other for the possession of the female, they were so mixed up in their movements, I failed to count the exact number and the preponderant sex.

Five examined: ♂ Wing 83-88 av. 85·7; ♀ wing 84-87, av. 85·5.

377. The Red-eared Bay Woodpecker. Blythipicus pyrrhotis pyrrhotis (Hodgs.).

Confined strictly to close forest with heavy undergrowth. Occurs around Gopaldhara at from 4,700′ to higher limits on the Nepal Frontier at 7,000′ or even appreciable higher in the Mai "Khola". This Woodpecker feeds in a great measure on the ground in such dense cover as seems more in keeping with the habitat of some of the Laughing-Thrushes. Seven specimens examined:

♂ Bill from feathers 47-48, av. 47·5; wing 145-148, av. 146·5.

♀ At base 45-48, av. 45·6; wing 146-149, av. 147·4.

All my Sikkim skins have the tail barred throughout; in a single example from Assam, this character is only faintly indicated, the centre pair being uniform rufous.

378. The Northern Rufous Woodpecker. Micropternus brachyurus phaioceps Blyth.

Gammie mentions this species as breeding at 2,000′ in the Tista Valley.

Obtained around Mangpu at 3,800′ (G. E. Shaw).

Absent at much lower elevations in the west of the Darjeeling district. I have failed to meet with it anywhere in the Rungbong Valley at its lowest limits.

379. The Himalayan Golden-backed Three-toed Woodpecker Tiga shorei (Vig.).

Recorded for the lower valleys of the Himalayas as far to the east as Bhotan. So far I have failed to locate it, and it is only likely to be found along the *Terai of the foot-hills.*

380. Tickell's Golden-backed Woodpecker. Chrysocolaptes gutticristatus gutticristatus (Tick.).

Confined to low elevations, probably not occurring much above 2,000′.

381. Hesse's Great Slaty Woodpecker. Alophonerpes pulverulentus harterti (Hesse).

Evidently does not occur higher than the Terai, as it is only likely to be found in heavy, forested tracts.

382. The Himalayan Speculed Piculet. Picumnus innominatus innominatus Burton.

Recorded up to 6,000′ and even ascending to 9,000′ (Stolickza); which latter extreme height evidently refers to a locality in the North-West Himalayas. Apparently *does not occur at a higher elevation than 4,500′ or thereabouts.* 4,700: (G. E. Shaw.), both in the interior of Sikkim and on the Outer Ranges. Occurs sparingly around Gopaldhara; noted at Singhik, 4,600′, and is generally distributed.

383. The Indian Rufous Piculet. Sasia ochracea ochracea Hodgs.

Occurs around Gopaldhara up to an elevation of 6,000′ at all events, and plentifully distributed throughout the whole area, both in the valleys and on the ridges. My observations place this Piculet with a *somewhat higher distribution* than *P. innominatus.* Observed commonly between Singhik and Dikchu in March, around an elevation of 3,500′. Gammie mentions this Piculet as breeding at 4,000′ in the Tista Valley, which locality probably refers to Mangpu.

384. The Japanese Wryneck. Jynx torquilla japonica Bp.

Represented in the National Collection by one specimen from Sikkim, January 1873. Evidently only occurs rarely at moderate elevations during "the cold weather"; as there is certainly no well-marked migration route through Sikkim as was obvious in Upper Assam, when it commonly occurred on its descent to the plains and at its time of departure. The few birds occurring on migration, may of course, pass over unnoticed without breaking their journey, though it seems hardly feasible. It is certainly remarkable that only a single occurrence has come to my notice during a period of ten years, when one was secured at 4,200′ in December 1911, below Gopaldhara; on the ground as on every former occasion. As this form has a wide distribution, I have considered it expedient to examine my Assam material. Nine specimens measure:

♂ Wing 82·5-86, av. 84·5; ♀ wing 80-85, av. 82·3.
♂ Bill from base, 15-19, av., 16·8; ♀ 15·5-17, av., 16·2.

Dr. Hartert gives the wing measurement, Ussuri, 80-86; Japan, 80-85; China, 80-86, thus the size of this Eastern form is fairly constant and Assam cold-weather migrants show similar measurements.

385. The Yellow-backed Honey-Guide. Indicator xanthonotus Blyth.

Recorded for Sikkim, "very rare" which is undoubtedly the case. Represented in the Tring Museum by one specimen ex. Elwes Collection, and in the British Museum from Native Sikkim as follows: ♂ October, ♀ December 1878. 2♂♂ February 1879, ♀ March 1874, ♂ April 1879. I have not been fortunate to meet with it. Evidently resident somewhere in the interior.

386. The Great Himalayan Barbet. Megalæma virens marshallorum Swinh. "Newal" Paharia.

Recorded for the Himalayas between 3,000′ and 8,000′. Breeds commonly above Gopaldhara up to 6,500′ at all events, and observed in the interior of Sikkim at Dikchu at 2,150′ in February and March. Also heard calling in the foot-hills of the Bhotan Dooars near the Raidak Gorge in January; none however were actually seen at plains-levels. Gopaldhara, 4,720′, 15-7-14; a party daily frequent the pear trees in the compound. 20-6-23, youngster brought in almost ready for flight, safely hand-reared to maturity.

The monotonous, wailing call of this Barbet is one of the most noticeable characteristics of the birds hereabouts.

387. The Assam Lineated Barbet. Thereiceryx lineatus hodgsoni (Bonap.).

Recorded for the Lower Himalayas, not ascending more than 2,000′ or 3,000′. These limits are too great an extreme for Sikkim. This Barbet appears to be *confined to its distribution area by the belt of heavy forest at the base of the hills.* I found it to be common in the sparsely wooded country, four to five miles away from the hills in the Eastern Dooars.

388. The Blue-throated Barbet. Cyanops asiaticus asiaticus (Lath.).

Recorded for the Lower Himalayas up to 3,500′ or 4,000′.

In the Rungbong Valley occurs up to 4,500′, and observed on one occasion at 5,200′, 26-12-21; also obtained up to an elevation of 6,000′, above Mangpu. (G.E. Shaw).

389. The Indian Blue-eared Barbet. Cyanops duvauceli cyanotis (Blyth).

Recorded for Sikkim. I have seen specimens from the Terai where it is probably far from common. It appears to be strictly *confined to the base of the hills* in the Eastern Himalayas.

390. The Golden-throated Barbet. Cyanops franklini franklini (Blyth).

This Barbet commonly occurs in the Rungbong Valley from 4,500′ up to 7,000′, and may on occasions considerably exceed the higher limit. Whilst it is found as low as 3,500′ in the interior of Sikkim; it appears not to be found below 4,500′ in the hills to the west of the Tista Valley as there is practically *no overlapping with C. asiatica in any areas of its distribution* though both species meet; apart from some dispersal which causes a slight perceptible intermingling during the winter, when food is none too plentiful. This movement does not affect the distinct breeding areas of either species.

Gopaldhara, 5,000′, 11-9-21. Two youngsters about to leave the nest; evidently this Barbet is double-brooded, judging by this late date.

The young bird has the head golden-green; forehead crimson and patch on occiput faintly tinged with crimson; ear-coverts shading into bluish-green throat and spot at base of lower mandible pale yellow; primary-coverts on carpus bluish-green; otherwise the general coloration is as well defined as in the adult. Taken young, these birds make charming pets, readily taking food out of one's hand and learning to recognise their master's voice and step. Tonglo, 10,000′, 5-2-12.* I saw an unmistakable Barbet which could only have been this bird, although no Barbets were calling at this high elevation in January and February.

391. The Northern Indian Roller. Coracias benghalensis benghalensis (L.).

Occurs at *plains-levels only*; observed at Rungpo, on the maidan, in the Tista Valley in Sikkim (March).

392. The Indian Broad-billed Roller. Eurystomus orientalis orientalis (L.)

Recorded for the base of the Himalayas up to 3,000′. Another *plains and low elevation* Roller; obtained up to an elevation of 2,000′ in the Tista Valley

(G. E. Shaw.), and reported to me as having actually been seen on the Chowrasta in the Station of Darjeeling by the late Mr. E. A. Wernicke.

393. The Common Indian Bee-eater. Merops orientalis orientalis Lath.

Commonly occurs at the *plains-level*, where it has been obtained in the south of the Darjeeling District at 500′, (G. E. Shaw). I noted it as being plentiful in the open country in the Eastern Dooars in January.

394. The Chestnut-headed Bee-eater. Melittophagus erythrocephalus erythrocephalus (Gmel.).

This Bee-eater has been obtained at the *foot of the hills* (G. E. Shaw).

395. The Blue-bearded Bee-eater. Nyctiornis athertoni (Jard. & Selby).

Observed in the Rungbong Valley at an elevation of 3,500′ in December 1911, and obtained up to an elevation of 1,800′ on the 1-9-20, in the Tista Valley, (G. E. Shaw). Recorded distribution up to about 4,000′. There is only a remote chance of meeting with it, except on rare occasions as above mentioned; as it appears to be strictly *confined to the base of the Lower Foot-hills and Plains.*

396. The Himalayan Pied Kingfisher. Ceryle lugubris guttulata Stejn.

Wherever this fine Kingfisher can get a sustenance, it is to be found on every river of consequence. In the Rungbong River, an odd pair or two reach the upper limits at an elevation approaching 4,750′. I have no information as to how far it penetrates into the interior by way of the Tista River; it has, however, been obtained on the "jhoras" in the lower portion of the valley up to an elevation of 1,200′. (G. E. Shaw).

397. The Common Indian Kingfisher. Alcedo atthis bengalensis Gmel.

Occurs in the Tista river and all tributaries where it has been obtained up to 1,900′, (G. E. Shaw). On the Rungbong River it ascends as far as there is a sufficiency of water, but as the river gets depleted in "the cold weather" from December to March, it is found more noticeably to frequent the lower reaches from 3,500′ downwards.

398. Blyth's Kingfisher. Alcedo iredalei Stuart Baker.

Recorded for the *Lower Foot-hills* of Sikkim.

399. The Indian Three-toed Kingfisher. Ceyx tridactylus tridactylus (Pall.).

Obtained on one occasion at Mangpu 3,600′, 6-9-13. (G. E. Shaw). This beautiful miniature Kingfisher seems addicted to wandering away from its accustomed haunts during "the rains" as was frequently noted in Assam, which accounts for it turning up in the most unexpected places.

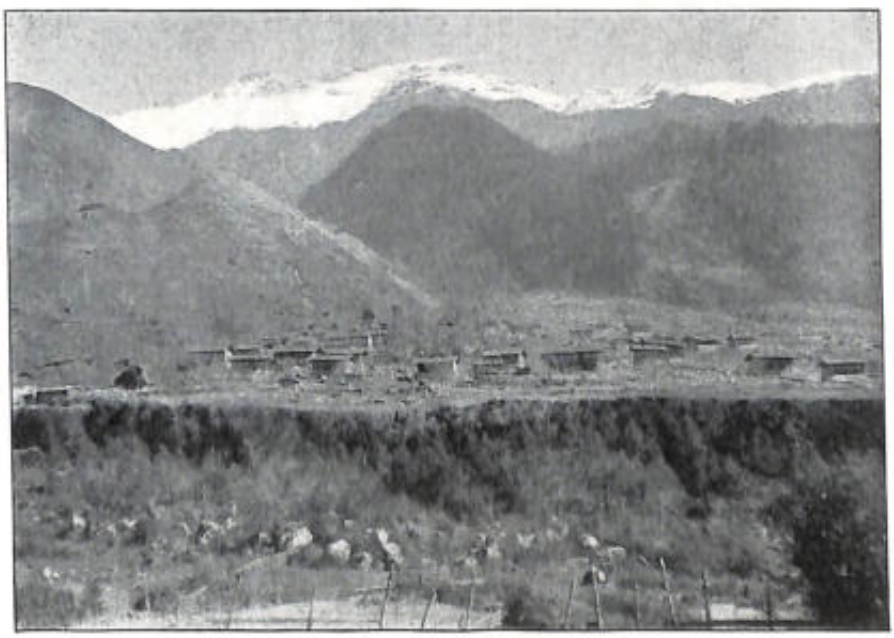
400. The Brown-headed Stork-billed Kingfisher. Ramphalcyon capensis gurial (Pearson).

I always regarded this Kingfisher as being strictly confined to the "Jhils" and sluggish streams of the Plains, until one was obtained adjacent to the Rungbong River during a dry spell of weather at 3,400′ on the 27-4-17, ♀; this specimen is altogether paler than any of my Assam skins: the point of the bill is much worn as a result of securing its food in the shallow water and stony bed



H. S. Photo.

LACHUNG VALLEY.
Looking north-east, elevation 9,000'. 11th March, 1920.



H. S. Photo.

LACHUNG VILLAGE, elevation 8,800'.
10th March, 1920.

of the river. Observed flying up stream on the 29-11-18,* at an elevation of 3,750′, and since this date I have seen it on several occasions over long periods though these occurrences have not been duly jotted down. It may ascend some the other swift-flowing, minor rivers of the foot-hills in a similar manner.

401. The Indian Ruddy Kingfisher. Entomothera coromanda coromanda (Lath.).

Recorded for the Lower Himalayas up to about 5,000′ for Sikkim.

No evidence has come to my knowledge in substantiation of its claim. As it is a rare bird generally and as there is a strong likelihood of it occurring at the foot of the hills "in forest" and being easily overlooked; it is worthy of inclusion on the recorded statement.

402. The Great Hornbill. Dichoceros bicornis (L.). "Kodong" Lepcha.

This exceptionally grand bird, attached to which there is so much interest in regard to its habits and in particular its nidification, may be regarded as the representative of the remarkable family of Hornbills; the different genera of which are worthy of more than casual notice.

Evidently sparingly distributed throughout the Tista Valley up to an elevation of 4,500′ at all events. More generally confined from the base up to a limit of 2,000′-3,000′ in the foot-hills. As it is only to be found in heavy forest; there can be little doubt that it formerly covered a wider tract of country but extensive cultivation, and improvident and disastrous methods in clearing the land have resulted more often than not in producing nothing more than a barren waste in place of magnificent forest. Nurbong, 2,500′, 14-3-14,* a party of four birds seen to settle in the almost inaccessible forest on the left bank of the Mahanuddi. Heard calling on rare occasions in the Balasan Valley, some miles above Panighata.

Hathipota, Eastern Dooars, 6-1-22,* I was gratified to come upon a party of six to eight birds in occupation of some lofty trees in virgin forest, but judging by the systematic harassing, amounting almost to persecution, by hoards of Paroquets (*Psittacula a fasciata*), there was little chance of ever obtaining that desired peace and quietness which the Hornbills stood sadly in need of.

There is every reason to suspect that a similar state of affairs exists towards the breeding season, as these pests will do their utmost to appropriate every nesting cavity, whether in occupation by the rightful owners or not. When competition for the right of survival becomes more acutes through the depletion of the forested tracts: the status of all our Hornbills is certain to be detrimentally affected. Opinions may differ as to the correct methods to adopt in this difficult question of giving protection to one species at the expenses of another. A drastic thinning-out of such Paroquets, as haunted the vicinity of their breeding haunts, would have a beneficial effect, and would seem to be the only feasible and correct course of action to ensure the hornbills them the necessary protection. As the broad facts of the preservation of our wonderful and rich avi-fauna unfortunately concern only a limited few, and are not rightly understood: it is premature to expect any efforts to be centred on special cases calling for protection, therefore meanwhile it would be advisible to confine all attention to the reservation of sanctuaries, and endeavour to create a healthy public interest in this direction.

403. The Large Indian Pied Hornbill. Anthracoceros coronatus affinis (Blyth).

Recorded for the Lower Himalayas.

404. The Rufous-necked Hornbill. Aceros nipalensis (Hodgs.). "Kolep" Lepcha.

Recorded for the Himalayas of Nepal, Sikkim and farther east from 2,000′ to about 6,000′. My first acquaintance with this Hornbill was noted as follows:

Nurbong, 1,800′, 10-3-14.* A large dark coloured Hornbill; bill, white, no perceptible casque ; tips of wings white, and a heavy patch similarly coloured at end of the tail, uttering a call somewhat resembling the syllables "ghwa" "ghawa."

Since this occasion I have seen a few obtained in the Tista Valley. Formerly Hornbills used to ascend to the upper limits of the Rungbong Valley in the recollection of the oldest residents, but have long since disappeared when their favourite trees had been felled. In the event of such an occurrence happening nowadays, I should almost doubt my powers of vision at such a surprise. In Hume's "Nests and Eggs of Indian Birds" (Oates) Vol. III, p.77, is an interesting and long account by Gammie of the nidification of this species in May at Poomong. Reported to me as having been seen above Gopaldhara in March 1922, when a nest was found this year in Nepal. Obtained also in 1922 above Rungmook, in pairs on both occasions.

405. The Tibetan Hoopœ. Upupa epops saturatus. Lonnb.

This Hoopoe is a common and familiar bird during the winter in the Plains and occurs at *moderate elevations on migration*. Gopaldhara, 4,720′. Odd Hoopoes make a brief sojourn almost yearly, on their descent to the plains; whilst the majority evidently pass over on migration. During the time they remain, are remarkably tame and as one or two invariably frequent the compound their arrival is always looked forward to with interest.

Earliest arrivals—7-9-17,* 11-9-17,* 26-9-18,* 19-9-20,* 2-10-21.*

All these records refer to the bungalow elevation of 4,720′, and to single birds. 3,500′, 28-9-21,* single bird. Mr. G.E. Shaw has seen it on migration at 5,300′, and at 8,000′. The earliest arrival noted at Mangpu, 3,860′, being on the 3-10-15, ♀.

Latest departures, 30-3-18,* Nagri, 4,500′. 17-3-20, above Turzum, 5,650′.

406. The Indian Hoopoe. Upupa epops orientalis Stuart Baker.

If I rightly understand the nomenclature and distribution of the forms of the resident, plains Hoopoe was previously denoted under *U. epops indica* I take it the Hoopoes observed on the following dates at Gopaldhara on the 22-8-18* and 30-9-19* refer to this race, as these were probably the resident, plains species; some slight doubt exists as to the former record, whilst the latter record undoubtedly has reference to a richly coloured bird. As no resident Hoopoe occurs in the Rungbong Valley, these occurrences denote a partial migratory movement before the termination of "the rains".

During the Mount Everest Expedition, Mr. A.F.R. Wollaston saw this Hoopoe several times flying over a glacier at an altitude of about 21,000′ in September and Mr. N.B. Kinnear remarks on this extraordinary altitude for a bird of such weak flight. For a list of the birds found at these extreme altitudes, consult his paper to which reference is made under other species. Kinnear refers these Hoopoes to "*orientalis*" and not "*saturatus*."

407. The Alpine Swift. Micropus melba melba (L.).

Recorded for Darjiling, though apparently there are no specimens in the B.M. Coll. from the Sikkim Himalaya. It is well represented by a fine series from Simla, so it evidently has a clearer defined status in the North-West Himalayas.

408. The Common Indian Swift. Micropus affinis affinis (Gray).

Recorded as ascending the Himalayas up to about 6,000′.

This Swift, wherever stablished in the verandahs of dwelling-houses, invariably usurps the bulky mud structure of the Swallow (*Hirundo daurica nipalensis*), and having once obtained possession, its occupancy becomes a permanency. At Gopaldhara, one such nest has been occupied for ten years; the birds remaining the whole year round. There is little doubt, they cover enormous distances when climatic conditions are not favourable; and when the whole surrounding hills are enveloped in mist, it is nothing short of miraculous how readily they locate their quarters and dash in with arrowy flight. I noted these Swifts to have young on the 6-5-15; and young birds to leave the nest on the 31-5-16*: a brood of the following year. They are absent for the whole day during the cold-weather months, and at Nurbong 2,050′, observations extending over a period of eight days from the 19—26-1-14. I noted the pairs arrived between 4-50 p.m. and 5-30 p.m. at the nests almost simultaneously, having been absent the whole day. Okayti, 7-6-23. I counted thirty-eight nests, comprising a colony, when every available site appeared to be occupied under the eaves of an office outbuilding.

Obtained in the Mai "Khola", East Nepal, ♂ ♀ 23-5-12.

409. The White-necked Spine-tail. Hirundapus caudacuta nudipes. (Hodgs.).

Recorded as throughout the Himalayas. Specimens in the B. M. Coll. from Sikkim are dated March, April, May (Mandelli.), one from Nepal (Hodgson.), and one from Bhotan (Pemberton). I have observed it on very few occasions; once above Okayti at 5,600′ approximately,* probably in May, when there was a party taking their food without any appreciable effort during a bright morning and at the Turzum factory when a pair were seen at an elevation of 4,900′ approximately, 24-6-21*; on this occasion they showed their wing power to the best advantage, when climatic conditions were not so congenial as on the previous occasion. Often observed at Gopaldhara at the oncoming of a storm half-a-dozen birds seen on the 28th April in company with several Swallows and again 31-5-23, on this occasion exclusively.

410. The White-rumped Spine-tail. Idacapus sylvatica (Tick.).

Recorded for Sikkim. Not represented in the National Collection by any Sikkim specimens.

411. The Hymalayan Swiftlet. Collocalia pusciphaga brevirostris (Mc Clell.).

Occurs at *all elevations up to 12,000′*, but its appearances are very erratic. Several observed on the Singile La Ridge near Phalut at 11,700′ on the 19-2-12, a ♂ secured out of a number at evening, a Kalo Pokhari at 10,160′ on the 22-5-12. Numbers observed hawking for food around the Gopaldhara Bw. at 4,720′ on the 15-8-15*. Obtained in the Tista Valley at 3,600′, ♂ 2-9-20. (G. E. Shaw). Blanford also records it from the Cho La at 12,000′ (August) and throughout the Tista Valley at low elevations in the autumn of 1870.

Hume records finding the Indian Crested Swift *Macropteryx coronatus* (Tick.) breeding in May in the Darjeeling Terai.

412. The Nepal Long-tailed Nightjar Caprimulgus macrurus nipalensis Hartert.

This Nightjar is more a bird of the Plains than the Hills, and I have failed to locate it in the valleys to the west. Obtained at elevations of from 2,500′-3,760′ in the Tista Valley. (G. E. Shaw). I have gone through all my Assam skins.

Nine examined: Juvenile, ♀ (June) wing 193; ♂ (July) wing 200, probably not quite fully grown. Adult ♂ wing 204-219, av. 210·8. Adult ♀ wing, 211-219, av., 214·3.

These specimens are very variable in the depth of tone and the barring on the underside.

413. The Himalayan Jungle Nightjar. Caprimulgus indicus jotaka. (Temm. & Schleg.)

Occurs up to 7,000′-8,000′ during the breeding season and found at all intermediate heights from the base of the hills in "the cold weather." Gopaldhara, 3,500′, 31-10-14, several in evidence. 3 ♂ ♂ 23-12-11. Mai Khola, East Nepal, ♀ 22-5-12, wing 200; obtained with two eggs which measured 30×19, av.

Five males examined: 3 ♂ ♂ Sikkim, wing 203-206; av. 205·7.
Bhotan Dooars, 27-1-22, ♂ wing 193. Assam, 12-2-05, ♂ wing 199.
Dr. Hartert gives the wing measurement for "*indicus*" 197-203, and for "*jotaka*" type, locality Japan, ♂ 212-224.
In size my specimens are nearer the typical form.

414. Gould's Great-eared Nightjar. Lyncornis cerviniceps cerviniceps Gould.

Included on the recorded specimen said by Jerdon to have been obtained in the Tista Valley.

415. Hodgson's Frogmouth. Batrachostomus hodgsoni (G. R. Gray).

Recorded for Sikkim at *low elevations*. Great Ranjit Valley, 3,000′ and 4,000′ (Hodgson), Namchi (Mandelli). Evidently as rare as it was in the Foot-hills of Assam.

416. The Red-headed Trogon. Pyrotrogon erythrocephalus erythrocephalus (Gould).

Recorded for the Himalayas up to *5,000′ at which elevation it occurs* at Gopaldhara, and as it is strictly a forest species it would appear to be isolated hereabouts at the upper limit of its range from its main distribution area, as for instance at Gopaldhara where to the south the country is under cultivation until the forest reserve is reached at about 2,000′, with the exception of sparsely wooded areas intervening.

417. The Asiatic Cuckoo. Cuculus canorus telephonus Heine.

With the commencement of the hot weather, it is possible to trace the ascent of the Cuckoo, as the birds commence calling almost immediately, when they enter the valleys, and announce their arrival according to the distance and elevation reached. Its appearances around Gopaldhara take place with marked regularity; and invariably occur during the latter days of March or the first week in April. Its arrival has been noted over a number of years. Gopaldhara, around 4,720′. First heard calling on the 1-4-14, and noted again on the 12th to be calling up to 6 p.m. The last occasion when I heard the familiar call being on the 11-7-14. The following year on the 31-3-15. Noted to be calling a few times at 6-30 a.m., on the 6-5-15. Calling somewhat inaudibly on the 23-3-16; its full note heard on the 27-3-16, and remarked as silent during July 1917 prior to the 21st; when it was heard to call, 31-3-17, heard again on the 2-4-17, and almost daily afterwards when the air resounded with each male bird endeavouring to outdo his neighbour. Heard above Avongrove at 5,500′ on the 3-4-18, having been reported to me on the 1st at 4,500′ around Sungma, (C. E. Brown). In 1919 calling commenced as early as the 19th of March, though the birds did not attain their full

vocal powers until a few weeks later. This cuckoo appears to ascend *up to about 9,000′ on the Outer Ranges*, around which elevation, I came across it in the Mai Valley in Nepal. Mr. G. E. Shaw has so far not obtained it above Mangpu beyond an elevation of 3,800′. Birds collected in April 1921, on the 13th were feeding on the earliest to appear, cicada (*Geana sulphurea* Hope.), which was plentiful, and *C. optatus* was also taking this Cicada in numbers as was proved on dissection. During 1923 at Gopaldhara in the Rungbong Valley; the first arrival was noted on the 2nd of April, and while one bird was calling at evening on the 13th of June, its utterances being nothing more than a choking effort: another bird was heard on the 10th of July at its best and others were in evidence calling audibly on the 16th or 27th of the same month.

Six specimens examined: ♂ Wing, 220-230, av., 225; ♀ wing, 204.

Soft parts: ♂ Iris gamboge-yellow; orbital skin yellow; bill greenish-black, deeper on culmen, a defined patch of yellow at the base of the upper mandible-gape bright orange; tarsus yellow. ♀ Iris, yellow; bill horny, greenish; yellow on the lower mandible; tarsus yellow.

418. The Himalayan Cuckoo. Cuculus optatus Gould.

The first of the migratory Cuckoos to put in an appearance, arriving at Gopaldhara in the Rungbong Valley about the middle of March; when it ascends to an elevation of over 7,000′. Jerdon has aptly described the call of this Cuckoo which is a sonorous "whut" of four syllables, and the preparatory note at the commencement is quite audible at close quarters. Heard calling on the 27-3-16, and possibly earlier, but not noted down. 12-3-18, calling at mid-day, and possibly few a days earlier. 19-3-19, first occasion heard. 16-3-20, calling for the first time and again on the 19th. On the 25-5-20 I heard this Cuckoo calling at an elevation of 3,550′, but most of the birds appear to be *confined from about 5,000′ and upwards.*

Six specimens examined: Collected from the 31st of March to the 25th of May. ♂ Wing 182-195, av. 186.

419. The Small Cuckoo. Cuculus intermedius intermedius Vahl.

I have no information respecting the exact date of arrival of this Cuckoo at Gopaldhara but my record of specimens obtained when the birds are particularly noisy, point to the end of May, and this in accordance with Jerdon's statement as quoted by Oates as to it being rarely heard at Darjeeling before this time, The earliest date at an elevation of 4,720′ being 11-5-21, and the remainder from the 25th of May to the 5th of June. In the Mai Valley, 24-5-12, *7,000′*, circum. With this exception all were collected at *elevations of from 3,750′-5,700′, chiefly above 5,00′*. Turzum, 5,200′, 12-9-17, ♀ (*a*) juvenile, rolling in fat; caught at a strong moth lamp. (O. Lindgren). Obtained at as low an elevation of 800′ in the Tista Valley. (G. E. Shaw). Eight specimens examined: One ♀ 5-6-20, is in the hepatic stage, so that more than one year must elapse in some cases before the adult plumage is attained. One ♂ 27-5-20, (*b*) shows signs of immaturity in that some of the greater-coverts and primary-coverts have not been moulted, the under feathers of upper tail-coverts are tinged with rufous, a few feathers on the forehead and crown are also rufous. It has a loud call, somewhat resembling the syllables "quik" "four" times rapidly uttered and this is the only call I have heard it produce.

Wing, ♀ (*a*) 150. ♂ (*b*) 146. 5 ♂ ♂ wing, 151-157, av., 154. ♀ wing, 141.

420. The Indian Cuckoo. Cuculus micropterus micropterus Gould.

This Cukoo is more frequently heard, if not actually seen at lower elevations than its near congeners. It arrives at Gopaldhara about the second week in

April and *does not appear to transcend an upward limit of 5,000'* where it gives ground to *C. optatus*, whereas *C. canorus* appears not to be hampered by any such restrictions. The surprising number of this parasitic group of birds, both in regard to species and numerical strength is no better proof of the wealth of bird-life in general which can support them all. In 1914 noted to be calling as late as the 4th and 11th of July. First heard calling during the following years : 12-4-15, when on the 19th one call was heard at night. 20-4-16, 10-4-17, and noted as calling after sunset on the 23rd, 12-4-18, 11-4-19, 10-4-21. It is generally silent during July but in 1916 they were noted to have their full vocal powers previous to the 21st. I have not had the opportunity of watching the courtship of any of the Cuckoos with the exception of *C. canorus*.

The well-known call of this Cuckoo has been rendered into common parlance by tea-planters as being best expressed in the term of "make more pekoe," though it may not always be advisable to take the hint and which might be better defined at times as an imprecation. In addition to this vocal effort a rapid thrice or twice repeated "quik" is uttered on occasions. The females seem to be more secretive and do not lend themselves to observation, which is natural during the egg-laying period. During 1923 at Gopaldhara in the Rungbong Valley; the first arrival was noted on the 6th April, calling at night and replied to by another. On other occasions heard on the morning of the 14th of June; on the 19th had lost none of its sonorous notes and still in evidence on the 25th. These latter occasions being the only records noted towards the close of its seasonal vocal efforts. Five specimens examined: ♂ Wing 194-200, av. 197·6.

421. The Large Hawk-Cuckoo. Hierococcyx sparverioides Vig.

Recorded as ascending the Himalayas in summer up to 9,000' or more.

Resident in the Rungbong Valley, being confined during "the cold weather" chiefly to the forest at elevations around 5,000'. These may be birds which have descended from higher limits ? As their place is vacated others probably arrive from lower limits as its numbers are certainly augmented during March and April. The silence of these birds during "the cold weather" is quite as pronounced a feature of their existence as their noisiness is towards the breeding season. So far I have *not obtained it above 6,000* while 4,000', is the highest limit above Mangpu for Mr. G. E. Shaw's records.

The following dates have reference to the period of its greatest activity. Gopaldhara, 4,720'. First heard calling on the 8-3-15, and again on the 15-3-15. During May there was a lull amongst all the Cuckoos with a recommencement at the last week. Finally heard on the 14-8-15, but only a feeble effort. 14-3-16, calling at evening and again on the 27-3-16. Noted to call on as late a date as the 21-7-16 and on a single occasion on the 11-10-16 which was most unusual, as during July there is a pleasant respite from the interminable volume of sound which prevails throughout April and June. During 1917 a single bird with no others in evidence was calling as late as the 27-7-17. 3,550', on the 23-2-18, one bird was observed to attempt calling but only managed to effect a two note utterance, the completed effort being attained on the 5-3-18; when a bird was heard to call around an elevation of 4,720' for three times at 6 p.m. on a dull day. 4,720'. First heard 19-3-19. Gangtok, around 6,000' much in evidence on the 14-3-20. Gopaldhara at 4,720' first time heard on the 9-3-21. "The rains" of 1923 were remarkable for spells of sunny weather, most of the rain falling in heavy showers at night which apparently had some influence on the Cuckoos as the pandemonium which reigns all day long and throughout the long hours of the night was certainly not so prolonged as is generally the case. Noted as calling on the 14th of June and during the first week in July when

the other species had for the most part finished. The preliminary "chu" "chu" "chu" call heard on the 12th also finally in evidence on the 1st August.

Nine specimens examined: ♂ Wing 217-230, av. 224·2; ♀ wing 217-221, av. 219.

422. The Common Hawk-Cuckoo. Hierococcyx varius (Vahl.).

Recorded for the Himalayas as far as east as Bhotan, ascending the hills in summer to about 7,000′. I have no knowledge of the status of this Cuckoo in the hills. It occurs *commonly in the plains* around Jalpaiguri; on the 18-2-15, it was in evidence judging by its clamorus call emanating on all sides. Not represented in the B. M. series from the Sikkim Himalayas.

423. Hodgson's Hawk-Cuckoo. Hierococcyx fugax nisicolor (Blyth).

Recorded for the Himalayas as far west as Nepal. Its *distribution is extended* by the record of a specimen obtained at 4,500′ above Mangpu, ♂ 7-5-20, (G. E. Shaw), in the hills *to the west of the Tista River*, though Mandelli is mentioned p. 384 in Vol. II of "Hume's Nests and Eggs" (Oates) as having obtained an oviduct egg from a specimen, exact locality not stated.

424. The Rufous-bellied Cuckoo. Cacomantis merulinus querulus Heine.

Recorded for the Eastern Himalayas from Nepal. I have no knowledge of this Cuckoo; which commonly occurred in the plains of Upper Assam, as to its status in these hills. Not represented in the B. M. series from the Sikkim Himalayas.

425. The Indian Plaintive Cuckoo. Cacomantis merulinus passerinus (Vahl.).

This Cuckoo occurs around Gopaldhara as a migratory bird in the summer, yet its appearance is somewhat irregular. During 1916, first heard to call on the 27th of March and in evidence on the 15th of August. During 1920, two ♂ ♂ obtained in the compound at 4,720′, 14—16-5-20, and noted again on the 19th. It has two calls: the first is best described in the syllables "pe" "peah" and to be often followed by a mournful effort of three notes, generally uttered in semi-tones thrice in an ascendant scale rendered in syllables "tay" "tā" "tay" or "dhay" "dā" "dhay", but more effectively.



During 1923 the preliminary call was first heard on the 4th of April. In evidence on the 13th of June and from the 11th to the 16th of July which last date was the final occasion on which it came under my notice.

Two specimens examined: ♂ Wing, 115-120.

Soft parts: Iris venetian-red or pale crimson-brown; tarsus dusky-yellow; soles ochreous; claws dark horny-yellow.

426. The Banded Bay Cuckoo. Penthoceryx sonneratii sonneratii (Lath.).

Obtained on one occasion in the Tista Valley at 2,000′. (G. E. Shaw). Represented in the B. M. series by one specimen from Darjeeling and one specimen from Sikkim, April 1873.

427. The Emerald Cuckoo. Chalcococcyx maculatus (Gm.)

A summer migrant of rare and irregular occurrence to the Rungbong Valley Easily overlooked in dense foliage. On its arrival at Gopaldhara in April, it is remarkably devoid of fear and shows a disinclination to avoid any possible chances of danger, trusting to its harmonizing plumage and unobtrusive habits for protection. I regret my inability to describe its call which is quite distinctive from any of the other Cuckoos and notwithstanding its weakness in volume savours of cuculine peculiarities. On occasions its vocal strains are produced during the stillness of the night. Information in respect to it is as follows: Gopaldhara, 4,500′, ♀ 11-4-18, ovaries active; a few birds seen, but the first to be obtained by a youth who had knocked it down at short range. 4,250′, ♂ 2-5-18. Three birds reported to me as having been seen by an intelligent chaprassi on the 22-4-18. 4,720′, 17-4-19. My attention was drawn to two pairs of this beautiful Cuckoo this morning as they were busily occupied making a systematic search of the foliage of the cherry trees. They were allowed to complete their task without molestation and the caterpillars suffered a diminution of their numbers accordingly.

During a partially weak ? monsoon in 1920, they appeared to be totally absent. The "Fauna" key to the species of this genus, as always seemed confusing, the distinguishing characters between the female of this species and "*xanthorhynchus*" are evidently transposed, and comparison and checking by the description shows this to have been the case.

1923. Gopaldhara, 6,000′. Juvenile females within a few days of leaving the nest were brought in on the 13th of June and 7th of July. The nests of the foster parents (*Cryptolopha castaneoceps*) out of others which I got eggs, having been found on previous occasions.

428. The Indian Drongo Cuckoo. Surniculus lugubris dicruroides (Hodgs.).

This Cuckoo arrives in the Rungbong Valley about the middle of April, or in some years, during the first week in April. At Mangpu, 3,860′, seen and heard as early as the 25-3-15. Gopaldhara, 4,720′, heard on the 2-4-15. 3,500′, in the bottom of the valley, 13-4-16, and again at 4,720′ on the 25-4-16, finally noted as calling on the 19-7-16. 4,720′, in evidence, 19-4-18.

I have gone into a long list of dates in reference to many of these Cuckoos at the period of intense sexual activity, as an aid in determining its duration, and at the same time in fixing their arrival, if not always their departure. Meanwhile my notes on oology will of necessity have to stand over until a future occasion.

429. The Pied Crested Cuckoo. Clamator jacobinus (Bodd).

Recorded for the Lower Himalayas. Unknown to either Mr. G. E. Shaw or myself. It would be an interesting fact, if the route were known of the specimen obtained at Tingri, 14,000′, by the Mount Everest Expedition. (*vide* Kinnear N. B., Ibis, Vol. IV, No. 3, July 1922, p. 504.)

430. The Red-winged Crested Cuckoo. Clamator coromandus (L.).

Recorded for the base of the Himalayas and farther east. The only locality known to me is that supplied by Mr. G. E. Shaw from below Mangpu at elevations of from 2,500′-3,600′ in the Tista Valley where specimens have been obtained as follows: 2,500′, ♂ 5-6-19. 3,500′, ♀ 22-4-19. 3,600′, ♀ 16-4-20. Mandelli appears to have obtained it from Namchi.

431. The Large Green-billed Malkoha. Rhopodytes tristis (Less.).

Recorded for the Outer Himalayas below about 8,000′. Obtained up to an elevation of 3,860′ at Mangpu. (G. E. Shaw). In the Rungbong Valley, it has an extension to the head of the valley up to 3,600′, being confined to the river-bed and surroundings as a resident. So far I have not seen it in any other locality hereabouts.

432. The Hill Sirkeer Cuckoo. Taccocua leschenaultii infuscata Blyth.

Recorded for the Lower Himalayas, and evidently referable to this form which, however, is unknown to me.

433. The Chinese Crow-Pheasant. Centropus sinensis sinensis (Steph.).

Occurs in the Tista Valley up to 3,600′ below Mangpu. (G. E. Shaw).
I have no record of its occurrence in the minor valleys to the west.

434. The Indian Lesser Crow-Pheasant. Centropus bengalensis bengalensis (Gm.)

Recorded as occurring up to about 5,000′ in Sikkim according to Gammie. Once only observed at Gopaldhara in the Rungbong Valley at an elevation of 3,440′, 28-1-15*; when it was flushed out of a reed-bed. As these Coucals are dependent on the necessary dense cover; it can only be locally distributed and absent from large tracts of the country.

435. The Large Assam Paroquet. Psittacula eupatria indoburmanica (Hume.).

Recorded for the Sikkim Terai; which statement also refers to
Psittacula cyanocephala cyanocephala (L.), and
Psittacula cyanocephala bengalensis (Forst.).

436. The Slaty-headed Paroquet. Psittacula schisticeps schisticeps (Hodgs.).

Recorded throughout the Himalayas below about 8,000′. This Paroquet performs an upward movement into the Rungbong Valley at the end of "the rains," when large parties may be observed in flight, attracted to their favourite feeding grounds which consist of berry-laden trees. Blanford gives *P. s. schisticeps* with a wing measurement of 6·5″ = 165, and a total length of 16″ against *P.s. finschi* with a wing measurement of 6″=152 in males and a total length of 17″. These total length measurements evidently require reversal as the former is the bigger bird of the two.

437. The Indian Red-breasted Paroquet. Psitaacula alexandri fasciata (P. L. S. Muller).

Recorded throughout the Lower Himalayas up to about 5,000′.
Obtained in the Tista Valley up to 3,800′. (G. E. Shaw). Only seen in the Rungbong Valley during "the cold weather"; which is a movement evidently connected with the shortness of the food supply, necessitating a wider area to be covered. As is well known these Paroquets in common with the rest take safety in numbers, and whilst the screeching that takes place may be the means of warning all laggards; it can only result in drawing attention to the flight, even if undertaken with great rapidity. The breeding habitat lies in the foot-hills to which reference has previously been made.

438. The Indian Loriquet. Coryllis vernalis (Sparm.).

Recorded from the Darjeeling Terai, eastwards to the Bhotan Duars and Assam. Authentic reports of its occurrence under the foot-hills of Bhotan have been given me, but so far I have not been able to substantiate its reported occurrence in the Rungbong Valley during "the cold weather", in which case it is a similar extension upwards along the bed of the river, at a time of food shortage.

439. The Bay Owl. Photodilus badius (Horsf.).

Strictly confined to the heavy forest of the Foot-hills from where I have seen only a few specimens, inclusive of a record for the Tista Valley,2,000′, 20-11-15 (G. E. Shaw).

440. The Short-eared Owl. Asio flammeus flammeus (Pontoppidan).

An irregular cold-season visitor on the *Outer Ranges at moderate elevations on its southerly migration* to the plains. Observed quartering the "dharas" at Okayti on the evening of the 27-12-21.* My specimens have been obtained in exposed ground on the ridges on both sides of the Rungbong Valley. Gopaldhara, 6,100′, ♀ 24-2-18. Turzum, 5,200′, ♀ 2-2-15. (O. Lindgren).

These two specimens compare similarly in colour and measurement with a ♀ from Tirhut, 21-12-04. (C. M. Inglis). The three ♀ ♀ measure: Wing 307-310, av. 309. whilst a ♂ from Hessamara, Upper Assam, is altogether paler with the streaks on the under surface much finer. Wing 294. Dr. Hartert does not consider this specimen to be referable to "*leucopsis*" (Brehm). The status of this Eastern form is obscure.

441. The Himalayan Wood-Owl. Strix aluco nivicola— (Blyth).

Recorded for the Sikkim Himalaya at elevations of 6,000′-14,000′.

This owl may not be so rare as it is generally supposed to be, in consequence of its nocturnal habits and high altitudinal distribution. Tonglo, Nepal-Sikkim Frontier, 10,000′. The first clue to this bird's whereabouts was the finding of a few feathers in the vicinity of some huge boulders in January 1911; evidently one of its haunts on the south face of the mountain, but it was not until the 17-5-12; when in camp at Kalo Pokhari at 10,160′, that I was able to obtain a specimen, a male being brought in by a "paharia" youth from the valley below in Nepal. Wing 290. Bill greenish-yellow. Stomach contained remains of Coleoptera, also a portion of a vole's skull, probably *Microtus sikkimensis*, several of which were trapped near my camp.

442. The Himalayan Brown Wood-Owl. Strix indrani newarensis Hodgs.

Recorded from the base of the hills up to 13,000′ in Sikkim.

A nocturnal owl, sometimes to be seen on occasions in the depths of forest towards evening, at elevations of from 5,500′-6,000′ at Gopaldhara; when it is on the alert, as if anticipating an attack from above and not as mindful of danger from below. The bird takes flight on the slightest audible noise at one's approach, and this is unavoidable as it is impossible to avoid crunching the thick layer of dry decayed leaves which carpet the ground, so common a feature in tropical forests and forests of moderate elevations in "the cold weather". It frequents the wooded portions in the station of Darjeeling, and occurs around Mangpu at elevations of from 3,600′-3,800′. (G. E. Shaw). Messrs. Barrett and

Shaw have both kept this Owl in semi-captivity, and it makes a docile and interesting pet when taken young. A pair disturbed in the forest at 6,000′ on Gopaldhara, 13-5-23*.

Three specimens examined : Gopaldhara, 6,000′, ♀ 27-1-18, one of a pair, wing 381. ♂ 10-3-18, wing 363; testes well advanced in development. 5,500′, ♂ 17-5-20, wing 385. Iris brown ; bill pale greenish-horny.

(To be continued.)

REVIEWS.

I. In the Higher Himalayas. By H. Whistler, F.Z.S., with 31 Illustrations from the author's photographs. 219 pp. Witherby & Co., London, 1924. 15 *s.*

Our well-known member and writer on the Birds of the Punjab, Mr. H. Whistler, has now given us a book on his travels and exploration "In the High Himalayas" It is well named as the author deals with nothing under 10,000 feet in height and confines his account pretty well to the little known provinces of Lahul and Spiti, the last outposts of the administration of the Punjab ere Tibet and Ladak are reached. The author starts us off up the Rhotang Pass from Kulu into Lahul and thence by easy stages to Gondla, where the Thakur of the Lahul has his castle. The author describes, as only one who is trained in natural history can do, the natural features, peoples, religion, customs, vegetation and fauna of this little known part; something of interest about all these being worked into a very readable narrative, since the chapters are not a mere diary but, a masse account from more than one visit. From Divil Daras and the Patseo Fair—the Wembley of the Tibetans and Lahulis—which are well described, we are introduced to the Ibex of Lahul, opportunities being taken *en route* for a little Shikar, sometimes successful, sometimes otherwise; but the difficulties of climbing and stalking at 13,000 feet or more must indeed be great while many a good chance is spoilt by the "Guardian of the Ibex", the great Snow Cock, as he rattles off down the hill side.

A detour through Spiti, a very little known country, is described with a wealth of detail which makes very interesting reading and an insight into the manners and customs of these remote people is afforded, while a visit to the famous Kyi monastery was successfully accomplished despite the obvious suspicions of the Lamas. A chapter itself is devoted to the wild Sheep of Spiti and the Burhel—and a cheerless camp at 16,000 feet on a bare hillside was compensated by some good stalks and fine heads.

The final chapters give a good account, unexaggerated and unadorned, of a day's Monal shooting with a dog and a 20 bore and a graphic account of a bear hunt in the Solang Nullah in Kulu, while the sights and attractions to visitors to the Kulu Valley has a chapter to itself. Lastly there is a short *Resume* of the birds ordinarily encountered in Lahul and Spiti and how the traveller may recognize each.

The book is well illustrated by photographs from the author's camera and a map is given to shew the position of the places visited. A very readable book. Those who know and love the Himalayas should get it. those who have never been there should read it and take it with them when they go as it is full of useful tips on travel and sport.

C. T.

II. Birds of an Indian Garden. By T. Bainbrigge Fletcher and C. M. Inglis. With 30 coloured plates and numerous Illustrations in the Text. 161 pp. Thacker Spenk & Co., Calcutta, 1924. Rs. 12.

There has recently appeared in the Indian Agricultural Journal a series of papers on "Some Common Indian Birds" under the joint authorship of Mr. Bainbridge Fletcher and Mr. C. M. Inglis. These are now being published in book form, in parts, under the title of "Birds of an Indian Garden."

Thirty different birds are dealt with and the book contains articles on the Jungle Crow, Indian House Crow, Bengal Tree Pie, Bengal Jungal Babler, Bengal Red-vented Bulbul and King Crow, etc.

The author has been well advised in following the nomenclature of Mr. Stuart Baker's list and the new volumes of the Fauna, but we think that in a popular work

of this kind trinomials are out of place and to the general public the Indian Tree Pie, whether it comes from Calcutta or Madras, is one and the same bird. In the case of the familiar Seven Sisters surely it would have been better to head the article "Jungle Babblers" and to mention the various common species found in different parts of the country. As it is the common Babbler of Bombay *Turdoides somervillie* is not even alluded to.

Under each species there is a general description of the bird and an account of its habits, next eggs and food, as far as is known. Coloured plates from paintings by Mr. Inglis accompany all the articles, and considering the price of the work these are quite well reproduced, but we would recommend Mr. Inglis not to attempt birds in flight—a very difficult subject and one seldom correctly achieved even by professional artists. The black and white drawings are the work of the artists at Pusa who are obviously more at home in drawing insects than birds, otherwise the Indian Tree Pie and Drongo would be more comfortable on their perches.

In spite of these drawbacks the illustrations will be very helpful in identifying the different birds and nature lovers in India will find much of interest in what Mr. Fletcher has to say about the various species.

This is we believe the first time a popular book with coloured plates has been published on Indian birds and we hope it will be the forerunner of many more.

The Society has a comparatively small number of Indian members, but that is not surprising since there is a great dearth of popular works with coloured plates on common Indian animals to rouse an interest in Natural History. A few more books like the present one should do much to help and, indirectly let us hope at the same time add to the membership of the society.

N. B. K.

III. A General Text Book of Entomology. By A. D. Imms. London Methuen & Co.; March 1925; pages XII+698 with illustrations; 36 shillings nett.

On the general subject of Entomology books a-many fill our shelves and bear witness to the progress of our knowledge of the study of insects. The earlier ones, of the seventeenth and early eighteenth centuries, were usually written in Latin, and are exemplified by Goedart's *Metamorphosis et Historia Naturalis Insectorum* (1662) and Swammerdam's *Historia Insectorum Generalis* (1733), with their quaint illustrations. The introduction of the binomial system, by which all animals were given a generic and a specific name, facilitated the recognition of different kinds of insects so that the second half of the eighteenth century saw the issue of numerous descriptive and iconographic works, of which those of Fabricus and Cramer may be taken as examples. About the same time the use of Latin began to fall into disuse, at least in the case of books on insects of local interest or of essentially popular publications, such as Yeats' *Institutions of Entomology* (1773). These led the way to more detailed books, such as Kirby and Spence's *Introduction to Entomology*, and this period closed about the time of the issue of Westwood's excellent *Introduction to the Modern Classification of Insects* (1839). Thereafter there commenced the period of specialization as, with the growth of knowledge, it soon became impossible for any one man to become and keep himself acquainted with progress in all branches of Entomology. Oliver Wendell Holmes drew an intentional caricature in his pen-portrait of the Scarabee, who could not claim to be an entomologist, or even an authority on Beetles, but who devoted himself to one group of these insects only: but here once more truth has outrivalled fiction and the present day sees

the Scarabee himself divided into specialists in various groups of Scarabaeid beetles. The growth of specialization is not, of course, peculiar to Entomology but has proceeded equally in all branches of knowledge, yet it is usually not realized what an enormously large field is covered nowadays by the study of insects, a field whose boundaries impinge on those of Commerce, Agriculture, Forestry, Medicine, Veterinary Science, Education, Zoology, Geology, Genetics and numerous others. General Text-books on Insects therefore meet a need of all modern entomologists as well as of those with a more general interest in the subject, and this need has been met by the issue of numerous publications of which it would be tedious to give any detailed list. One of the most successful of the English text books has been Sharp's two volumes in the *Cambridge Natural History* (1895, 1899) but these, though excellent in their day, have been rendered rather out-of-date by the very considerable accessions to knowledge during the last thirty years.

It is, therefore, with considerable interest that the working entomologist examines each new Text-book as it appears to see how far it will help him in his work. Many are merely elementary or popular, some are frankly poor, and others are excellent. In this last category we may place Dr. Imms' *General Text-book of Entomology*, which has just been published, and whose aim, in the author's own words, " has been to present the chief facts concerning the structure, physiology, development and classification of the Insecta and the biology of their more important representatives.... .... The object throughout the book has been to present before the reader essentials but, at the same time, to indicate where fuller information is available." These objects have been admirably attained, the subject-matter being dealt with in three sections, (1) Anatomy and Physiology, (2) Development, and (3) Classification, each section being fully illustrated and accompanied by adequate lists of literature.

This book comprises 700 pages and is throughout well-written, well-illustrated and well-produced. There are a few minor corrections which will doubtless find their way into a second edition : meanwhile, Dr. Imms' Text-book should find a place, and largely replace Sharp's volumes, in every entomological library and laboratory.

T. B. F.

EDITORIAL.

THE Committee of the Society wish to record their thanks to Mr. F. V. Evans of Hayman's Green, West Derby, Liverpool, for the valuable books recently presented by him to the Library. The books received are Gould's "Birds of Asia" in six volumes and a "Hundred Birds of the Himalayas" by the same author. The books are beautifully illustrated. Mr. Evans has also expressed his willingness to present the Library with such other books as we may be in particular need of. The Society is further indebted to Mr. Evans for his presentation of oil paintings and prints illustrative of old Bombay and its neighbourhood. It has been decided to place these pictures on exhibition in the Art Gallery of the Prince of Wales' Museum, where they will be of no little interest to both visitors and residents of this City. We feel sure that members of the Society will join us in expressing our appreciation of Mr. Evans' very generous donations.

The Museum has also been fortunate in receiving some valuable gifts among which is a fine head of the Himalayan Grey Goral (*N. goral*). The horns measure 9¼", a record! The head was presented by Mr. H. Simmons who shot the animal some years ago in the neighbourhood of Mussoorie. A photograph and a reference to this trophy appears in Col. Ward's serial on the "Game Animals of Kashmir and the Adjacent Hill Provinces" on page 130 of this volume. Another fine acquisition is the head of a Nilgiri Thar (*H. hylocrius*) with horns measuring 16½"×9½" presented by Capt. H. R. Irvine. This is very nearly the record. These trophies make very welcome additions to the Society's collection of heads of Indian Big Game now exhibited in the Prince of Wales' Museum. Continuous progress has been made in the Museum during the past year—in addition to the mounted Gaur recently placed on exhibition we have now been able to show a fine example of a fully set-up Kashmir Stag received from Col. Burton.

Col. Burton has also presented the museum with a good example of the C. P. 'Barasingh' or Swamp Deer. Good complete skins of the Sambhar, the Brow-antlered Deer and the Hog Deer are still required to complete our exhibit of Indian Deer. We hope that next shooting season some reader of the Journal will help us to fill these deficiencies. The subject of shooting prompts us to refer to the further notes and comments on Mr. Dunbar Brander's "Wild Animals of Central India" published in the present issue. Mr. Dunbar Brander's book is unquestionably the best and most informative work of its kind that has appeared within recent years and the comment it has occasioned sufficiently indicates the general interest it has aroused. In a review of the book which was printed in Vol. XXX, No. 1 of the Journal, the reviewer in commenting on the manner in which the Sloth Bear attacks human beings, remarked that the question is one of some interest and that careful and detailed reports by Civil and Agency Surgeons and their subordinate medical establishments, as to the cases of mauling by bears which come to their notice, would probably clear up the question. He now writes to the effect that it is more than likely that many injuries said or supposed to have been caused by the claws are the result of bites and that such a case has come within his own knowledge and observation. Will members of the Society, both those of the Medical profession and others who are in a position to make notes on such cases or to cause them to be made, collect as much material as possible to confirm or refute this view. The point raised is one among many which might well be answered by sportsmen-naturalists.

Few countries in the world offer such unlimited scope as India does to the Amateur Naturalist for the prosecution of his hobby. To take for example the subject of Indian Bird Life in which so many are interested—how little is known of the local migration of Indian Birds; certain common species appear in a given locality at a certain date and depart at another. What is the date of arrival and departure? The subject of distribution of Indian Birds, both general and altitudinal, has still to make considerable headway before we can

be abreast of what is known of this in Western countries. There are besides such interesting subjects as colour variation and hybridization in Birds. In the *Field* of April 30th, 1925, there is a beautiful drawing by Frohawk of a hybrid Mallard and Pintail which was shot in Sussex; many instances of hybridization amongst our wild duck must come under the notice of shikaris, a list of these occurrences would be of no small value. Further there are observations to be made on the food and feeding habits of birds, their methods of courtship and display, nesting habits, variation in the eggs, size of clutches, etc. All accurate observation on these phases of bird life would be valuable and merit placing on record. In Western countries an enormous mass of information has been made available by numerous observers whose initial interest in the subject can be traced to the numerous, easily accessible, cheap, readable and well illustrated books on the Natural History of the country. That there is a dearth of such books in reference to India we have already pointed out. It is for this reason that books, such as " Birds of an Indian Garden " by Mr. Bainbrigge Fletcher and C. M. Inglis which is reviewed in the present number, are always welcome. The book, as the authors state in the preface, is mainly intended for those whose pleasure in observing our Common Indian Birds is in a great measure lessened by their want of knowledge of the birds concerned. There must be many in India both European and Indian to whom the " Birds of an Indian Garden " will appeal and to these we gladly recommend the book. We also take this opportunity of congratulating the authors on the able manner in which they have helped to fill a long felt want. The book is illustrated by 31 coloured plates and is remarkably cheap at the price at which it is offered. Naturally, coloured illustrations are an asset to a work of this type as they go a long way in helping the reader to recognise the species described. This bring us to the point that the present number of the Journal is the first for many years which is not prefaced with the usual coloured plate illustrating Mr. Stuart Baker's popular serial on Indian Game Birds. Mr. Stuart Baker, in addition to the arduous task of rewriting the Volumes on Birds in the Fauna of British India series, has found time to maintain unbroken the sequence of his very interesting articles on Game Birds. He now proposes to complete the work by a serial on the Wading Birds, but unfortunately the Manuscript and the coloured plate were not ready in time for inclusion in this issue, we hope, however to be in a position to commence the series in the next number.

By the time the Journal is in the hands of members the monsoon will be on us and the rains will inevitably be followed, in most districts, by redoubled activity on the part of the pestilential mosquito. It will come as news to many that the Coconut Palm stands condemned as a potential nursery for these disease-bearing insects. A mosquito survey of the palm trees in Tanga, East Africa, by Dr. Haworth has led to the conclusion that the local mosquitoes breed freely on the crowns of the coconut palms almost continuously throughout the year and even in times of comparative drought, when collections of storm water have subsided and when rot holes in trees have evaporated, the crowns of the palms appear to act as reserve breeding grounds from which other suitable places may be stocked wherever these appear later from rainfall or other causes. In a notice of Dr. Haworth's report which appears in the review of Applied Entomology for March 1925 it is stated that " what has been demonstrated for a portion of the East Coast of Africa is probably taking place in tropical lands throughout the world, wherever the coconut palm flourishes, and no successful anti-mosquito campaign can therefore ignore the coconut palm as a possible breeding place for these insects. . . . The treating of the crowns with oily or larvicidal substances, owing to the labour involved and the periodical mechanical damage to the crowns, would be impracticable. The clearing of coconut palms from the neighbourhood of all inhabited areas would be economically impossible, but it is suggested that the planting of coconuts should be prohibited within towns and cities and that all Government owned palms should be immediately removed. "

MISCELLANEOUS NOTES.

No. I.—BREEDING SEASON OF THE NILGIRI LANGUR.

Does the Nilgiri Langur breed twice a year, or does the breeding season differ according to latitude, or according to altitude? I append the following observations in reference to the subject:—

(1) At Kodaikanal, 7,000 feet altitude.

8th May 1919, I shot a large female; a fully formed young one in the womb.

5th June 1919, I saw a female with a young one clinging to her breast.

20th April 1920, I shot a female with a young one in her arms. I tried to rear the one, but it died after two days.

(2) At Kattali Malai, 20 miles west of Ambasamudram in the Tinnevelly District, 4,000 altitude.

28th December 1924, a friend of mine fired at a langur, which got away leaving behind a young one.

29th December 1924, another young one was brought to me by a shikari. These two were only a few days old. They died three days later in spite of all our efforts to rear them.

C. LEIGH, S. J.

TRICHINOPOLY,
13*th January* 1925.

No. II.—WILD DOGS AND JUNGLE TRAGEDIES.

Dunbar Brander, writing on the Wild Dog in his excellent book "Wild Animals in Central India" (which by the way all should read), says he has never heard of wild dogs attacking bear or bison, but that he has no doubt that the latter are sometimes killed. I sometime back sent you a note* on wild dogs attacking a bear, an occurrence witnessed by Col. H. K. of Bangalore and myself while out after bear in these jungles (the Billigirirangans) last May. The bear was making for its cave, but I doubt whether it would have reached it. Its progress was very slow, attacked as it was, by about eight to a dozen dogs all round it. Dogs in front would engage its attention while those behind attacked its hind quarters; the bear would then turn round on the latter and instantly the dogs in front would again divert its attention to them by rushing in, but out again before the bear could touch them. The bear let out a series of coughing roars each time he turned on his tormentors in his rear. It was a bear my friend was out after and the bear was therefore bagged, and I regret to say that we were unable to slay a single dog.

With regard to wild dogs killing bison I have never heard of cases of mature bison being killed by them but I have twice come across cases of bison calves having been killed by them and in each case I think the dogs had stampeded the herd and cut off the calf.

I have twice come across sambar standing in water up to their shoulders and screaming and once swimming, and in all cases the dogs were all round them and hanging on to them. On each occasion I drove the dogs off, bagging several, but I fear that they got on their victim's tracks again.

In 1916 I saw the remains of a panther that had been killed by wild dogs in a Sholaga's "podu". The Sholagas described the fight to me, it had been fast and furious, the panther rushing backwards and forwards was eventually disembowelled by the dogs that kept pace with it. I could find no traces of any dogs having been killed and the Sholagas declared that none were injured. The scene took place in clear view of their huts. That however the reverse

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* *Vide* Vol. XXX, Miscellaneous Notes, p. 218.

sometimes occurs is proved by the fact that Mr. C. W. G. M., of these hills, not long ago came across the remains of two wild dogs that had been killed and eaten by a panther.

Cases have undoubtedly occurred of tiger being killed by the dogs. I was informed of a case of this nature by my tracker some years back and his story was corroborated by others who were co-witnesses of the scene and I have no reason to doubt their tale. In this case apparently the men saw the tiger loping along at a good pace with dogs keeping pace with him and snapping at his sides and hindquarters: they then saw the tiger leap on to a tree which leaned over nearly horizontally. The dogs trotted all round while one, apparently the leader, of the pack, leaped into the air repeatedly, ineffectively trying to reach the tiger. After a time the tiger, tiring of his uncomfortable position, suddenly made a tremendous leap over the dogs' heads to the ground and here met his death, being disembowelled by the dogs as he barely touched the ground.

Wild dogs attacked a sounder of pig last year in the shola behind my bungalow and tore two sows to pieces before they were driven off by my servants. Although some distance away I heard the sows screaming and later saw what was left of them.

Wild Dogs are not the only perpetrators of tragedies in the jungle: tiger and panther take their toll on deer and antelope and on other game: Dunbar Brander mentions coming on a bear blinded in a fight with a tiger and Capt. H. J. L. F., of these hills, not long back came on a spot in these jungles where a tiger had attacked and killed a bear after a terrific battle, and had then eaten it. In the same way some years back I discovered traces of a fight between a tiger and a bear after hearing a hideous din the previous night: I was in camp at the time, the noise lasted for about half an hour. There was a good deal of black hair lying about, a little of the tiger's hair, and a fair amount of blood: there was no drag. In 1916 I saw the remains of two big bull bison that had been killed by a tiger, one a fortnight after the other: and I have twice seen the remains of cow bison that had been also killed and eaten by tiger. I was informed by the Sholagas that a tiger would follow and attack a bull bison for days until it fell an easy prey through utter weariness. In 1915 Mr. C. W. G. M. saw a tiger attempting to stalk a herd of bison, but in this case the herd had already seen the tiger: Mr. M. managed to bag the tiger. Tiger generally avoid a conflict with wild boar, but I have frequently seen remains of sows killed by tiger, and on one occasion those of a large boar, which the tiger had evidently caught unawares. Mr. C. W. G. M. once bagged a tiger standing over the body of a fine stag sambar hwhich it had just killed, the death cries of the stag in fact having drawn Mr. M. to the spot: the tiger's sides were still heaving with the exertion of pulling down the stag. I witnessed a never to be forgotten sight in November 1917: a stag sambar, after belling three times suddenly dashed out of a shola not far from me followed a few paces behind by a large tiger: the stag had not as yet got into its full stride and in a moment the tiger had overtaken and brought it down: I had a clear view of the stag crashing down with the tiger on its back and in a second the tiger was at its throat and all was over. In my excitement it never occurred to me that I was in full view of the tiger till too late, the tiger saw me and slunk quickly off into longer grass, giving me no chance to get in a shot, and then into a shola which the grass led up to. I need not here describe how I lost this tiger entirely through bad management on my part. I have known animals meet their death in unusual ways in the jungles: I once came on the remains of a panther that had met its death by attacking a porcupine: its decomposed head was run through and through by no less than seventeen quills, two of which had penetrated the eyes into its brain. Its paws were also full of quills. The panther had evidently rushed the porcupine which, seeing it in time, had quite obviously whirled round presenting its back to the panther with quills erect,

such being their method of defence. There was no sign of the porcupine having been killed.

A few years back Mr. C. W. G. M. hot a stag sambar which, in attempting to escape, had got itself entangled in a mass of stout creepers in an extraordinary fashion. The stag was undoubtedly being throttled. In 1918 three cow Elephants died within a few *yards* of each other not far from my Estate: the local Forest Ranger put their deaths down to anthrax, but I doubt this as these elephants had formed part of a large herd and no further deaths were reported. Sholagas informed me that they had probably died through eating poisoned pumpkins in the fields at the foot of these hills. This herd had been in the habit of visiting the cultivation down below and the idea was that the ryots had put out poisoned pumpkins in the hopes of killing off one or two, if so, their hopes were amply fulfilled! It is anyhow most remarkable that the three elephants should have died in a bunch as it were. I visited the spot as soon as the state of the remains had got beyond the overpowering stage; the elephants had died not twenty yards from each other. I now come to an event which to my mind is the most extraordinary occurrence I have ever witnessed or heard of. In September 1915, while out on shikar, I wounded a wild boar in a deep valley and on following it up came on it lying down about half a mile further up the valley. The jungle here consisted of dense bamboo of the smaller type. I put a shot into the old boar which finished it off, and immediately after heard crashes to my right and left front, the next second a tusker and a large solitary bull bison appeared in view careering from opposite directions along two elephant paths that ran, cutting each other, across our front and away from us (two trackers were with me), and behind a clump of bamboos, where the two paths crossed, the tusker and the bull bison met. There was a tremendous thud and the bison was lifted off its feet and flung against another bamboo clump where it lay with a gaping hole in its left side caused by the elephant's left tusk. As they met the elephant emitted a noise through its trunk like escaping steam. The tusker did not pause but carried on along the path and later met my tiffin cooly and, the man said, chased him, with disastrous results to my lunch. I approached the bison: it seemed incapable of moving and ay breathing heavily, obviously dying. I finished it off with a throat shot. The elephant's tusk had penetrated the bison's body to the depth of a foot or more. The bison carried quite a good head. Now the question arises, did the two animals accidently collide? or, finding himself in such close proximity to the bison and thinking the latter was responsible for the disturbance, did the tusker deliberately ram the bison? I am inclined to the latter view and my trackers agreed with me. I think that both animals could have swerved sufficiently to allow each other to pass without colliding had they so desired: possibly the bison did swerve but the elephant probably counteracted this by swerving inwards or keeping straight on. It is unfortunate that the actual impact took place behind bamboos and was thus hidden from our view. Both animals had been thoroughly disturbed by my shot which in the valley had been magnified. The wind was blowing down the valley which accounted for the fact that my first shot had not worried them. A year or two later a well known Planter and Sportsman of Coorg told me that a very similar occurrence had been witnessed by his Kurumba tracker in those jungles, the elephant in this case being a rogue. In May 1919 Capt. H. J. L. F. shot a proscribed rogue elephant in these parts: near by were the remains of a solitary bull bison that had been killed and trodden out flat by the elephant. It should be interesting to hear of further details of tragedies in jungle life observed by members of the B. N. H. Soc.

R. C. MORRIS.

ATTIKAN *via* MYSORE,
S. INDIA, *October 15th*, 1924.

No. III.—"WILD ANIMALS OF CENTRAL INDIA".

Panther.—In his Chapter on Leopards and Panthers in "Wild Animals of Central India" the author mentions that three or four leopards will sometimes be seen together. In 1921, a family of 6 panthers were killing on the borders of my Estate: the family comprised the parents, two three-parts grown panthers, and two small cubs. On approaching their kill the family would come out of the Shola in the above order, one behind the other. Needless to say the family did not remain long united, the parents and the three-quarter grown ones being bagged in a very short time.

Sambar.—Writing of the sore place so commonly seen at the base of a Sambar Stag's neck the author remarks that he has associated the phenomenon as being in some way connected with the new growth of hair. I think he is mistaken in this, as I have seen sambar with this sore place from September to April both on these hills (the Billigirirangans) and on the Nelliampathies (Malabar). It is generally an open sore about the size of a rupee in some cases, and much larger in others, surrounded by a large bare hairless patch. I have never seen a hind bearing this sore, and not all stags have it. I should say it was undoubtedly formed by a fungus that grows in the hair or skin, as in ringworm, the bare patch round it being the result of the sambar rubbing itself against branches, etc.

Chital.—Writing on the chital stag's roaring the author describes it as "of the nature of a whistle but louder and longer than the cry of alarm". I would not describe the call as in the nature of a whistle at all. In fact the call, as I have heard it uttered on innumerable occasions at the foot of these hills, is not unlike the hoarse cry of a man, lowering in note as it ends off.

Muntjac or Barking Deer.—In writing of the "clicking" noise muntjac are frequently heard to make when galloping off the author says: "Several previous writers have referred to a peculiar rattling noise they make when moving away .....I have no doubt that the sound referred to is the same as that which I have described above" (here the author refers to his description of the muntjac's short, sharp, jerky barks frequently given out while galloping off in alarm). On reading the above one cannot but gain the impression that the author has not heard the "rattling noise" other writers have referred to, for no one who has heard this peculiar clicking noise could possibly confuse it with the short jerky barks given out by a muntjac when alarmed and bounding off. This rattling or clicking noise can best be described as the noise made by knocking two bones together sharply and rapidly with a pause between every third stroke. I share the belief that this noise is caused by the cloven hoofs of the animal coming together at every bound. The noise is only heard when the muntjac goes off in a clumsy bounding gallop, and never when it *rushes* off at full speed.

With regard to the muntjac s pedicles I have seen several heads of muntjac shot here with 5" pedicles. Another interesting fact is that the muntjac on these hills is a larger animal in body and skull altogether than those elsewhere in South India.

The Four-Horned Antelope.—The author remarks that in some cases the growth of the anterior horns of this little animal "seems to be altogether arrested." This certainly applies to the Four-horned Antelope to be found on these hills, which have only two horns (the posterior ones—a good head carrying horns about 4½" in length), no sign of the anterior horns being apparent. The author further remarks that this little antelope "is not gregarious, and is found singly or in pairs, the two fawns accompanying the parents until the rains" this is so as a rule, but I have however on two or three occasions seen groups of 5 or 6 mature four-horned antelope, especially on one favourite hill-top here.

Bison.—In his chapter on the Indian Bison or Gaur the author writes: "Two bulls of about the same age often consort together and I once shot two old bulls, right and left, leaving a village tank in Chanda. This is the only case in which I

have ever known bison to approach the habitations of man*". Bison, however, at the foot of these hills nightly enter the fields in spite of the watchmen's shouts. It is a fact that two bulls often consort together, but my experience has been that in nearly every case one of the bulls has been an older and finer animal than the other. The younger one has always seemed to me to be rather more on the alert, and in many ways gives one the impression that he acts as his companion's "fag." During the breeding season they attach themselves to a herd and fight each other furiously. The author, writing on the sounds uttered by bison, says: " Bulls when breeding, and in the herd for that purpose, utter the most absurd piping or whistling sound, more like the call of a bird than anything else, and absurd by reason of it emanating from so large and powerful an animal". I know the sound the author refers to well, and have frequently heard bulls utter it from November to February, but I should describe it rather as a sing-song humming or moaning sound often, starting shrill and gradually lowering and deepening in note until it dies away. I once heard a solitary bull making a most extraordinary noise which I thought was being uttered by an elephant. On being assured by my Sholaga trackers that the sound emanated from a bull-bison we approached in the direction the sound was coming from and observed a solitary bull tramping steadily along and every now and then making a noise something akin to the prolonged trumpet of an elephant. The month was April so well out of the breeding season although my trackers informed me that it was calling for a mate. I am unable to account for its unusual behaviour. In discussing the method of shooting bison the author says: " One of the first difficulties the novice encounters is to distinguish bulls from cows". I cannot agree with this: a good shootable bull stands head and shoulders higher than a cow: he is an immense animal with an enormous dorsal ridge, and coal black; and, unless the shootable bulls in the Central Indian jungles are very much smaller than those to be found in these parts, I cannot conceive how any mistake can possibly be made, the difference being so marked. The author goes on to say that frontal shots should be avoided, and that only solid bullets should be used. On both these points I disagree with him also: a well placed chest shot is very fatal, and there is nothing in my opinion against the sportsman using soft-nosed bullets (with high-velocity rifles) when shooting bison I do not consider that anything smaller than a·450 bore rifle should be used however. I speak from experience: I have shot a good many bison and have just as frequently been out with others after bison, and in every case soft-nosed bullets have been used with success. Referring to the colour of a bison's eyes the author writes: "I agree with Major Stockley in stating the iris to be brown: any blue that exists is confined to the cornea": nevertheless the impression conveyed to one when observing a bison's eyes (whether living or dead) is that they are blue. This is due to the fact that the centre of the eye is blue, and rimmed with brown.

Tiger.—I am afraid I cannot agree with the author also, when he writes that the use of an electric lamp when sitting up over a kill for tiger oversteps the mark, that is to say if his remarks are meant to apply to the South Indian jungles as, well. Kills on these hills occur more often than not in dense jungle through which the brightest moonlight barely penetrates, and if the sportsman does not have the assistance of artificial light he might just as well not sit up at all. I have not found that "the tiger stands in stupid wonder gazing at what it no doubt considers some phenomenal star": only on one occasion did a tiger give me an easy stationary shot on turning on the light—and I missed !! In the majority of cases the tiger, I have found, bounds away alarmed and a quick and often difficult shot has to be taken. Mr. Dunbar Brander's opinion on this matter may be the correct one in connection with the jungles he writes of, but not I think in regard to the South Indian hill jungles. Quite recently, a tiger

* There is an old record in the journal of a pair of Bison appearing on the rifle range at Kamptee, C. P., while musketry practice was in progress the exciting hunt that ensued resulted in one of the animals being done to death in Kamptee Bazar.—Eds.

never even gave me the slightest chance of getting in a shot, although it came to the kill three times the tiger was out of the area lit up by the light within a fraction of a second of the light being turned on each time.

Flying Squirrels.—Writing of the Flying Squirrel the author describes the ' booming" noise these animals make when they emerge from their holes after dark. He omits to mention however the Flying Squirrel's common call which somewhat resembles a long-drawn-out throaty cat's "me-ow" often ending in a deep " o-o-oom ". It is curious that the author has not included the Indian Pangolin (often miscalled the Armadillo) in his chapter on " Other jungle animals ": and this omission leads one to gather that this scaly little animal does not occur in the Central Indian Jungles, and I should like to know if this is so: It is extremely nocturnal, in 13 years I have only seen one in daylight; but they are fairly common in these jungles. I recently came on the remains of one that had been killed and eaten by a panther. The Badagas on the Nilgiris and on these hills prize the larger scales through which they bore a hole and wear them as rings. Their food consists of ants and insects and one comes across the small holes they scrape out in the jungle quite often.

RALPH C. MORRIS.

HONNAMETTI ESTATE,
ATTIKAN *via* MYSORE,
24th February 1925.

We append the following comments by Mr. A. Dunbar Brander on the above.

Sambar.—The sore patch on the necks of sambar is not common in the Central Provinces. There are many other parts of India where the phenomenon can be observed more frequently, giving more opportunity of discovering the cause. My remark in " Wild animals in Central India" is as follows—" occurring as they (the spots) do in the region of a hair whorl or centre I have associated the phenomenon as being in some way connected with the new growth of hair." It is obvious this is a mere theory: as much so as Mr. Morris' explanation is. Mr. Morris says he has only seen the sore on stags. Can he explain why the ring worm should confine itself to one sex *?

Chital.—Great numbers of your readers must have heard chital calling hundreds of times. Written language is a poor medium by which to convey sound. I much prefer my own description of the sound to Mr. Morris unless, that is to say, the Chital of Southern India makes a different call to those of Central India.

Muntjac.—Mr. Morris must give me the credit for having heard the noise referred to. Supporting the views that he does, it is surprising that he does not refer to the well known fact that the domestic sheep can and does click its toes or hoofs. In writing my book there was a simple explanation to offer, but there was no temptation to make use of it as I did not think the noise made by the Muntjac emanated from the feet and I had to say so. To have said otherwise, would have been to have abandoned my beliefs, because an obvious and handy explanation was forthcoming. Can Mr. Morris explain the pause between every third stroke if the noise is to be ascribed to the hoofs coming together at every bound ? And how is this accomplished on the very uneven ground they so constantly frequent often making anything in the nature of a rythmic action impossible.

Four-horned Antelope.—This animal is not gregarious in the Central Provinces. Mr. Morris refers to having seen 5 or 6 mature animals together " especially on one favourite hill top." Their association together might have been due to the attraction of " the favourite hill top " and not any desire of consorting with each

* In Vol. XXVIII, p. 1125 of the Journal, Mr. R. A. H. McConnell records the shooting of a sambar hind with 'sore neck'.—Eds.

other. The point is worth considering. I have seen African duikers and four-horned antelope on hundreds of occasions and I have never known them to be gregarious.

Bison.—It is very satisfactory to have confirmation of the very peculiar cry made by bulls when breeding as, so far as I know, I am the first author who has referred to this call. If Mr. Morris had had as much experience of enforcing the game laws as I have had he would know the ease with which a cow can be mistaken for a bull, one does not expect sportsmen with Mr. Morris' experience to make mistakes, but possibly 90 per cent. of the permit holders are novices. What frequently results in a cow being shot is the sportsman firing at what he *thinks* is the biggest animal—and it *often appears to be so.* Imagine a herd of bison grazing in a grass maidan, the grass 4 to 5 ft. high, a very common occurrence. The ground is uneven, there are slight depressions and eminences. A cow happens to be on some slight eminence concealed by grass and unknown to the sportsman. The bull may be in a depression, at any rate a cow on an eminence of even a foot seems to dominate the whole herd, is at once selected as the bull and downed. The advice was therefore tendered not to trust to *apparent bulk* for *identification*, and it is sound advice. It was never even hinted that the bull is not considerably larger than the cow, but in the Central Provinces the difference in size is not so marked as Mr. Morris' language would imply. There is often no difference, absolutely, in colour. I would always tender the advice to avoid frontal shots. This of course does not mean to say that a frontal shot is not to be taken if no other seems possible, but where a choice of angle is procurable avoid the frontal shot.

I absolutely join issue regarding the use of soft-nosed bullets from either a low or a high velocity rifle and, in point of fact, better results are often made by the former weapon with this class of projectile. The modern soft-nosed bullet fired from a high velocity rifle is often most unsatisfactory. They are apt to fly to pieces on hitting a large bone, especially so on a *surface* bone. The great point however about using solid bullets is that they will do everything to a beast like a bison that a soft-nosed bullet will, and in addition they will do a *great deal more*. Angle need not be considered to the same extent—the bullet will rake the beast. I once knocked down a bull which never rose again, with a solid hardened ·577 bullet fired into its tail as it went away: an impossible shot with a soft-nosed bullet. Soft-nosed bullets are often exceedingly cruel and wounded bison sometimes escape or are only killed after a long hunt.

Bison can be killed and often are, in a most satisfactory manner by soft-nosed bullets: they would have been equally well killed however by a bullet having more consistency and it is only a question of time in order to come across a case in which the soft-nosed bullet fails and one regrets not having used a harder and more consistent projectile. In the course of my experience I have dropped 3 bison in their tracks with a soft-nosed bullet fired from a Standard Mauser rifle and I fired no other shots at bison from this weapon, but I do not therefore recommend either the bullet or the weapon. I entirely agree with Mr. Morris' remarks about the bison's eye: it gives off a blue light as described by him. The blueness is not in dispute, its source is. I have never seen a bison with an eye which could be described as having a blue iris in the ordinary accepted sense of the term. There are a number of the best herd of Aberdeen Angus Cattle in the Spey Valley, they are readily accessible to me: they all have the typical bison's eye and can be studied at leisure.

Tiger.—It was never expected that my criticism of the electric lamp would have general acceptance; all the same I have had a great deal of encouragement from perfect strangers. I only used the electric lamp as an experiment as long ago as 1905. I found that unless the tiger became aware of one by movement or noise in turning over the light they behaved as described. African observers have confirmed this behaviour with respect to other animals. Since 1905 the electric light has come into general use there are bound to be sophisticated tigers.

Flying Squirrels.—I expect Mr. Morris' description of the call and mine refer to the same noise as he ends up his attempt to reproduce the call with 0-0-00m. I made no attempt to reproduce the call but referred to it as a "booming" noise.

Pangolin.—A reference to this animal appeared to me to be outside the scope of the declared purpose of the chapter on "other animals;" as a matter of fact I drafted a page on it and then cut it out. It is rare and still more rarely seen. In some districts the jungle tribes know nothing of it. I found more evidence of it in the Seoni and Melaghat divisions than elsewhere. In the latter I met a fair number of old Korkus who had come across one, perhaps two, in their lives. I have only seen two myself. Jungle fires sometimes produce their shells. I daresay professional snake catchers might produce one, given a reasonable time, certainly no one else could and the animal is so outside the "Ken" and the "interest" of the average visitor to the Central Provinces I think was rightly omitted.

A. A. DUNBAR BRANDER

IVY BANK, ELGIN,
SCOTLAND, *March* 1925.

No. IV.—BLACK JACKAL.

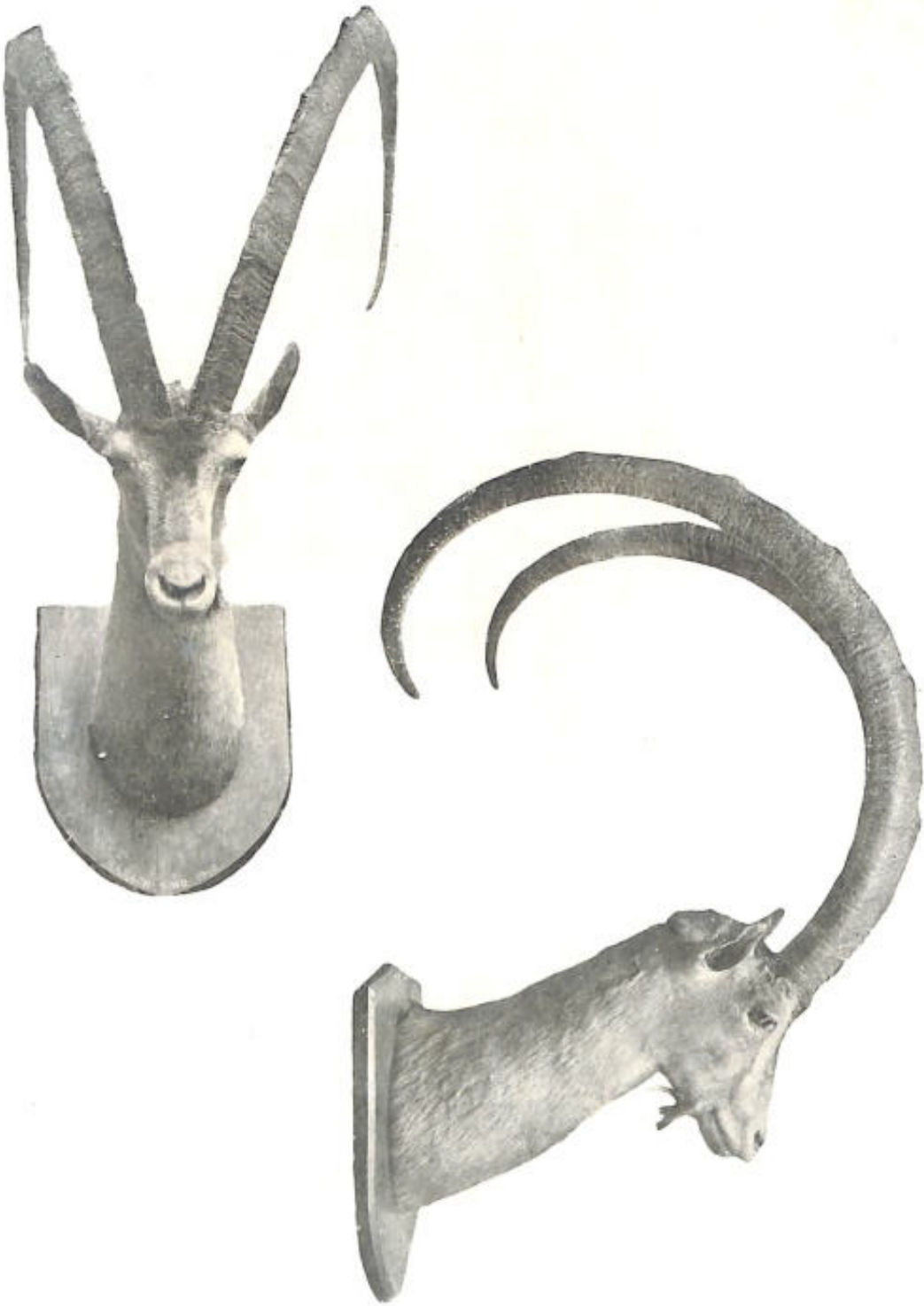
A black jackal was seen by me on the evening of the 19th April 1924, at about 5 p.m. near Shirali, a village, on the south border of the Kanara District, about 2 miles from the sea. I was in a motor car when it passed across the road in front of the car going towards the riverside. At first I thought it was a dog: but when I saw 2 or 3 other jackals of the ordinary colour following it and also when I observed its tail closely I suspected it was a jackal. It ran on stopping every little while to look behind—a thing which jackals usually do. I then wrote to Mr. T.R. Bell, C.I.E., and also to the Bombay Natural History Society and was told that they were not aware of the existence of a black jackal. I then tried to catch it alive. The usual haunt of this queer animal was found out. This was in a small woodland *within the village* in which there were some small rocky caves. The villagers told me that this jackal had been observed very often in the village, during the last two years. It used to go to the river-side for fishing. I sent down a big box-trap, fitted with a small compartment for the bait. Fowls and fish were daily put in as bait; but neither this jackal nor others would come near them. We next tried to catch it in a net by beating the jungles, but it eluded us. At last on the 1st of January it was luckily caught in a net along with a normal-coloured female jackal. Both were put into the box. It gave some trouble but the man boldly pushed it in. While with me for 2 or 3 days, I put live chickens inside the box for its food; but though the chickens walked over its body, its mouth, etc., it did not touch them during the day time, but at night it used to finish off everything that was put into its cage and drink water copiously.

There are some black dogs in the village and it is possible that the animal is a cross-breed, *i.e.* a hybrid dog-jackal.

M. S. TUGGERSE,
Divisional Forest Officer.

KANARA COAST DIVISION,
HONAVAR, *8th February* 1925.

[The animal was forwarded to Bombay through Mr. T. R. Bell and is now in the local Zoo—there seems to be no doubt that it is a hybrid dog-jackal and not a melanistic form of the common jackal. The back and head of the animal are black. It has a brown spot above each eye, the chin and lips are white—the underparts creamy, and there is a certain amount of rufous on the legs. The tail is black and quite bushy. Interbreeding between



RECORD SIND WILD GOAT. (CAPRA HIRCUS BLYTHI.)
Length 32 $\frac{7}{16}$", girth 7 $\frac{1}{2}$".

domesticated dogs and cats with corresponding wild species undoubtedly occurs, though authenticated records are rare. Many of the tame village cats are very similar in colour and markings to the common wild cats, while the jackal-like appearance of many pariah dogs and the wolf-like appearance of others seems to indicate that cross-breeding does take place.

The origin of the domestic dog is still involved in mystery, some Naturalists believe it be a distinct species descended from one that no longer exists in wild state, others trace its ancestors to the wild or half wild races either of true dogs, wolves or jackals, while others believe it to be the result of mingling of two or more wild species or races. Blanford is of opinion that the common Indian pie-dogs may be in part descended from wolves, he adds however that they are probably chiefly derived from Jackals.—EDS.

No. V.—A RECORD SIND WILD GOAT.

(*CAPRA HIRCUS BLYTHI.*)

(*With a plate.*)

Early in November, 1912, I was again able to visit the Khirthar Range in Sind (for the third time) and on this occasion my camp, consisting of one small *raoti* for myself and one for my servants, was pitched half way up the hill, near a pool of clear water in the bottom of a ravine which had not then dried up. The local "shikaris", disdaining such comforts, were content with a camel hair blanket and a good fire at night. We started early in the morning, reaching the top of the hill before the sun rose and then working our way across a succession of rather steep ravines. About 9 o'clock we came on a heard of Ibex, slowly feeding their way upwards, with one quite good head amongst them; but my chief "shikari"—a "Baluch" by caste and the best of stalkers—implored me not to shoot as the big head they had marked down a few days previously was probably not far off. So, skirting the herd with caution, we went on again and an hour later spotted another herd, which must have numbered at least 60, spread out on the opposite side of the ravine to where we were lying. Almost on a level with us, and well above the rest of the herd, a fidgety nanny was continually stamping and snorting, effectively preventing us from examining those animals which were down in the bed of the ravine. The "shikaris" however were convinced that this was the herd they were looking for as they had seen a big male with one horn among those visible, which they assured me belonged to the same herd as the big one. The animals had taken up their position for the day and, as they were not likely to move for some hours, we sat down for a bite and a rest, one of the party keeping an eye on the herd. About 3 o'clock the herd began to move and, led by the fidgety female, moved up and over the opposite side of the ravine at a slow walk. Those in the bed of the ravine got up one by one and followed the others. Amongst these were several big heads and each time one appeared I looked enquiringly at the head "shikari" but each time he shook his head. The last to appear was a big buck-goat with very curly horns and I proceeded to get my sights on to him, making sure that he was *the* big one. A sharp hiss and a violent shake of the head from the "shikari" stopped me and I again watched. After a perceptible interval, when I was beginning to think that the big head only existed in the "shakari's" imagination, an Ibex suddenly got up from behind a bush and stood for a minute looking alternately down the valley and towards the rest of the herd, the last of whom must have been 100 yards away from him.

I then saw that the "shikari" had spoken the truth, as although in actual body he was on the small side his horns looked enormous. He took some time

to make up his mind to follow the others, and it was probably owing to this habit of his of hanging behind that he had escaped so long. Finally he moved up slowly after the herd, giving me a crossing shot at about 200 yards. What with the excitement of watching for so long, and the actual sight of the big Ibex, I was none too steady as my first shot was too high and, as I afterwards discovered, did little damage. He stood perfectly still at the shot, puzzled as to where it had come from. While he was still thinking a second bullet caught him behind the shoulder and he rolled down the ravine about 30 yards, finally getting caught in a bush where he hung by his horns. In this position his throat was cut by a wildly excited " shikari " who fled down the hill regardless of his neck in order to get him before the last breath was out of his body. Meanwhile I, on the top of the ravine, was thumping the head " shikari " on the back in honour of the occasion. Two days later I got the curly-horned buck out of the same herd. His horns were 46½". We took the big Ibex back to camp in triumph and I measured him next morning.

The following are the measurements recorded by me:—

Right Horn	.. ..	52 $\frac{7}{16}$ (Broken tip).
Left Horn	.. ..	51½
Girth	.. ..	7½

The right horn measured 52¾" when the animal was shot, the subsequent reduction being due to shrinkage.

The above measurements have been verified by Major W. B. Trevenen, at Poona. I enclose two photographs of the head in question.

I may add that I have shot many animals of the species between the years 1910-1918. The following measurements of heads in my possession shows the average size of a really good head of the Wild Goat in Sind.

One head of 47¾", one head 46½", 6 heads 45" and one head 42½". All shot in the Khirthar Range and in my possession at present.

" Ryecotes," Yeravda, R. L. McCULLOCH.

Poona, *February 9th*, 1925.

[There is a head of a Sind Wild Goat in the British Museum measuring 52⅜" × 7⅜" shot by Col. F. Marston—Eds.]

No. VI.—THE ALLIED GROSBEAK (*PERRISOSPIZA AFFINIS* Blyth.)

This grosbeak was originally described by Blyth (J.A.S.B. xxiv. 179, 1855) From the ' Alpine Punjab,' but in spite of this fact, and Jerdon's further statement (B.I. ii. 385) that " It has only hitherto been sent from the extreme north-west, *viz.*, the Alpine Punjab", doubt has persistently been thrown on the authenticity of the specimen in the Pinwell collection (British Museum) labelled Dharmsala.

The following remarks by Surg.-General L. C. Stewart (Zoologist, 1886. p. 290) however settle the question of typel ocality, which should be restricted to Hazara. He says " On looking over a collection of birds belonging to Major Blagrave of the Trigonometrical Survey, I found some examples of a large rosbeak which seemed different from any of the above-named and which had been shot in the hills beyond Murree in the far north-west. On sending them to Calcutta they were pronounced new and named by Blyth *Coccothraustes affinis*."

The Dharmsala locality has now been confirmed by my obtaining a male from a pair which were evidently breeding in the Kharshu Oak (*Quercus semicarpifoliata*) forest about the Kareri Lake 10,000, just west of Dharmsala.

The species is widely distributed and locally common in Central and Upper Gahrwal (Jour. B. N. H. S., xxviii, 151) and therefore clearly extends throughout the whole of the Western Himalayas. In view therefore of the coincidence in the ranges of *Perrisospiza icteroides and P. affinis* they must be treated as separate species and not as races of one bird.

BATTLE, SUSSEX,
26th November 1924.

HUGH WHISTLER, F.Z.S.,
Indian Police.

No. VII.—ON THE BREEDING OF THE INDIAN TREE PIPIT (*ANTHUS HODGSONI*) IN KULU.

This Pipit has long been known to breed in Kulu, as one of the first recorded eggs was received by Hume from the snowy range bordering on Spiti in Upper Kulu where it was taken on 3rd June (N. and E., 2nd ed., II, 209). There are however few accounts on record of the nidification of this bird so it may be of interest to relate the following experience.

On 16th June 1922 I stole a day from my official duties in order to visit the far-famed and beautiful Jalouri Pass (10,500′) which carries the trade road from Inner to Outer Saraj in Lower Kulu. Many interesting birds were found to be breeding in the forests that clothe the Jalouri ridge, and these delayed and entertained my ascent of the Pass.

As soon however as we climbed on to the open ground of the ridge to the east of the actual Pass we met with the males of the Indian Tree Pipit which were all in song. There were a number about and they kept on flying into the air for a short distance and then volplaning down to the ground or the topmost twig of an oak, with wings and tail outspread, singing loudly all the while. The song was lark-like in character, rather than the usual wheezy characteristic song of the Pipits. The back of the ridge was here very open and bare, save for a short crop of grass dotted with anemones, and a search failed to reveal any nests: it is possible that the nests belonging to these males were in the oak woods that clothed the slopes on both sides, though I hardly believe so.

We then proceeded further along the bare and narrow ridge; the northern slope was free of forest for some distance below the summit doubtless owing to the cold winds that swept continuously up from the valley, though here and there thickets of rhododendron and other bushes withstood its force. The southern slopes, which face towards Simla, were, however, covered with an unbroken forest of Kharshu Oak (*Quercus semicarpifoliata*) which stretched up to within a few yards of the top of the ridge; here it left a small area, warm and sheltered in the sunlight, and covered with large patches of *Cotoneaster microphylla*; this is a curious evergreen creeping shrub, with thick woody stems and tiny round leaves and flowers, which forms a dense rough carpet on the ground. This sheltered portion of the ridge proved to be the nesting ground of the Pipit and here four nests were soon discovered in less than quarter of a mile, though no males were observed in this area, nor was their song heard.

The first nest was found by my orderly in the course of a general search. It contained 4 eggs nearly ready to hatch, though the bird was not present at the moment of discovery. However when we returned later to the spot I flushed her from the nest and she flew up into an oak tree where I shot her.

The site of this nest was typical of all that we saw, it was placed in a hollow of the ground under the interlacing stems of the *Cotoneaster*, being almost concealed by them from sight and very difficult to discover in consequence.

A second nest with 4 fresh eggs was revealed by the bird which flew off just in front of us as we slowly searched another patch of *Cotoneaster*; each time this bird was flushed she flew up into the oaks at the edge of the forest.

A third nest found in the course of our search contained three slightly incubated eggs, one of which was damaged. It was deserted, and doubtless the sitting bird had been attacked by some enemy, possibly a snake as there were some about.

The fourth nest was again revealed by the bird leaving it in front of us. She however did not fly up into the oaks, but each time fluttered along the ground into a patch of scrub and so on down the steep hill side, with the action characteristic of most hill-breeding Pipits.

The last three nests were similar in construction, a mass of moss and dry grass with a well constructed cup of fine dry grass stems lined with a few hairs. The first nest differed slightly in that there was practically no moss in the foundations, and there was a thick lining of the curious spine-like hairs of the musk-deer.

Next day I found one egg in a deserted nest which was littered with a few feathers as if the bird had been caught on it. This nest was rather wider and lined with coarse grass, and the situation was more open at the foot of a clump of growing bracken. It was on the northern slope of the hill, 500 feet lower than the other nests, and in a more open situation further from the oak forest.

The eggs obtained were all typical in colour and size.

BATTLE, SUSSEX,
31*st December* 1924.

HUGH WHISTLER, F.L.S., F.Z.S.,
Indian Police.

No. VIII.—THE COTTON TEAL.

You may be interested to hear that on the 28th August this year a cotton teal's nest was discovered in a box-like hole at the end of a coping on the roof of Government House, Rangoon, 68 feet from the ground. There were 13 young birds which had apparently been pushed out by the mother and fallen to the ground, some of them hitting some telephone wires about 15 feet from the ground. A servant, who saw some of them falling, was emphatic that they fell like a stone for a long distance and then fluttered and broke the fall as they approached the ground. He did not see any of them being carried down by the mother in her feet. The mother and the whole brood were caught, but in the night the mother escaped and all efforts to save the young birds by artificial feeding failed.

GOVERNOR'S CAMP,
BURMA,
25*th August* 1924.

HARCOURT BUTLER.

[The lofty situation of the nest above the ground is remarkable. Stuart Baker (*vide* Indian Ducks, etc.) could not recall from his observations any that were above 15 or 16 feet from the ground. He mentions Oates' record of a nest on a mango tree 30 feet from the ground and quotes Cripps who says that the birds even ' laid their eggs in the factory chimneys." The method by which the newly hatched goslets are brought to the ground, as reported by Sir Harcourt Butler throws fresh light on the nesting habits of the species.—EDS.]

No. IX.—OCCURRENCE OF THE SCAUP DUCK (*FULIGULA MARILLA*) IN NORTHERN INDIA.

An example of the Scaup duck (*Nyroca marilla*) was sent to the Society by Mr. G. J. Monahan, I.C.S. It was shot in the north of the Monghyr District, Bengal, on the 31st December 1924. The Scaup is a duck of very northern latitudes " breeding in the Palaeartic and Nearctic regions in the extreme north of Europe, Asia and America up to, if not beyond, north-east latitude 70°, in Asia." It is described as a very rare winter visitor to India. A second example, a female, was forwarded by Mr. J. C. Higgins. The bird was shot at Ipop, 15 miles south of Imphal, Manipur. The taking of this duck in the Monghyr District and in Manipur adds to the existing records of its very occasional occurrence in India.

BOMBAY NATURAL HISTORY SOCIETY. S. H. PRATER, C.M.Z.S.

5th March 1925.

No. X.—THE LENGTH ATTAINED BY AND THE HABITS OF THE GAHRIAL (*G. GANGETICUS*).

In reply to an article I recently wrote for Blackwood's Magazine on the subject of " Crocodiles "—a correspondent (whom I have never met) has sent me a letter in which he states that the biggest Gahrials he shot were in the Gogra at Fyzabad in 1920—which attained a length of 21'-6" in one case—and between 18' and 19' in the other. I would invite correspondence on this subject, and request information of authentic instances of Gahrial attaining a greater length.

My correspondent also stated that the largest specimen which was killed during August 1920, contained " besides pounds weight of native glass and metal ornaments, the entire hind-quarters of a dhobi's donkey".

It is quite probable that I am completely at fault but I was always under the impression that gahrial lived exclusively on fish—and I also believed that the formation of its throat, precluded any possibility of its swallowing such huge morsels as a donkey's hind quarters, or portion of human beings and corpses. I request enlightenment on this point.

KENYA COLONY, EAST AFRICA, C. R. S. PITMAN,

31st October 1924. Major.

[Bangles and other human ornaments are found quite often in the stomach of the Gahrial—the name Gahrial by the way is said to be derived from the likeness of the large knob or, protuberance, seen on the snouts of old males to a *gahra* or earthen pot used by the natives of N. India. These finds are generally regarded as evidence of the reptiles having dined off a carcase. The slenderness of the jaws and the fineness of the teeth, compared with those of the mugger, are believed to restrict the gahrial to the capture of fish and smaller prey and to prevent its attacking larger quarry—but there is nothing in the structure of the reptile to prevent it from swallowing quite large mouthfuls, as has been indicated in the present instance. The stomach of a crocodile is small but this does not prevent him from making a large meal, as a great portion of the

food is first stowed away in a capacious gullet. Stones are frequently found within the stomach, these are usually malodorous and bear evidence of having been in the stomach for some time. They are presumably swallowed as an aid to digestion, in the same manner as a bird stocks its gizzard with grit and sand.

The largest of the 3 Indian Crocodiles is the Estuary Crocodile (*C. porosus*) of the East Coast, the Sunderbunds, Ceylon and the back-waters of Travancore —a specimen 33 feet long is on record—but doubts have been cast on the correctness of this measurement. Readers of this Journal will probably be able to furnish authentic measurements of large mugger, gahrial, and estuary crocodiles shot by them.—EDS.]

No. XI.—BOA CONSTRICTOR *vs.* ALLIGATOR.

(*With a Block.*)

With reference to Mr. Coleridge Beadon's note on a python swallowing a monitor on page 229 of this volume, we publish the accompanying photo of an



alligator killed by a Boa Constrictor on the River Masparito, Venezuela. The alligator was 10 feet long and the snake about 20 feet. The photo was sent by Mr. Sydney P. Mortimer, Mariacarbo, Venezuela, to "*Overseas*", the monthly Journal of the Overseas League. The largest of the South American Boas is the Anaconda (*Eunectis murinus*) ; which is stated to commonly reach a length of 33 feet. Our reticulated Python (*P. reticulatus*) of Burma and the Malay countries runs it very close with 30 feet. The true Boas, as distinguished from the Pythons, are common to the hotter regions of South America and Madagascar— the only true Boas (*Boinæ*) which occur within Indian limits are the small Black Earth Boa (*Eryx jaculus*) and the Red Earth Boa (*Eryx conicus*).

[EDITORS.]

No. XII.—TIGER KILLED BY A COBRA.



Strange Foster parents!

The following is an account of a tigress which died as a result of its being bitten by a cobra in the Jamnagar Zoo, Kathiawar. A correspondent reporting the case in the *Times of India* writes as follows:—

"An incident which is probably unprecedented in the case of animals in captivity occurred recently in the Zoological Gardens at Jamnagar. Among the fine specimens, kept there by His Highness the Jam Saheb, was a tigress with three cubs. On going his rounds early one morning the keeper was not a little surprised to find the tigress stark and stiff. Immediate search for the cause of this sudden demise: on the part of what had been overnight a thoroughly healthy animal, revealed a cobra sleeping peacefully coiled up in a corner of the cage. A gun speedily did the needful despatch. On examination the tigress was found to have been bitten in the cheek. The three cubs were all very much alive and well. How they failed to attract a bite is "wrapt in mystery". Or perhaps the cobra, having expended its venom on the tigress, may have bitten one and proved harmless. However, no mark of such a bite could be traced, and the three cubs are now as lively as crickets, the cynosure of many curious and admiring eyes. His Highness' guests are often at the Zoo handling these playful little beasts and watching them at feeding time. In this function a trio of sturdy goats plays an important and, it must be said, extraordinarily complaisant part. The foster mothers play the game in most sporting fashion and very seldom attempt to butt their sturdy "offspring." Doubtless the time is not far distant when sharper claws and teeth will bring a change on the scene, but at present the trio of *budmashes* is thriving apace and looking very well upon its enforced diet."

The following extract from the report of the Veterinary Surgeon in charge of the Zoo was forwarded to us by the Private Secretary to H. H. the Maharaja of Jamnagar.

"The tigress *Sunder* was alright on the 9th December. Next morning when the keeper of the animals went to see them as usual, he found the tigress dead. He informed me, whereupon I went there. The tigress was taken out of the cage. On an examination it was found that she was bitten on the lower jaw just below the angle of the mouth on the left side. The part bitten was swollen and there was hæmorrhage from the nostrils and from the rectum. On a post-mortem examination it was found that all the organs inside were little or more congested and blood was found coagulated on exposure to atmosphere, *i.e.*, after removal from the blood vessels."

"The tigress left three cubs—two females and one male about a month old. For their nourishment she-goats are kept and they are suckling them. The cubs are quite well and in good condition. The incident occurred during the night."

We are indebted to the Editor of the *Times of India* for permission to publish the interesting photo reproduced above.

[EDITORS.]

No. XIII.—RECORD OF A DEATH FROM BITE OF THE HAMADRYAD OR KING COBRA (*NAIA HANNA*).

In your Journal, Vol. XXX, No. 1, 1st October 1924, on page No. 194, in the paper by Col. F. Wall, I.M.S., read before the B.N.H.S.'s meeting held on 22nd July 1924, it says:—

"I know of no case of a bite in a European."

About 10 or 12 years ago, Mr. Slater of the Geological Dept. of the Mysore Service was bitten by a King Cobra.

This happened at Hoonsakoltti, near Thirthally, in the Shimoga District, Mysore State, S. India.

The Forest Ranger informed me that Slater and a cooly were going out one morning with a 12 Bore gun. Close to the Traveller's Bungalow they saw the snake lying sunning itself. The cooly begged of Slater to shoot it. But Slater was keen on snakes, and finding that the Hamadryad was lying quiet went up and put his foot on its head. He was wearing long boots or leather leggings. But the snake managed to wrench its head loose and struck Slater above the knee, and escaped.

Slater cut the wounds and sucked the blood, and put ligatures, etc. The nearest doctor was sent for and everything possible was done. But Slater died in the evening.

The Thirthally jungles are noted for Hamadryads and local people hold it in great dread.

MYSORE, S. INDIA,
4th December 1924.

CHARLES THEOBALD, F.Z.S.

No. XIV.—RECOVERY FROM THE BITE OF *ECHIS CARINATA*.

The subject bitten was an Indian woman aged about forty years. The snake attached itself to her bare ankle and was killed by her husband, who was accompanying her.

She was seen by me five minutes later.

The snake was recognised to be an *Echis carinata*.

SYMPTOMS.—Very severe pain in the right foot at the seat of the injury. Pain running up the inner side of the leg. Vomiting. No symptoms of fear exhibited. Pulse normal.

Examination showed the foot to be swollen. There was a small raised patch immediately below the right internal malleolus. On the summit of this there were two small punctures from which there was a slight discharge of blood-stained serum.

TREATMENT.—A rubber torniquet was immediately applied below the knee. A local anæsthetic was injected into the surrounding tissues and a large crucial incision was made over the bite. The four resulting triangular flaps were dissected back. As much blood as possible was squeezed from the wound and then Potassium Permanganate crystals were well rubbed in. Calcium Chloride grs. 20 were given by the mouth.

The tourniquet caused so much pain that it had to be removed after three hours. Following this there was a moderate amount of bleeding which was checked by tight bandaging. The patient had a sleepless night owing to the pain. She was given Calcium Chloride grs. 15 t.i.d. and kept in a recumbent position.

From this on, her recovery was uneventful. She was allowed to sit up on the fourth day. Her wound healed by the eighth day. She is now quite well.

STATION HOSPITAL,
SATARA,
27*th September* 1924.

H. J. RICE,
Capt., I.M.S.

No. XV.—VIPER AND WHITE-THROAT.

On the 23rd July while looking for Birds' nests on a hill-side at about 6,000 feet altitude near Pari Mahal (Srinagar-Kashmir), I came across a White-throat's nest (*Sylvia curruca affinis*) in a low thorny bush, about 2 feet from the ground. To my surprise I saw the nest was occupied by a small snake.

I despatched the snake which was a viper, dark greyish brown in colour and 16 inches in length.

The viper had a marked bulge in its body which on dissection was found to be caused by the mother white-throat's body which had evidently been swallowed quite recently. The nest was empty, but the eggs or young had probably been disposed of by the snake before tackling the parent bird though I could not detect them in the snake's internal economy. This Viper is, I think, somewhat rare in Kashmir though the Pit Viper (*Ancistrodon himalayense*) is very common. This latter snake does not however climb bushes.

Srinagar,
Kashmir.

B. B. OSMASTON,
I. F. S. (*retired*).

[The viper referred to is possibly the Levantine viper (*Vipera lebetina.*) —EDS.]

No. XVI.—A LIST OF FISH OBTAINED IN THE SARAN DISTRICT, BEHAR, CHIEFLY FROM THE GHOGRA RIVER NEAR THE TOWN OF CHAPRA AND IN ITS VICINITY.

This collection was made many years ago during a period of about a year. Only a few of the smaller species were preserved in spirit but drawings to scale were made of most of the larger ones after they had been identified. Although the list shows some sixty species, more would have been added if observations had been prolonged over a longer period. Several common forms are not recorded and Elasmobranchs, in the form of Rays, are certainly found, for they are very common in the Ganges and even ascend the Jumna and it is at Chapra that the Ghogra joins the Ganges.

Some of these records are, nevertheless, interesting especially those of *Ophichthys boro* and of the Pipe Fish *Doryichthys cuncalus*. Local vernacular names of the fishes are given and in most cases the date and locality in which each specimen was taken. I have used for the species the nomenclature of Day in the Fish volumes of the Fauna of British India and have given his numbers after the serial number.

Order TELEOSTEI.

Suborder *MALACOPTERYGI.*

Family NTOPTERIDÆ.

1.	519.	*Notopterus kapirat*, Pallas. Common. R. Ghogra Darauli, 3-10-06.	*Golai Moi.*
2.	520.	*Notopterus chitala*, H.B. Chapra, R. Ghogra, 8-10-06 Common	*Moi.*

Family *Clupeidæ.*

3.	469.	*Clupea chapra*, H. B. Ghogra R. 20-10-06.	*Suaia.*
4.	470.	*Clupea ilisha*, H. B. Plentiful during the monsoon	*Hilsa.*
5.	498.	*Eugraulis tilara*, H. B. Ghogra R. 21-9-06.	*Phussia.*

Suborder *OSTARIOPHYSI.*

Family CYPRINIDÆ.

Subfamily *Cyprininæ.*

6.	295.	*Labeo gonius*, H. B. Ghogra R. 3-10-06 ..	*Kursa.*
7.	297.	*Labeo rohita*, H. B. Ghogra R. 30-8-06. Very common	*Rahu.*
8.	321.	*Cirrhina mrigala*, H. B. Ghogra R. 30-7-06.	*Nainee.*
9.	322.	*Cirrhina latia*, H. B. Ghogra R. 4-10-06 ..	*Rewa.*
10.	323.	*Cirrhina reba*, H. B. Ghogra R. 30-10-06..	*Bunsa.*
11.	332.	*Catla buchanani*, Cuv and Val Ghogra R. 25-10-06	*Cutla.*
12.	341.	*Barbus sarana*, H. B.	*Durhee.*
13.	375.	*Barbus parrah*, Day. Telpa, Ghogra R. 4-10-06	*Phurrah.*
14.	391.	*Barbus stoliczkanus*, Day	*Hurda.*
15.	398.	*Barbus stigma*, Cuv and Val. Chapra, Ghogra R. 22-10-06. Very common ..	*Pottiah.*
16.	399.	*Barbus crysopternus*, McClell	*Pottiah.*
17.	409.	*Nuria danrica*, H. B. Common	*Dahwiee.*
18.	411.	*Rasbora daniconius*, H. B. Common.	
19.	417.	*Rohtee cotio*, H. B. Chiran, Ghogra R. 14-10-06	*Gurda.*
20.	435.	*Barilus bola*, H. B. Chapra, Ghogra R. 17-10-06	*Girgittee.*
21.	449.	*Chela gora*, H. B. Chapra, Ghogra R. 2-10-06. Very common. Subfamily *Cobitidinæ.*	*Chelhua.*
22.	230.	*Botiadario*, H. B. Jelalpur, R. Ghogra 14-1-07	*Baghwa.*
23.	231.	*Botia gelo*, H. B. Jelalpur, Ghogra R. 14-1-07	*Baghwa.*
24.	237.	*Lepidocephalichthys guntea*, H. B. Chapra.	
25.	247.	*Nemachilus botius*, H. B. Chapra, Ghogra R. 9-1-07	*Nuktee.*

Family SILURIDÆ.

Subfamily *Clariinæ*.

26.	121.	*Clarias magur*, H. B.	*Mangri.*

Subfamily *Silurinæ*.

27.	131.	*Amblyceps mangois*, H. B. Chapra, Ghogra R. 20-11-07	*Banguri.*
28.	132.	*Saccobranchus fossilis*, Bloch. Ghegta, Ghogra R. Common..	*Singhee.*
29.	134.	*Wallago attu*, Bl. Schn. Khanua nulla, Ghogra R.	*Boyari.*
30.	135.	*Eutropiichthys vacha*, H. B. Chapra, Ghogra R. 2-10-06. Common	*Pias.*
31.	138.	*Callichrous bimaculatus*, Bloch. Chapra, Ghogra R. 27-9-06. Very common ..	*Ghuktee.*
32.	143.	*Ailia coila*, H. B. Indaie, Ghogra R. 30-9-06	*Suthree.*
33.	148.	*Pseudeutropius murius*, H. B. Ghegta, Ghogra R. 14-10-06. Common	*Bachua.*
34.	151.	*Pseudeutropius garua*, H. B. Chapra, Ghogra R. 22-9-06. Very common	*Ghorua Bachua.*
35.	154.	*Silundia gangetica*, Cuv, and Val. Very common	*Silond.*

Subfamily *Bagrinæ*.

36.	156.	*Macrones aor*, H. B. Chapra Ghogra R. 13-9-06. Very common	*Tangra.*
37.	163.	*Macrones cavasius*, H. B. Chapra, Ghogra R. 27-9-06. Very common	*Susna Tangra.*
38.	164.	*Macrones tengara*, H. B. Telpa, Ghogra R. 19-10-06. Very common	*Pulwa Tengra.*
39.	175.	*Rita buchanani*, Bleeker, Chapra, Ghogra R. 6-10-06 Common	*Reta.*

Subfamily *Doradinæ*.

40.	112.	*Sisor rhabdophorus*, H. B. Chapra, Ghogra R. Not common. Only observed once.. ..	*Chennuah.*
41.	207.	*Bagarius yarrellii* H. B. Revelgung, Ghogra R. 20-9-06. Common	*Goshta.*
42.	218.	*Erethistes hara*, H. B. Chapra, Tel nulla, Ghogra R. 30-10-06.	
43.	228.	*Nangra viridescens*, H. B. Ghagta, Ghogra R. 14-10-06	*Nunra Tangra.*

Sub order *APODES*.

Family ANGUILLIDÆ.

44.	95.	*Anguilla bengalensis*, Grey and Hardw. Bam. Not common, but taken now and then.	
45.	105.	*Ophichthys boro*, H. B. Chapra, Ghogra R. ..	

Sub order *CATOSTEOMI*.

Family SYNGNATHIDÆ.

46.	1361.	*Doryichthys cuncalus*, H. B. Ghogra R.	

Sub order *PERCESOCES.*

Family SCOMBRESOCIDÆ.

47. 536. *Belone cancila*, H. B., Chapra, Ghogra R. 21-9-06. Very common .. .. .. *Kowal.*

Family MUGILIDÆ.

48. 1182. *Mugil corsula*, H. B. Ghogra R. Very common .. .. *Arwari.*

Family OPHIOCEPHALIDÆ.

49. 1295, *Ophiocephalus gachua*, H. B. Revilgung, Ghogra R. 5-1-07. Common .. .. .. *Charna.*

50. 1203. *Ophiocephalus striatus* .. .. .. *Gurrai.*

51. 1206. *Ophiocephalus punctatus*, Bloch., Tank, Chapra, 1-10-06. Common .. .. *Ghurrai.*

Sub order *ACANTHOPTERYGII.*

Division PERCIFORMES.

Family NANDIDÆ.

52. 827. *Nandus marmoratus*, Cuv, and Val. Newajitola, Ghogra R. 30-10-06 .. *Dhalo.* The specimen figured is rather pale and devoid of all marblings on the body but some are present on the head and there is a dark spot on the free portion of the tail.

Family SERRANIDÆ.

Subfamily *Ambassinæ.*

53. 628. *Ambassis nama*, H. B. Chapra, Ghogra R. 27-10-06. Very common .. .. .. *Tikulia.*

54. 629. *Ambassis ranga*, H. B. Very common .. *Tikulia.*

Family SCIÆNIDÆ.

55. 868. *Sciæna coitor*, H. B. Ghogra R. 30-9-06 .. *Puthree.*

Family OSPHROMENIDÆ.

56. 1215. *Trichogaster lalius*, H. B. Kuthrie, Chapra, Ghogra R. 17-10-06. Very common. *Dhal.*

Division GOBIFORMES.

Family GOBIDÆ.

57. 1093. *Eleotris, fusca*, Bl. Schn, Bulla. Chapra, Ghogra R. 16-10-06. .. .. ..

Sub order *OPISTHOMI.*

Family MASTACEMBELIDÆ.

58. 1155. *Rhynchobdella aculeata*, Bloch., Chapra, Ghogra R. 25-9-06 .. .. *Gaichee.*

59. 1159. *Mastacembelus armatus*, Lacep. Chapra, Ghogra R. 29-9-06 .. .. *Bamie.*

Sub order *PLECTOGNATHI.*

Family GYMNODONTES.

60. 1406. *Tetrodon cutcutia*, H. B., Newajitola, Ghogra, R. 16-9-06 .. .. *Dathkirwa.*

E. A. D'ABREU,
Curator,
Nagpur Museum.

No. XVII.—THE OCCURRENCE OF THE SPINY-EEL (*RHYNCHOBDELLA ACULEATA* BLOCH), IN THE CENTRAL PROVINCES AND EXTENSION OF ITS HABITAT.

The distribution given by Day for this fish in India is limited to the brackish waters within tidal influence in the deltas of the larger rivers.

It really ascends the rivers to a far greater distance, and will probably prove to have a much wider range even in fresh-water tanks far from tidal-influence. It is common in the Ganges at least as far as Patna and Chapra and is even found in the Ghogra. In Behar, it is well known and has a distinct vernacular name '*Gaichee*'; differentiating it from *Bamie* and *Bam*, the terms applied to *Mastacembelus armatus* and other eels. I was not a little surprised when I found I had taken two specimens from an inland tank at Nagbhir in the North of the Chanda district in these provinces.

Other spiny-eels found locally are *M. armatus* and *M. pancalus*. The former may easily be recognised by its continuous dorsal, caudal, and anal fins. *R. aculeata* resembles *M. pancalus* in having the caudal fin disconnected with the dorsal and anal, but may be distinguished by having the snout transversely striate below and by the ocelli on the dorsal fin. The only other known Indian representative of this genus is *R. dhanashorii*, Hora, described in the Records of the Indian Museum, Vol. XXII, p. 205, from a single individual obtained in Dhanashori stream, about a mile from Dimapur, Assam. It was also taken far inland and in fresh water. This species differs from *R. aculeata* in having a characteristic colouration quite unlike *aculeata*. It is dull olivaceous with pale lines extending downwards and forwards from the base of the dorsal fin and becoming obscure in the belly region. Behind the vent these lines are joined together in an irregular manner to form a reticulation. A pale longitudinal band extends backwards from behind the eye and becomes obscure in the post anal region. The lower surface is pale, speckled with black on the lower surface of the head. The fins are dark, minutely banded and speckled with dull white; there are no ocelli on the dorsal fin. Its proportions are also different and the caudal and pectoral rays are 16 and 17 respectively, while in *aculeata* they are 15 and 23.

E. A. D'ABREU, F.Z.S.

CENTRAL MUSEUM,
NAGPUR, C. P.,
8th November 1924.

No. XVIII.—FORMULA FOR ESTIMATING WEIGHT OF MAHSEER.

For several years past I have always made it a practice to carefully measure my fish in addition to weighing them, and, with a very few exceptions, have not been satisfied that the most generally recognised formula for estimating their weight from the measurements is as correct as it might be, at any rate when applied to Lake Mahseer, such as are caught in Lake Fife, Khadakwasla, near Poona.

The earliest reference to any formula for this purpose is so far as I am aware, that referred to on page 74 of 'The Angler's Handbook' by G. H. Lacey and Dr. E. Cretin, and is, I think, the one most generally accepted, reading as follows :—

" First take the length and girth of the fish in inches ; add " together the length, and one-third of the length ; multiply the result by the square of the girth,and divide by 1,000, and the result will be the weight of the fish in pounds."

This formula may briefly be written down thus :—

$$\frac{(L + \frac{1}{3}L) \times (G)}{1000} = W$$

The author states that he has tried this formula with fish of all sizes up to 61 lbs., and found it approximately correct, *i.e.*, within 2 lbs. of actual weight in all fish up to 50 lbs., the tendency being to be a little in excess of *actual* weight. He further goes on to describe how the measurements should be taken :—" The length for this calculation is taken from the mouth (closed) to the *end* of the tail, and the girth is that of the thickest part of the fish's body.....the tail should not be closed when measuring for the data for this calculation. It should be expanded or stretched to its full extent as if the fish was swimming."

Another formula is given on page 139 of the same edition under the heading ' Weighing Giant Fish.' :—" Take the length of the fish *in feet*, leaving out the tail; cube the number thus got, the product will be the weight in pounds, *i.e.*, Weight = (length in feet) 3."

This is obviously a much too rough and ready rule to apply to smaller fish weighing from twenty to thirty pounds, and, as Thomas points out on page 37 of ' The Rod in India' (third edition), entirely ignores the question of girth which obviously must be taken into consideration in order to arrive at any approximately correct result. As regards this omission of girth the latter author goes on to say :—" This omission.....is met by a kindly correspondent writing to me that he has found the following pretty correct :—' Take' he says, 'the length and girth in inches. Add together, and divide by two. This gives the weight in pounds pretty near.' "

As Thomas then proceeds to point out, however, this formula cannot possibly be applied to small fish. His remarks are as follows :—" Possibly it does when fish run over a certain weight, say ten or fifteen pounds, but it must be surely very much out when they are smaller. For instance a masheer of twelve inches long, without adding anything for girth, can never weigh six pounds." Even for larger fish I found this formula hopelessly inaccurate as the following two instances taken at random from my records of weights and measurements will show—

A ten pound fish measured 30" in length and 17" in girth.
A 15 lbs. fish " 33½" " " 19½" "

According to the above formula the former should weigh 23½ lbs. and the latter 27 lbs., the error in one case amounting to 13½ lbs. and to 12 lbs. in the other, which results speak for themselves.

' Skene Dhu ' in referring to the first of the three formulae mentioned above states on page 193 of ' The Mighty Mahseer' that it is generally fairly accurate with mahseer. He does not however state how the length of the fish is to be taken, so presumably his method of measurement is the same as previously quoted.

The above are the only three formulae with which I am acquainted and, for reasons shown above, we need only concern ourselves with the first when dealing with mahseer, this being :—

$$\frac{(L + \frac{1}{3}L) \times (G)^2}{1000} = W$$

where L is the extreme length in inches when the tail is opened and G the girth, W being the weight in pounds.

I will in future refer to this formula as ' A.'

I have now very carefully measured forty fish of all sizes ranging from 2 lbs. to 21½ lbs. In applying the formula ' A ' I found that *in every case* the result was an error *in excess*, the actual amount of error increasing more or less proportionately as the size of the fish measured also increased, thus proving that, as the *percentage* of error was fairly constant, the fault lay in the formula.

I thereupon adopted the same formula but with the following alteration, *i.e.*, that the length was taken from the mouth (closed) to the *fork* of the tail.

I will call this amended formula ' B.'

I then applied formula ' B' to the same forty fish, but found that although this was considerably more accurate than ' A' the general tendency of the error was still *in excess*, there being only four cases where the error was a ' minus ' one, and of these cases the amount of error in three was negligible.

I therefore again modified the formula by substituting ' ¼ length ' instead of '½ length ', this final formula which I will call ' C,' reading as follows:—

$$\frac{(L + \frac{1}{4}L) \times (G)^2}{1000} = W$$

where G is greatest girth and L is the length from the closed mouth to *fork* of tail.

On applying formula ' C ' to the same forty fish again the results were even better than I had hoped.

Out of the forty fish measured in 31 cases 'C' was more accurate than ' B ', whilst in only 3 cases did 'A' give a more correct result than ' C '.

In only three cases did ' C ' show an error in excess of one pound, (but under 2 lbs.), and these three fish were all abnormal.

In two cases the girth measurements were abnormally large in proportion to the length, and the errors shewn by ' A ' for both these fish exceeded 4 lbs., whilst ' B ' also showed an excess error of more than 2½ lbs. in both instances.

In the third fish the girth was abnormally small, and in this case ' A ' was the most correct formula of the three.

The errors under ' C ' were more or less evenly divided under + and — heads, but the general tendency (excluding the three abnormal fish) was to very slightly *under*-estimate.

The summarised statement below gives the *net* results of the experiments with the three different formulae, and also the *average* errors both including and excluding the three abnormal fish referred to above.

All the fish which were measured were caught in Lake Fife, and it is possible that these fish are of a 'stockier' build than those taken from running water. It would be interesting if other anglers would apply this formula to river fish and state the results. At any rate I feel certain that, so far as Lake Mahseer are concerned, it will be hard to evolve any other formula which will give better results than ' C, ' a net error of less than one pound in nearly four hundred pounds of fish weighed being an extraordinarily accurate result.

All the fish were weighed on a fixed spring balance which has been carefully checked with standard weights and found absolutely correct.

SUMMARY OF TESTS.

Number of fish weighed.	Actual aggregate weight of fish in pounds.
40	393.00

NET ERRORS OF FORMULAE IN POUNDS.

' A '	' B '	' C '
+64·64	+25·82	+ ·79

AVERAGE ERRORS OF FORMULAE IN POUNDS.

' A '	' B '	' C '
1·61	·69	·31

AVERAGE ERRORS OF FORMULAE IN POUNDS
(when excluding the three abnormal fish referred to above).

'A'	'B'	'C'
1·49	·59	·29

Formula 'A' $\frac{(L + \frac{1}{3}L) + (G)^2}{1000} = W$ Where L = extreme length from mouth to tail.

Formula 'B' $\frac{(L + \frac{1}{3}L) + (G)^2}{1000} = W$ Where L = length from mouth to *fork* of tail.

Formula 'C' $\frac{L + \frac{1}{4}L + (G)^2}{1000} = W$ Where L = length from mouth to *fork* of tail.

W. B. TREVENEN,
Major.

C.W.I., POONA, *February* 1925.

No. XX.—THE CEYLON RACES OF *TERIAS BLANDA*, Bdv., AND *SARI*, Horsf.

In 1881 Moore in his "Lepidoptera of Ceylon" described and figured under the name of *Terias rotundalis* what he supposed to be the two sexes of a single species, but which we now know belong to different species, *blanda* and *sari*, each represented in Ceylon by a distinct race; and as the same name cannot be borne by two species or races in the same genus, the question arises which is to have it. In all matters of naming we museum "naturalists", a maligned but harmless and even necessary crowd, grope our difficult way by means of the rules and decisions laid down by the International Commission on Zoological Nomenclature, helped out, as are all laws, by common usage. In this particular case there seems to be no definite decision that applies, but in practice it has been thought to be in accordance with the general "law of priority" that the sex whose description comes first in the text usually the ♂, should retain the name, and that what follows about the ♀ (or of course the ♂ if that comes last) should be treated as a mistaken addition and disregarded.

In cases however where the first-mentioned is already provided with a valid name, then to prevent the new name being wasted, the second partner in the ill-assorted union has been allowed in usage to retain it, and this seems on the whole a sensible plan. But in the case of *rotundalis* this concession does not apply. There was no valid prior name, for the name *citrina* introduced by Moore on the preceding page had been already used in the genus *Terias* and so was "stillborn".

Consequently, it seems to me that the first-mentioned, the ♂ needs the name and must have it, and no subsequent names (*uniformis*, *templetonii*) applied to the subspecies of *blanda* which the ♂ represents can alter this fact, or permit the transfer of the name *rotundalis* to the ♀ which represents the *sari* sub-species. Hence Bingham in 1907, keeps the name *rotundalis* under *silhetana* (=*blanda*) and when we find Ormiston (Spolia' Zeylanica xi, p. 135-p. 158, Oct. 1919) describing and figuring the ♀ together with its proper ♂ as *rotundalis*, for the reasons given above I hold his action invalid, and propose to rename the Ceylon race of *sari* as *ormistoni*, nom. nov. and to restrict the name *rotundalis* to the race of *blanda*.

Type, Moore's original ♀ specimen, now in B. M. Description figures ♂ ♀, as above.

BRITISH MUSEUM (NATURAL HISTORY),
S. KENSINGTON.

H. T. G. WATKINS.

PROCEEDINGS.

Proceedings of the Annual General Meeting held on the 4th February 1925.

The annual general meeting of the members of the Bombay Natural History Society was held in the Board Room of the Prince of Wales' Museum on February 4 at 6 p.m. The Hon. Sir Norman Macleod presiding.

The following 21 new members were elected since the last meeting:—Mrs. J. R. Hood (England), Mr. F. X. Miranda (Savantwadi), Captain S. L. Bhatia (Bombay), Dr. R. Wittwer (Bombay), Major J. D. Scale (Assam), Mr. R. C. Richardson (Khandwa, C. P.), Mr. E. S. Lewis (Delhi), The Principal (ex-officio), of the Royal Institute of Science, Bombay; Mr. E. Sheehy (Bombay), Mr. V. S. Kupuswamy (Bellary), Dr. J. N. Leith (Lumbding, Assam), Mr. T. K. Mirchandani (Dharwar), Mrs. O. A. Geoghegan (Dera Ismail Khan), Mr. B. H. Osmaston, (Haldwani, U. P.), Mr. J. I. Miller (Calcutta), Mr. J. E. Duncan, (Mandalay), Mr. Wm. T. Tallent-Bateman (Bombay), The Mess Secretary, 5-12th F. F. Regiment, Q. V. O. Corps of Guides, Aden; Mr. E. P. Laurente (N. Shan States, Burma), Lt.-Col. F. C. Bewsher (Saraband, Palestine), Lt. L. A. G. Pinhey (Delhi).

The appointment of offices for the ensuing year was as follows:—Patron: H. R. H. the Prince of Wales, Vice-Patron—H. H. the Maharao of Cutch, President—H. E. the Rt. Hon. Lt.-Col. Sir Leslie Wilson; Vice-Presidents—The Hon. Sir Norman Macleod, H. H. the Maharao of Cutch, Rev. E. Blatter, S.J.; Managing Committee—Mr. T. Bainbridge Fletcher, Pusa; Mr. T. R. Bell, Karwar; Mr. R. D. Bell, Bombay; Mr. J. P. Bradshaw, Bombay; Mr. H. A. W. Brent, Bombay; Lt.-Col. W. H. Evans, Simla; Major F. C. Fraser, Mercara; Dr. F. H. Gravely, Madras; Prof. V. N. Hate, Bombay; Mr. J. E. B. Hotson, Bombay; Mr. C. M. Inglis, Darjeeling; Mr. F. Ludlow, Tibet; Sir Henry Macnaghten, Bombay; Mr. J. G. Ridland, Bombay; Mr. P. M. D. Sanderson, Calcutta; Major C. H. Stockley, Kohat, N. W. F. P.; Dr. D. A. Turkhud, Madras; Col. F. Wall, Maymyo; Mr. H. Whistler, Punjab; Ex-officio Members—Mr. R. A. Spense, Honorary Secretary; Mr. G. F. J. Cumberlege, Honorary Treasurer.

The Honorary Treasurer Mr. G. F. J. Cumberlege placed before the meeting the audited statement of accounts, which, together with the Treasurer's report, will be published in full in the Journal.

Continuous progress has been made in the Natural History Section of the Prince of Wales' Museum.

Members were able to inspect the new fully mounted Gaur or Indian Bison presented to the Society by the Forest Department. The animal, which is a splendid bull gaur, stands nearly 6 feet at the shoulder and carries a grand pair of horns. It was mounted in the Society's Laboratories, under the Curator's supervision, by Mr. C. McCann, the Society's Assistant Curator, and does great credit to the high standard of work achieved by the Preparation Department. The animal gives a graphic impression of the massive proportions of the Indian Gaur, the largest of existing bovines, and makes a splendid acquisition to the Mammal Gallery.

Mr. S. H. Prater, the Curator, delivered an interesting lecture on Indian Reptiles. The lecturer carried his audience back to the remote past, millions of years before man's appearance, when reptiles held dominance over the earth. He showed how reptiles were at that time adapted to every mode of existence.

At the present day reptiles no longer possessed the mastery of the earth, the sky or the sea. No reptiles possessed the power of true flight—and if we excluded the sea snakes which were comparatively small in size—no reptiles were truly marine, even the sea turtles had to come ashore to deposit their eggs. On land the reptiles no longer compared in size to their gigantic ancestors—some of them found refuge as burrowers in the earth or by hiding on its surface, others found food and shelter on trees while a number led a semi-aquatic existence on marshes, lakes and rivers.

After defining exactly what was meant by the term reptiles, the lecturer proceeded to deal with four main classes of reptiles, the crocodiles, tortoises, lizards and snakes.

Coming finally to the treatment of snake bite the lecturer explained that the tying of a ligature, incision of the wound or even amputation of the limb though recommended as being useful in reducing the amount of venom taken up in the system were of little value if a lethal dose had already been absorbed.

Science had provided an efficient remedy against the bite of the Cobra and the Russel's Viper in the anti-serum now manufactured at Kassauli and available at the Parel Laboratory. No serum was available against the bite of the Krait; the Phoorsa and other poisonous snakes because a sufficient quantity of the venoms of these snakes was not available for the manufacture of anti-serums on a commercial basis but for this we would have a remedy against the poison of any snake. The lecture was illustrated with a fine series of lantern slides reproduced from photographs by the Assistant Curator, Mr. C. McCann.

ACCOUNTS FOR 1924.

The Honorary Treasurer Mr. G. F. J. Cumberlege placed the audited statement of accounts before the meeting. He said—"The first thing that will probably strike you is the closing accounts of Rs. 6,564-0-7 which is about Rs. 29,000 less than we opened with two years ago. The Journal Account and the Game Bird Books are the heaviest drain on our funds and it is interesting to note that about Rs. 30,000 are locked up in stock of Journals and Rs. 25,000 in Game Books—a total of Rs. 55,000. It is estimated that the other books and charts published by the Society have a value of Rs. 6,000, so that in all Rs. 60,000 is locked up in stock and over Rs. 20,000 is still due to the publishers and binders for Game books not included in the above estimate. It is not very gratifying to learn that only 18 copies of each volume were sold last year. Enquiries are being received for the next volume of the Game book, but there can be no talk of further publishing activities till funds are forthcoming, and the only way we can raise funds is by members doing all they can to rope in new members and to make them buy the Society's publications. Last year the Honorary Treasurer said he hoped the Publishers of the Journal would reduce their charges, but you will see that this item has, in fact, increased, by about Rs. 1,300. No doubt the Honorary Secretary will tell us of his unsuccessful efforts to get the better of the publisher.

At the close of 1923 the number of members on the books were:—Life members 155 and ordinary members 1,131. At the close of 1924 the Life members number 161 and ordinary members 1,122, showing an increase of 6 Life members and a decrease of 9 ordinary members, 81 members joined during the year and deaths and resignations amount to 93. In terms of cash it means that our subscriptions have dropped by Rs. 3,828-7-3.

Salaries show a saving of Rs. 3,049-11-8, the increase of Rs 3,200-0-0 last year being due to Mr. Ellison's gratuity. Excluding this item, salaries have increased by Rs. 151. The Prince of Wales Museum still contributes half the salary of certain of the Society's employees.

With the exception of rent practically every other item of expenditure has been reduced, thanks to the energy of the Hon. Secretary.

The Mammal Fund. This shows a further drop, the closing balance being Rs. 4,298-2-9 against an opening balance of Rs. 10,153-5-7. Colonel Meinetzhagen is however kindly paying Mr. La Personne's salary for the next eighteen months under an arrangement which is very satisfactory to the Society. Mr. La-Personne's salary is by far the heaviest item of expenditure in the Mammal Fund.

It is proposed shortly to close the Mammal Fund and merge it into the common account. There seems no point in running two accounts and, in fact, by doing so we lose interest on our funds."

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT OF ACCOUNTS from 1st January to 31st December 1924.

Dr. Cr.

RECEIPTS.	Rs. a. p.	Rs. a. p.
OPENING BALANCE ON 1ST JANUARY 1924.		
Fixed Deposit with the Netherland Trading Society	6,000 0 0	
Balance on Current Account with National Bank of India, Ltd., Bombay	4,560 10 9	
Cash on hand	250 0 0	
Balance on Current Account with National Bank of India, Ltd., London, £171-7-3 @ 1	2,570 7 0	13,381 1 9
Collection of Subscription in arrears	529 8 0	
" " for current year	23,326 6 0	
" " in advance	1,036 0 0	
	24,891 14 0	
Less—Refund of Subscription	287 9 0	24,604 5 0
Life Membership Subscription	1,574 8 0	
Entrance fees	1,800 0 0	3,374 8 0
Registration fees	335 0 0	
Sales of Journals	2,647 9 4	
" Snake Charts	882 15 7	
" Game Books	1,594 6 0	
" Snake Books	79 2 0	
" Pigeon Books	56 0 0	
" Other printed matters	24 0 0	
" Hand List of Birds	79 8 0	
" Iraq Fauna	64 6 0	
" Plates	96 0 0	
Taxidermy Charges	420 8 0	
Charges recovered	123 6 8	
Sundries	353 3 10	
Interest on Investments, etc.	3,667 10 3	
Receipts from Advt. in the Journals	283 12 0	10,707 7 8
Advance to Staff recovered 1923	140 0 0	
" " " 1924	320 0 0	460 0 0
		Rs. 52,527 6 5

PAYMENTS.	Rs. a. p.	Rs. a. p.
Journal Account	22,387 12 4	
Salaries	14,564 13 4	
General Charges, Petty Cash, etc.	1,300 14 6	
Rent	4,554 4 0	
Printing and Stationery	440 5 0	
Postage	1,293 8 0	
Library Account	232 12 8	
Furniture	112 8 0	
Audit Fee	250 0 0	
Fire Insurance Premium	187 8 0	
Profit on Snake Books paid to Col. Wall	62 0 0	45,386 5 10
Amount advanced to Staff during 1924	....	577 0 0
Amount transferred in Mammal Fund	1,000 0 0	
Balance on Current Account with National Bank of India, Ltd., Bombay	2,735 5 7	
Cash on hand	150 0 0	
Balance on current account with the Nat. Bank of India, Ltd., London, £178-11-7 @ 1	2,678 11 0	6,564 0 7
		52,527 6 5
Securities with the National Bank of India, Limited, Bombay.		
3½% Govt. of India Pro-Notes	8,800 0 0	
4 % Govt. of India Conversion Loan	10,000 0 0	
4 % Bombay Port Trust Ungd. Bonds	14,000 0 0	
4 % City of Bombay Imp. Trust Bonds	15,000 0 0	
6½% Bombay Development Loan	8,000 0 0	
6 % Bonds 1926 Pro-Notes	10,000 0 0	
	Rs. 65,800 0 0	

BOMBAY, *30th January* 1925.

Examined and found correct.
(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

We have seen a letter from the National Bank of India, Ltd., Bombay, to the effect that the above Securities were held on the Society's behalf on 31st December 1924, also a certificate from the National Bank of India, Ltd., London, for the balance with them.

(Sd.) G. F. J. CUMBERLEGE,
Honorary Treasurer,
Bombay Natural History Society.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

MAMMAL FUND ACCOUNT.

BOMBAY NATURAL HISTORY SOCIETY.

Dr. *STATEMENT OF ACCOUNTS from 1st January to 31st December* 1924. Cr.

	Rs. a. p.	Rs. a. p.		Rs. a. p.	Rs. a. p.
OPENING BALANCE ON 1ST JANUARY 1924.					
Fixed Deposit with Netherlands Trading Society at 3½ per cent.	9,000 0 0		Salary of Mr. V. S. LaPersonne	3,622 10 0	
			,, Mr. C. McCann	1,400 0 0	5,022 10 0
On Current Account with the National Bank of India, Ld., Bombay	1,153 5 7		Cost of Cartridges	202 10 0	
		10,153 5 7	Audit fee	30 0 0	
Interest on Current Account	29 13 0		Freight on Specimen boxes, &c	212 6 6	
,, Fixed Deposit	341 9 7		Travelling expenses to Collector	259 8 0	
Sale proceeds of gun	111 0 0		General charges and Sundries	179 4 9	
		482 6 7	Postage and Telegrams	56 5 0	
Loan from Society's account		1,000 0 0	Collecting expenses	1,374 13 2	2,314 15 5
			Fixed Deposit with Netherlands Trading Society at 4½ per cent	3,500 0 0	
			On Current Account with National Bank of India, Ld., Bombay	798 2 9	4,298 2 9
		11,635 12 2			11,635 12 2

BOMBAY, 30th *January* 1925.

Examined and found correct.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

(Sd.) G. F. J. CUMBERLEGE,
Honorary Treasurer,
Bombay Natural History Society.



SHOU (*Cervus wallichi*)
Shot by Major A. de C. Rennick



SHOU (*Cervus wallichi*)
Bombay Nat. Hist. Society's Collection

JOURNAL

OF THE

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DEC., 1925 VOL. XXX No. 4

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES

BEING NATURAL HISTORY NOTES

BY

COL. A. E. WARD

PART V

(*Continued from page* 524 *of this volume.*)

(*With one plate and three text figures.*)

[1] *CERVIDAE :* The Deer (*contd.*)

The Shou.—*Cervus wallichi.*

There seems to be little doubt as to the habitat of this fine deer, which may be briefly stated as Northern Bhutan and the Tangpo and Brahmaputra Valleys and Southern Tibet.

Not many Shou have been shot by Europeans, but several pairs of horns have been purchased or given to travellers.

The head figured on the plate is in the Bombay Natural History Society's collection. Plate 1 also shows a Stag shot by Major A. de C. Rennick, who kindly sent me the photograph. Rowland Ward gives the measurements:—

Outside curve	Girth	Tip to tip	Points
46″	5 and $\frac{7}{8}$	25″	5 + 5

Colonel F. M. Bailey, to whom I am much indebted, shot a Shou on September 12, 1913; the description was published in *The Field*, October 3, 1914. Reference can only be made to Bombay Natural History Society's Journal, XXIV, No. 1, where Bailey's interesting notes from Southern Tibet are published.

Hodgson, many years ago, presented a head ($55\frac{3}{4}$″ × $6\frac{1}{2}$″) of ten points to the British Museum. Major Rennick also gave his specimen and Mr. A. O. Hume had two or three pairs of horns and

[1] The previous article on the *Cervidae* of Kashmir appeared on pages 253 *et seq.* of this volume.—EDS.

these he bequeathed to the same Museum. Colonel Bailey also found horns of 54″ and Colonel Tanner brought down from Northern Bhutan a beautiful head, of the same length. This was in Simla for some years and was greatly admired. I do not know from where Lydekker copied the Shou's head he shows as a typical specimen, but it is very like Tanner's. The brow antler appears to be short, as is the case generally with the Hangul or Kashmir Stag, but exceptions are found to occur in both species—the third tine is shorter than the second in most antlers. On Major Rennick's specimen the brow antler is well developed.

Compared with the Kashmir Hangul the skull of the Shou is very much larger: the Hangul's skull is in extreme length from 15½″ to 16″ whilst the skull of a Shou is 17½″ and Blanford gives a measurement of 18¼″.

Judging from the comparatively few antlers about whose identity there is no doubt, the number of points are, like the Kashmir Stag, normally 5 + 5 in number; but one of Mr. Hume's specimens was 7 + 6, and Rowland Ward gives two others as 8 + 6 and 6 + 5. Again, Lydekker mentions a head with 13 points from a valley not far from Lhassa.

The Shou is amongst the largest of the Red deer, the antlers are not unlike those of the Hangul, the beam bends forward from the trez tine and the shape of the beam is not unlike that of the Spotted deer.

The subdivision of the Shou deer into two races appears to be unjustifiable, and the report of its existence near the sacred lakes of Mansarowar appears to be untrue; anyone who has gone up the Sutlej to its source must know that there is no grazing or browsing to be had. Not very far to the southward is the Tarai where there are no Shou, and the Tarai is the only forest in which this huge deer could exist.

Thorold's Deer.—*Cervus albirostris.*

Thorold's Deer is of medium size; it is brown in colour with the inner portion of the ears white; so also is the muzzle. The yellow on the buttocks is very plainly to be seen. There is no trez tine.

It is believed that Przewalski first obtained this deer, and Dr. Thorold undoubtedly obtained two specimens north of Lhassa; in consequence arose the name of 'Thorold's' deer or '*Cervus thoroldi*.' The habitat is northwards and north-eastward of Lhassa.

The largest horn is mentioned on page 31 of Rowland Ward's *Records of Big Game* (eighth edition of 1922).

Length of horn on outside curve	Tip to tip	Widest inside	Points
47″	34¼″	36½″	5 + 5

The locality is Central Tibet: what is exactly meant by Central Tibet it is difficult to determine, but probably the habitat given above is more appropriate.

The only photograph I have is not my property nor do I know where the horn was found.

Knowing so little about the deer I propose to conclude this portion of the article with the remark that Thorold's deer is a distinct species.

Having now dealt with the Elaphine group of deer let us take up the beautiful Roe that is called the Siberian Roe deer or the Asiatic Roebuck.

Genus *CAPREOLUS*: ROE DEER.



The Siberian Roe.—*Capreolus pygargus.*

THE SIBERIAN ROE.—*Capreolus pygargus.*

The common native name is *Illik*. The late Mr. Church writes on the subject of this animal, giving details of its pursuit. The distribution is the Altai, parts of the Caucasus, Turkestan, etc.[1]

[1] The typical race is from the Semiretshinsk Altai,

The Thian Shan race is called '*tianschanicus*'. Some of the finest heads are from the Thian Shan, notably one shot by Col. C. B. Wood, who very kindly contributed the beautiful photograph.

Length on outside curve	Circumference	Tip to tip
17"	$4\frac{3}{8}$	$12\frac{3}{4}$"

These are Rowland Ward's measurements. One longer is mentioned on page 85 of his records. Numbers of this animal have been shot.

Years ago I arranged with the late Rajah Sir Amar Singh to endeavour to import and acclimatize the Siberian, or as it is generally called, the Manchurian Roe in the State Game Reserves belonging to His Highness the Maharajah. The plan fell through when I left Kashmir in 1908; since then, the importation of this Roe has been talked about. Roe deer are difficult to deal with in captivity, but if they could be brought down safely they ought to do well, provided the leopards and Indian martens could be kept down. The climate of Kashmir would be quite suitable.

Genus *Muntiacus*: Barking Deer.

The Barking Deer.—*Muntiacus vaginalis.*

The Barking deer is widely known in India and in the Himalayas as the *Khakur*. I have never heard the name *Jungly Bakri* except in parts of the Central Provinces.

The range includes India, Burma, the Malay Peninsula, Siam, Java, Sumatra, Borneo, etc. The several races that are distributed over this wide area need not be dwelt upon in the present paper. A short—horned species known as *Muntiacus crinifrons* occurs in Eastern China.

Distribution. Throughout most parts of India, in Burmah, Ceylon, etc.—in most of the hilly tracts.

Most sportsmen have shot the Barking deer, coming on the nimble little animal suddenly in the more open forest, or hearing its peculiar startled call in the dense ringal clumps or amongst bush jungle—the startled call is distinctly a bark of fright.

Personally, I have always had a dislike to shooting this delightful deer owing, as I do to it, success in getting a tiger, that was the terror of the lower Siwalik Hills, and in ridding the vicinity of hill stations of dog-eating leopards.

The Barking deer has long upper teeth or tusks protruding from the gums. With these tusks the animal can cause gashes. Gunga, a grand companion who followed me for years, was once badly cut in the fleshy part of the thumb, by the tusks of a Muntjac; the wound took weeks to heal.

If the Barking deer can be got to feed and are allowed to be loose they thrive well. Being inordinately fond of grain, they must be carefully guarded on the march. A tame barking deer used to jump up into a Bunniah's cart; finally it succumbed to eating too much grain.

Dunbar Brander puts the weight of a good buck at 48 lb., height at shoulder 24 inches. A female weighed close on 38 lb., that is an

abnormal weight. The average of five very large bucks was—height, 26″; weight 46 lb. A really good horn is given on page 217 in Mr. Dunbar Brander's delightful work, *Wild Animals in Central India.*

Horn outside curve	Girth	Tip to tip
7″	$3\frac{3}{4}$″	$3\frac{1}{8}$″

The hairy pedicle which carries the horn measures about 4″. Barking deer cast their horns annually. I see no reason to doubt this fact, undoubtedly the horns are shed in the summer months when few sportsmen care to tramp about amongst the hills, and as the horns are generally hard by October the idea has been formed that this deer does not shed its horns year by year. Living as I have done in the jungles throughout the year I have always seen hornless muntjac in July and August and have frequently picked up fallen horns.

The colouring varies from dark to fairly light red; the stomach, under the jaw and part of the throat are white as a rule.

Females are said to be of a lighter red, but this is not very marked.

Genus *Moschus*: MUSK DEER.



The Musk Deer.—*Moschus moschiferus moschiferus.*

THE MUSK DEER.—*Moschus moschiferus moschiferus.*

Kastura (=Musk) is the native name in most of the Himalayas—*Rebjo* in Laddak. *Rous* and *Kastura* in Kashmir.

Distribution.—The Himalayas extending from the East to Gilgit on the west. Found also in China and Siberia. The Chinese race to the westward is called *Moschus moschiferus sijanicus.*

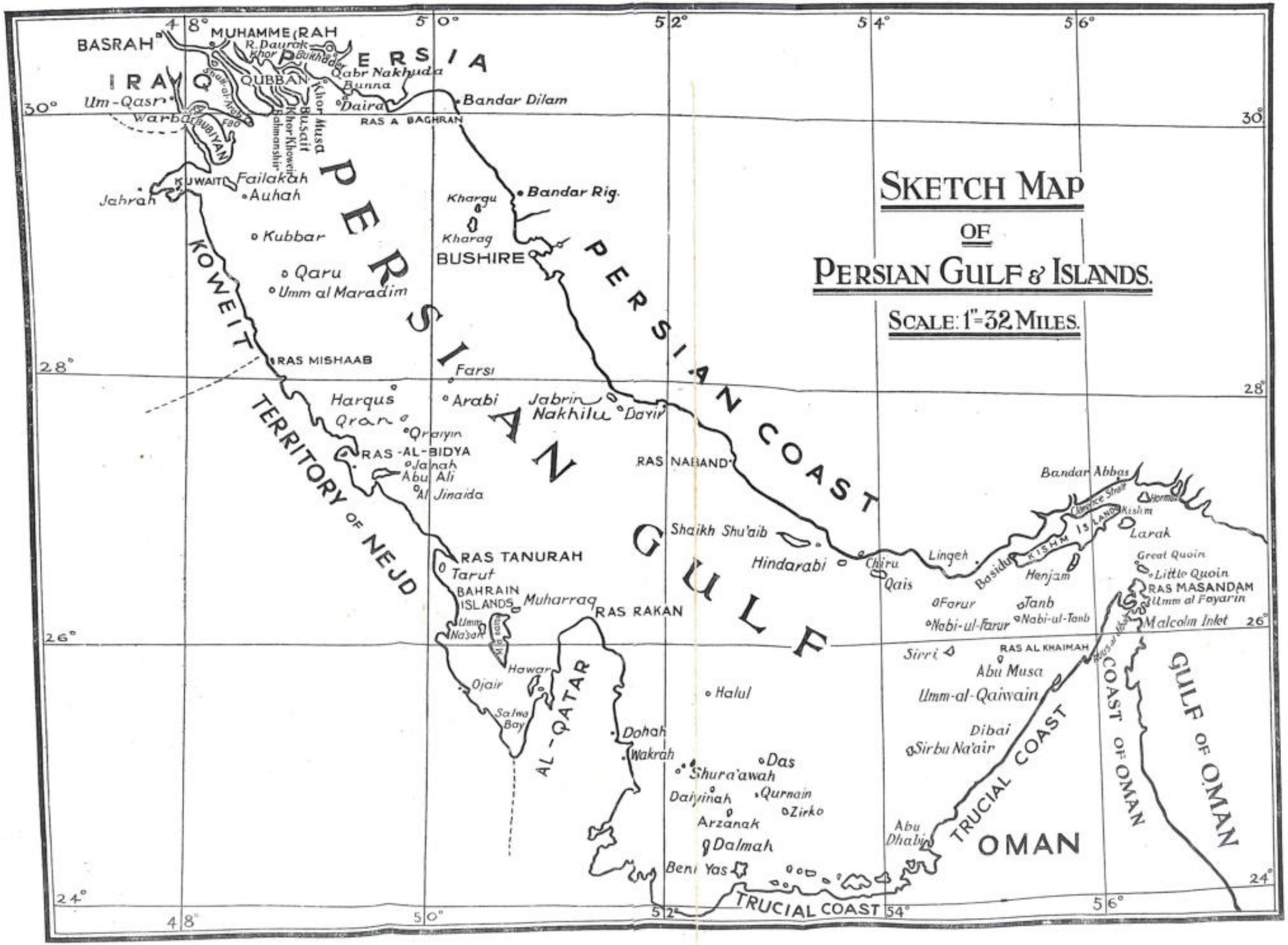
The Musk deer varies considerably in size, ranging from 22 to 30 lb. in weight with a shoulder height of about 19 inches; the hind quarters have frequently a height of 21 to 22 inches. The fur is coarse and brittle, in fact, the body covering is more in the nature of soft spiky hair, which breaks easily. This renders the skin useless as a trophy.

This deer is hornless in both sexes. The only trophy obtainable is the pair of tusks in the upper jaw, which measure from about 2 to 3½ inches; these tusks are imbedded in the gums. The maximum total length of the tusk is about 3½ to 4 inches. The glandular pouch which holds the musk is greatly sought after, as much as Rs. 32 being, at times, paid for what is called the musk pod. Consequently in spite of all precautions Musk deer are decreasing in numbers year by year, and, but for this deer being preserved as a 'royalty', (i.e., belonging to the ruling chief), it would have become extinct in Kashmir.

Very little sport is to be obtained from the pursuit of the Musk Deer. After a pair of the canine tusks have been secured these small animals should be left in peace; sufficient enemies exist, without bringing the modern small bore rifle to lessen the numbers of a forest-living animal. The nets and shot guns of poachers and leopards, wild dogs, Indian martens, foxes, etc., all prey on the Musk deer.

Years ago at Badiar in the Jinsar Forests of the United Provinces an effort was made to populate with these deer a fairly large tract of hillside. Every aid was afforded by nature and suitable food, shade, rocks and shrubs existed. At first many Musk deer tenanted the country which was preserved. One morning, whilst out after Cheer pheasants, I put up many without any beaters, a few years afterwards not a single Musk deer was to be found, they had all dispersed. This only shows how fruitless it is to try and interfere with the laws which govern wild animal life. Whether the Musk deer objected to being overcrowded, or had eaten up the selected portions of the herbage it is impossible to say—perhaps disease had occurred—it is useless to speculate. Undoubtedly it is always the case that overcrowding causes disease and at that we must leave it. But for the intervention of man, wild animals would still be plentiful, the reproduction of the jungle fauna if left alone would be balanced by nature, the numbers would possibly fluctuate as the vermin gained the ascendency; as the game decreased the flesh-eating animals would wander off to better hunting grounds, the numbers of the animals on the devastated ground would again increase and so on *ad infinitum.*

(To be continued)


SKETCH MAP
OF
PERSIAN GULF & ISLANDS.
SCALE: 1"=32 MILES.
PERSIAN GULF
PERSIAN COAST
KOWEIT TERRITORY OF NEJD
AL-QATAR
TRUCIAL COAST
OMAN
COAST OF OMAN
GULF OF OMAN
BASRAH
IRAQ
MUHAMMERAH
PERSIA
QUBBAN
Qabr Nakhuda
Bunna
Daira
Bandar Dilam
RAS A BAGHRAN
Um-Qasr
Warbah
SUBIYAN
KUWAIT
Failakah
Auhah
Jahrah
Kubbar
Qaru
Umm al Maradim
Kharqu
Kharag
Bandar Rig
BUSHIRE
RAS MISHAAB
Farsi
Harqus
Qran
Qraiyin
Arabi
Jabrin
Nakhilu
Dayir
RAS-AL-BIDYA
Janah
Abu Ali
Al Jinaida
RAS NABAND
RAS TANURAH
Tarut
BAHRAIN ISLANDS
Muharraq
RAS RAKAN
Umm Na'asan
Hawar
Ojair
Salwa Bay
Halul
Dohah
Wakrah
Das
Shura'awah
Daiyinah
Qurnain
Zirko
Arzanak
Dalmah
Beni Yas
Shaikh Shu'aib
Hindarabi
Chiru
Qais
Lingeh
Basidu
KISHM ISLAND
Henjam
Bandar Abbas
Larak
Great Quoin
Little Quoin
RAS MASANDAM
Umm al Fayarin
Malcolm Inlet
Farur
Nabi-ul-Farur
Tanb
Nabi-ul-Tanb
Sirri
RAS AL KHAIMAH
Abu Musa
Umm-al-Qaiwain
Dibai
Sirbu Na'air
Abu Dhabi
48°
50°
52°
54°
56°
30°
28°
26°
24°

BIRDS OF THE PERSIAN GULF ISLANDS

BY

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(LATE CAPT., R.A.M.C.)

ASSISTED BY

MAJOR-GENERAL SIR PERCY Z. COX, G.C.M.G., G.C.I.E., K.C.S.I., M.B.O.U.

AND

MAJOR R. E. CHEESMAN, M.B.O.U., F.R.G.S.

(*With four plates and a map*)

During the last four or five years a considerable amount of information has been gathered together about the bird life on various islets in the Persian Gulf, with a large collection of skins and series of eggs. The skins were presented to the British Museum and the Bombay Natural History Society and the eggs to the British Museum and Mr. E. C. S. Baker. Some islands were visited by Sir Percy Cox and Capt. R. E. Cheesman personally and to others Sir Percy Cox sent his collector Mr. La Personne to investigate. I have considered it best to refer to the avifauna of each island separately as the islets visited extend from the extreme north-west to the extreme south-east of the Gulf, a matter of some 550 miles. This paper is founded therefore on notes made by the above three observers and on specimens brought home. Notes on the eggs of the Tropic Bird and Cormorant have been kindly supplied me by Mr. Stuart Baker.

Starting at the south-eastern end at the entrance to the Gulf :—

I. GREAT AND LITTLE QUOIN.

Two rocky islets, with a lighthouse, situated under Ras Masandan, the high rocky headland of Oman. Visited by Sir Percy Cox and Capt. Cheesman, September 23, 1920, who landed on Little Quoin. Several pairs of *Phaëton aetherius indicus* were flying round and in and out of crannies and probably had bred there. An Osprey and a pair of *Corvus corax ruficollis* seemed to be the only inhabitants. I may state that I have seen a clutch of three eggs of the Osprey said to have been taken on this island prior to 1914. On March 16, 1921, Swifts were seen doubtless, *Micropus murinus*, entering crevices in the cliff on the south side, the flock composed quite 200 birds but Capt. Cheesman could not be sure that they were breeding there. A few *Phaëtons* were seen near the island.

On May 6, some Persian Shearwaters were seen off the islands: on April 9, many were seen at sea off Ras-al-Hadd, Gulf of Oman, flying south, where also thousands of Red-necked Phaleropes were observed in flocks of 10 to 20. These flocks fly in the trough of the waves and just skim the crest. They swim with ease in a rough sea and are always very wild. (R. E. C.)

II. HENJAM.

This small island, five miles long and 2½ broad, lies on the Persian side of the Straits of Ormuz under the lee of Kishim Island which itself is separated from the Persian mainland by Clarence Strait on the north. It is an important cable station of the Indo-European Telegraph Company and port of call for the B. I. Company's steamers. There is a native village with 30 houses and date groves on the western side and a larger village exists in the south.

Col. Butler was there for three days, May 17 to 20, 1877 (*S. F.*, vol. v) and Capt. Cheesman spent a few hours ashore on March 15 and 17, 1921. It is of volcanic formation with strata of shells, rocks and larva, and very little sand. At the south end there are a few bushes and about half a dozen Sidera trees (*Zizyphus* sp.) up to twenty feet high are dotted about the island. Hills rise 350 feet and are very bare. The following are recorded :—

Raven. *Corvus corax* subsp. A raven was seen on March 15 which Cheesman thought was *ruficollis*.

Crested Lark. *Galerida cristata* subsp. A few pairs are resident, noted by Cheesman and Butler. No specimens.

White-eared Bulbul. *Pycnonotus leucotis* subsp. A few pairs are resident. Cheesman saw old nests in the Sidera trees. No specimens.

Great Grey Shrike. *Lanius excubitor*. Butler records this in May as *lahtora* ; more probably it is *aucheri* and it must be resident.

Osprey. *Pandion haliaëtus*. A pair were seen on March 15 by Cheesman ; they were ' very agitated ' so probably had a nest on the island.

Black Kite. *Milvus migrans*. Seen on March 15.

Egyptian vulture. *Neophron percnopterus*. Several seen on March 15. Possibly resident.

Macqueen's Bustard. *Chlamydotis undulata macqueeni*. Butler was told that a pair had been shot in the first week of April 1877 and that the female had an egg ready for extrusion.

Cormorant. *Phalacrocorax carbo* ? Cheesman saw numbers in the vicinity on March 15.

Red-wattled Lapwing. *Lobivanellus indicus aigneri*. This Lapwing was noted by Butler and must have been resident.

Kentish Plover. *Charadrius alexandrinus alexandrinus*. Noted in March and May 20, is doubtless resident.

Little Ringed Plover. *Charadrius dubius curonicus*. Obtained on March 15.

Oystercatcher. *Hæmatopus ostralegus longipes*.
Curlew. *Numenius arquata lineatus*.
Common Sandpiper. *Tringa hypoleucus*.
} Noted on March 15.

Red-necked Phalerope. *Phaleropus lobatus*. Noted at sea in the vicinity in March and as late as May 17.

Reef Heron. *Demiegretta sacra asha*.
Slender-billed Gull. *Larus genei* (= gelastes).
Black-headed Gull. *Larus ridibundus*.
} Noted on March 15.

Sooty Tern. *Sterna anæthetus fuligula*.
Lesser Crested Tern. *Sterna bengalensis bengalensis*.
} Noted on March 15 and May 17.

Large Crested Tern. *Sterna bergii velox*.
Sandwich Tern. *Sterna s. sandwichensis*.
White-cheeked Tern. *Sterna repressa*.
} Obtained on March 15 at Kishim. Noted on May 17.

III. Tanb and Nabi-u-Tanb.

Tanb Island situated at the eastern end of the Persian Gulf in Lat. 26° 16"N. and Long. 55° 19'E. will be familiar to those who have gone from Indian ports up to Basra, as the British India Company's ships pass within a mile or so of the island. As there is a lighthouse and water on the island it was chosen by Sir Percy Cox as a suitable place to send a collector in order to see to what extent migration could be observed and what species halted there during the spring passage. After a preliminary visit by Sir Percy Cox and Capt. R. E. Cheesman and with the kind co-operation of the Director, Royal Indian Marine, the collector was sent to live on the island during the period March 13 to April 14, 1921.

The island is about eight miles in circumference and consists of a volcanic nucleus with a large accretion of coral round it. On the east side is a flat shelving silvery strand and towards the centre of the island the land rises by a series of ridges of volcanic rock to 165 feet where the lighthouse stands. The light is visible for twenty-one miles. The western side is rocky with occasional sand beaches. On the north-east the land ends in a cliff thirty to forty feet high. At the south end there is an Arab village with three wells, a clump of date palms, two banyan trees and a small amount of cultivation. Most of the island is desert, the low parts support a certain amount of *Sueda*

bushes while in the valleys between the ridges there are dwarf acacias some of which attain the size of bushes fifteen feet high.

The lighthouse failed to add a single specimen ; no doubt in the clear atmosphere of the Persian Gulf night, birds are not attracted to the lantern and I found the same thing at Manora Light, Karachi.

Nabi-u-Tanb lies seven miles south-west of Tanb and is one mile long and three and a quarter miles broad with a rocky hill 116 feet high ; it is barren, uninhabited and without water.

Sixty-three species are now recorded from the two islands and in nearly every case the identifications are borne out by specimens ; only seven species are resident—Raven, Great Grey Shrike, Crested Lark, Osprey, Norfolk Plover, Kentish Plover and Reef Heron. Three are breeding visitors—Sooty Tern, White-checked Tern and Tropic Bird. The rest are passage migrants except perhaps a few Waders, Chiffchaff, Isabelline and Desert Wheatears which may be winter visitors, while the exact status of several are doubtful :—

Brown-necked Raven. *Corvus c. ruficollis.* One pair inhabits the island, breeding on the ledge of a clay cliff. On March 24 they had three young.

Grey-backed Warbler. *Aëdon g. familiaris.* One on March 24 ; a few on March 29 in scrub on the hillside.

Upcher's Warbler. *Hippolais languida.* Fairly common on April 2 when there was a small ' rush ' of Warblers which took shelter under walls and in thorn bushes in the small bushy valleys ; one secured April 3.

Eastern Orphean Warbler. *Sylvia h. crassirostris.* Noted from March 30 to April 2 during the rush.

Menetries' Warbler. *Sylvia mystacea.* Came in in numbers on April 1 and 2.

Desert Warbler. *Sylvia n. nana.* One obtained in bushes on the hill—top on April 2.

Chiffchaff. *Phylloscopus c. collybita.* A female W 58 obtained March 29 is quite indistinguishable from English specimens.

Brown Willow Warbler. *Phylloscopus c. tristis.* One obtained on March 30. Chiffchaffs were present on the island on arrival on March 13 and an influx took place on March 30. They frequented the date garden chiefly.

Great Grey Shrike. *Lanius e. aucheri* : Resident and one of the commonest birds on the island, frequenting the acacias. In about every fifth bush there were nests of varying ages. On March 19 a nest contained young already, but some were building yet and in some cases old nests appeared to be repaired. Eggs were found up to April 12 and four seemed to be the usual clutch. A larder discovered on March 21 close to a nest contained a chick of a Wader (probably Kentish Plover) and two shrike chicks belonging to some other pair. Shrikes were present on the island on September 23.

Bay-backed Shrike. *Lanius vittatus.* Two seen and one obtained March 24. Status doubtful. This is the most western record of this Indian species, of which a point from 100 miles W.N.W. of Bampur in Persian Baluchistan has hitherto been the western limit.

Masked Shrike. *Lanius nubicus.* Several noted and obtained on passage between March 24 and 28 frequenting low acacia bushes. This is an extension of this bird's range eastward ; Blanford did not meet with it in Eastern Persia.

Isabelline Shrike. *Lanius isabellinus.* On passage from March 22 to 30.

Red-tailed Shrike. *Lanius phœnicuroides.* On March 28 and April 2 a few in the date grove.

Woodchat Shrike. *Lanius senator niloticus.* Single bird obtained on March 19 and 20. Scarce. The previous easternmost record of this bird is from Niriz (east of Shiraz) where it breeds.

Pied Flycatcher. *Muscicapa hypoleuca semitorquata.* On March 22, 1918, I saw a male on board when off Tanb Island ; this is the most eastern record that I am aware of.

Indian Pied Wheatear. *Œnanthe picata.* Noted as fairly abundant on March 27.

Pied Wheatear. *Œnanthe leucomela leucomela.* Obtained on several dates, on March 27 to April 7, presumably on passage.

Isabelline Wheatear. *Œnanthe isabellina.* Fairly abundant up to end of March, probably a winter visitor.

Desert Wheatear. *Œnanthe deserti atrogularis.* Abundant on arrival on March 13 ; probably a winter visitor ; last noted on April 2.

Stonechat. *Saxicola torquata maura*. One obtained on March 23.

Redstart. *Phœnicurus phœnicurus mesoleuca*. Obtained on passage on March 23 and 27, both males. The known breeding quarters and winter habitat (Abyssinia, etc.) of this bird lie well to the west of Tanb Island. Blanford did not meet with it in Eastern Persia.

Black Redstart. *Phœnicurus ochruros phœnicuroides*. Several on passage on March 27 to 30. Breeds in Persia.

White-throated Robin. *Irania gutturalis*. A male obtained on March 29 Was the only one seen.

Rock Thrush. *Monticola saxatilis*. One obtained on April 6.

White-breasted Munia. *Uroloncha malabarica*. One obtained on April 7, the only one seen. This bird must, I think, have been a stray ; it may possibly occur further west into Persia than is known. There are two in the British Museum from Muscat collected by Sir Percy Cox, but its occurrence on Tanb is the furthest west that I am a ware of.

Ortolan Bunting. *Emberiza hortulana*. One caught in a rat trap in the date garden on March 27.

Grey-headed Bunting. *Emberiza cineracea semenowi*. One obtained on March 23 on passage. This must be about the most eastern record of this bird.

Black-headed bunting. *Emberiza melanocephala*. Several arrived on April 3 ; the next day a flock of 20–30 (nearly all males) were seen in some new wheat, by April 7 all had gone. The large east to west migration of this species therefore touches this island.

Common Swallow. *Hirunda rustica*. Several seen on April 4, and some passed over to the north on April 14. Apparently only a passage migrant.

White Wagtail. *Motacilla alba dukhunensis*. Plentiful in the date garden and in the lighthouse quarters on March 27. Breeds in Siberia.

Blue-headed-Wagtail. *Motacilla flava beema*.

Black-headed-Wagtail. *Motacilla feldegg melanogriseus*. An arrival of wagtails took place on March 22 and more on the next two days—they frequented chiefly the sandy plain and were gone by March 25. Several specimens of these two forms were obtained of both sexes.

Grey Wagtail. *Motacilla cinerea*. Several with the yellow wagtails were obtained. Tail 100–103.

Tree Pipit. *Anthus trivialis trivialis*. A few with larks on March 29.

Crested Lark. *Galerida cristata* subsp. Resident and common. Unfortunately no series of the Crested Lark was obtained. There are two freshly moulted specimens obtained on September 23, and two worn bleached birds on March 28 and April 2. The former of course are not necessarily the resident bird, they are both males with wing 109–105 which is small for *magna* nor do they resemble *magna* quite in colour. They are darker, not so grey as *chendoola*, though odd ones of the latter race come very near them ; on the other hand I have seen no *chendoola* with a wing as long as 109. They do not appear either to be *tardinata*, not having the breast and back so coarsely marked. The two breeding birds have wing measurements ♂ 104 ♀ 98, much smaller than any *magna*, and they are far more worn and bleached than specimens of *chendoola* are at the same time of year.

Common Bee-eater. *Merops apiaster*. First seen on March 17, two on April 3.

Persian Bee-eater. *Merops persicus persicus*. First noted on April 1.

Hoopoe. *Upupa epops epops*. Two seen on March 14.

Pallid Swift. *Micropus murinus murinus*. A flock of about 20 was on the island on arrival and were seen on and off to the end of the month. Status doubtful.

Cuckoo. *Cuculus canorus subtelephonus*. One obtained, a female, on April 13 ; two had been on the island for some time ; a very pale bird with wing 190. From an examination of Central Asian cuckoos I am inclined to think that Zarudny's *subtelephonus* should be recognized : the grey parts are distinctly pale, they are mostly finely barred and have short wings.

Scops Owl. *Otus scops pulchellus*. One caught on March 20, one on March 16 ; heard on March 24 and 27. Single birds on passage.

Osprey. *Pandion haliaëtus*. A pair frequented the island and were obtained ; the Osprey does not breed on Tanb and the organs of these birds were minute. Another pair however frequents Nabi-u-Tanb and nests on the



The home of a Crab Plover Colony, Warba Island.
May 19, 1907.

(*Photo by Sir P. Z. Cox*).



Cormorants nesting on Halul Islands.

(*Enlargement from a photo by Major R. E. Cheesman.*)

top of the islet (100 ft). Two nests were examined there, both were empty on April 9 and appeared to be alternative nests.

Black Kite. *Milvus migrans*. Two seen on April 11.

Harrier. *Circus sp.* Two seen on September 23.

Kestrel. *Falco tinnunculus tinnunculus*. Odd ones seen from time to time, one obtained on March 26. Probably a winter visitor.

Turtle dove. *Streptopelia* sp. A Turtle Dove was seen on April 13. Probably *S. t. arenicolor* or *S. senegalensis*.

Spotted Sandgrouse. *Pterocles senegallus*. Flock noted several times between March 13 and April 7; on being disturbed they flew out towards the Persian mainland and may have been visitors thence. No evidence of breeding could be obtained.

Stone Curlew. *Œdicnemus œdicnemus astutus*. At least one pair resident on the island. A male obtained on March 29 had an incubation patch. W. 225.

Cream-coloured Courser. *Cursorius cursor* (= *gallicus* : auct.). Seen between March 14 and 25. Status uncertain.

Turnstone. *Arenaria interpres*. Flock on the shore during last half of March; one windswept bird was blown into the loose folds of an Arab's garment and captured.

Grey Plover. *Squatarola squatarola squatarola*. Two obtained on March 20 were the only ones seen. ♂ W. 197, B. 30; ♀ W. 191, B. 29.; obviously belong to the typical race.

Little Ringed Plover. *Charadrius curonicus dubius*. A few inhabited the sandy plain away from the seashore up to April 6.

Kentish Plover. *Charadrius alexandrinus alexandrinus*. Common, resident and breeding. Nest with 3 eggs on March 15, five yards from edge of sea cliff four feet high. Another nest with three eggs was made of a few twigs and a single goat's-dropping in sandy soil amongst short scrub, also near the cliff's edge on March 28. 3 ♂♂ W. 110–115, B. 15·5–17·5 (exp). 7 ♀♀ W. 108–112, B. 15·5–17·5. This series is not distinguishable from a series from Egypt.

Mongolian Sand Plover. *Charadrius mongolus atrifrons*. Winter visitor; one obtained from a flock September 29 and another on April 11.

Geoffrey's Sand Plover. *Charadrius leschenaultii*. Two obtained out of a large flock on September 23; probably also a winter visitor.

Sanderling. *Caladris alba*. A flock frequented the beach most of the time.

Oystercatcher. *Hæmatopus ostralegus*. Flock seen on March 13.

Red-necked Phalerope. *Phalaropus lobatus*. Seen near the island on April 3 and 9.

Hemprich's Gull. *Larus hemprichi*. Three seen, two obtained on Nabi-u-Tanb on April 9. No sign of breeding.

White-cheeked Tern. *Sterna repressa*. Many on the island at the south end on September 23; Sir Percy Cox found a colony of 2–300 preparing to breed on the sandy plain on the south-east promontory on May 28, 1905; natives say they breed in great numbers. Another large colony were beginning to breed on Nabi-u-Tanb on May 28, 1905. La Personne does not record any terns so that presumably none arrive at the nesting ground as early as April 14. Many breeding on Nabi-u-Tanb on June 30, 1923.

Sooty Tern. *Sterna anæthetus fuligula*. Sir Percy Cox found a colony on Nabi-u-Tanb on May 28, 1905. Breeding there on June 30, 1923 in numbers.

Cormorant. *Phalacrocorax* sp. ? Seen on March 13 near the island.

Tropic Bird. *Phaeton œtherius indicus*. This Tropic Bird does not breed on Tanb itself, but on Nabi-u-Tanb, an islet seven miles west of Tanb; young and old birds were brought to La Personne by fishermen in the first week of April 1921 and on the ninth he paid a flying visit to the islet. The islet is about a mile in diameter and except for a short beach is girt by high cliffs, which, on their interior face slope down to the centre, forming a bowl where at that time there was a swamp. There are no trees, but there is some scrub on the plain. At the base of the sea cliffs are many water worn fissures, mere cracks at the top and eight inches to two feet wide at the base and going in some six feet some ending in an enlarged chamber; it was in these fissures that the Tropic Birds were breeding. A good many were seen to be flying in and out of the fissures entering and leaving close to where the fissures met the beach. It seems that only one pair occupied each fissure; most nesting sites held one young bird but from one two young and a rotten egg were taken as well as a pair of adults. The egg appeared to be a year

old, and it is not recorded whether the two young were together or not. The young taken varied in size, a few were just feathering, but most were nearly ready to fly. On March 24, 1923, La Personne paid another flying visit and obtained one egg almost ready to hatch.

The young in down is well covered with greyish-white down, darker grey on the occiput. The young fully feathered resembles the adult except for colour of bill and feet and that the central tail feathers are short and tipped with black. 4 ♂♂ W. 282–295, B. 52–55 (exp.); central tail feathers exceed the rest by 225–235. 5 ♀♀ W. 284–293, B. 52–56·5 (exp.); central tail feathers exceed the rest by 176 (worn) to 235. Bill orange; feet blue and chrome yellow.

In no case were the long central feathers perfect: either one was broken or moulting or missing.

The first absolutely authentic egg ever taken of this bird was one procured by La Personne on April 9, 1921, at Nabi-u-Tanb Island. The ground colour of this egg is a pale reddish cream and it is densely covered all over with freckles and tiny specks of darker reddish brown. Towards the broader end these spots become larger; much more numerous and much darker, forming a blackish red cap at the extreme end, the spots running into one another and forming big patches. The texture, like that of all Tropic Birds, is very coarse, the surface being rough to the touch and altogether glossless. In shape, it is a long and blunt oval, and it measures 58·0 × 42·6 mm.

The other egg in the Cox-Cheesman collection and labelled 'Unknown' is undoubtedly also an egg of this species. It was taken on Nabi-u-Tanb Island on April 23, 1923, and like the last described egg, was very hard set, in this egg the bird being almost ready to hatch. The egg differs considerably from the last. The ground colour is a dull white, only very faintly tinged with cream. The markings consist of deep red—brown blotches, numerous and large at the extreme larger end, very sparse and much paler elsewhere. The texture is the same, but it is a small, proportionately rather broader egg, measuring 54·6 × 41·6.

'I have a third egg of this species in my collection taken by Major Pitman in April on one of the small islands in the Persian Gulf. This is a much larger egg, measuring 64·0 × 48·1, and was not identified by Major Pitman, who thought it might be that of an Osprey laid by accident on the ground. It is, I think, however, undoubtedly the egg of this Tropic Bird. It differs considerably from either of the two eggs already described. The ground colour is dull white, with hardly any markings at all over the greater part of the surface, but with a broad scattered ring of dull light brown blotches and smears at the larger end.'

These three eggs will probably be found to represent the extreme range of colouration in the eggs of this Tropic Bird, and they can be exactly matched with eggs of *Phaëthon rubricaudus*.

Persian Shearwater. *Puffinus persicus*. Seen on March 14 off the island; apparently does not breed on Tanb. The breeding ground remains unknown though it must be in this neighbourhood somewhere. The type was obtained between Gwader and Muscat on February 21, 1872 and is moulting its wings. The only other specimen in the British Museum was obtained between Gwadar and Henjam by Butler on May 17, 1877, when he found it common but very shy. On March 22, 1918, I found it swarming in the Straits of Ormuz and saw one flock of over 200 birds, but saw none west of Tanb. At the same place on November 17, I saw none. Until it can be ascertained what month this bird breeds in it is hopeless to try and find its nesting place.

Reef Heron. *Demiegretta sacra asha*. Two seen. A nest with three eggs was found by Sir Percy Cox on Nabi-u-Tanb on May 28, 1905.

IV. Nabi-ul-Farur.

Is 4 miles long and 2½ broad and rises in dark volcanic hills to a height of 465 feet. The firm belief that this might be the breeding ground of the Persian Shearwater led Sir Percy Cox to send La Personne to investigate the island in 1923. Visited by La Personne on July 6, 1923. 45 miles W. by S. of Tanb Island.

Sooty Tern. *Sterna anaetheta fuligula* and White-cheeked Tern. *Sterna repressa*.

Were nesting in large numbers; eggs fresh. Between this island and

Abu Musa several flocks of Persian Shearwater *Puffinus persicus*, 22–30 in each flock, were seen by Cheesman on March 18, 1921. The birds appeared to be feeding on surface fry.

V. Sir-Bu-Na' Air.

Sixty-five miles south of Nabi-ul-Farur. Visited by Sir Percy Cox on May 29, 1905. Northern half is a waste of volcanic debris; southern half holds some scanty *salsola* vegetation.

White-cheeked Tern. *Sterna repressa*, Sooty Tern. *Sterna a. fuligula* and Lesser Crested Tern. *Sterna b. bengalensis*. Were seen in numbers, together with a few Large Crested Tern. *Sterna bergii velox* and Hemprich's Gull. *Larus hemprichi*. No birds were as yet breeding.

VI. Halul Island.

Is 1½ miles long and 1 mile broad and about 115 miles W. by N. of Sir-bu-Na' Air and 75 S. E. of Ras Rakan. Visited by Sir Percy Cox on July 25, 1906 and by Capt. Cheesman, March 19, 1921.

A rocky island with small cone-shaped hills rising to 100 feet, rocks dark red with iron oxide; at the north end a gravel plain half a mile across ending in small cliffs to the sea; at the south end there is some scrub (*Halopeplis perfoliata*).

The following birds were recorded :—

Common Wheatear. *Œnanthe œnanthe*. Pied Chat. *Œ. leucomela*.
Blue-headed Wagtail. *Motacilla flava*. White Wagtail. *M. alba*.
Common Swallow. *Hirundo rustica*. Red-rumped Swallow. *H. rufula*.
Tawny Pipit. *Anthus campestris griseus*. Sand Martin. *Riparia riparia*.
Hoopoe. *Upupa epops*. All halting on passage March 19, 1921.
Tropic Bird. *Phaeton indicus*. Three seen on March 19.
Black-headed Gull. *Larus ridibundus*. Few.
Slender-billed Gull. *Larus genei*. Thousands; on March 19.

Lesser Black-backed Gull. *Larus fuscus taimyrensis*. A good many round the island; these birds appeared over the cormorant colony as soon as the latter were disturbed, swooping down to devour eggs and chicks as well as regurgitated food thrown out by the young and the parent birds.

White-cheeked Tern. *Sterna albigena*, Sooty Tern. *Sterna a. fuligula* and Lesser Crested Tern. *Sterna b. bengalensis* are recorded by Sir Percy Cox on July 25, 1906, but apparently their eggs had been recently taken by Arabs. Cheesman saw many terns off the island during his visit.

Osprey. *Pandion haliaëtus*. Two pairs were breeding during Cheesman's visit; from one nest the young had already flown and the youngsters were found on the shore. The nest was situated on the top of a cone-shaped hill and held only fish remains and remains of young cormorants. The other nest, also situated on a cone-shaped hill, held two young almost ready to fly. The nest was made of sticks of a dead salt bush (*Salsola ?*) and was about 1 foot thick and 5·6 feet across; by the nest were the remains of a tern, a slender-billed gull and fish. On January 21, 1919, Capt. Poyntz, R. I. M., took 3 eggs from one of the nests. Another disused nest was probably an alternative site.

Socotra Cormorant. *Phalacrocorax nigrogularis*. The most interesting discovery made during the exploration of the Persian Gulf Islands was the finding of the breeding quarters of this cormorant. This species was first discovered on the island of Socotra on December 7, 1898 (see *Birds of Socotra*, p. 49) since when little or nothing seems to have been published about it. On March 19, 1921, R. I. M. S. 'Nearchus' anchored off Halul Island and Capt. Cheesman was able to go ashore. Ten miles distant from the island a thin cloud of Cormorants could be seen wending their way towards land and from the numbers subsequently seen it was surmised that a vast colony must here exist. Capt. Cheesman timed one flock which was leaving the island for the fishing grounds and found it took 8 minutes to pass a fixed point at the rate of 20 per second—roughly 10,000 birds in a flock. The colony was located on the gravel plain at the north end with no difficulty—indeed it could be smelt half a mile away! Here cormorants were standing about like black ninepins in thousands while another army were esconced on the cliff's edge. On being disturbed the colony began to walk towards the sea, some rising on the wing

after a clumsy run, a few remaining on their nests till approach was made within 30 yards. No sooner had the cormorants departed than fifty Black-backed Gulls (*L. taimyrensis*) appearing from nowhere swooped down to seize such eggs and young as they could and to gobble up the fish ejected by the frightened parents and young. The nests were either scratched depressions in the gravel or slightly raised above the surface, no material but gravel being used; the nests almost touched each other, some contained three eggs, some two or only one, while others had young in all stages. The young, blind and naked at first, later on when they can walk get a coat of white down. Two birds shot off the nest proved to be males.

The adult has the feet and gular pouch black, iris green, bill black. An immature bird (a year old?) has the feet pink-brown, iris whitish, gular pouch pinkish, bill light brown to bluish. The nestling is covered with pure white down except round the eyes and upper part of neck and gular region; the iris is pinkish white, legs and feet ivory white.

It is very remarkable to find that the chick of the cormorant has white down as those of *carbo*, *javanicus* and *graculus* have dark brown or black down.

Whether this Cormorant nests on Socotra and intermediate islets between the Persian Gulf and that island or is only a non-breeding visitor there remains to be seen. Capt. Cheesman probably hit off the tail end of the breeding season on Halul as the Captain of the 'Nearchus', Capt. Poyntz, visited the island on January 21, 1919 and found multitudes of eggs and young, but at the end of April 1920 no birds were to be seen there. Moreover by March 19, Cheesman found many young on the wing.

Measurements of 3 ♂♂. W. 285 (worn) 297, 289; Bill from angle 74, 73, 71; Ts. 73; Md. toe with claw 93.

According to Ogilvie Grant the three Socotra birds in the British Museum measure ♂ W. 298–310; ♀ 275 mm.

The eggs of this bird are probably the most interesting in many ways taken by Sir Percy Cox and Major Cheesman, and form a most remarkable variation from any previously known eggs of cormorants or darters. In ground colour they are a pale blue similar to all other cormorants' eggs and like the latter are normally covered all over with a heavy deposit of calcareous matter, though in many cases this is not nearly so thick as it is in most birds of this genus. In a few the deposit is almost wanting.

Unlike all other birds of this genus, or indeed family, there are well-defined dark amber brown blotches for the most part confined to the larger end, but in some equally, though sparsely, distributed all over the egg. These markings, although in many instances concealed or semi-concealed by the lime deposited over them, are the same as primary or superficial markings on the eggs of other birds. In some cases there are also subsidiary under-surface markings which appear to be a pale neutral tint, or grey, though if sufficient of the shell is scratched off, they would of course appear to be amber brown like the rest.

The eggs do not vary much in size, ranging between 53·6 by 34·6 and 48·7 by 33·5, and in breadth between 50·1 by 33·1 and 52·0 by 36·0 mm. An egg in Mr. Jourdain's collection from some island in the Persian Gulf is larger, 56·7 × 37·4.

VII. Farsi and Arabi.

Two island sandbanks 10 feet and 3 feet respectively, above high water, about fifteen miles apart, situated almost in the centre of the Gulf between Bushire and Ras-al-Bidya on the Arabian Coast. Visited by Lapersonne April 23, 1921.

Farsi.

The more northerly of the two and the larger, consists of about 5 or 6 acres of sand with a fringe of rocks off the north beach. There is some low vegetation in the centre and the south end.

Terns and cormorants were seen and the latter evidently bred there. Several halting migrants were seen and the following species obtained:—

Rock Thrush. *Monticola saxatilis*, Blue-headed Wagtail. *Motacilla flava* sub. sp., ♀; Common Redstart. *Phœnicurus ph. phœnicurus*, Bluethroat. *Cyanosylvia suecica magna*. Common Roller. *Coracias garrula semenowi*, Scops Owl. *Otus scops pulchellus*; Black Kite. *Milvus migrans* and



Cormorant (*Phalacrocorax nigrogularis*) Colony on Halul Islands.
Gulls waiting overhead to prey on eggs when Cormorants leave.
(*Photo by Major R. E. Cheesman*).



Young Cormorants (*P. nigrogularis*) in white down on Farsi Island.
(*Photo by Lt. Hindman, R.I.M.*)



Young Ospreys
in nest.
Halul Islands.



Site of Osprey's nest on Halul Islands.

(*Photos by Major R. E. Cheesman*).

Kestrel. *Falco tinnunculus* were also seen. In 1878 Col. Butler received many eggs of *Sterna bengalensis* from an island 'close to Arabi.'

Arabi.

Is a sandbank fringed with rocks just above sea-level, and is only 100 yards square ; it has no vegetation.

A few Terns and Cormorants were seen and they are said to breed ; numbers of dead young Cormorants were found on the beach. The following passage migrants were obtained :—

Ortolan Bunting. *Emberiza hortulana*, Rock Thrush. *Monticola saxatilis*. Eastern Turtle Dove. *Streptopelia turtur arenicolor*, Nordmann's Pratincole, *Glareola nordmanni*.

VIII. Um-Al-Maradim and Qaru.

Visited by Sir Percy Cox on June 11, 1905.

Um-Al-Maradim. A sand islet situated about 20 miles off the Koweit Coast about half mile in extent, 20 feet high and covered with scrub. White-cheeked, Sooty and Lesser Crested Terns, *Sterna repressa*, *S. anætheta fuligula*, and *S. b. bengalensis* were found nesting. Here and there among small colonies of *bengalensis* was a nest of *fuligula* under any little bush which happened to be in the former's territory. In one or two cases a small colony of *repressa* were nesting in the middle of colonies of *bengalensis*. A small group of Crab Plover, *Dromas ardeola* were seen and corpses of young Cormorants were found.

Qaru.

An islet about 15 miles north-east of Um-al-Maradim. The same terns were seen on this islet, but it was apparently not used as a breeding ground. A flock of Cormorants were seen and the island was strewn with dried-up corpses of half—grown young.

IX. Kubbar.

A small sand islet 8 feet high and covered with scrub. Situated about 30 miles north of the last group and about 20 from the Koweit Coast and 32 from Koweit. Visited by Sir Percy on Cox June 9, 1905 and by La Personne on April 24, 1921.

Sir Percy Cox found the following :—

White-cheeked Tern. *Sterna repressa*. Small separate colonies in the open ; some attempt was made at a nest ; two eggs seemed the usual number and they varied much in colour in the same nest.

Sooty Tern. *Sterna anætheta fuligula*. Breeding in small colonies and also scattered singly all over the island.

Lesser Crested Tern. *Sterna bengalensis bengalensis*. Breeding in numbers.

La Personne found :—

Crab Plover, *Dromas ardeola*. Many holes on the higher ground and a flock was seen.

Reef Heron, *Demiegretta sacra asha*. Six or eight nests, these consisted of twigs placed on masses of weeds a foot and a half high. The nests contained 3 to 4 eggs.

X. Auhah.

Situated 3 miles off the south-west of the inhabited island of Failakah which is at the entrance to Koweit Bay. A rocky islet reduced at high water to an area of 200 × 300 yards, there is little or no scrub. Visited by La Personne on June 12, 1923.

Crab Plover. *Dromas ardeola*. Breeds in numbers. The parent birds were seen carrying pulped crabs to young in the holes ; the young in down walk with difficulty and make a noise like the young of chickens.

Squacco Heron. *Ardeola ralloides*. One obtained on passage near Auhah on April 25, 1921.

White-cheeked Tern. *Sterna repressa*. } Breeding in great numbers.
S. b. bengalensis. }

Sooty Tern. *Sterna a. fuligula*. Nesting in disused holes of *Dromas ardeola*, the single egg being placed about six inches down the hole. The eggs were fresh.

Houbara. *Chlamydotis houbara macqueeni*. One seen by Capt. Cheesman off the Shat-al-Arab bar flying north on November 5, 1923.

A NEW SNAKE FROM BURMA

BY

COL. F. WALL, C.M.G., K.H.S.

Among a collection of snakes from Huton, Kachin Hills (4,500 feet) aggregating 79 specimens, received recently through the kindness of the Rev. Father Gilhodes, I find three specimens of a species of *Rhabdophis* hitherto indescribed, which I propose to designate.

Rhabdophis speciosus sp : nov :

TYPE. ♂. 805 mm. (2 feet, 7¾ inches), the tail 218 mm. (8¾ inches).

GENERAL CHARACTERS. Snout, moderately declivous, moderately narrowed. Nostril, moderate, situated in both nasals, and occupying the 2nd and 3rd fifths of the nasal suture. Eye, large, its diameter equals its distance to the anterior edge of the nostril. Pupil round. Neck, moderately contracted. Body, moderately robust, cylindrical. Tail, rather long.

LEPIDOSIS. *Rostral*—Rostro-nasal sutures rather longer than the rostro-internasals; portion visible above about half the suture between the internasals. *Internasals*, two; the anterior border about two-thirds the length of the posterior border; the suture between them a shade less than that between the praefrontal fellows. *Praefrontals*, a pair. *Frontal*, a shade longer than the snout. *Nasals*, two. *Loreal*, about three-fifths the length of the nasals. *Præocular*, one. *Postoculars*, three. *Temporals*, two anterior. *Supralabials*, eight; the 1st and 2nd touching the nasals, 4th and 5th the eye, and the 6th and 7th the anterior temporals. *Sublinguals*, two pairs, the posterior rather longer than the anterior, separated by three azygos and a pair of scales, behind which is the narrow first ventral. *Infralabials*, the 5th, 6th and 7th touch the posterior sublinguals. *Costals*, in 17 rows two head-lengths behind the head, 19 at midbody, 17 two heads-lengths before the vent. About three heads-lengths behind the head a new row of scales appears on each side of the vertebrals. The rows remain 19 to about four or five head-lengths behind midbody when the fourth row above the ventrals disappears. Keels present in all rows at midbody. Apical facets in pairs, very distinct. Apical emargination present. The scales of the vertebral row are about half as broad as their length, and half the breadth of those in the ultimate row. The scales in the ultimate row are not quite as broad as long. *Ventrals*, 166, the two first narrow. *Anal*, divided. *Subcaudals*, 87, paired.

COLOUR. Dull olive-green dorsally, with a series of closely set, vertical pale spots on the 4th and 5th rows above the ventrals, continued well down the tail. A fairly distinct chequering of blackish and ochraceous yellow spots in the anterior part of the body, and a bright ochraceous bar across the occiput, a little behind the parietal shields. Belly dirty whitish, peppered with black and grey spots, denser on the basal parts of the ventral and subcaudal shields, and in the posterior part of the body. Anteriorly this peppering is chiefly lateral. Head olive-brown above merging to dirty white on the lip. The posterior edges of the supralabials dark, black and conspicuous on the 5th and 6th of the series. Lower lips and sublingual region palest buff, immaculate.

DENTITION. From specimen No. 3. *Maxilla*, carries 29 teeth. Diacranterian. The praecranterian 27, anodontodont, isodont. Cranterian 2, obliquely set and fully twice the length of the preceding. The praecranterian space would accommodate one tooth. *Palatine*, 19 left, 20 right; anodontodont, isodont, not quite so long as the maxilla. *Pterygoid*, 26 left, 27 right; anodontodont, isodont; about as long as the palatine. *Mandibular*, 31 left, 32 (33 ?) right; anodontodont, kumatodont; the median as long as the maxillary.

REMARKS. Specimens 2 and 3 agree with the type except that the ventrals number ♂ 168, ♀ 167; and the subcaudals ♂ 86, ♀ 87. The number of costal rows anteriorly is very unusual for a species of this genus. Specimen 2 is a ♂ 710 mm. (2 feet, 4 inches) long, the tail 188 mm. (7 inches). Specimen 3 is a ♀ 622 mm. (2 feet and ½ an inch) long, the tail 168 mm. (6 inches).

AN ORIENTAL HUNTING WASP *SPHEX LOBATUS*

BY

MAJOR R. W. G. HINGSTON, I.M.S.

PART I

GENERAL HABITS

Home of sphex—Her appearance—General habits—Manner of hunting—Excavations—Expulsion of cricket—Mode of battle—Storing of victim—Application of egg.

I recall a wide expanse of river-bed. It is a mere neglected sandy plain, a dusty waste, swept with ripples, fissured by the sun, and thirsting for the vivifying rains of summer to inundate its crumbling soil. Rank weeds are rooted in its ruts and furrows, a coarse and brittle jungle-grass clothes it in a withered scrub, while here and there some hardy tamarisk adorns it in a more luxuriant garb. For four months in the year it is a waste of water, caused by the floods of the neighbouring river that submerge it at the time of the monsoon. But at other periods it is a sun—baked plain, a broad wilderness of desiccated sand.

This is the type of district beloved of the sphex. The blazing sun of early May, the crumbling, coarse and parched soil, the sands that burn to the human touch, these are the particular attributes of Nature in which this solitary wasp delights. Let us seek her when the sun stands high in the heavens, for it is then that she rejoices at her work. Nor is the beauty and the splendour of her colouring out of harmony with the full blaze of light.*

The species I refer to is the *Sphex lobatus*, a sparkling gem of metallic splendour not uncommon on the Indian plains. She is to be found throughout the whole of the peninsula, and also in Burma and Ceylon. To the east she extends to China and the Malayan region ; to the west into the continent of Africa.

Let us glance for a moment, in a little detail, at the glorious magnificence and beauty of her dress. Her head is in the form of an oval disc that looks forward from a narrow neck. It glistens with a brilliant metallic green ; round about the ocelli there is a gleam of yellow, and on either side are the large black eyes. From in front project the sensitive antennae, delicate elastic—jointed rods that naturally assume a spiral turn, while below are the toothed and intercrossing jaws, each with its sickle-shaped point. Her stout thorax gleams with the iridescence of the head. Behind it is adorned with fine transverse lines that seem to strengthen the lustrous glow ; in front it is a pure and polished green with

* Naturalists interested in the hunting-wasps will find the habits of the following species, *Ampulex assimilis Psammochares melas, Cryptocheilus rubellus, Psammochares rutilus,* described in detail *Nature at the Desert's Edge,* Witherby and Co., 326 High Holborn, London.

evanescent tints of gold. The same splendour is extended even to the thread-like waist, and the conical abdomen is a dazzling sheen, a mingling of yellow and blue and purple and gold according to the angle of the light. Her long scintillating wings give forth a reddish gleam and terminate in purplish tips, while her legs, well armed with numerous spines, are refulgent in green and blue. In body length she is exactly one inch, and her showy integuments are like an armour, for they are as solid as a coat of mail.

A record of the operations of this Indian sphex is a piecework of scattered facts. She wanders alone on the sandy waste without any settled abode. We are sure not to find her at the time we want her ; then suddenly, at some unexpected moment, she happens to cross our path. Nor is she so common as to be daily encountered, at least in this neglected tract. We must make the most and best of every opportunity and patiently depend on chance. On each occasion she will tell us something fresh about herself, and by blending the records of these accidental meetings we will learn the details of her work.

A tireless industry, an incessant activity, an outburst of glowing energy and enthusiasm when approaching the object of her desire, these are the most striking features in the disposition of this hunting-wasp. She is naturally timid except when busily engaged. Her powers of vision are excellent and she sees an intruder from a distance. On his approach she either immediately takes to her wings, or, if engaged at hunting, she will just flit away a little distance and wait until the object that disturbed her has passed. She needs the glare of sunlight for her work. It is then that we find her feverishly digging in the soil, but when the clouds appear she seeks seclusion. I then see her hiding in the midst of the tamarisk, clinging motionless to a cluster of leaves. She is strictly solitary in her general habits : her explorations, her excavations, the slaying of her victims are always conducted alone. At only one time do I see a trace of any social instinct. It occurs at the close of the day's work. The sphex then retires to the shelter of the tamarisk where she prepares to spend the night. I sometimes see three or four of them in the same bush, often hidden in the densest part and fixed to the stems and leaves. It is the only indication of any feeling of companionship in their otherwise solitary lives.

As a rule we will encounter her when seeking her prey. In the reproductive season the greater part of her time seems to be spent in the labours of the chase. The object of her search is the *Brachytrypes achatinus*, a stout-built cricket of great strength and unusually massive size. Its body is a smooth and shining brown that passes into yellow beneath. Its huge head presents a formidable appearance. On either side are the piercing coal-black eyes ; between them the projecting filiform antennae, and below the sharp and rigid lip that protects the thick grinding jaws. The sphex will not find this monster on the surface ; it lives in the bottom of a deep burrow from where it emerges only by night. Its capture necessitates a long search followed by a slow and laborious excavation into the depths of its subterranean retreat.

She confines herself strictly to this one species. For some reason

the *Brachytrypes*, and this kind alone, is best suited for the purpose in view. There are numerous other kinds of crickets that inhabit this soil. Some live near the surface or just under the clods and she could take them with the greatest ease. But she despises all the smaller and more common kinds ; she must have the great monster beneath.

The *Brachytrypes* is most partial to the sloping ground at the margin of the river-bed. It seems to like those places where the once swollen river touched upon the shelving bank. This, therefore, is the ground best suited for our purpose. If gifted with patience, we may here disentangle the successive stages in the operations of the sphex. Here she comes, like a green sparkling gem, hurrying over the dusty soil. She runs in and out amongst the tussocks of grass, round about the thicker stumps of the tamarisk, then out upon the open space of hot and crumbling sand. Her golden wings are constantly quivering, and those wonderfully sensitive points, the antennae, are perpetually touching and testing the soil. She is systematic in all actions, and maintains a constant and persistent search. She explores little hollows, plunges down into tunnels and thoroughly investigates every place she meets. She gives most attention to the gloomiest nooks, to the depths of the burrows, to the under surface of the clods ; no likely spot is passed unnoticed ; nothing is missed in her untiring search. Here and there she scuffles a little in the soil as though she imagined that something lay hidden beneath. At times she digs a little deeper, perhaps down to the base of her wings. But the excavation usually results in nothing; she expends in this way much fruitless effort and then runs off to repeat the process elsewhere. At other times she is more persistent in her excavations ; she returns to the same place again and again, as though she felt that, in spite of failure, something must surely lie buried beneath. But in the end she will usually desert this spot also, often rising on her powerful wings and disappearing in a green flash of light.

At length she will find some spot of particular interest. Instead of just a few casual shuffles she will burrow excitedly into the soil. Let us now watch her with a little care. We will probably be not alone in our attentive observation ; there is frequently another creature watching her too. A little fly is hovering stationary in the air. It has fixed her with its penetrating eye. It holds itself at a height of about a foot above her and a similar distance behind. From its ærial watch-tower it follows every movement ; it advances when she advances ; it turns when she turns ; if she stops to dig, it just hovers in its place giving forth a gentle hum. It always holds itself at the same distance from her and follows her wherever she goes. Thus together we watch the operations. Both of us are eager, though for different reasons, to witness the fulfilment of the work.

The soil is ideal for the purpose of excavation, being loose and sandy and easily thrust aside. At first she may hesitate as to the best place to dig. As a consequence she often scuffles in three or four places before she alights on the exact spot. At length, having found it, she bursts into enthusiasm. Before her lies a mound of upturned soil, ejected debris scattered on the surface which has

been thrown up from some cavern beneath. Into this she plunges, raking and scuffling ; she must know that the object that calls forth such energy lies buried deep down in the earth. She is an expert in the art of mining operations. Her excavation advances with great rapidity and in a minute or two she has shaped a hollow in the sand. Any obstructing herbage she thrusts forcibly to one side. With her fore legs she rakes back the looser debris, working them alternately with such energy and speed that the sand is shot backward jet after jet in an almost continuous stream. The spouts issue forth between her hind legs like a miniature volcano of dust. She employs her mandibles for the coarser work. With these she tears away the roots and the stems, hoists out the bulkier nodules of earth and drags them to the mouth of the hole. Often she is not satisfied at just leaving them near the entrance ; the larger pieces, the clods, which to her must be enormous boulders, the stems, which in proportion are like trunks of trees, these she designedly drags farthest away so as to prevent them slipping back again into the hole. Thus she advances by raking and digging. Whatever obstructs her she breaks it down, applying to it her jaws or her vertex or her legs.

As she descends she has not only to eject the soil, but she finds that the material shot backward between her legs tends in part to fall back on her again. A loose hillock of debris accumulates at the mouth which threatens to collapse into the hole. She realizes the danger and takes steps to meet it. At intervals she backs upward out of the burrow, ascends the hillock, scatters back the dust until it is swept clear of the hole. Then she immediately plunges back into the tunnel, and soon digs herself down out of sight, though the signs of her excavation are still apparent from the succession of jets that come shooting from the hole.

At length the volcano suddenly ceases. We no longer see the sphex backing up to the surface, and the work of excavation seems to have come to an end. She has broken through the barrier that obstructed the gateway and is now in the cricket's den.

For a variable time everything is silent. It may be half a minute ; it may be a minute or more before the next step in the drama occurs. Then a huge head appears at the aperture. Two glaring eyes peer forth into the open and two long antennae are thrust through the gate. The brown fleshy body quickly follows, and soon the whole of the enormous cricket emerges with a sudden rush. Close upon its heels comes the excited wasp, mad with enthusiasm, her colours flashing as though the ardour of the chase had added to her sheen. In a few swift leaps the cricket is away, with the mouth of the burrow a yard or two behind. For a moment the wasp may be temporarily at fault. She rushes about in search of her quarry, sometimes hunting in the wrong direction, but soon she finds the track of her spoil. Then commences the chase in the open. The sphex, all aglow with excitement and anger, pursues her quarry with a passionate rush. Away goes the cricket leap after leap, and after it the murderous sphex. She reaches it, comes up from behind it, for she dare not face its powerful jaws. She clutches at it ; there is for a moment a swift and disordered scuffle,

but the cricket manages to break away. The chase continues ; the cricket makes a longer leap than usual, with the result that the sphex for a moment loses it, but she soon recovers the trail. Again she seizes it ; this time her grip is rather more secure, and she makes an effort to apply her sting. The moment, however, has not yet come : the cricket a second time struggles from her grasp, again it breaks into a succession of leaps, but the wasp is now close up behind it, soon she has it gripped for the third time and the cricket is now doomed. This time she clutches it firmly by the back. She fixes her mandibles on one of its wings, she clings onto its body with her curved claws, she curls her abdomen round one of its flanks and thrusts the tip underneath its chest. Immediately she attempts to sting her victim ; two or three times we see her pointed spear project, but the thrusts which she gives it are so quick and sudden that we cannot tell if it is driven home. Soon, however, she changes to a steadier operation. She presses forward her abdomen right under the thorax until its point is almost at the cricket's head, then out comes the long and quivering sting which she plunges into the cricket's neck. This is quite different from her previous efforts. It is not just a sudden, almost instantaneous, act, the mere insertion of the spear for a moment after which it is as quickly withdrawn. This is a long and steady and determined effort. For half a minute she remains thus locked with her victim, her body curled around its flank and her sting embedded in its neck. She makes not a movement of any kind, with her claws and her mandibles she just maintains a grip while the deadly poison takes effect.

In this one stroke the battle is finished. This last thrust secures immediate conquest, but, in order to be effective, it must be perfect and precise. It is not easy for her to achieve this final stroke, hence it is that the cricket so frequently escapes. The wasp must first adjust herself round the flank of her victim, gain a suitable purchase with her claws and mandibles, before she can apply her sting. It is difficult to do this with a struggling victim, and thus the cricket often manages to shake her off. But once the final plunge is made, once the tissues of the throat are pierced, then the struggle is instantaneously ended and the cricket rolls over in a helpless heap as though it were struck dead. Its legs fall, its antennae droop, it lies on the sand without a trace of motion, to all appearances a lifeless thing.

The sphex now steadily withdraws her weapon and awakens from that fixed immobile attitude which held her while her thrust was being driven home. She scarcely waits a moment ; she seems to know clearly that her conquest is complete. Getting astride her victim, she seizes it by the antennæ and immediately commences to draw it away. I take the prostrate victim from her jaws. To all appearances it is absolutely dead. Not a heave of the body, not a tremor of the limbs, even the antennæ hang limp and motionless ; the cricket, in fact, is so completely paralyzed that it shows not a trace of life.

Let us pause for a moment over some details of this contest ; it is the most important and exciting episode in the life of this

animated sphex. The battle is by no means a one-sided affair with certain victory assured to the wasp. The cricket is not lacking in the capabilities of defence. Though its fleshy body is deficient in armour, yet it is supplied with powerful instruments of battle and is superior in muscular strength. Its hind thighs are stout and fusiform-shaped rods that can kick with tremendous force, while the shanks are armed with double rows of backwardly projecting spines. Its mandibles are massive triangular structures, each being obliquely cut into a curve and fixed on a pyramidal base. Their opposing surfaces are sharpened to an edge, their extremities terminate in in-turned points, and the cutting margins are suitably provided with blunt and jagged teeth. Such are the weapons that the wasp must circumvent before she can apply her sting.

We will see that the cricket in the final struggle can sometimes use these weapons to effect. Six times have I been witness to the expulsion of the monster ; on five occasions the fascinating contest followed, not brought about by any artifice of my own, but a battle fought on the open sand in a free and unfavoured field. Four times victory fell to the wasp ; twice the cricket escaped. The first conflict was that which I have just described and is typical of the general character of the fight. On the second occasion the tables were turned. The sphex managed to come upon her victim clumsily. Instead of approaching it skilfully in the rear, she happened to advance with a rush upon its head, and, instead of getting her sting underneath the thorax, she drove it against the cricket's face. This was a fault in fundamental tactics ; it was probably due to a simple error, since the cricket at the time lay crouching on the sand and the wasp must have mistaken its head for its tail. Her adversary instantly seized the advantage ; it closed its massive jaws upon her leg and held her with a firm grip. She drew back in a frenzy, dragged and struggled, and at length managed to tear herself away. But she clearly had received the worst of the tussle. For a little while she lay half collapsed on the ground, then walked slowly and haltingly off, and refused to come again to the fight. Through the clumsiness of her attack the cricket had conquered ; nor was it at a loss to make the most of its advantage, for it left the arena in a few hurried leaps and soon dug itself into the sand.

On the third occasion also the cricket escaped. This time it did not gain the victory in battle ; it eluded its pursuer by the strength of its legs and the rapidity of its successive leaps. Its first jump carried it far from the burrow, after which it did not rest till it was yards away, with the result that the wasp on coming to the surface was unable to take up the pursuit.

The fourth was one of the deadly contests. This time the wasp at her first grip got a hold of the cricket by a hind leg. Then very deftly she worked herself forward until she obtained the usual purchase on a wing. Again I observed the same detailed operations, the adjustment of the sphex to the cricket's flank, the few preliminary strokes underneath the thorax, and then the final deadly thrust straight into the victim's neck. The one detail of the operation that still remained uncertain was the nature of these swift preliminary strokes. Are they actual poisonous thrusts,

genuine stings which penetrate the integument, or are they mere external probings which fail to be driven in? They are quick and sudden and utterly unlike the prolonged thrust that finally quells the struggles of the prey. In this contest they scarcely seemed to pierce the body, nor did the cricket seem much the worse for their effects. At first it appeared as though they were not real stings, but the searching and probing of an excited sphex eagerly feeling for the point at which to strike.

On the fifth occasion I saw only one preliminary sting. The wasp first gripped her victim by a hind leg, then, bending forward beneath its body, drove her lance into the abdominal mass. After this she took her customary hold upon a wing and plunged her sting into the tissues of the neck. Thus the preliminary stinging is variable in position and number; it is the final act that never fails.

The sixth contest disclosed additional variations. It was a battle greatly to the advantage of the sphex, for she had fallen on her victim at the mouth of the burrow when it was entangled in a tussock of grass. I here had a good view of the preliminary perforations. Three times I saw her thrust her sting into the thorax, after which she made a fourth stab into the abdomen, followed by a fifth into the side of the chest; then she came forward into the final position in order to reach the neck. The cricket seemed injured by these five preliminary stings, not, however, to any very great extent. The stab had to be made deep into the neck before quiescence occurred.

With the help of the records of these successive contests we can summarize the deadly strategy of the sphex. Her first grip is usually made on the cricket's hind leg, and the wasp, without waiting another moment, immediately applies her sting. Her first thrusts are merely of a preliminary nature; they are swiftly made, rapidly repeated, vary from about two to five in number, are applied to the under-surface of the thorax and abdomen, and, though they impede the cricket to some extent, yet they fail to produce a condition of paralysis, because they just penetrate the surface integument and do not reach the nervous chain. Thus, these preliminary stings are auxiliary blows; they are given in order momentarily to stagger the cricket and so enable the wasp to curl herself forward into the position for the final stroke. The last thrust is utterly different from the rest. The plunge into the neck is the blow of victory; it is from this alone that helplessness results.

The cricket, being vanquished, must next be removed. The wasp stands astride of it, her legs wide apart. She seizes the thread-like antennæ in her mandibles and walks her burden over the sand. It is a heavy load to which she has applied her strength: the monster may appear eight or ten times her size, yet she drags at it impetuously, hauling it over the leaves, round about the loose clods of earth and through the stiff stems of the grass. She makes no attempt to raise her victim. Her wings may vibrate with excitement or anger, but so massive a burden makes flight impossible, so she is compelled to keep her transportation to the soil. If the cricket is small and satisfactorily paralysed, she can move it along at a walking pace. But if it is large or has some

power of movement, then she may burst into a frenzy of passion, seize it by the throat, crush it with her mandibles and tear apart the tissues of its neck. This is, however, not a general occurrence, it is but a rough accessory to the more perfect operation, and is usually reserved for a victim that is regaining its strength before she has time to bury it underground.

She drags it off to the burrow from where it was expelled. It may be a journey of only a foot or two, but, on the other hand, it may be a tedious business if she has been involved in a difficult chase. When she reaches the gateway she thinks of storing her burden. Now she may often desert it for a little while ; she may either have some difficulty in finding the entrance or she may pay a visit to the interior of the tunnel to see if it is suitably prepared. At length she returns, finds her burden at the place where she left it, and then drags it to the edge of the gate. She places the cricket in such a position that its head is turned towards the entrance of the shaft. Again the sphex enters and for a moment disappears. Almost immediately she returns, takes hold of the cricket by the antennae and pulls it head first into the tube. For about a minute she remains below ; then, on emerging, she takes a stand over the entrance, shuffles back the sand into the tunnel and thus seals the open gate. This last is a rapid and skilful operation: the soil is loose and she is an expert at the work. In a few minutes the gateway is sufficiently closed, and, satisfied with this, she disappears.

Let us now investigate what has happened within. I follow down the tunnel into the sandy soil. It is a straight tube, slightly oblique in direction, and about equal to a middle finger in width. Its upper portion lies in the crumbling sand, but its lower half enters a more compact stratum which is pleasantly moist and cool. After tracing it down for fourteen inches I come upon the blind end. There is no special dilatation to be seen, nothing in the nature of an artificial chamber ; it is merely a straight blind tube. The cricket is crouching at the bottom of this tunnel. It is seated with its head looking towards the gate. I expect to find it paralysed and helpless, for such it was when being dragged in. But it is seated erect looking out through the tunnel. I disturb it and it advances, coming forward on to the upturned soil. This, indeed, is a surprising resurrection. It took scarcely fifteen minutes to uproot the burrow, yet in that time the cricket has thrown off its stupor and returned to vigorous life. It is certainly enfeebled to some degree, but, on my interference, it goes off with a rush, its antennae quiver, its body pulsates, it can run and leap and make good efforts to escape ; moreover, when I capture it to bring it back to the tube it attacks me with its powerful jaws.

In conclusion let us examine it with a little care. To the front of its chest, a little to one side, the sphex has affixed an egg. It is of a narrow, elongated, oval shape, white in colour, and three-quarters of an inch in length. The wasp always anchors it in the same position, transversely across the cricket's breast. There is a good reason for this fixity of instinct. The object in view is the security of the egg. It is a structure composed of the most delicate substance : the slightest pressure will destroy its vitality, and friction

will tear it from its hold. Moreover, the cricket regains such strength that the egg will be exposed to many vicissitudes while its development is taking place. Hence it must be fixed to some special place where it will be free from external hurt. The most suitable spot is the cricket's breast ; there it is lodged in a deep recess, anchored to a surface which is free from movement and protected laterally by the bases of the limbs. There too it is sufficiently raised from the ground to escape friction when the cricket moves.

All the stages in the drama which I have here described, the laborious search, the frenzied excavation, the expulsion, the battle, the incarceration in the sand, all have been directed to the one purpose, the affixation of this tiny egg. With this act the duty of the hour is finished. The victim is stored, the egg is layed, the mouth of the tunnel is tightly closed. This episode in the life of the sphex is over ; she thinks no more of her buried treasure, but goes off to repeat the drama elsewhere.

(*To be continued*)

AN ACCOUNT OF SOME FRESH WATER CILIATES FROM LAHORE

BY

AMAR NATH GULATI, M.Sc.

(With two plates)

Before undertaking the description of the various forms a few words about the Ciliates in general will not be about of place.

The Ciliates are the most abundant and familiar of microscopic forms of life. They derive their popular name ciliate on account of the presence of small vibratile locomotary appendages called cilia. They are also called Infusoria, a term which was generally used to denote the various microscopic organisms which make their appearance in infusions exposed to air, but now the limits of the term have been narrowed down to denote Ciliata and Suctoria only.

They are mostly free-living aquatic forms, both marine and fresh water, but a large number of parasitic forms are also known to occur in the digestive tract of man, mammals and other vertebrata.

They are considered to be the highest of Protozoa, because in no other class namely Rhizopoda (amœba-like) Flagellata, or Sporozoa, does the cell-body attain so great a complication of parts, or so high a degree of structural differentiation. Unlike the above-named three classes, the Ciliata possess a well-developed mouth, sometimes a gullet also, an anus ; quite often organs of offence and defence, nuclei typically two in number : macronucleus and micronucleus, besides cilia the typical organs of locomotion which are again modified into simple cilia, cirri, membranellæ, and undulating membranes according as to the use they are put to, viz., cilia for swimming, cirri for creeping on the mud at the bottom of pools, and membranellæ and undulating membranes for assisting in prehension of food.

The present paper is based on the examination of samples of water from various localities in the near vicinity of Lahore. Several ponds, ditches, artificial small ponds (*chabacha*), small pools on the banks of the River Ravi, and the Chota Ravi, and the bed of the drying up canal-water-course, were occasionally visited at different hours of the day for making such collections. Samples of running water were also often examined.

The observations were carried on during a period of ten months from June 1923 to April 1924, i. e., to include the physical conditions of the above-named localities, during the hottest, the rainy and the coldest months of the year. The bottom collections were always seen to be full of Protozoon life. The surface water, when covered over with whitish or green vegetable scum also showed a great number of these organisms.

The special features of the localities visited were that the ponds were covered over with a thick scum of duck-weed ; the ditches and artificial small ponds had putrifying dry leaves in them, and only those small pools on the banks of the river were selected for taking samples of water which had a thick whitish scum over the surface, for the reason that the thicker the scum, the larger was the number of organisms found in it.

The ciliate Protozoa were seen to live in association with flagellate Protozoa and Rotifers in the surface collections and the bottom collections showed the presence of several Nematode larvæ and other Oligocheata.

Ciliates of the genera. *Holophrya, Spathidium, Lacrymaria, Coleps, Didinium, Dileptus, Loxophyllum, Nassula, Chilodon, Glaucoma, Colpidium, Colpoda, Urocentrum, Cyclidium, Sigmostomum,* g.n., *Telotrochidium, Halteria, Urostyla, Pleurotricha* and *Gastrostyla* were found ; some of the species being new and others being described for the first time in India.

The only recent work on the fresh-water protozoan fauna of India is that by Professor B. L. Bhatia, and Professor E. N. Ghosh of Calcutta Medical College. I have referred to the former's papers, being unable to get hold of

Professor Ghosh's papers some of which have been published in comparatively little-known local journals, I have simply referred to the brief notes about his ppaers in the abstracts in the *Journal of the Royal Microscopical Society*. The only previous work worth mentioning is that of J. H. Carter, who studied these forms in Bombay towards the middle of the last century, and published a number of papers in the *Annals and Magazine of Natural History*. I could not refer to these papers, but I got the list of forms recorded by him from the table given in Professor Bhatia's papers. I have followed Schewiakoff's classification of these organisms as given by Hickson in Lankester's system. For specific diagnosis I have referred to Saville Kent's *Manual of the Infusoria* and Eyeferth's *Einfachste Lebensformen* and *Fresh-water Biology* by Ward and Whiple. Various other papers the loan of which I obtained from Professor B. L. Bhatia, and others that I was able to consult in from various journals, are arranged in alphabetical order in the reference list given at the end.

I wish to take this opportunity of expressing my indebtedness to Professor B. Bhatia for his valuable guidance.

Order—HOLOTRICHA.

Sub-order—GYMNOSTOMATA.

Family—*HOLOPHRYINA* Perty.

Genus—*Holophrya* Ehren.

Holophrya simplex Schewiakoff. (Plate I, fig. 1.)

Body 52 × 39 mic., oval, cylindrical, a little less than one and a half times as long as broad. Entirely ciliate, cilia small, and close set. Body full of vegetable matter, so details of internal structure could not be seen in the living specimens. Oral aperture at the anterior end, not projecting ; pharynx absent. Contractile vacuole single, subcentral. Macronucleus oval in shape, situated in the middle of the body ; micronucleus, a small round structure, lying near the periphery. Habitat : stagnant water covered over with thick green scum ; surface sample,

A few specimens of this species, as defined above were found in a temporary collection of water in a ditch on the road-side in front of the Biological Laboratory, Government College, Lahore, on the 25th January 1924, at about 9 a.m. It was only occasionally that specimens of this species were found in collections from this water. The arrangement of cilia in longitudinal striæ could not be made out on account of their being full of vegetable matter. Only one contractile vacuole was seen. No feeding vacuoles were seen, due probably also to the dark appearance of the body. There were no trichocysts. The shape of macronucleus described in this species is globular, but in the specimens obtained by me the shape is ovoidal. They correspond with the description given in Eyeferth in all other respects.

This species is being recorded for the first time in India.

Genus—*Spathidium* Dujard.

Spathidium spathula O. F. Muller, var. *moniliforme* B. L. Bhatia. (Plate I, fig. 2.)

Body 112 × 85 mic. ; flask-shaped, neck of the flask being extremely small ; flexible ; anterior end narrower than the middle of the body ; width increases posteriorly, the posterior end being broadly rounded. Mouth occupies almost completely the narrow anterior end. The margins of the oral portion are padded. The general surface of the body appears to be striate. The ciliation is uniform except that the cilia round the anterior end are slightly longer. The movements of the animal are slow. Contractile vacuole is poster-terminal. Macronucleus consists of a long chain of small beads. Length is one and a half times as long as the width. It differs from the description given by Professor B. L. Bhatia in the proportion of length to width, the width noted by him being only 20 mic. against 105 mic. of its length, while in the specimens obtained by me length is only 1½ times as long as broad. Only

a few specimens were obtained so the measurements have not been considered as a specific character.

Habitat : Stagnant water from a drain in February.

Genus—*Lacrymaria* Ehren.

Lacrymaria striata sp. novo. (Plate I, fig. 3.)

Body 90 × 43 mic. ; elongated ; ellipsoidal in shape ; anterior end shaped like the cork of a bottle, and surrounded by a ring of cilia ; the body tapers to a narrow posterior end, which is completely occupied by the contractile vacuoles. Greatest width lies in front of the middle. Mouth at the anterior tip without any gullet. The whole of the body has a dark brown appearance except at the two ends, where it is transparent. Striations are both longitudinal and transverse. The anterior end is separated from the rest of the body by a constriction. Locomotion is not very swift. It has a calm, gliding movement, rotating round its axis. Length is twice as much as the breadth. Macronucleus oval, lies a little below the middle of the body. Micronucleus small, and round, lies about the middle of the body, a little in front of the macronucleus.

Habitat : From the stagnant water of a drain. The specimens encountered differ from all other known species of the genus as regards the general form of the body ; of the longitudinal and transverse striations of the cuticle ; and the contractile vacuole, which occupies the whole of the posterior end. The name *L. striata* is suggested. Specimens obtained were few.

Family—*COLEPINA* Ehren.

Genus—*Coleps* Nitzsch.

Coleps hirtus O. F. Muller. (Plate I, fig. 4.)

Body 52 × 24 mic., ovate, sub-cylindrical, more or less barrel-shaped ; persistent in form ; about twice as long as broad. Anterior margin denticulate ; three spinous processes developed at the posterior extremity ; cuticular surface usually longitudinally and transversely furrowed, and thus divided into quadrangular areas. Ciliated all round, cilia round the oral aperture are slightly larger than those on the general body surface. Anal apertures are situated at the anterior and posterior ends respectively. Macronucleus is spherical and central in position. Contractile vacuole is single, and is situated posteriorly. Brisk movement ; rotates vigorously on its own axis, when it wants to throw out excreta. The colour of the animal is dark brown.

Habitat : Pond water among duckweed and algæ, more generally at the bottom. From a small pond near Data Ganj Bakhash.

Family—*CYCLODINA* Stein.

Genus—*Didinium* Stein.

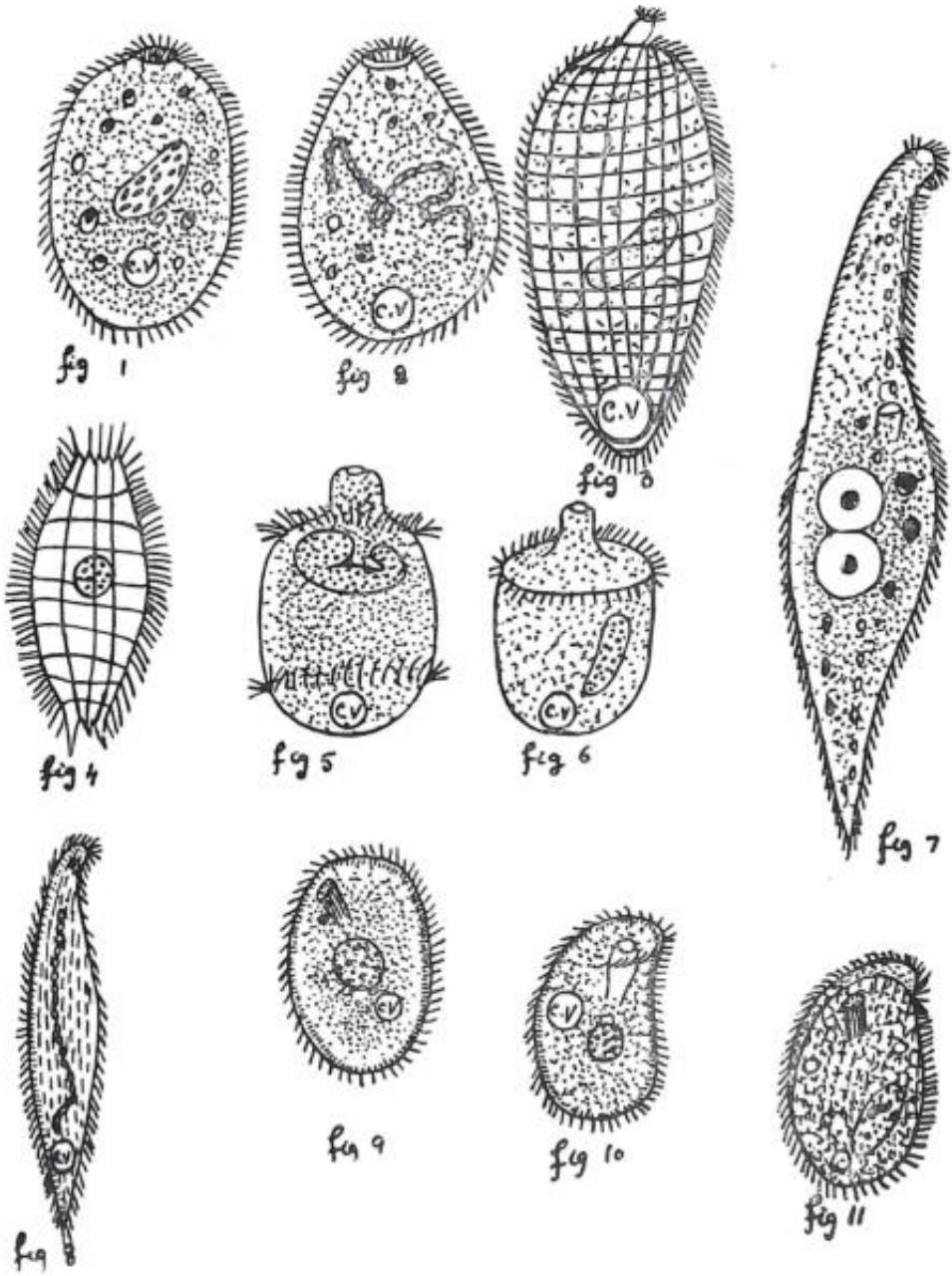
Didinium nasutum Stein. (Plate I, fig. 5.)

Free-swimming animal-cules ; body 102 × 40 mic., ovate, or sub-cylindrical, about one and a half times as long as broad, the anterior border produced into a snout-like process ; it is a protrusible, tubular projection, at the distal extremity of which is the oral aperture. Cilia restricted to two girdles, subservient merely to the purpose of locomotion. Anterior girdle of cilia is developed close to the base of the proboscis. The posterior girdle is at a distance of one-third of the total length of the animal from the posterior extremity. Micronucleus : band-like, curved into a horse-shoe, lying close to the anterior girdle of cilia. Contractile vacuole postero—terminal. Anal aperture at the posterior extremity close to the position of the contractile vacuole. Greenish or white in colour.

Habitat : Pond water brought along with frogs from near Chauburji.

Didinium balbianii Butschli. (Plate I, fig. 6.)

Specimens of this rare form were met with in the same water from which the other species *D. nasutum* was found. This is characterized by the presence of a single girdle of cilia situated near the base of the proboscis,



FRESH-WATER CILIATES FROM LAHORE

Macronucleus is seen to lie along the long axis of the body. It is band-like and only slightly curved at the two ends. The contractile vacuole is posteroterminal. Length 50 mic., width 35 mic.

It is conceivable that forms described as *D. balbianii* are only individuals resulting from a transverse division of individuals of *D. nasutum* which have not had time to develop a posterior ciliary girdle. But further observations are regarded essential to establish the specific identify of the two.

Family—*TRACHELINA* Stein.

Genus—*Dileptus* (Dujardin) emend. Wrzeaniowski.

Dileptus gigas (Clap. and Lachm.) Wrzeaniowski.

(Syn. *Vibris anser* O.F. Muller ; *Amphileptus gigas* Clap. and Lachm.).

Plate I, Fig. 7.

Body elongate, lanceolate, pointed posteriorly, the anterior trunk-like appendage equals one half of the total length of the entire body. The body, and the neck showed movements characteristic of the species, locomotion consisting chiefly of swift progression in a straight forward direction, accompanied by rotation of the body on its long axis, the proboscis meanwhile being thrust around in a tentative manner in search of prey. The specimens obtained by me are on an average 150 mic. in length. The cilia covering the body are very fine and close-set, and the neck shows a narrow groove along which the strong adoral cilia are situated. The body does not show any longitudinal striations, but the endoplasm is finely granular. The proboscis is transparent, while the rest of the body appears darker on account of the greater density of endoplasm in that region. Macronucleus consists of two rounded bodies placed side by side. Micronucleus is present and lies near the macronucleus. Pharynx cylindrical, at the top of which the mouth is situated, lies near the base of the proboscis.

Habitat : Found in small pools on the bed of the drying up water-course running through Gol Bagh.

Family—*AMPHILEPTINA* Butschli.

Genus—*Loxophyllum* Dujard.

Loxophyllum meleagris Ehren. (Plate I, fig. 8.)

Free swimming ; flattened ; flexible ; finely and entirely ciliate, lanceolate, the anterior extremity bluntly pointed, and curved, the posterior end is somewhat rounded. Length is to breadth as 5 is to 1. Average length 70 mic., average breadth 14 mic. Locomotion, quiet and gliding. Trichocysts present along one border. Mouth ventrally situated. Contractile vacuole lies near the posterior extremity. Cilia arranged in longitudinal striations on the general body surface. Macronucleus long, cord-like, twisted round itself like a rope.

Habitat : Bottom samples of stagnant water. I obtained only two specimens in the month of October 1923.

This species is being recorded for the first time from India.

Family—*NASSULINA* Butschli.

Genus—*Nassula* Ehren.

Nassula rubens Clap. and Lachm. (Plate I, fig. 9.)

Body 90 × 50 mic., ovate, cylindrical ; flexible ; not polymorphic, equally rounded at the two ends. Evenly ciliate. Brick red, or rose colour. Pharyngeal armature consisting of distinct rod-like teeth ; the tube formed by them is slightly wider anteriorly. Trichocysts are abundant all round. Contractile vacuole is single, subcentral. Macronucleus consists of chromatinic masses within the nuclear membrane. Micronucleus : small, rounded lying near pharyngeal tube. These specimens differ from those described by Kent as regards the ratio between length and width only.

Habitat : Found in pools on the bed of the drying up water-course running through Gol Bagh.

This species is being recorded for the first time in India.

Nassula ambigua Stein. (Plate I, fig. 10.)

Body 80 × 50 mic., oval ; anteriorly deflected a little along an oblique row of cilia ; equally rounded at both extremities about one and a half times as long as broad. Evenly ciliate. Pharynx consists of a horny tube dilated anteriorly, and has got no rod apparatus. Contractile vacuole single, spherical, central in position. Macronucleus rounded, micronucleus could not be seen. Beautifully coloured with red and green dots.

Habitat : Pools on the bank of the water-course in the Gol Bagh.

This species is being recorded for the first time from India.

Family—*CHLAMYDODONTA* Stein.

Genus—*Chilodon* Ehren.

Chilodon cucullus Muller. O.F. (Plate I, fig. 11.)

Body 45 × 28 mic., flattened, persistent in shape, sub-ovate, produced anteriorly into a lamellar, flexible, lip-like prominence, sharply pointed and curved towards the left. Locomotion gliding and undulating. The lip-like projection is obliquely striate ; but the general body surface bears cilia along fine longitudinal striations ; cilia are close-set and fine. Mouth, in the anterior one-third of the body, is succeeded by a tubular pharynx containing delicate rods. Numerous small vacuoles are distributed in all parts of the body. Macronucleus oval, with one or more big chromatin masses, micronucleus lies close to the macronucleus ; contractile vacuoles more than one, and irregularly distributed.

Habitat : Found in large numbers in the month of February 1924, from small pools on the bank of the Chota Ravi.

Sub-order—HYMENOSTOMATA Delage.

Family—*CHILIFERA* Butschli.

Genus—*Glaucoma* Ehren.

Glaucoma scintillans Ehren. (Plate II, fig. 12.)

Oval in form ; persistent in shape, with a convex dorsal and a flattened ventral surface. Oral aperture is situated ventrally towards the anterior extremity, and is associated with a minute vibrating flap-like membrane. The contractile vacuole is posteriorly located. Cilia are evenly distributed all over the body, being disposed in longitudinal striæ on the general body surface.

Macronucleus oval, shows a granular structure and lies in the centre of the body. Micronucleus small, rounded, lies on one side of the macronucleus. There are several food vacuoles in the body cavity distributed round the macronucleus in an irregular manner. Length is one and a half times as long as the width. Colour is greenish white.

Habitat : Found from the ditch outside the college laboratory in January 1924.

This species is being recorded for the first time from India.

Genus—*Colpidium* Stein.

Colpidium striatum Stokes. (Plate II, fig. 13.)

Body 35 × 17 mic., egg-shaped, anterior end thinner than the posterior ; persistent in shape. Mouth near the anterior end with two undulating membranes, one of which is continued down into the gullet. Cilia evenly distributed, arranged in longitudinal rows on the body surface. Length is about twice as long as the breadth. Contractile vacuole single, lies near the posterior end. Macronucleus is a rounded structure with a central big chromatin mass. Micronucleus small, situated a little in front of the centrally located macronucleus.

Habitat : Infusion of dry leaves and hay.

This species is being recorded for the first time from India.

Colpidium compyla Stokes. (Plate II, fig. 14.)

Body ellipsoidal, more elongated than in *C. striatum*, persistent in shape, sharply rounded at the two ends, length is four times as long as the breadth. Cilia are evenly distributed all over the body and are arranged in longitudinal

rows. Mouth as in other members of the genus. Contractile vacuole is single posteroterminal. Macronucleus rounded, lying in the anterior half, near the centre of the body. Micronucleus lies near the contractile vacuole near the posterior extremity. Stained preparation show the micronucleus distinctly. Length 70 mic. width 17 mic.

Habitat : Hay infusion.

This species is being recorded for the first time from India.

Colpidium colpoda Stein. (Plate II, fig. 15.)

Body egg-shaped, anterior end seems to be twisted round the body, mouth followed by a short gullet supporting an undulating membrane which projects out in a tongue-like manner ; cilia evenly distributed all over the body, oblique rows of cilia on the general surface. Contractile vacuole is single and posteroterminal. Macronucleus centrally placed shows two big chromatin masses and small particles of chromatin besides. The body is filled up with numerous food vacuoles. The cysts are rounded and burst open to set free at least 4 individuals, when the conditions are favourable. Length twice as much as the breadth, i.e., 70 mic. and 35 mic. respectively.

Habitat : Infusion of dry leaves.

Genus—*Colpoda* Muller.

Colpoda cucullus Ehren. (Plate II, fig. 16.)

Body 46 × 28 mic., kidney-shaped ; not persistent, protoplasm flows to flow into different forms ; the anterior end is curved. Length is to breadth as three is to two. Ciliation even, in oblique longitudinal rows on the general body surface. Contractile vacuole single, sub-central. Macro and micro-nuclei both present, situated posteriorly. Locomotion swift.

Habitat : Infusion of hay and dry leaves.

It is very similar to *Colpidium colpoda*, except in its kidney-like form which exhibits changeability.

This species is being recorded for the first time from India.

Family—*UROCENTRINA* Clap and Lach.

Genus—*Urocentrum* Nitzsch.

Urocentrum turbo. Ehren. (Plate II, fig. 17.)

Body 45 × 32 mic., almost cylindrical ; rounded anteriorly and posteriorly. Locomotion quick ; darting off like an arrow, with simultaneous rotation on long axis, and showing jerks among changes of direction. Cilia reduced to two bands, one anteriorly and the other posteriorly. The anterior band consists of many rows of cilia. There is a bunch of long cirri at the posterior end. Mouth on the ventral side with a flap-like undulating membrane, leading into a gullet which opens near the contractile vacuole to the out by the minute anus. The contractile vacuole is spherical, and is seem to be formed by the coalescence of four long canals. Macronucleus : horse-shoe shaped shows a granular structure ; micronucleus was not seen.

Habitat : Found in a pond near Data Ganj Bakhash and in a small pond in Gol Bagh in October and February respectively.

This genus and species is being recorded for the first time from India.

Genus—*Telotrochidium* Kent.

Telotrochidium natthaii sp. nov. (Plate II, fig. 18.)

Animalcules entirely free swimming, ovate, companulate or subquadrate, with a round convex anterior margin, and a knob-like projection protruded asymmetrically on one side of the posterior margin. This knob is retractile and the retracted specimens appear cup-like. Cilia are restricted to two girdles only, each consisting of a single row of cilia all round. The posterior girdle is hidden from view on retraction. Mouth lies about the middle of the body on the ventral side and leads into a ciliated gullet which opens out by the anus situated close to the posterior projection. There are one or sometimes two contractile vacuoles which lie in the neighbourhood of the mouth. Macronucleus is a long ribbon with numerous karyosome-like bodies. The two extremities are curved up to give it a horse-shoe appearance.

Micronucleus oval or rounded, usually found lying at one of the angles of the macronucleus. The usual ratio between the length and the breadth is as 4 : 3. Fission is always lohgitudinal, animalcules increase in breadth and ratio of length to breadth becomes 5 : 7. A constriction appears in the hinder region by the formation of an other knob-like projection on the other side. The constriction deepens and the two animals appear as if fused together. The macronucleus is now a straightened ribbon stretching at its full length along the width of the animal. The micronucleus divides but the process of division has not been determined, but probably it is by mitosis as the two halves have been seen to be united by a thin cord. These animalcules go on dividing by binary fission till the size is reduced to one-fourth of the parent form. These appear more or less like the gametes of Vorticella. Some of these are rounded and others become elongated, the latter are smaller in size. They do not seem to possess any mouth or anus probably because the process of division becomes rapid and the formation of these organs cannot keep pace with the division rate. The nucleus in these forms has been seen to be oval in form. No micronucleus was seen. Rounded and elongated forms were seen to come together and fuse completely, till the elongated small individual had flown completely into the rounded individuals and was one with it. Nuclear changes of this process could not be observed, because the above-noted stages were encountered in a hanging drop preparation. The individual thus formed had got encysted on the second day. Normal individuals were also seen to encyst in such preparations after two days at the most. The cysts are spherical, with a thick outer coat. There are two or more vacuoles inside each encysted individual. The whole of the protoplasm is seen to rotate in freshly encysted individuals. The structural appearance is granular with a darker granular zone along one margin showing the position of the nucleus. Length 145 mic., breadth 108 mic., greatest breadth in the anterior half in the region of the anterior girdle of cilia.

Habitat : Found in a ditch where dried leaves were rotting.

Specimens were found in great abundance and they were later on grown on Schewiakoff's culture fluid in which they flourished and multiplied in large numbers. At first sight they present a resemblance to detached vorticellæ, but on more intimate acquaintance, they showed resemblance to *Urocentrum* in many respects and so they have been referred to that family group. The organism however differs from the genus *Urocentrum*, in the mode of locomotion ; the character of the ciliary girdles, which are only one row thick as also in the anterior girdle of *Urocentrum*, but the posterior girdle runs obliquely here almost along the posterior border, while it runs transversely in *Urocentrum* about one-third of its length from its posterior end ; mouth is without a flap-like undulating membrane, only one or at the most two or three caudal bristles replace the bunch of caudal cirri found in *Urocentrum*, and also in its mode of binary fission. It shows a good deal of resemblance to a genus *Telotrochidium* discovered by Kent as regards its shape, mode of locomotion, presence of two ciliary girdles only one row thick, and in the longitudinal mode of fission. It however differs from *Telotrochidium* in the following respects :—

(1) The posterior girdle of cilia runs obliquely almost along the posterior border, which runs transversely across the body in *Telotrochidium*, at about one-third of the length of the body from the posterior end.

(2) There is no thick annular border associated with the anterior girdle of cilia, as described in the type species of the genus *Telotrochidium*.

(3) The posterior end is not described as retractile in *Telotrochidium*, while it is so in these animalcules. The organism retracts this posterior end with a jerk recalling the contraction of a vorticellid.

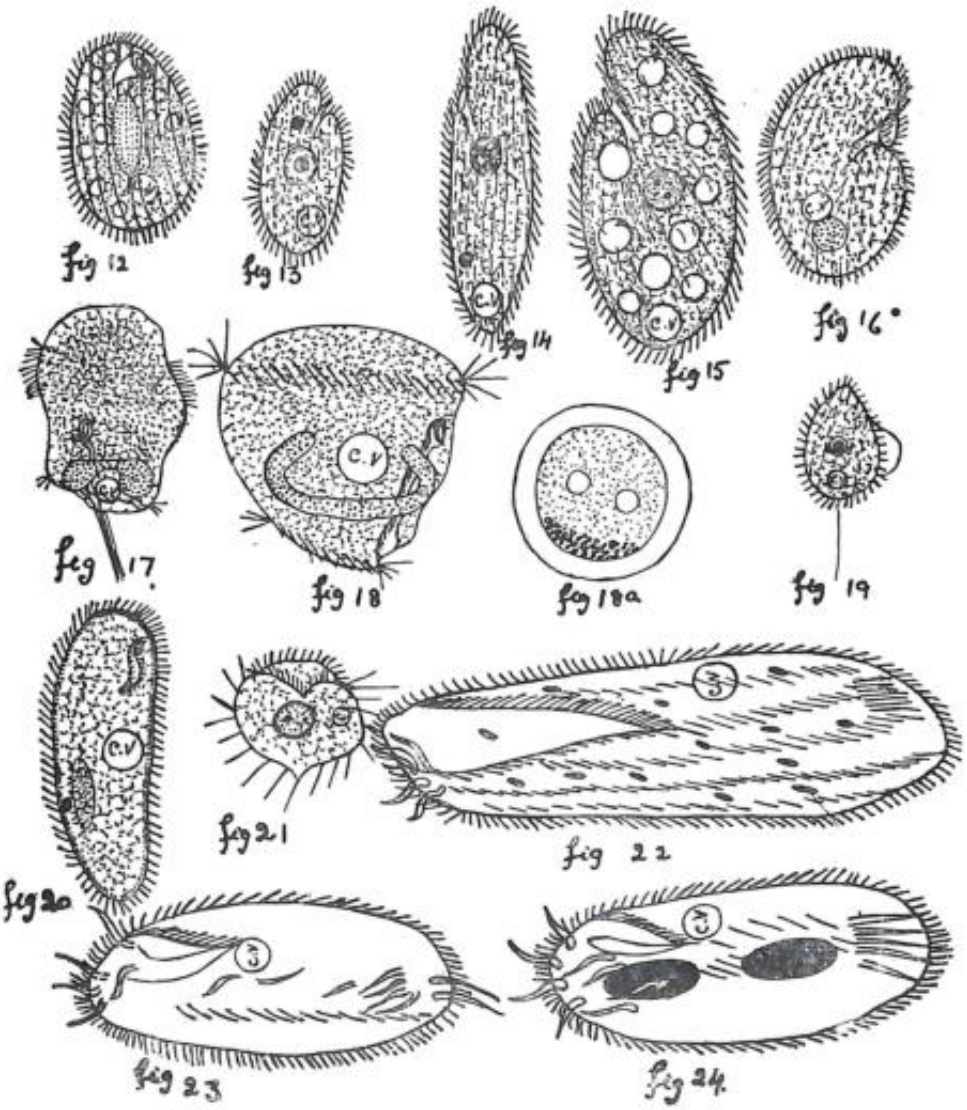
Taking into consideration the above-mentioned points, the specific name *matthaii* is suggested as a small tribute of gratitude to my worthy teacher, Professor George Matthai.

Family—*PLEURONEMINA* Butschli.

Genus—*Cyclidium* Clap. and Lach.

Cyclidium glaucoma Ehren. (Plate II, fig. 19.)

Body 25 × 14 mic., egg-shaped ; broader at the posterior extremity with a long bristle posteriorly. Locomotion very swift, shooting like an arrow,



FRESH-WATER CILIATES FROM LAHORE

alternating with standing still. Very quick, changing its directions, often in a jerky manner. The cuticular surface is longitudinally striate, the peristome does not extend much further behind the middle of the body, and the undulating membrane is large, hood-like and extensile. The macronucleus is central and spherical with a karyosome in the centre. The contractile vacuole is situated near the posterior end.

Habitat : Stagnant water in pools on the bank of the Chota Ravi in November.

Family—*CHILIFERA* Butschli.

Genus—*Sigmostomum* Gen. Nov.

Sigmostomum indicum sp. nov. (Plate II, fig. 20.)

Body 145 × 52 mic., oval, anterior end a little broader than the posterior end. Cylindrical, persistent in shape. Eugulfs large filamentous algæ, as big as its own length or even larger. In the latter case the wall of the body gets projected out at a point where the filament pushes it. Often one end of the algal filament is seen projecting out of the mouth opening or the anal opening. Cilia are evenly distributed all over the body. Mouth is situated on the ventral surface in the anterior half of the body, and there is no peristomial field leading to it. There is no gullet. Mouth is an S shaped slit lined by undulating membranes on both the lips. Locomotion swift, restless, rotating round its axis. Contractile vacuole single, spherical, situated near the periphery at about equal distance from either end of the body. Trichocysts studded all round below the outer layers of the ectoplasm. They are shot out on application of various fixatives or even very weak grades of alcohol. Macronucleus is oval in shape, lies in the posterior half of the body and presents a granular structure ; these granules seen to be united by a reticulate net-work. Micronucleus small, lying by the side of the macronucleus, is also oval in shape. Length is about three times the breadth.

Habitat : Pond water, surface collections covered over with filamentous algæ. I found it from small temporary collections of water near the fountain pond opposite the Town Hall.

The organism is placed in the family *Chilifera* by virtue of its possessing the following characters :—

1. Absence of peristomial field.
2. Mouth in the anterior half.
3. Gullet scarcely developed.
4. Undulating membranelless at the edge of the mouth.

The organism differs from any of the genera described in this family in the combination of the following characters :—

Mouth not situated at the anterior end, curved in the form of an S and provided with undulating membranelless along with lips, gullet completely absent, posterior end of the body without a caudal cilium. The contractile vacuole in the middle of the body, macronucleus oval, trichocysts well-developed, persistent shape of the body, and the locomotion being always accompanied with rotation on its own axis.

It comes nearest to the genus Glaucoma in the combination of the above characters but differs from it by the fact that there is a membranelle all round the margin of the mouth instead of a continued undulating membrane. The macronucleus is oval and the contractile vacuole is situated in the middle of the body.

The name *Sigmostomum* is suggested for this genus and the species is proposed to be called *S. indicum.*

Order—HETEROTRICHA Stein.

Family—*HALTERINA* Clap and Lach.

Genus—*Halteria* Dujard.

Halteria grandinella Muller. (Plate II, fig. 21.)

Body 28 × 28 mic., free swimming animalcules. Form somewhat spherical, usually terminating posteriorly in a somewhat narrower obtusely rounded point ; and a small triangular depression at the anterior end associated with a spiral of fine cilia ; a zone of long hair-like setæ or springing hairs are developed round

the central region of the body, the flexure of which enables the animalcules to progress through water, by a series of leaping movements. Contractile vacuole in the anterior half, spherical in form. Macronucleus : oval or kidney shaped, with one or two karyosome-like bodies in it.

Habitat : Fresh-water from little pools on the bank of the canal water course in Gol Bagh.

Order—HYPOTRICHA Stein.

Family—*OXYTRICHA* Stein.

Genus—*Urostyla* Ehren.

Urostyla weissii Stein. (Plate II, fig. 22.)

Body 130 × 42 mic., elongated elliptical, flexible to a high degree. Three to five frontal cirri and 7-8 anal cilia. Colour yellowish. Anterior is narrower than the posterior ; greatest width in the posterior half of the body. Peristome field forming an acute angled triangle extending to a little beyond the anterior one-third of the body. There are five median rows of short ventral setæ. Marginal cilia form a continuous row. Contractile vacuole single sub-central. Macronucleus broken up into many small oval bodies ; micronucleus not distinguishable.

Habitat : Surface collections of water among algal filament.

This species is being recorded for the first time from India.

Family—*PLEUROTRICHINA* Butschli.

Genus—*Pleurotricha* Stein.

Pleurotricha grandis Stein. (Plate II, fig. 23.)

Free swimming. Persistent in shape ; elongate elliptical, length twice as much as the width. Peristome not extending up to the middle. Six frontal cirri well-developed ; three or four scattered ventral setæ ; anal setæ disposed in two groups, each 5-6 in number, two of them are projecting posteriorly much beyond the margin. One or more rows of cilia supplementing the modified cirri on the ventral side. Contractile vacuole near the peristomial angle.

Habitat : In infusion of dry leaves.

Genus—*Gastrostyla* Engelmann.

Gastrostyla setifera Engelmann.

Plate II, fig. 24.

Body 90 × 30 mic., elongated, widest centrally, about two and a half times as long as broad. Peristome field hardly extending up to the middle of the body; its reflected border bearing a band-like undulating membrane. Eight frontal styles disposed of in a definite arrangement supplemented by two short rows of ventral setæ ; five anal styles besides. Contractile vacuole single, spherical. Macronucleus consists of two pear shaped bodies. Micronucleus was not seen.

Habitat : From a small pond near Data Ganj Bakhash in October.

This genus is being recorded for the first time from India.

GENERAL SUMMARY

To summarize, I have, in all come across 20 genera in 29 species of fresh water ciliates as represented in the table below. Out of these 17 genera have already been recorded by the previous workers. Out of the remaining 5 genera, 4 are being recorded for the first time from India and one I propose to call new to science. I have, however, in the present paper restricted to the description of those species only where I had something to add to the already-known facts about them or that they were either new species to science or were described for the first time in India. The following is the table of the Indian species of ciliates :—

Species			*Other authors*	*By the author*
Holophrya lateralis S. K.	...	...	+	—
,, *indica* Bhatia	...	...	+	—
,, *bengalensis* Ghosh	...	...	+	—
,, *annandalei* Ghosh	...	...	+	—
,, *simplex* Schew	...	...	—	+

Species	Other authors	By the author
Urotricha globosa Schew.	+	−
Enchelys arcuata Clap. and Lachm. ...	+	−
Spathidium spathula var *moniliforme bhatia* ...	+	+
Prorodon teres Ehren.	+	−
,, *eudentatus* Clap. and Lachm. ...	+	−
Lacrymaria vermicularis Ehren.	+	−
,, *striata* sp. nov.	−	+
Coleps hirtus Muller	+	+
,, *kenti* Bhatia	+	−
,, *uncinatus* Clap. and Lachm. ...	+	−
Didinium nasutum Stein.	+	+
,, *balbiani* Butschli.	−	+
Mesodinium pulex Clap. and Lachm. ...	+	−
Loxophyllum fasciola Ehren.	+	−
,, ,, sub. sp. *punjabensis* Bhatia	+	−
,, *meleagris* Ehren.	−	+
Loxodes rostrum Ehren.	+	−
Nassula sp.	+	−
,, *stromphii* Ehren.	+	−
,, *rubens* Clap and Lachm.	−	+
,, *ambigua* Stein	−	+
Chilodon cucullus Muller	−	+
Glaucoma pyriformis (Stein) ?	+	−
,, *scirilillans* Ehren.	−	+
Trichoda pura Ehren.	+	−
Frontonia leucas Ehren....	+	−
Ophryoglena sp. (*Otostoma carteri* S. K.) ...	+	−
Colpidium striatum Stokes	−	+
,, *comyla* Stokes	−	+
,, *colpoda* Stein	−	+
Colpoda cucullus Ehren.	−	+
Paramoecium aurelia Muller	+	+
,, *caudatum* Ehren.	+	+
,, *bursaria* Ehren.	+	+
Urocentrum turbo Ehren.	−	+
Telotrochidium matthaii sp. nov.	−	+
Cyclidium glaucoma Ehren.	+	+
Sigmostomum indicum g. n. sp. nov. ...	−	+
Pleurotricha grandis Stein	+	+
Urostyla weissi Stein	+	+
Gastrostyla setifera Engelmann	−	+
Euplotes charon Muller	+	+
Aspidisca costata Dujard	+	−
,, *lynceus* Ehren.	+	−
Scyphidia formentelii S. A.	+	−
Vorticella microstoma Ehren.	+	+
,, *patellina* Muller	+	−
,, *convallaria* L	+	−
,, *campanula* Ehren.	−	+
Vorticella citrina Ehren.	+	−
Carchesium epistylidis Clap. and Lachm. ...	+	−
,, *polypinum* Ehren.	+	−
Epistylis galea Ehren.	+	−
,, *plicatilis* Ehren.	+	−
,, *articulata* From	+	−
Cothurnia sp. (= *Pyxicola carteri* S. K). ...	+	−
Vaginicola sp.	+	−
Sphærophrya sp.	+	−
,, *pusilla* Clap. and Lachm. ...	+	−
Podophrya fixa Ehren.	+	−
,, *libera* Perty	−	+
Tokophrya quadripartita Clap. and Lachm. ...	+	−
Acineta tuberosa Ehren.	+	−

The freshwater Protozoa are no doubt cosmopolitan in their distribution and the conclusions drawn by Schewiakoff after an elaborate study of their distribution, and as already confirmed by Professor Bhatia can be confirmed by me also in so far as they apply to the group *Ciliata*. Out of the 32 species studied by me as many as 29 are such as are already described from other countries. Only three of them I am proposing to call new species. Two of these new species I have studied in detail as much as the circumstances allowed. I grew one of these species, namely *Telotrochidium matthai* in Schewiakoff's culture fluid with a little modification. However my observation could not cover the whole life-history of this species.

Works dealing with Indian forms

(1) Annandale, N.—The Fauna of Brackish Ponds at Port Canning, Lower Bengal. Rec. Ind. Mus., i, pt. 1 (1907).

(2) Bhatia, B. L.—Notes on the Ciliate Protozoa of Lahore, *Ibid.*, xii, pt. 5. No. 15 (1916).

(3) Do. Notes on Fresh-water Ciliate Protozoa of India I and II Journ. Roy. Micr. Soc. (1920) and (1922) vols.

(4) Carter, H. J.—Further Observations on the Development of Gonidia, etc. Ann. Mag. Nat. Hist., xvi. (2) (1856)

(5) Do. Notes on the Fresh-water Infusoria of the Island of Bombay. *Ibid.*, xviii, (2), Nos. 104, 105 (1856).

(6) Notes and Corrections on the Organization of Infusoria, etc. *Ibid.*, viii. (3), No. 46 (1861).

(7) Notes on the Filigerous Green Infusoria of the Island of Bombay. *Ibid.*, iii. (4) No. 16 (1869).

(8) Ghosh, E.—Studies on Infusoria, II. Rec. Ind. Mus., xvi, pt. 1 (1919).

(9) Grant, G. W.—In Th. Cantor's paper on General Features of Chusan, with remarks on the flora and fauna of that island. Ann. Mag. Nat. Hist., xviii. (2), (1856).

(10) Mitchell, J.—Notes from Madras. Quarter. Journ. Micr. Sci., n.s. ii. (1862).

(11) Simmons, W. J.—Note on species of podophyra found in Calcutta. Amer. Monthly Micr. Journ., x.

References for best figures and description

As to the best references for figures and descriptions of the species, the author has found numbers 18 and 28 of the reference list at the end of the paper to be the best. Another book on fresh water Biology by Ward and Whiple, is also recommended.

LIST OF THE BOOKS CONSULTED

1. André, E. (1914). Récherchés sur la faune pelagique du Leman et Description de nouveaux genére d'Infusoire. *Reveue Suisse de Zoologie.*
2. Andre, E. (1915). Contribution a l'étude de la faune infusorienne du lac Majeur. *Revue Suisse de Zoologie, vol. 23, No. 4.*
3. Andre, E. (1916). Contribution a l'étude de la faune infusorienne du leman. *Revue Suisse de Zoologie, vol. 24, No. 10.*
4. Bhatia, B. L. (1919). Notes on the ciliate Protozoa of Lahore. *Records of the Indian Museum, vol. XII, Part V, No. 15.*
5. Bhatia, B. L. (1920). Notes on fresh water ciliate Protozoa of India. *Jour. R. Micr. Soc, pp. 257-67.*
6. Bhatia, B. L. (1922). Notes on fresh water ciliate Protozoa of India, *vol. II. Jour. R. Micr. Soc., pp. 27-36.*
7. Bodine, J. H. (1923). Excystation of *Colpoda cuculus* ; some factors affecting excystation on its resting cysts. *Journ. Exp. Zool. vol. 37.*
8. Busch, W. (1921). Studies uber ciliation des Nordatlanti-schen ozeans und schwarzen Meerss. *Arch. f. Prot Bd. 42.*

9. Calkins, G. N. (1901). The Protozoa. New York.
10. Calkins and Cull. (1907). The conjugation of *Paramoecium aurelia* (caudatum) *Arch. f. Prot. Bd. X.*
11. Calkins, G. N. (1911). Effects produced by cutting Paramœcium cells *Biological Bulletin, vol. xxi, No. 1.*
12. Calkins, G. N. (1921). *Uroleptus mobilis.* Engelm. IV. Effect of cutting during conjugation. *Journ. Exp. Zoo., vol. 34, No. 3.*
13. Claus and Grobben (1910). Lehrbuch der Zoologie. (Marburg in Hessen).
14. Cordero, E. H. (1918). Estudios sobre algunos Protozoarios ciliados de las aguas dulces del Uruguay. *Anales de la facultê* de Medicina, Montevideo, Tomo 3, fasciculo 89.
15. Dawson, J. A. (1919 and 1920). An experimental study of an amicronucleate oxytricha. *Journ. Exp. Zoo, vols. 29-30.*
16. Dehorne, A. (1920). Contribution a l'étude comparée de l'appareil nucleaire des infusoires cilies (*Paramoecium caudatum*, et *Colpidium trauncatum*) des Euglenes et des Cyanophycess. *Arch. Zoo. Exp. et Gen., Tome 60, fascicule 2.*
17. Delage and Herouard (1896). Trâite de Zoologie Concrete Tome 1 Paris.
18. Eyeferth, B. Einfachste Lebensformen des tier-und Pflanzenreichs. 4 Auflage Von W. Schoenichen und A. Kalberlah.
19. Gray, J. (1922). The mechnism of ciliary movement. *Proc. Roy. Soc., B., vol. 93.*
20. ,, (1923). The mechnism of ciliary movement. III The effect Temperature. *Proc. Roy. Soc. B., vol. 95.*
21. Gregory, L. H. (1922). The conjugation of *Oxytricha fallax. Journ. Morphology, vol. 37.*
22. Hartmann, M. (1907). Das System der Protozoon. *Arch. f. Prot. Bd. 10.*
23. Hartog, M. M. (1891). Abstract Maupas's researches on multiplication and fertilization in ciliate infusorian. *Q. J. M. S., vol. 32.*
24 Hartog, M. M. (1906). Protozoa, *Cambridge Natural History, vol. 1, London.*
25. Hickson, S. J. (1913). Protozoa, Infusoria. *A Treatise on Zoology, vol. 1, London.*
26. Hollis, H. B. (1922). Biolgin del *Chilodon cucullatus. Revista Mexicana de Biologia.*
27. Juday, C. (1919). A fresh water anærobic ciliate. *Biological Bulletin, vol. xxxvi, No. 2.*
28. Kent, S. (1880-1881). A Manual of Infusoria, London, vols. 2 and 3.
29. Lankester, E. R. (1873). Blue Stentorian. The colouring matter of *Stentor caerulus. Q. J. M. S., vol. 13.*
30. ,, (1908). A Treatise on Zoology, vols. 1 and 2.
31. Mast, S. O. (1917). Conjugation and incystment in *Didinium nasutum* with special reference to their significance. *Journ. Exp. Zoo., vol. 23, No. 2.*
32. Minchin, E. A. (1909). On mounting rotifers and protista in Canada balsam. *Q. J. M. S., vol. 53.*
33. ,, (1912). An introduction to the study of Protozoa, London.
34. Parker, T. J. and Haswell, W. N. (1897) A Text Book of Zoology. London.
35. Philips, R. L. (1922) The growth of *Paramœcium* in infusions of known bacterial contents. *Journ. Exp. Zoo., vol. 36.*
36. Sallitt, J. A. (1884). On the chlorophyll corpuscles of some infusoria. *Q. J. M. S., vol. 24.*
37. Taylor, C. V. (1923). A contractile vacuole in *Euplotes* an example of the sol gel reversibility of cytoplasm. *Journ. Exp. Zool., vol. 37.*
38. Woodruff, L. L. (1921). The present status of the long continued pedigree culture of *Paramœcium aurelia* at Yale University. *Proc. National. Acad of Science, vol. 7.*
39. Woodruff, L. L. and Spencer, H. (1922). On the method of macronuclear disintegration during endomyxis in *Paramœcium aurelia. Proc. Soc. Exp. Biology and Medicine.*
Note. * Marks the best references for figures and description of species.
40. Young, B. B. (1922). A contribution and morphology and physiology of the genus *Uronychia. Journ. Exp. Zoo., vol. 36, No. 3.*

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(*Continued from page 639 of this Volume.*)

Part VIII

(*With 1 Plate*)

H.50. Surendra.—The Acacia Blues. (Plate 29.)

1a (4). Above purple with broad dark borders. Below dark brown with very narrow black markings, some of which may be outwardly silver edged; unf a spot middle and end cell, 2 costal spots, a highly irregular discal line and submarginal spots. Unh basal and discal irregular line and submarginal dots; lobe black and a black spot in 2 with obscure green metallic scales; ground colour darkened mid termen F and about discal line H.

1b (3). ♂ tailed at v2; ♀ at vs 2 and 3.

1 (2). H highly excavated between 1 and 2, anal lobe large. ♂ upf dark purple blue; ♀ brown, paler brown on disc.

α. Small. ♀ pale discal area usually sharp defined. ♂ blue on H.

quercetorum discalis, M. (30-34). The Common Acacia Blue. Ceylon. C.

β. Small. ♀ pale discal area F diffuse. ♂ blue colour more restricted and absent on H.

quercetorum biplagiata, But. S. India. C.

γ. Larger, ♀ as last. ♂ with blue on H. Specimens from Assam, N. Burma and the Andamans are larger than from elsewhere.

**quercetorum quercetorum. M.* (30-40). Dun—Burma. Andamans. C.

2 (1). H straight between vs. 1 and 2, lobe small. ♂ above dark purple blue, borders half as wide as in last. ♀ dull lilac blue, shading basally to dull metallic blue; variable, may be all dull metallic blue. Tails very short and narrow.

amisena, Hew. (32-40). The Burmese Acacia Blue Tavoy—S. Burma. R.

3 (1b). ♂ ♀ Tailless, only a tooth at v2. ♂ above dark purple blue, borders as last. ♀ dark brown, bases broadly paler.

florimel, Doh. (36). The Tailless Acacia Blue. Tavoy—S. Burma. R.

4 (1a). Below pale ochreous brown, glossed vinous, no cell or costal spot unf. Unf a waved silvery discal line; unh an irregular silver line near base, another through end cell and a third post discal; tornal markings small. Single tail at v2.

α. ♂ above deep shining purple, border 2mm to 5 at apex. ♀ pale purple blue, more restricted than in ♂.

todara todara, M. (34-38). The Silver streaked Acacia Blue. S. India. R.

β. ♂ as last. ♀ rather pale purple, not purple blue.

* *todara distorta, DeN.* Sikkim—Shan States. R.

γ, ♀ pale metallic blue, border 1mm to 4 at apex, a black spot end cell. Below darker and markings rather differently arranged, being a cross between No. 4 and No. 1; unf discal line obliquely bent in from v3 to costa; unh central line as in No. 1 and post-discal line obscure as in No. 1.

todara karennia, Evans. (32). Karen-Dawnas. VR.

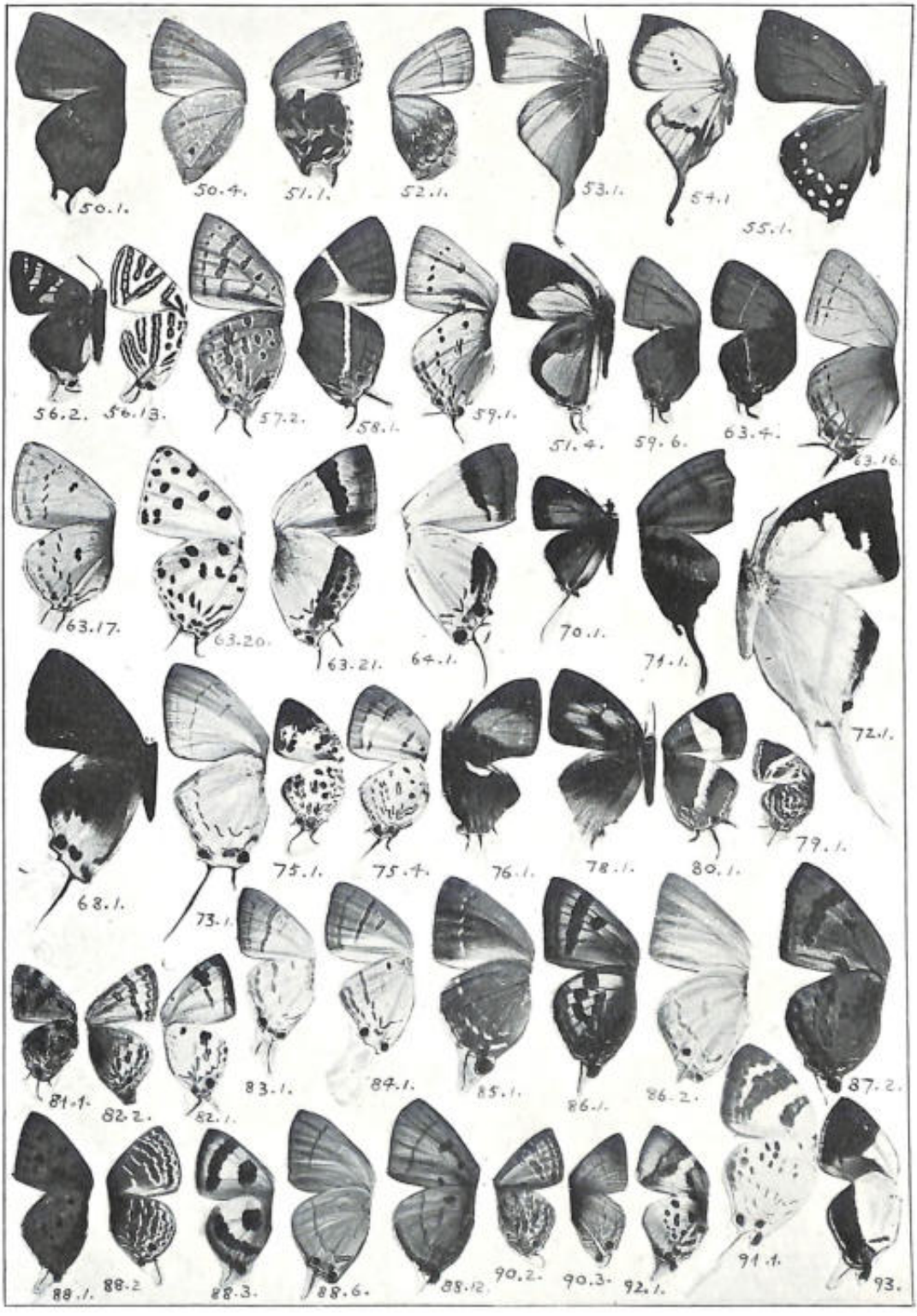
H.51. Mota—The Saffron. (Plate 29.)

♂ above dark purple with a broad dark apex and narrow border; ♀ purple blue, paler, border F broad and all H dark brown. Below saffron; unf a dark bar end cell, a post discal and submarginal line, area between clouded; unh almost entirely covered with large dark brown irregular markings, white edged and coalesced, lobe ochreous and termen irrorated white scales.

* *massyla, Hew.* (42-35). The Saffron. Bhutan—Burma. R.

H.52. Semanga—The Rededge. (Plate 29.)

Above shining violet blue, border F 2mm. to 4 at apex; H costa broadly dark, tornus orange from dorsum to 3, crowned black. Below pale ochreous



Groups 50-52. *Surendra*: 53-55. *Loxura*.

H. **Lycaenidae**. 56-57. *Spindasis*: 58-63. *Tajuria*: 64-70. *Jacoona*: 71-78. *Marmessus*: 79-80. *Horaga*: 81. *Catapoecilma*: 82-84. *Hypolycaena*: 86 93. *Artipe*.

H.52. Semanga—*(contd.)*

brown ; F a discal and submarginal ferruginous line ; H basal area unmarked, outer half ferruginous red, inwardly with series of oblique metallic blue streaks, centrally with large obscure black spots, most prominent in 2 and 6 irrorated white scales along termen, especially near tornus.

* *superba, Druce.* (32). The Rededge. Mergui. VR.

H.53. Loxura.—The Yamfly. (Plate 29.)

Above orange, broad black apex and termen F, narrow border H, bases more or less suffused dark brown. Below ochreous with more or less obscure pale brown basal spots, discal and submarginal bands.

α. Upf inner edge of black apex evenly arched ; bases slightly darker, suffused.

atymnus arcuata, M. (36–40). The Yamfly. Ceylon. NR.

β. From as next to a dark orange with broader black apex, extending to base along costa, inner edge evenly arched, bases broadly suffused, vs 6 and 7 H prominently black. Apex F more rounded.

atymnus surya, M. S. India. NR.

γ. Dark apex narrower, inner edge obtusely angled, DSF not basally suffused, vs 6 and 7 H not black. Paler than last.

* *atymnus atymnus, Cr.* Central India—Mussooria-Burma. C.

δ. Larger, brighter orange, apex broader, evenly arched and penetrated by yellow veins, base prominently suffused dark brown and in H practically the whole wing suffused.

atymnus prabha, M. (40–42). Andamans. Nicobars. NR.

H.54. Yasoda.—The Branded Yamfly. (Plate 29.)

Above orange with a black apex and border F ; upf with a black bar end cell and 3 discal spots ; uph a bar end cell and an oblique discal band ; the black markings may be reduced or absent. Below ochreous to ochreous brown with more or less obscure black rings, arranged irregularly towards base and as a discal band, which turns white towards dorsum H ; tornal markings obsolete ;

**tripunctata, Hew.* (42–40). The Branded Yamfly. Sikkim-Burma. R.

H.55. Drina.—The Yams. (Plate 29.)

1 (2). ♂♀ above dark brown, outwardly darker ; H discal row white spots followed by a submarginal row, larger in ♀. Below silky white, narrow discal and submarginal brown bands, tornal markings H obscure.

**donina, Hew.* (45–48). The Brown Yam. Lushai Hills—Burma. NR.

2 (1). ♂ upf except for base and broad termen, shining purple blue and the veins on the blue area pale yellow ; ♀ all dark brown ; uph dark brown with 2 large tornal white spots and a broad white sub-tornal band. Below white, apex and margin F broad dark chocolate brown, the inner third of the dark area being darker ; unh upper half of termen dark brown and a broad sub-tornal dark band.

mancia, Hew. (42–46). The Blue Yam. Mergui. R.

H.56. Spindasis—The Silverlines. (Plate 29.)

Below with silver centred broad dark bars and spots on a pale ground. Above dark brown, more or less shot blue, or fulvous ; tornus H usually broadly orange.

1a (2a). Unf sub-apical markings form a Y, consisting of a bar mid 4–5 placed centrally below 2 costal spots. Above mostly tawny, no blue ; tornus uph and unh not orange.

1 A (1 B). Above bases clear yellow. Upf pale apical spot in 6 only and never white. Dorsum F excavate posteriorly. Unf Submarginal band inwardly edged by crescentic lines.

epargyros, Evers. (30–34). The yellow Silverline. Baluchistan, R.

1 B (1 A). Above bases grey. Upf pale apical spot in 6 may extend into 5 and 4 and is white. Unf submarginal band inwardly edged straight lines. Dorsum F evenly convex.

α. Unh lowest of the 3 sub-basal spots rounded or elongate. Above bright tawny, base only suffused brown scales, black bands prominent in ♂, may be obsolete in ♀ ; on F marginal and submarginal black bands well separated.

H. 56. Spindasis—(*contd.*)

acamas hypargyros, But. (30-36). The Tawny Silverline. Cutch. Sind, Baluchistan. Punjab. R.

β. Below as last. Above much darker, suffused brown scales ; in ♂ leaving only some tawny colour round the black spots F and very little on H : ♀ more tawny : marginal and submarginal lines widened and often confluent, forming a single very broad dusky band.

acamas chitralensis, Riley (34-38). Chitral. NR.

2a (1a). Unf sub-apical markings consist of an inner short and an outer long bar, each made up of 2 conjoined spots ; these bars may be parallel or may form a V.

2b (14). Unh sub-basal band ends on v1 and is never continued along it.

2c (10a). Unf with a basal streak along the costa from the central cell bar ; this streak in the DSF may only be indicated by a few silver scales and be hard to see. The basal markings in the cell unf consist of a streak from the base under the scv and a spot beyond, the two being conjoined or separate ; in the DSF the streak may be absent.

2d (4a). Unh sub-basal band entirely confluent from the costa to v1. Below yellow with conspicuous red bands, more or less black edged.

2 (3). ♂ above not or only very faintly blue shot, ♀ without conspicuous plumbeous scales.

α. Upf orange areas restricted. Unh central band more separated from the postdiscal band, rendering discal yellow area wider.

vulcanus fusca, M. (26-34). The Common Silverline. Ceylon. C.

β. Upf orange areas wider. Unh bands more evenly spaced.

**vulcanus vulcanus, F.* India. C.

γ. ♂ upf orange markings reduced to a few streaks ; ♀ plain dark brown. Below bands very wide.

vulcanus tavoyana, Evans. Tavoy. R.

3 (2). ♂ uph blue shot ; ♀ with plumbeous scales on H and dorsal area F. Upf orange areas pale, restricted and suffused darker scales.

α. ♂ above pale blue shot only on H.

schistacea schistacea M. (28-37). The Plumbeous Silverline. Ceylon. S. India. NR.

β. ♂ above lower half F and all H pale blue shot.

schistacea gabriel, Swin. (30). N. Burma. R.

4a (2d). Unh sub-basal band broken into 3 spots, the upper 2 of which may be conjoined.

4b (9). Unf arrangement of sub-apical spots normal, outer spots in 4 and 6, inner spots in 5 and 7, each pair one above the other and conjoined ; the inner edge of the spot in 6 may touch the outer edge of the spot in 5 thereby forming a rough V, submarginal line never continuous.

4 (5-6a). ♂ above iridescent pale blue, ♀ dull blue ; no orange patches upf or plumbeous scales. Below pale brownish ochreous, bands concolorous with ground and faintly outlined black, silver centres prominent. Very variable.

lilacinus, M. (32-36.) The Lilac Silverline. Bangalore, Kasauli, Assam, Mhow, Malda, Hardwar. R.

5 (4-6a). ♂ above dusky violet brown at apex F, rest dull greenish grey, shot light blue. ♀ except for dark apex shining plumbeous silvery. Below dull reddish brown, markings very narrow.

abnormis, M. (40-44). The Abnormal Silverline. S India. VR.

6a (4-5). ♂ above dark blue shot, ♀ dark brown, the blue colour more or less replaced by plumbeous scales.

6 (7a). Below brick red with well defined markings. ♂ above intense black, shot dark blue up to v3. ♀ upf with a small diffuse orange spot, the blue shot replaced by a slight dusting of blue scales.

nubilus, M. (27-32). The Clouded Silverline. Ceylon. R.

7a (6). Below not brick red.

7 (8). ♀ with plumbeous scales above. ♂ ♀ with a well defined triangular orange patch upf. ♂ upf blue shot area not above v2.

α. ♂ upf dark brown with a more or less well defined orange patch upf, large and extending into 2 in the WSF, small and obscure in the DSF ; WSF only shot blue in 1, in DSF carried up into 2 and 3. Below pale yellow in WSF with well-defined markings, DSF khaki to reddish brown with markings tending to become obsolete.

H.56. Spindasis.—(*contd*).

ictis ceylanica, Fd. (27-32). The Common Silverline. Ceylon. C.

β. Larger. Upf orange patch well defined and almost invariably present. WSF below with very well defined dark bands : DSF khaki with bands nearly obsolete.

ictis ictis, Hew. (30-35). India. C.

8 (7). ♀ above no plumbeous scales. ♂ upf at most a small obscure orange patch ; in ♀ the patch is oval or circular, not triangular and does not extend below v3. Below khaki to reddish brown, markings well defined in WSF, faint in DSF. ♂ upf shot blue area above v2.

α. Comparatively small.

elima fairlici, Ormiston. (28-35). The Scarce Shot Silverline. Ceylon. NR.

β. Rather larger. Very variable.

elima elima, M. (32-38). India. R.

γ. Much larger.

elima uniformis, M. (36-42). Chitral—Kashmir. NR.

9 (4b). Unf sub-apical markings abnormal ; 3 outer spots in 4, 5 and 6 that in 5 slightly shifted in ; single inner spot in 7 midway between the outer spots and the discal band. ♂ above dark brown with a prominent orange patch upf, most of F blue shot, which colour extends over the orange area, presenting a peculiar appearance. ♀ dark brown, no plumbeous scales. Below khaki with narrow markings rather as in the DSF of *ictis*.

maximus, El. (35-42). The Karen Silverline. Shan States—Karens. NR.

10a (2c). Unf no costal markings above the scv, between the central cell bar and the base.

10b (13). Unf basal markings in cell as for 3c.

10 (11a). Unf sub-marginal line obscure, absent or discontinuous. Below bands very narrowly black-edged. Above dark brown, ♂ blue shot F and H ; ♀ with the blue shot replaced by plumbeous scales.

α. Below pale ochreous, bands concolorous or slightly darker than the ground, silver line often absent. ♂ ♀ with a more or less well developed orange patch upf, often absent.

nipalicus nipalicus, M. (36-42). The Silvergrey Silverline. Kulu—Nepal. R.

β. Below pale cinnamon red, bands darker, silver line obsolete, ♂ ♀ usually with a prominent orange patch.

nipalicus sani, DeN. Sikkim. R.

γ. Below as last, rather darker. ♂ upf darker, no orange patch. Below pale to dark cinnamon red, silver lines may be prominent ; lobe maroon or black ; discal band F and H more broken. ♀ above no orange, H and discal area F pale silver grey, scales closely set, not sparse as in other races.

nipalicus evansii, Tytler. Nagas Shan States—Karens. R.

11a (10). Unf submarginal line continuous and sharply defined.

11 (12). Below khaki with narrow dark bands. Above dark brown, ♂ shot blue and with no orange patch upf.

rukmini, DeN. (33-38). The khaki Silverline. Sikkim—Assam. VR.

12 (11). Below pale yellow, with broader black bands. ♂ shot blue, often with small orange spot upf : ♀ brown, with broad orange area.

elwesi, Riley (MS). Elwes' Silverline. Kumaon to Assam. VR.

13 (10b). Unf base cell with a continuous club-shaped streak. Above dark brown, no orange on F ; ♂ shot blue F and H. Below pale yellow with black bands to cinnamon red with red bands.

**syama peguanus, M.* (26-40). The Club Silverline. Orissa. Sikkim—Burma. C.

14 (2b). Unh sub-basal band continued along v1 to or nearly to the lower end of the central band, sometimes macular. Unf basal marking consists of a broad bar across the cell, the upper edge of which is joined to the base by a streak over the scv and on either side of it, which streak does not reach the central cell spot ; submarginal line usually continuous, but may be merged to the sub-marginal line ; sub-apical spots V shaped. Above as last.

α. Below bands very broad, ground colour pale yellow to reddish ochreous, bands usually red, very rarely black or nearly so, unh the sub-basal band in the DSF may not be continued along v1.

H.56. Spindasis.—(*contd.*)

lohita lazularia, M. (36-42). The Long-banded Silverline. Ceylon. S. India R.

β. Below pale yellow, bands black to red, very variable. Unf sub-marginal line wide and joined to the marginal line in the WSF., thin and macular in the DSF.

lohita himalayanus, M. (30-42). Sikkim—N. Burma. C.

γ. As last, but smaller. Unf submarginal line always narrow and continuous.

lohita seliga, Fr. (28-34). Karens—S. Burma. C.

δ. Below bands always black, submarginal line narrow and continuous. Unh sub-basal band always meets the central band.

lohita zoilus, M. (30-36). Andamans. NR.

H.57. Zesius.—The Redspot. (Plate 29.)

♂ above copper red outwardly darker and inwardly glosed violet with a fuscous border, 1mm.; ♀ rather pale powdery blue, may be purple tinged, with broad borders of variable width; uph with 2 tornal black spots, orange crowned in ♀. Below pale grey with white edged brown markings, turning reddish towards base, arranged as in *Amblypodia*; discal bands fairly regular; tornal spots black, crowned orange or entirely orange.

**chrysomallus, Hew.* (38-44). The Redspot. Ceylon. S. India. Orissa. NR.

H.58. Dacalana.—The Tufted Royal. (Plate 29.)

♂ above pale shining azure blue, border F ½mm.-5 at apex; uph with a white patch mid costa; ♀ paler, with a prominent white patch end cell F. Below rather pale brown, crossed by an even white band, central on F, discal on H and followed by a thin sub-marginal black line; tornal lobe black and an orange crowned black spot in 2 with white scales between. ♂ unf with a tuft of white hairs mid dorsum; uph brand above base 6 covered with blue scales and on a polished area.

1 (2). F v9 absent. Unh white band very narrow, just under 1mm. Considerable seasonal variation.

pennicilligera, DeN. (38-42). The Assam Tufted Royal. Assam—Dawnas. NR.

2 (1). F v9 present. Unh white band just over 1mm.

vidura burmana, M. (35-38). The Malay Tufted Royal. Dawnas-S. Burma. NR.

H.59. Pratapa.—The Tufted Royals. (Plate 29.)

Above blue with broad black apex F and H and borders F. Below pale brown to white with a thin discal line and tornal orange spots.

1 (2a). Below pale brown with a white band as in *Dacalana*, but broader and expanding towards the dorsum and costa. Above as *Dacalana*; considerable seasonal variation in width of borders. ♂ unf tuft black; brand uph dark brown, oval, on a polished area.

cotys, Hew. (33-37). The White banded Royal. Sikkim—N. Burma. NR.

2a (1). Below no white band. ♀ uph veins darkened.

2 (3a). Below polished silver grey with a discal series of separate black spots, broad bars end cells and a prominent spot mid 7 H. ♂ upf bright shining blue; upf a large black spot bases 2 and 3 and another mid 1. ♀ pale purple blue turning whitish towards apex F. ♂ unf tuft brown; dark brand uph on a black polished area.

** ctesia, Hew.* (38-40). The Bi-spot Royal. Kumaon—Shan States, NR.

3a (2). Below a narrow dark discal line, no spots.

3 (4a). Unf discal line not below v2; unh upper bar of discal line in 7 shifted in. Below ♂ polished silver; ♀ white with an ochreous tinge; no bars end cells. ♂ above shining blue; ♀ pale blue. ♂ unf tuft black; uph brand large and dark.

α. ♂ above paler and greenish. Below discal line faint and macular.

lucida argentea, Aur. (37-42). The Silver Royal. S. India. R.

β. ♂ upf with blue streaks on the black apex. Uph blue extends into 6. Below discal line continuous.

lucida minturna, Fruh. (30-40). Sikkim-Dawnas. R.

H.59. Pratapa.—(*contd.*)

4a (3). Unf discal line continued to vl except in faintly marked specimens.

4 (5a). Below white, discal line macular, bars end cells faint ; unh upper bar of discal line in 7 shifted out. ♂ above shining blue, ♀ pale blue or purple blue, turning whitish outwardly on F. ♂ unf tuft black ; uph dark brand very large and conspicuous on a dark area.

α. ♂ above darker, border F straight to dorsum or nearly so. Below discal line often faint.

deva deva, M. (32–40). The White Royal. Ceylon, S. India—Central Provinces. R.

β. ♂ paler. WSF ♂ upf border prominently angled mid 1 and continued along dorsum.

**deva lila, M.* Mussoorie-Rangoon. NR.

5a (4). Unf discal line continuous, not macular.

5 (6a). Below pale grey with a white bar end cell, prominent on F. ♂ above shining deep blue. ♀ pale violet blue, white beyond end cell F. Lobe dark orange. ♂ unf tuft dark brown ; brand uph small and inconspicuous.

α. ♂ above blue restricted on F, just enters cell and not into 2, border angled mid 1 and continued to mid dorsum. ♀ uph all dark brown, powdered with violet blue scales.

icetas icetas, Hew. (30-37). The Dark Blue Royal. Kangra-Kumaon. R.

β. ♂ upf blue crosses cell and enters base 2 ; border angled mid 1 and continued ¼ along dorsum. ♀ uph violet blue.

icetas extensa, Evans. Sikkim-Karens. R.

γ. ♂ above blue paler and with a greenish tinge, much more extensive, entirely fills cell and extends to base 3 ; border not angled mid 1 or continued along dorsum.

icetas mishmia, Evans. Mishmi Hills. VR.

6a (5). Below no bars end cells.

6 (7). Below pale brown discal line on F inwardly curved at upper end, outwardly white edged. ♂ upf blue to base 4. ♀ above pale dull powdery blue, border broad and angled mid 1 on F, broad on H. ♂ unf tuft pale yellow ; uph brand large, but inconspicuous.

α. ♂ above shining purple blue ; H border 1mm.

* *icetoides carmentalis, DeN.* (30-32). The Blue Royal. Assam. NR.

β. ♂ above shining blue ; H border a thread. Unh tornal orange area large, portions in 1a and 2 united.

icetoides icetoides, El. Karens—S. Burma. R.

7 (6). Below creamy brown, unf discal line straight at costa, lower part curved, nearer end cell than termen. ♂ above pale shining blue, apex F very broadly black, but border reduced to a thread at tornus, no border H. ♀ pale purple blue. ♂ unf 2 tufts, inner long and black, outer short and white. Wings produced ; inner tail broad and ciliate.

cleobis, God. (27–38). The Broadtail Royal. S. India. Dun—N. Burma. NR.

H.60. Maneca.—The Slate Royal.

♂ above dull slatey blue, broad dark apices and border F, border H 2mm. and veins dark. ♀ slightly paler and border narrower. Lobe prominently ochreous and cilia white. Below greyish white with narrow bars ends cells and a macular discal line ; tornal markings H reduced. ♂ uph brand large and black.

bhotea, DeN. (26–27). The Slate Royal. Sikkim—Assam. R.

H.61. Britomartis.—The Baby Royals.

Very similar to *Pratapa*, but smaller. Body blue above. Below pale brown, discal line orange, no bars ends cells, marginal markings obscure ; tornal markings H prominent and a broad orange area.

1 (2). Unf discal line midway between end cell and termen ; unh orange at tornus in 1a and 2 not coalesced. ♂ above rather pale shining blue, black apex F extends into end cell and all space 3, border at tornus 1mm. and a thread on H. ♂ pale dull slatey blue, border not quite so broad as in ♂ and H costa and apex broadly dark brown. No ♂ brand.

buto, DeN. (32). The Baby Royal. Assam—Burma. NR.

2 (1). Unf discal line much nearer end cell than margin ; unh tornal orange in 1a and 2 coalesced. ♂ above shining cerulean blue, apex F reduced, inner

H.61. Britomartis.—(*contd.*)
edge curved, not straight. ♂ upf a large prominent patch of modified scales before end cell and in bases 2 and 3, which disappears with petrol.
cleoboides, El. (25-28). The Azure Royal. Karens—S. Burma. R.

H.62. Creusa.—The Black-branded Royal.

♂ above pale shining greenish blue, apex F broadly black reducing to 2mm at the tornus, bases 2 and 3 blue; a black brand in outer half and cell; H apex dark brown. ♀ paler and blue more extensive. Below very pale brown, no bars end cells, discal line dark ferruginous, on F nearer cell than termen; H tornal markings small; orange crowns separate and well separated from the discal band.
culta, DeN. (32). The Black-branded Royal. Assam. R.

H.63. Tajuria.—The Royals. (Plate 29.)

Very like *Pratapa* and the ♀ ♀ are hard to distinguish, but in *Pratapa* the veins on the hindwing are dusky, which is not the case in *Tajuria.*
1a (10a). Unh irrorated white scales in 1 extend sideways into 1a and 2 and sometimes into 3.
1b (5a). Below ochreous or ferruginous.
1 (2a). Unh tornal spots crowned by a metallic green line. ♂ above dark purple blue, very restricted. ♀ paler, blue colour enters 3 on F. Below ♂ dark chocolate, ♀ yellow to pale ferruginous.
α. ♂ upf blue in lower half of cell, basal ⅔ of 1a and 1.
jangala ravata, M. (32–42). The Chocolate Royal, Sikkim—Burma. C.
β. ♂ upf blue powdery, confined to basal ½ of 1a and 1.
jangala andamanica, WM. Andamans. NR.
2a (1). Unh no metallic green line over tornal spots.
2 (3a). Below yellow, no discal line; unh tornal irrorated area surmounted by a white irregular line. ♂ above rich shining dark blue in 1a and 1 F and just entering cell; H blue with broad dark border.
donatana, DeN. (32). The Dawna Royal. Dawnas. VR.
3a (2). Below discal line prominent and white edged.
3 (4). Unh a white irregular line over the tornal irrorated area. Below yellow, discal line unf about midway between the termen and end cell. Upf ♂ black: ♀ lower discal area pale blue.
α. ♂ uph costa only pale blue, extending to v5. ♀ blue just enters base 2; uph with only sparse blue scales about base to middle.
megistia megistia, Hew. (32-34). The Orange and Black Royal. Assam. NR.
β. ♂ uph all pale shining blue, except for narrow black termen. ♀ blue more extensive on F and H all blue except apex.
megistia thria, DeN. Dawnas—S. Burma. R.
4 (3). Unh no white line over the tornal irrorated area. Below chestnut, discal line unf much nearer end cell than termen.
α. ♂ upf black; uph costa only pale blue, extending to v5 and into cell. Unf discal line sinuous.
yajna yajna, Doh. (34). The Chestnut and Black Royal. Mussoorie Kumaon. VR.
β. As last, but uph blue costal area extends to v4 and into cell. Unf discal line straight. ♀ upf lower discal area and uph pale powdery blue.
**yajna istroidea, DeN.* (32-34). Sikkim—Assam. R.
γ. ♂ upf shining pale blue in 1a and 1, not reaching v1; uph all blue except for narrow terminal border. Below paler. Lobe above mostly fulvous.
yajna ellisi, Evans. (34). N. Shan States. R.
5a (1b). Below pale brown to brown sometimes rosy in No. 8. ♂ ♀ above pale blue except for costa and apex and termen F. ♀ upf denser black beyond end cell (except 7b).
5b (7a). Below with bars end cells F and H; brown discal line midway between termen and end cell and area beyond paler; unh upper end of discal line usually shifted out.
5 (6). ♂ shining green, on F in basal ½ of 2 and ½ of 3; ♀ blue in ⅔ of 2 and ½ of 3; uph lower ½ of 6 blue to termen and in ♀ basal ⅔ of 6 blue. Unh orange tornal spots prominent.

H.63. Tajuria.—*(contd.)*

mantra, Fd. (42–44). Felder's Royal. Tavoy—S. Burma. VR.

6 (5). ♂ pale non-shining blue, on F only to base 2 ; ♀ in ½ of 2 and ⅓ of 3. ♂ ♀ uph blue only in base of 6. Unh orange tornal spots very reduced.

oeela, DeN. (47–48). DeNiceville's Royal. Karens—S. Burma. VR.

7a (5b). Below bar end cell absent on H and at most faint on F ; unf discal line nearer termen than end cell ; ground colour uniform.

7b (6). Below brown, discal line not prominently white edged. ♀ upf a prominent fuscous area of modified scales, disappearing with petrol, at and beyond end cell. ♂ upf blue in ⅔ cell, 1a and 1 ; in ♀ extending into 2 and 3.

7 (8). Unh discal line not conspicuously broken at v4. ♂ above pale shining greenish blue ; uph costa broadly dark brown, filling all 6 except extreme base.

ogyges, DeN. (47–48). The Large Branded Royal. Moulmein—S. Burma. VR.

8 (7). Unh discal line conspicuously broken at v4; below often rosy, especially in ♀. ♀ above pale blue.

melastigma, DeN. (40–46). The Branded Royal, N. Kanara, Kumaon—Burma. R.

9 (7b). Below very pale brown, discal line prominently white edged ; tornal orange markings H large. ♂ ♀ above pale blue, rather powdery, extending on F in ♂ into basal ½ or ⅓ of 2, in ♀ up to base 3 and most of 2 ; uph lobe orange crowned.

ister, Hew. (32–39). The Uncertain Royal. Assam. VR.

10a (1a). Unh tornal white irrorations confined to 1. Below white to pale brown, discal line not white edged.

10b (27). Unf no broad discal band.

10c (17a). Unh no spot on dorsum between end of discal line and base. Below with a narrow discal line, which may be absent.

10d (15a). Below discal line about midway between termen and end cell, continuous.

10 (11a). Unh discal line not parallel to termen, very straight and continuous to the middle of 2 from the costa. Below pale brown, discal line ferruginous, submarginal line prominent, no bars end cells. ♂ above pale blue in DSF, reaching base 3 ; WSF darker, blue more restricted ; ♀ paler, with a white spot beyond end cell F ; uph lobe mostly red.

diaeus, Hew. (33-36). The Straightline Royal, Mussoorie—N. Burma. R.

11a (10). Unh discal line parallel to termen, very irregular, brown. Below cell bars usually present. Uph lobe mostly black.

11b (14). Above pale cerulean blue ; ♂ upf blue in most of cell and to v3, terminal border narrow in 1a and 1 : ♀ blue very extensive. Below white to grey.

11 (12–13). ♂ above very pale cerulean blue, entering 3 upf ; ♀ area beyond cell upf prominently very pale.

albiplaga, DeN. (34–37). The Pallid Royal. Sikkim—Tavoy. R.

12 (11–13). Darker ; ♂ upf no blue in 3. Below darker, discal lines prominent, tornal spots reduced. Often no tail at v2.

sebonga, Tyt. (35). Tytler's Royal. Manipur. R.

13 (11–12). As last. Below paler, discal lines absent, tornal spots prominent. ♀ upf black apex broader, evenly curved, no tooth.

isaeus, Hew. (35). The Bornean Royal. S. Burma (DeN). VR.

14 (11b). Above dusky dark powdery blue ; ♂ upf blue colour may just enter 2, terminal border broad ; ♀ blue colour just enters base 3. Below pale brown : considerable seasonal variation.

thyia, DeN. (30–36). The Dusky Royal. Assam. R.

15a (10d). Below discal line much nearer termen than end cell, macular and may be absent ; pale grey to white, bars end cells present or absent ; on H discal line broken in at 3 and 4, so that lower part is shifted in compared to the upper part ; tornal markings more or less prominent. ♀ uph nearly always with a wavy black discal line.

15 (16). Above cilia conspicuously white. ♂ above slatey blue, on F in lower ½ of cell, basal ½ of 1a and 1, but may extend to base 3 ; on H there may be a wavy discal line as in ♀. ♀ upf blue more extensive, to beyond end cell where it is paler, sometimes whitish. ♂ ♀ uph 2 tornal black spots in 1 and 2.

H.63. Tajuria.—*(contd.)*

jehana, M. (30–37). The Plains Blue Royal. Ceylon. S. India—Bengal and Dun. NR.

♂. *v. ceylanica*, *Riley*, Blue upf extending above v2. NR.

16 (15). Cilia brown, or long hairs only white. ♂ above dark shining blue or greenish blue; upf cell blue and may extend to base 3. ♀ greyish blue, becoming whitish outwardly on F.

α. Darker blue. Smaller.

* *cippus longinus*, *F.* (31–45). The Peacock Royal. Ceylon. C.

β. Brighter. Larger.

cippus cippus, *F.* India, Burma. C.

17a (10c). Unh a small black spot on dorsum between the end of the discal band and the base. Below white; H tornal markings very reduced.

17 (18a). Unh no black spot in 8 internal to the discal band. Below bars end cells wide, discal line broken very irregular on H; unh black spot at apex. Upf disc white, turning bluish at base and dorsum, broad black border extending along dorsum, bluish white scales at tornus; uph bluish, turning white beyond end cell and base 6, rest of 6 dark brown to costa. ♀ as ♂ but wings more rounded.

* *illurgis*, *Hew.* (38–42). The White Royal. Mussoorie—N. Burma. R.

18a (17). Unh a black spot just below v8 between end cell and base.

18b (20). Below with a narrow irregular discal line, bars end cells narrow.

18 (19). Unf discal line in 1 not concave. Above as in last with white patches F and H.

illurgioides, *DeN.* (38–42). The Scarce White Royal. Mussoorie—Assam. R.

19 (18). Unf discal line concave in 1. Above ♂ pale blue, extending on upf to termen in 1 and filling basal ⅔ of 2. ♀ with broad dark border at termen upf and along costa uph; upf blue colour extending to 3 and turning whitish on disc.

luculentus nila, *Swin.* (38–42). The Chinese Royal. Assam. VR.

20 (18b). Below no discal line, but with several large irregularly placed black spots. Above pale blue turning whitish on disc F and beyond cell H, with broad dark borders F and costa H, extending along costa F. ♀ white with borders as in ♂.

* *maculata*, *Hew.* (36–44). The Spotted Royal. Sikkim—Burma. NR.

21 (10b). Below white with a broad dark discal band, no bars end cells. Above ♂ shining violet blue, border 1mm to 3 at apex F. ♀ dark brown.

α. Lobe above mostly black. ♀ uph with a row of submarginal white spots. Below discal band dark brown, outwardly defined by a white line, diffused outwardly; H a waved line above tornus quite separate from the tornal markings, black spot in 2.

jalindra macarita, *Fr.* (36–44). The Banded Royal. S. India. R.

β. As last. ♀ uph a white subterminal line in 1-2. Below discal band chocolate; H tornal green scales more prominent; white diffused areas beyond discal band more extensive.

**jalindra indra*, *M.* Orissa. Sikkim—Karens. NR.

γ. Lobe above mostly orange. ♀ uph no white spots. Below ground colour bluish white, discal band ferruginous brown, on F only separated from the marginal ferruginous area by a narrow white line to v2; H discal and marginal dark areas coalesced, no wavy discal line above tornus; tornal orange very extensive.

jalindra tarpina, *Hew.* Andamans. NR.

H.64. Charana.—The Mandarin Blue. (Plate 29.)

1 (2). ♂ above pale blue, black apex fills ⅓ of cell and the dark border extends along the dorsum; H costal border broad. ♀ above dark brown, tornal area H white with black spots. Below discal band ferruginous brown, confluent with paler ferruginous brown marginal area: marked as in H 63-21.

**mandarinus*, *Hew.* (40–44). The Mandarin Blue, Sikkim—Burma. Andamans. NR.

2 (1). ♂ above rich deep blue, much restricted. ♀ tornal white area uph reduced. Below border purple brown with no white submarginal line.

cepheis, *DeN.* (45). The Cachar Mandarin Blue. Assam. VR.

H.65. Jacoona—The Great Imperial.

♂ above pale shining blue at base F and H and a blue bar beyond the cell F on the black apex ; ♀ dark brown : uph tornal area white with two large black spots. Below white, apex F broadly and H narrowly silky ochreous ; unh tornal spots prominent and irrorated metallic scales, a very broken black discal line from 1a to 4. ♂ upf black brand on disc only showing with petrol.

anasuja, Fd. (46-50). The Great Imperial. N. Shan States.—S. Burma. VR.

H.66. Manto.—The Green Imperial.

♂ above bright shining greenish blue with a broad black apex F. ♀ dark brown with a broad white tornal area uph bearing black spots. Below ♂ chrome yellow outwardly darker ; ♀ paler ; H with prominent tornal spots.

hypoleuca martina, Hew. (44-47). The Green Imperial. Tavoy—S. Burma. R.

H.67. Mantoides—The Brush Imperial.

♂ ♀ above dark brown with a broad white tornal area uph, bearing black spots. Below silky ; F dorsum broadly white, remainder ochreous, darkening towards apex ; H white, costa and apex ochreous ; a discal black line, very obscure on F and prominent tornal spots H.

licinius, Druce. (36-44). The Brush Imperial. Dawnas—S. Burma. VR.

H.68. Neocheritra.—The Grand Imperials. (Plate 29).

1 (2). ♂ upf base shining pale blue, apex dark brown, inwardly angled and there may be a white patch in 2 ; uph dark brown, tornal area broadly white, crowned by some scattered blue scales and bearing black spots. ♀ dark brown with sometimes a white discal patch F ; H tornal area as ♂. Below white, apices ochreous brown, broad in F and bearing two suffused white fasciæ, narrower on H and bearing one white fascia : H with an irregular discal line from 1a to 2 and prominent tornal black spots, sprinkled with metallic blue scales.

**fabronia Hew.* (37-44). The Pale Grand Imperial. Sikkim—Burma. R.

2 (1). ♂ above dark purple blue with broad black apex F and border H tornus whitish, with a black spot in 1. ♀ dark brown with the tornus H white, bearing two confluent black spots. Below white with unmarked bright ochreous apices and the usual tornal markings H.

amrita, Fd. (35-50). The Dark Grand Imperial. Karens—S. Burma. VR.

H.69. Purlisa—The Giant Imperial.

♂ above shining blue with broad black apex F and border H. Below dark ashy with a darker postdiscal band and submarginal lunules ; tornal area sprinkled metallic scales.

gigantea, Dist. (52). The Giant Imperial. S. Burma. VR.

H.70. Suasa.—The Red Imperial. (Plate 29.)

♂ upf orange with black apex and border, base powdered bright blue scales, veins black ; uph pale blue with black apex and costa, black tornal spots in 1a and 2. ♀ upf orange with dark brown apex and border and base broadly darkened ; uph dark brown with tornal white area, bearing black spots. Below white ; F a broad ochreous brown discal band from costa to v3 continuing to v1, as a narrow brown line, margin broadly ochreous brown ; H a prominent black spot in 7 near base in ♂ only, a narrow discal and submarginal brown line, ending in prominent black spot in 7, prominent tornal spots.

**lisides, Hew.* (27-30). The Red Imperial. Assam—Burma. R.

H.71. Cheritrella.—The Truncate Imperial. (Plate 29.)

♂ upf dark purple blue with broad black apex and border ; uph pale shining blue with broad dark brown borders, lobe ochreous. ♀ much paler blue with two discal white spots upf. Below rather pale ochreous brown with darker markings, few and obscure on F, numerous on H ; tornal markings H absent except for some white irroration.

truncipennis, DeN. (32-36). The Truncate Imperial. Sikkim—Karens. R.

H.72. Neomyrina.—The White Imperial. (Plate 29.)

♂ ♀ above white with broad black apex F, shot blue in ♂. Below white with broad grey, black edged, markings arranged as in *Amblypodia* and with tornal black spots, crowned with metallic green scales.

**hiemalis*, *God.* (50–58). The White Imperial. Dawnas—S. Burma. NR.

H.73. Cheritra.—The Common Imperial. (Plate 29.)

♂ ♀ above dark brown with a purple tinge in ♂; a white tornal area H, bearing black spots. Below very faint bars at ends of celis; a narrow discal line F; a discal and submarginal line H and tornal black spots. Crowned metallic scales.

α. Below pure white, apex F faintly tinged ochreous; unf discal line black, highly waved and macular.

freja pseudojaffra, *M.* (38–42). The Common Imperial. Ceylon. NR.

β. Unf discal line regular and continuous. Uph white area more extensive.

freja jaffra, *But.* S. India. NR.

γ. Below ♂ pale ochreous, darkening at apex and termen F and apex H. ♀ white, outwardly ochreous. Unf discal line ochreous.

**freja freja*. *F.* Kumaon—Tavoy. NR.

δ. Below ♂ ♀ white; ♂ costa narrowly, apex and termen broadly bright ochreous; ♀ the ochreous apex unf very wide. Unf discal line ochreous.

freja regia, *Evans.* Mergui. C.

H.74. Ticherra.—The Blue Imperial.

♂ above dark purple blue, border 1mm; black tornal spots H coalesced and crowned by two white spots. ♀ dark brown. Below WSF bright ochreous, faintly marked as in *Cheritra*; DSF pale brown, markings more prominent and some obscure central markings.

acte, *M.* (34–38). The Blue Imperial. Kumaon—Burma. NR.

H.75. Biduanda.—The Posies. (Plate 29.)

1a (3a). Unf white, discal band not of same width throughout and broken in middle; unh upper spot of discal band in line with rest. Unf prominent chocolate spots in cell, narrow ferruginous or brown line end cell and a chocolate discal band, which is very wide to v3 and merges into the chocolate apex; margin below v3 ochreous, inwardly edged by a dark line. Unh white with basal brown rings or spots, an irregular double discal line, the upper end of which is darker and filled in as a single line, a very narrow submarginal line; prominent black spots and metallic scales. Tails v1 4 mm, v2 7mm, ♀ v3 1½mm; no ♂ brand.

1 (2). Unf discal band well separated from line end cell; a narrow dark line beyond upper part of discal band, the outer edge of which and of the discal band is obscurely white edged; the discal band in 2 consists of 2 narrow chocolate or ferruginous lines, which may coalesce, and in 3 of 2 chocolate lines, which are often coalesced. ♂ above dark brown; costa H orange and tornal area broadly pale shining blue with black marginal spots in 1a and 2.

α. Below markings not so pronounced and paler. ♂ above paler; upf with a sharply defined white patch at bases 2 and 3. ♀ dark brown with an orange discal patch on F and some faint tornal grey scales H.

melisa cyara, *Hew.* (20–25). The Blue Posy. Sikkim—N. Burma. VR.

β. Below strongly marked. ♂ upf no white patch. ♀ dark brown with a small orange spot end cell F, which may be obsolete or diffused; pale tornal area of variable extent and colour from bluish to white and more or less divided by darker veins.

**melisa melisa*, *Hew.* Karens—S. Burma. NR.

2 (1). Unf upper part of discal band coalesced to upper part of bar end cell and to line beyond, outwardly edged by a narrow, clearly defined, irregular white line; discal band in 2 consists of a single ochreous line and in 1 of a single chocolate line (or 2 spots); submarginal line regular, not waved, widened inwardly in 1 nearly to the discal band. Unh 2 narrow single lines at end cell (in *melisa* there is an outer narrow line and an inner double line, which may be coalesced). ♂ above dark shining violet blue, border 1mm, tornal spots in 1 and 2 crowned by bluish white scales. ♀ dark brown, a prominent orange discal spot on F; a broad bluish white tornal area H, which is not divided by darker veins.

H.75. Biduanda.—*(contd.)*

nicevillei, Doh. (30–33). The Violet Posy. Tavoy—S. Burma. R.

3a (1a). Unf ochreous, apex broadly washed brown, markings brown on the brown area, ochreous elsewhere ; discal band of even width, unbroken. Unh very like 1 a, but upper part of discal band in 7 shifted in to over cell bar. Unf spot base cell, bars mid and end cell. ♀ dark brown, a broad orange discal patch F and bluish tornus H.

3 (4). ♂ no brand. Above dark brown ; upf with an orange discal patch, beyond which the apex is deep violet blue, sparsely frosted white scales ; uph termen and tornus frosted white scales, mixed anteriorly with blue scales. Tails v1 2mm, v2 5mm, v3 1mm.

scudderii, Doh. (27–30). The Frosted Posy. Dawnas to S. Burma. VR.

4 (3). ♂ uph a shining dark brown brand about base 6 and shining yellow beyond. ♂ above dark violet blue, no border ; a more or less obscure or obsolete reddish discal patch on F. Tails v1 4mm, v2 10mm, v3 in ♀ 2mm.

******thesmia fabricii*, M. (32–35). The Dark Posy : Dawnas—S. Burma. NR.

β. ♂ upf, discal red patch more prominent ; ♀ orange red area more restricted. Unf apex not brown washed.

thesmia thesmia, Hew. S. Mergui. R.

H.76. Marmessus.—The Common Posy. (Plate 29.)

Upf orange red, base and apex dark brown ; ♂ uph pale shining blue, becoming purple towards apex and cerulean towards tornus ; ♀ uph dark brown with a more or less prominent orange discal patch. Below as H 74.4, but unf all ochreous and unh upper part of discal band in 6 and 7 shifted in, apex broadly pale ochreous. Tails v1 4mm, v2 10mm, v3 2mm.

******lisias boisduvali, M.* (26–30). The Common Posy. Karen—S. Burma. C.

H.77. Eoxylides.—The Branded Imperial.

Above dark brown ; ♂ upf some sparse blue scales above mid dorsum ; uph a broad white tornal area to v5, lobe black and two confluent tornal black spots, the white area edged bluish in ♂. Below bright ferruginous : F unmarked ; H tornal area as above, an irregular black discal line and a white bar end cell. Tails v1 2mm, v2 10mm, v3 2mm.

tharis, Hub, (34–36). The Branded Imperial. S. Burma. VR.

H.78. Thamala.—The Cardinal. (Plate 29.)

♂ above brilliant deep scarlet ; upf a dark border and some of the veins black. ♀ dark brown ; a large central orange area F intersected by a broad dark brown streak from base running below cell ; uph tornus widely irrorated bluish scales. Below crimson overlaid ochreous scales, obscure bars end cells a narrow dark obscure waved discal line ; tornal markings reduced and some sparse white scales. There is a second form of underside, ochreous not overlying crimson scales ; dusky in ♂ and markings obscure ; clear in ♀ and markings prominent. Tails v1 2mm, v2 3mm in ♂ ; in ♀ v1 3mm and v2 7mm.

miniata, M. (34–36). The Cardinal. Bhamo—S. Burma. NR.

H.79. Rathinda.—The Monkeypuzzle. (Plate 29.)

♂ ♀ above dark brown ; a white spot end cell F continued into 2 and 3 ; 2 black tornal spots H crowned by a dark ochreous fascia. Below ochreous brown to white ; on F some irregular dark basal markings, a curved white discal band, beyond which the apex is ochreous brown, bearing a white submarginal line ; H covered with numerous irregular markings. H angled at v4. Tails v1 2mm, v2 6mm, v3 2½mm.

***** *amor, F.* (26–28). The Monkeypuzzle. Ceylon. S. India.—Assam. NR.

H.80. Horaga.—The Onyxes. (Plate 29.)

Mostly cyaneous blue above with a dark blue apex F and a prominent white discal patch. Below ochreous or brown with a prominent white discal band across both wings to middle of 1 on H, whence to the dorsum there is a metallic green line ; tornal markings prominent and crowned by a metallic green line, which may run to costa. ♂ in Nos. 1 and 2 has an oval ochreous brand along basal half of v1, dorsum bowed. Tails v1 2mm, v2 4mm, and v3 1mm.

1a (3a). Unf ♂ with a well defined brand. Unh white band well defined.

H.80. Horaga.—(*contd.*)

1 (2) ♂ ♀ above cyaneous blue, but shade is very variable. Unf either the white band or the dark line bordering it outwardly extends well above v6.

α. Upf blue colour paler and brighter, extending well beyond the end of the discal white patch in 2 and 3 ; white patch not into 1 ; H blue to termen. Unf discal band to costa. Unh discal band of even width. Below ochreous to ochreous brown. Tail at v3 nearly obsolete.

onyx cingalensis, M. (30–33). The Common Onyx. Ceylon—S. India. R.

β. Upf blue colour darker, but very variable, never extending beyond the discal white patch, which always enters 1 ; very variable below. Tail at v3 short.

* *onyx onyx, M.* (27–31). Kangra—S. Burma. NR.

γ. ♂ upf white patch small, divided by black veins and not below v2 ; blue colour absent or restricted to powdery scales at base ; H greenish. ♀ white patch very large ; base sprinkled dull blue scales ; H all brown. Below dark ochreous brown. Tail at v3 comparatively long.

onyx rana, DeN. (30–33). Andamans. NR.

2 (1) ♀ above shining violet. ♂ upf white patch very small, 1½mm. Below ochreous brown, white band very narrow and straight and on F neither the white band nor the dark line bordering it extend above v6.

halba, Dist. (28–30). The Malay Onyx. Mergui. VR.

3a (1a). No ♂ brand. Unh white band very narrow and sullied. Unf discal band never above v6.

3 (4). Unh white band diffused outwards, straight. ♂ upf dark brown, white patch nearly to v1 ; H shining violet nearly to termen. Below dark ochreous brown, outwardly paler.

albimacula, Wm. (25–27). The Violet Onyx. Andamans. VR.

4 (3). Unh discal band not diffused outwards, somewhat convex. ♂ ♀ above dark brown or violet brown, discal white patch F may extend into 1. Below uniform, rather dark brownish ochreous.

viola, M. (22–28). The Brown Onyx. S. India. Kangra—Burma. R.

H.81. Catapoecilma.—The Tinsels. (Plate 29.)

Termen scalloped and cilia prominently chequered ; H not angled, lobe ill developed also tornal markings below. Tails v1 1mm, v2 4½mm and v3 1½mm.

1a (3). Below with numerous more or less regular ochreous bands and spots, edged metallic green and black.

1 (2). Below rather pale brown, bands and spots comparatively irregular, upper part of discal band on F broken up and post discal band beyond highly irregular ; on H spots at base and mid 7 separate. ♂ above dark violet blue, border 1mm. ♀ pale violet blue, border broader.

α. In ♀ borders above narrower and inwardly scalloped along termen F.

elegans myositina, Fruh. (28–32). The Common Tinsel. Ceylon, S. India. R.

β. Borders broader ; in ♀ 3mm and inwardly even along termen F.

**elegans major, Fruh.* Orissa. Mussoorie—Burma. NR.

2 (1). Below bright ochreous, bands and spots regular. Above as last.

subochracea, El. (27–29). The Yellow Tinsel. Nagas—Tavoy. R.

3 (1a). Below no regular spots or bands ; chrome yellow, densely and evenly striated with black and bearing scattered greenish silver metallic scales and streaks. ♂ above smoky purple black, obscurely violet shot ; on F near base there may be some powdery dull blue scales ; ♀ as No. 1.

delicatum, DeN. (32–35). The Dark Tinsel. Sikkim—Assam. R.

H.82. Chilaria. The Tits. (Plate 29.)

1a (3). Unh a prominent black spot in 7 towards base ; unf discal band completely broken at v4.

1 (2). Unf small black costal spot above mid cell. ♂ above pale blue with broad black apex and termen F, narrow black costa and apex H ; the black apex F shot deep purple blue ; blue colour F of very variable extent. ♀ brown, lower part of disc F may be whitish ; H tornal area broadly bleish white and veins darkened. Below white, faint bars end cells, making ochreous, black edged ; upper part discal band on F much wider than lower part ; discal band on H broken in 4 and 6 ; tornal spots prominent, orange crowned. Tails delicate, v1 4mm and v2 2mm.

H.82. Chliaria.—*(contd.)*

othona, Hew. (24-27). The Orchid Tit. South India. Dun—Burma. Andamans. NR.

2 (1). Unf no spot on costa. ♂ above pale blue, broadly black bordered, the inner portion of the border shot iridescent purple blue. ♀ dark brown, discs whitish. Below pale grey, marking concolorous and black edged. Tails v1 3mm and v2 1½mm.

α. Unh upper spot of discal band black. ♂ blue colour very restricted.

kina kina. Hew. (26-29). The Blue Tit. Dun—Kumaon. R.

β. Unh upper spot of discal band as rest. Blue colour very variable.

**kina cachara, M.* (27-31). Sikkim—Dawnas. NR.

3 (1a). Unh no spot in 7 towards base. ♂ above dark purple blue, except for black apex and border shot shining purple. ♀ brown, prominent white tornal area H, bearing marginal black spots. Below faint bars end cells; discal band narrow, ochreous, white edged, placed much nearer end cell than margin, straight and continuous on F, broken sharply on H at v4; very little orange at tornus.

α. Larger. Below white, apex F broadly ochreous. Tails v1 8mm and v2 4mm.

merguia watsoni, Swin. (27-29). The Purple Tit. Chin-Karens. R.

β. Smaller. Below grey, apex F broadly pale ochreous. Tails v1 8mm and v2 4 mm.

merguia merguia, Doh. (21-24). Dawnas—S. Burma. R.

H.83. Hypolycaena.—The Tits. (Plate 29.)

1a (3). Unh a prominent spot in 7 near base. Tails v1 5mm v2 4mm.

1 (2). Unh basal spot in 7 black. ♂ above dark reddish purple brown; ♀ dark brown, obscure black tornal spots H, crowned deep orange. Below white, faint bars end cells; black edged obscure ochreous discal band, broken at v4 on F and H and upper part wider; small tornal spots, obscurely yellow crowned.

nilgirica, M. (28-32). The Nilgiri Tit. Ceylon, S. India. R.

2 (1). Unh basal spot in 7 ochreous. Above very dark shining brown. ♂ paler and duller, prominent orange crowned tornal spots H. Below white, all markings narrow ochreous, white edged.

α. Uph spot in 2 only crowned ochreous. Unf discal band slightly shifted in at v4, apex broadly and margin narrowly ochreous; unh discal band broken at v4 and slightly at v6: tornal markings prominent, space 1 mostly ochreous.

**thecloides thecloides, Fd.* (30-32). The Brown Tit. Tavoy—S. Burma. R.

β. Uph ochreous tornal area wider, from 1a to 3. Unf discal band straight, termen only narrowly ochreous. Unh discal band straight to v4: ochreous crown to spot in 2 prominent, but hardly spreading sideways, space 1 being mostly dark.

thecloides nicobarica, Evans. (31-33). Nicobars. R.

3 (1a). Unh no spot in 7 near base. ♂ above changing from black to shining purple except for black borders. Upf prominent black area of modified scales on disc. ♀ above dark brown; uph an obscure white disconnected discal fascia in 1-3: tornal spot in 2 prominently white edged and a narrow white submarginal fascia in 3-4. Below grey with faint ochreous tinge, double bars end cells; an ochreous, white edged, discal line, continuous on F, broken on H at v4 and v6, tornal spot in 2 prominent, ochreous crowned. Tails v1 6mm and v2 5 mm.

α. Smaller. In ♀ uph tornal spot in 1 hardly defined.

erylus himavantus, Fruh. (32-36). The Common Tit. Sikkim—Burma. C.

β. Larger. In ♀ uph tornal spot in 1 defined by white edging.

erylus andamana, Fruh. (34-38). Andamans. NR.

H.84. Zeltus.—The Fluffy Tit. (Plate 29.)

♂ above very pale blue, powdery on F and confined to base; the broad black apex F and H shot deep purple. ♀ dark brown, tornal spots in 1a and 2 prominently white ringed and on a white area. Below bluish white, apices broadly pale ochreous brown, markings darker; double lines end cells; a narrow discal line, continuous on F, broken at v3, 4 and 6 on H; prominent black costal spot near base 7; tornal spots prominent, but not crowned orange. Tails fluffy at v1 13mm, at v2 7 mm.

* *elolus, F.* (28-32). The Fluffy Tit. Sikkim—Burma. NR.

H.85. Artipe.—The Green Flash. (Plate 29.)

♂ above shining blue, black bordered; ♀ dark brown; lobe green, black centred. Below verdigris green with a narrow white discal line and end cell bars; in ♀ tornal area H broadly white.

eryx, L. (♂ 40, ♀ 56). The Green Flash. Sikkim—Burma. Andamans. R.

v. skinneri, Wm. Below yellow. VR.

H.86. Deudoryx.—The Cornelians. (Plate 29.)

♂ above red with broad dark brown border, ♀ brown with sometimes the disc F paler. Below with cell bars and a discal band; H lobe black, orange crowned, a black spot in 2 and some metallic scales in 1. Above lobe black centred.

1 (2). Below markings very broad, continuous. Below uniform brown, markings white edged. ♂ scarlet above.

α. Smaller. Below rather dark brown.

epijarbas epijarbas, M. (34–38). The Cornelian. Ceylon, S. India—Orissa. NR.

β. Larger. Pale brown below.

epijarbas ancus, Fruh. (38–43). Chitral—Kumaon. NR.

γ. Very variable; usually rather dark brown below.

epijarbas amatius, Fruh. (36–44). Sikkim—Burma, Andamans, Nicobars, C.

* *v. diara, Swin.* Below very dark brown, outer part of the disc F and upper half H white, crossed by black veins. R.

2 (1). Below pale polished grey, outwardly pale ferruginous; markings narrow, catenulated, prominently white edged, slightly darker than the ground, of separated spots on F, conjoined on H; discal band H much nearer margin and upper spot in line. ♂ above paler red; ♀ may have a pale red discal area on F.

α. Below markings prominent, complete.

hypargyria gaetulia, DeN. (40–44). The Scarce Cornelian. Assam—N. Shan States. R.

β. Below markings becoming obsolete and may be reduced to spots in 2, 3, 4H.

hypargyria hypargyria, E1. Karens. VR.

H.87. Virachola.—The Guava Blues. (Plate 29.)

Below markings broad, bars end cells more or less white edged, discal band and tornal markings as in *Deudoryx*.

1 (2). Below pale brown, markings slightly darker; no spot in cell F nor near base 7 H. ♂ above dark fuscous brown sometimes paler on disc, shot brilliant violet blue on lower part of disc F and on most of H; tornal spot in 2 usually present and some bluish scales between it and the lobe. ♀ paler fuscous brown, darker towards end cell F, beyond which there is an ochreous patch and sometimes a similar tornal patch; H marginal spot in 2 usually prominent and orange crowned.

isocrates isocrates, F. (40–44). The Common Guava Blue. Ceylon, India, C.

β. Termen F convex in ♂. ♂ above dull purple, glossed pink. Below rich dark vinous buff, markings very obscure.

isocrates rosacea, Tytler. Manipur. R.

2 (1). Below very variable, pale to dark brown, often purple washed; markings darker than ground, centrally brown, outwardly black and more or less white edged; discal band on F anteriorly oblique and may be broken at v4; a spot in cell. H nearly always with a prominent spot base 7. ♂ above blue with a broad dark brown border F, much blacker in cell, beyond which there may be a dark ochreous patch. ♀ blue colour paler and more extensive, a whitish or pale ochreous patch beyond cell F.

α. ♂ above pale, shining blue. ♀ pale blue, white patch diffused. Below dull, markings less prominent.

perse ghela, Fruh. (48–52). The large Guava Blue. Ceylon, S. India. NR.

β. Darker, but very variable above and below. ♀ upf white patch smaller, not diffused. Unf very rarely a spot in cell. ♂ unf a brand above mid v1.

H.87. Virachola.—(*contd.*)

perse perse. Hew. Kangra—Assam, Orissa. N. Burma. NR.
γ. Unf always a spot in cell. Upf ♂ ♀ ochreous or white patch absent.
perse smilis, Hew. Andamans. S. Burma. R.

H.88. Rapala.—The Flashes. (Plate 29.)

Normal pattern below consists of a bar end cell and a discal band followed by a more or less distinct submarginal line; tornal spots more or less distinct, Nos. 1–3 are abnormal.

1a (7a). ♂ uph brand fills base of 6 or (in Nos. 5, 6 and 6a) has a detached portion along the base of v6.

1 (2a). ♂ uph brand enters cell. ♂ above dark indigo, shot brilliant deep blue, borders broad; ♀ shining indigo blue with narrower border. Below purple brown, washed shining purple and bearing a number of large, white ringed, dark spots; F spot in cell, double spot end cell, 3 discal and 3 apical spots; H 2 costal spots in 7, inner one very large, spot in cell double, spot end cell and discal row. ♂ brand shining dark blue; tuft brown, prominent.

**subguttata, El.* (32–35). The Spotted Flash. Karens—S. Burma. R.

2a (1). ♂ uph brand not into cell. Below banded, not spotted.

2b (4). Below pattern abnormal.

2 (3). Below rather pale brown, marked with narrow white lines; F line near end cell, continued into 1, a pair of discal lines joined at the lower end, a short apical line and lunular submarginal lines; H line through centre of cell from 1–8, a discal pair, broken at 1, a postdiscal line and 2 submarginal lunular lines; prominent tornal black spots, crowned orange and metallic scales. ♂ above brilliant shining blue, confined to base on F. ♀ dull pale purple blue, bases darkened and borders broad. ♂ brand small, pale grey in centre of polished patch; tuft black, prominent.

kessuma deliochus, Hew. (30–33). The Whiteline Flash. Shan States—S. Burma. VR.

3 (2). Below yellowish white, F and H a very large greenish white patch end cell and a very broad discal band, margins greenish brown; tornal markings small, no orange. ♂ above dark shining purple, shot brilliant blue on H, borders black on F. ♀ unknown. ♂ brand pale brown, circular, behind origin v7 and with a detached portion at base 6; tuft brown, short.

**abnormis, El.* (30–33). The Abnormal Flash. Karens—S. Burma. R.

4a (2b). Below pattern normal.

4b (6b). ♂ unf tuft mid dorsum.

4 (5–6a). Below very pale brown, markings obscure, broad, white edged either side. ♂ above shining purple blue, broad black border on F. ♀ paler duller and border narrower. ♂ brand dark brown, elongated, runs along over v7 and fills base 6; tuft pale brown inconspicuous. Apex F and tornus H more produced than usual.

refulgens DeN. (31–33). The Refulgent Flash Assam—Karens. VR.

5 (4–6). Below bright ferruginous with a dark ferruginous discal band, normally placed on H, but on F just beyond end cell; no bars end cells; tornal markings reduced, but crowned powdery white scales. ♂ above purple brown, shot deep blue at base F and over most of H; ♀ pale ferruginous; lobe ferruginous. ♂ brand pale yellow, circular, above origin v7 and with a detached portion along the SCV between origins vs 6 and 7; tuft brown, inconspicuous.

lankana, M. (38–41). The Malabar Flash. Ceylon. S. India. R.

6a (4–5). Below bright ochreous. ♀ paler; discal line narrow, brown, outwardly white edged and on F curved in at upper end. ♂ above red, broad border F running from 1a along dorsum; black border F and red area H shot rich purple. ♀ brown. ♂ brand as in last; tuft pale ochreous to ferruginous.

α. ♂ above coppery red. ♀ often paler on disc upf. Below pale yellow. Very variable.

**suffusa suffusa. M.* (33–37). The Suffused Flash. Assam—S. Burma. NR.

β. ♂ above bright red, not entering cell F and veins not black; H cell and dorsum and veins black; ♀ cupreous on disc. Below ♂ coppery ochreous; ♀ pale yellow, markings prominent; tornal spot in 2 crowned ochreous.

suffusa rubicunda, Evans. (33–35). Andamans. R.

6b (4b). ♂ unf no tuft mid dorsum; brand uph as in No. 6a, but smaller. Above dull red with broad fuscous borders F and dusky veins; the red colour

H.88. Rapala.—*(contd.)*

may be more or less fuscous overlaid, especially in ♀. Lobe small, ochreous. Below pale brown, single white bars end cells, discal bands rather broad, slightly darker than ground, white edged outwardly and on F much curved in apically ; on H curved parallel to termen. ♂ tornal spots in 2 prominent, orange crowned.

hades, DeN. (39-44). The Malay Flash. Dawnas—S. Burma. VR.

7a (1a). ♂ uph brand entirely above v7 and mostly behind its origin.

7 (8a). ♂ unf large polished area mid dorsum ; brand brown, large, circular ; tuft dark brown, prominent ; upf a black discal patch of modified scales.

♂ above very dark blue, shot brilliant deep blue ; ♀ dull purple, shading to the dark brown border. Below ♂ DSF greenish ochreous, WSF ochreous brown ; ♀ bright ochreous ; discal line narrow, outwardly white edged, broken on H.

tara, DeN. (33-41). The Assam Flash. Kumaon—Assam. NR.

8a (7). ♂ unf no polished area.

8b (16a). Unh discal band more or less curved and parallel to termen.

8c (12a). ♂ above blue.

8 (9a). Below bands very dark brown, broad, not white edged ; ground colour variable from uniform pale to dark ochreous brown, bases often darker. Body below prominently ochreous. ♂ above dark blue, shot most brilliant rich deep blue, border F broad. ♀ above rich shining blue, veins black. ♂ brand as No. 7 ; tuft dark brown, broad.

α. Upf no brand in ♂. Variable with the season.

sphinx sphinx F. (36-38). The Brilliant Flash. Assam—Rangoon. R.

β. Upf a sharply defined brand at bases 2 and 3 in ♂.

sphinx rhoecus, DeN. S. Shan States—S. Burma. R.

9a (8). Below bands white edged ; unh band white edged both sides and lower edge cell bar touches the discal band or nearly so ; tornal markings prominent, spot in 2 orange ringed and crowned.

9 (10a). Unf discal band double, comparatively broad and white edged on both sides. ♂ above dark shining greenish indigo blue, shading on F to a shining black border ; not shot blue. ♀ pale shining steely blue, more or less purple glossed. Below from slatey brown, often with a purple or greenish gloss to nearly white in the DSF ; markings always darker than the ground, sometimes as narrow as in No. 10 or so wide that the discal band coalesces with the cell bars. ♂ brand pale brown, circular ; tuft black or dark brown ; upf bases vs. 2, 3 and 4 denuded of scales and more or less darkened.

α. Smaller, paler and narrower banded below.

varuna lazulina, M. (28-32). The Indigo Flash. Ceylon, S. India, NR.

β. Similar. Very pale below.

varuna grisea, M. (28-32). Kangra—Kumaon, R.

γ. WSF always larger. Very variable above and below, often very broad banded.

varuna orseis, Hew. (29-35). Sikkim—Burma. Andamans. NR.

δ. unh tornus broadly white powdered.

varuna rogersi, Swin. (32). Nicobars. R.

10a (9). Unf band single, only white edged outwardly. ♂ above dark slatey blue, shot more or less brilliant deep blue. ♀ as No. 9, rather darker and more purple. ♂ brand as No. 9, darker ; tuft dark brown.

10 (11). Below pale brown to slatey brown, sometimes with a purple wash ; ♀ sometimes ochreous brown. ♂ above shot on lower part of disc F and most of H. Considerable seasonal variation.

schistacea, M. (30-33). The Slate Flash. Ceylon. India—Burma. Andamans. C.

11 (10). Below very pale greenish grey. ♂ above only shot blue on H.

scintilla, DeN. (30-32). The Scarce Slate Flash, Sikkim—Burma. R.

12a (8c). ♂ above some shade of red. ♀ dull blue, brown coppery or red.

12b (14a). Below some shade of ochreous. ♀ dull blue or brown.

12 (13). ♂ above coppery red. ♀ dull blue or purple blue shading to fuscous. ♂ brand pale grey, oval ; tuft brown.

α. ♂ above dark copper red colour extensive, border not continuing along dorsum F ; H red to termen, lobe ochreous. Below ochreous brown, markings dark brown, white edged outwardly ; unf a spot in cell nearly always

H.88. **Rapala**—(*contd.*)
present in ♂, usually absent in ♀; unh a spot near base 7 nearly always present in ♂.

**pheretimus petosiris, Hew.* (38–42). The Copper Flash. Sikkim—Burma. NR.

β. ♂ above darker, copper red area F confined to a patch in middle of disc and very restricted on H; ♀ dull shining blue; lobe black. Below darker, discal bands more irregular; unf spot in cell present in ♂, absent in ♀; unh ♂ no spot in 7.

pheretimus pheretimus, Hew. (36–40). Victoria Point, S. Mergui. NR.

13 (12). ♂ above bright scarlet, may be very obscurely purple shot; border broad and continued along dorsum F; H base and dorsum broadly black; lobe ochreous. ♀ plain brown. Below coppery ochreous of a variable shade, markings narrow, tornal spot in 2 ochreous crowned. ♂ brand pale ochreous, brown or grey, small and oval; tuft brown.

α. ♂ above red colour extends into 4 F; veins more or less black. Below DSF pale brownish ochreous; WSF coppery ochreous.

dieneces dieneces, Hew. (30–36). The Scarlet Flash. Bengal. Assam—Burma. NR.

β. ♂ above red colour not above v4 on F; vs F not black, on H all black and red colour of equal extent in 6 and 5. Below darker, copper brown.

dieneces intermedia, Stg. Andamans. NR.

14a (12b). Below slatey grey, no ochreous tinge. ♂ brand dull brown, not conspicuous. In ♂ dark border on F not continued along dorsum.

14 (15). ♂ above bright red; shot purple; border broad and vs F black, but not markedly so; WSF duskier and border broader. ♀ paler red. Lobe black with a few orange and metallic scales. Unh tornal spot in 2 not prominent nor orange crowned.

melampus, Cr. (33–38). The Indian Red Flash. Ceylon, S. India—Orissa, Mussoorie—Kumaon. NR.

15 (14). ♂ above bright red; vs. 2, 3 and 4 on F prominently black; H all red except in 7 and veins not black (DSF may be dusky red with vs. on H black). ♀ coppery brown, with fuscous border as in ♂. Lobe red. Unh tornal spot in 2 prominent, orange crowned.

jarbas, F. (35–41). The Common Red Flash. Sikkim—Burma. C.

16a (8b). Unh discal band straight to v2 or at least to v3, sometimes even convex to termen, further from termen at upper than at lower end. ♂ brand dark brown, inconspicuous, behind origin v7, tuft pale brown, often inconspicuous or absent in Nos. 16 and 17, always absent in No. 18. Tornal spots unh not prominent, spot in 2 always orange crowned.

16b (18). Above blue.

16 (17). ♂ above dark purple blue, shot brilliant deep blue, broad border on F. ♀ paler, steely blue above. Below rather pale ochreous brown, sometimes purple glossed, discal bands prominently dark brown, obscurely white edged outwardly.

buxaria, DeN. (38–42). The Shot Flash. Sikkim—Assam. R.

17 (16). ♂ above not shot blue. Very variable above and below. ♂ above dark steely blue to purple, border broad on F and often with an orange discal patch; ♀ paler. Below very pale brown to dark ochreous brown, with or without a purple or rosy gloss; discal band narrow ferruginous or dark brown, outwardly obscurely white edged.

α. Generally paler and smaller.

nissa nissa, Kollar. (34–38). The Common Flash. Kashmir—Sikkim. C.

β. Generally larger and brighter.

nissa rectivitta, M. (36–40). Sikkim—Assam. C.

v. rosacea, DeN. Below rosy. R.

γ. Always with a large orange spot upf; steely blue above.

nissa nissoides, Swin. N. Burma—Shan States. C.

18 (16b). ♂ above dark brown, obscurely purple glossed with large central red areas F and H of variable extent and more extensive in the ♀; on H red area crossed by black veins; lobe red. Below rather pale brown, double faint bars end cells; discal band broad on F, narrow on H, slightly darker than ground, prominently white edged outwardly, on F slightly broken in.

micans selira, M. (32–34). The Red Himalayan Flash. Chitral—Kumaon. C.

H.90. Sinthusa.—The Sparks. (Plate 29.)

Below markings very much as in *Rapala*, bars end cells and discal band.

1 (2a). Below white, markings yellow centred and black edged; discal band catenulated, broken usually at v4 F and H; unh dark bar mid cell and another in 7 above it; tornal spots prominent, orange obscure, metallic scales in 1. ♂ above greyish white, base F suffused dark brown and border very broad. ♀ as ♂ but pale area much more extensive. Lobe ochreous. ♂ unf no tuft, but with an oval orange patch of modified scales along v1.

virgo. El. (32-36). The Pale Spark. Sikkim—Manipur. VR.

♀ *v. confusa, Tyt.* The greyish white colour replaced by shining light blue. VR.

2a (1). Below not usually white and markings not yellow centred. ♂ unf with a tuft. Lobe above black centred with orange and metallic scales. ♂ above very deep blue, shot rich blue, border F broad; H rich shining purple blue; black portions of wing with a bronzy gloss. ♀ brown, often with a pale discal patch F and pale tornal area H.

2 (3). Below pale grey, no ferruginous tinge, markings broad, dark grey, white edged both sides; F discal band irregular, broken at v4; on H broken at 2, 4 and 6; cell bars nearly coalesce with the discal bands; H black spot mid cell and a larger one above it in 7. ♂ uph blue colour extends from v1 to v6 and through lower half of cell.

α. Below markings comparatively narrow, catenulated, marginal markings obscure. ♀ dark brown, may be slightly paler on disc F and before margin H and there may be some obscure bluish white patches in 1-4 H.

chandrana chandrana, M. (28-32). The Broad Spark. Kangra—Kumaon. R.

β. Below markings broader; in WSF marginal markings prominent: DSF sometimes nearly white below. Typical ♀ as in α.

**chandrana grotei, M.* Sikkim—Burma. NR.

♀ *v. albidus, Evans.* Upf with a sharply defined or diffused yellowish white discal patch; uph from as in typical form to almost entirely bluish white.

♀ *v. rubidus, Evans.* Upf with a more or less distinct red discal patch.

3 (2). Below bars and cells and discal band very narrow, nearly linear, ferruginous, outwardly white edged; on F discal band continuous, unbroken: on H broken at v2 and 4. ♀ as in No. 2 α above.

α. ♂ uph blue colour confined to margin in 1, 2 and 3, extending to end cell in 3 and 4. Below pale grey with a ferruginous tinge; in ♀ apex F pale ferruginous.

nasaka pallidior, Fruh. (28-32). The Narrow Spark. Kangra—Kumaon. R.

β. ♂ uph blue in 1-4 from margin to mid cell and along margin to 6. Below darker, markings more prominent. Unf termen ferruginous.

nasaka amba, Kirby. Sikkim—Burma. R.

H.91. Bindahara.—The Planes. (Plate 29.)

♂ above velvet black; above tail H as well as tail and lobe pale ochreous. ♀ dark brown; tornal area, lobe and tail white, veins black, prominent marginal spot in 2. Below ♂ ochreous; F outer half and H apex dark brown; ♀ white; F broad dark brown band through mid cell and a broad discal band, broken out at v4; H 4 basal spots, double spot end cell and a much broken discal band consisting of 2 parallel lines, the interval between in the ♂ and sometimes in the ♀ being filled in dark brown in 6 and 7; black tornal spots in 1 and 2 crowned metallic scales and by the submarginal dark line.

α. ♂ uph margin brilliant purple blue in 3-5, followed by green in 2. Below ♂ pale ochreous: dark bands very prominent in ♀.

**phocides moorei, Fruh.* (38-42). The Plane. Ceylon, S. India. R.

β. ♂ uph uniform dark brown. Below darker ochreous.

phocides phocides, F. (36-40). Sikkim—Burma. Andamans. R.

γ. As last, but below paler and all markings tend to complete obsolescence. ♀ below markings pale ochreous.

phocides areca, Fd. (36-40). Nicobars. R.

H.92. Araotes.—The Witch. (Plate 29.)

♂ upf black, basal half shot brilliant blue; uph brilliant deep blue, except for dark brown costa, ♀ dark brown, disc F obscurely reddish; H tornal

H.92. Araotes.—(*contd.*)

area bluish white, veins black. Below white ; F basal ⅓ and apical ⅓ ochreous, black edged ; H base and disc with irregular black markings, apex ochreous ; tornal marking prominent, crowned metallic scales.

**lapithis, M.* (28-32). The Witch. Sikkim—Burma. R.

H.93. Sithon.—The Plush. (Plate 29.)

♂ above brilliant deep shining blue, border 2mm. to 3 at apex ; H terminal ⅓ blue, rest black. ♀ dark brown, reddish on F ; tornal area H bluish white and veins black. Below white outer ⅓ F and outer ⅓ H dark chocolate brown in ♂, bright ochreous in ♀ ; F dark area divided by a white discal line, beyond which the apex is paler ; H apex and upper part termen paler, black discal line in 1a and 1 ; tornal area narrowly black, outwardly white edged and crowned metallic green scales in 1 and 2, a second metallic green line in 1 and a terminal line in 1a.

**nedymond ismarus, Fruh.* 30-34. The Plush. Dawnas—S. Burma. NR.

H.94. Liphyra.—The Moth Butterfly. (Plate 27.)

Above brown to rich yellow with an irregular, broad black border ; upf a large black spot at end cell, extending into bases 2 and 3 ; uph a black spot end cell and large spots at bases of 2 and 3. Below dull yellow, marked rather as above.

**brassolis, Wd.* (86-92). The Moth Butterfly, Sikkim—Burma. VR.

NOTE.—(1) From an examination of the types, I am satisfied that *Poritia geta* (H. 2.4) is a race of *pleurata* ; typical *pleurata* is hardly separable from *regia*. Fruhstorfer in Arch. Nat. 1917, puts *geta* as *hewitsoni*, which is incorrect. Mr. G. E. R. Cooper obtained 2 examples of a *Simiskina* in Mergui, which differed from examples of *pediada* I had from Tavoy : I find that his specimens correspond exactly with Hewitson's type of *pediada* and that my Tavoy insect is a race of *pasira, Moulton*, from Borneo and I have called it *dohertyi* : it differs from *pasira* in being browner below. (H3. 2 and 4). Fruhstorfer follows Swinhœ in keeping *potina* distinct from *phalia* ; from an examination of the types I am certain that they are conspecific, though I cannot say what species Swinhœ's blue ♀ from Labuan pertains to. (H 3-5). To Mr. Cooper belongs the credit of establishing *elsiei* (H. 3. 7).

(2) The Genus *Nacaduba* (H. 30) has given a great deal of trouble. I have examined the types of *pavana, hermus, atrata, prominens* and *akaba*, while Mr. Riley had kindly dissected a number of specimens on my behalf and Mr. Ormiston has studied most carefully the members of the genus occurring in Ceylon. The results are given in the key and, though finality has by no means been reached, some progress has, I think, been made. What has generally been accepted as *pavana* by all recent authors including Fruhstorfer in Leiden Zool. Med. 1915, covers 3 species, two of which are without doubt *pavana* and *hermus* ; the 3rd I have called *vajuva, Fruh*, but cannot say if this name is correct. The names in the *atrata* group are, I think, correct : it will be noted that Mr. Ormiston has established the existence of a hitherto unsuspected species in Ceylon. Mr. Ormiston has also established the identity of *Nacaduba noreia, Fd.* and its relationship to *hampsoni* seems clear : Major C. H. Stockley obtained a specimen of *noreia* in Burma recently.

(3). Fruhstorfer in Arch. Nat. 1915, produced a revision of the genus *Jamides* (late *Lampides*) (H. 31). He gives *pura* as a synonym of *celeno*, from which it is perfectly distinct. He places *coruscans* and *singalensis*, as races of *suidas, Fd.*, and *kondulana* but both are to my mind very distinct species, which cannot be linked up with Malayan species. He also places *pseudelpis* as a race of *kondulana* : the type of *kondulana* is in Vienna and I have not seen it, nor I believe had Fruhstorfer : for the present I prefer to treat it as a race of *elpis* and to treat *pseudelpis* as a separate species.

(4) *Curetis* (H. 44) has been treated in accordance with Chapman's revision in N.Z. 1915. Personally I am not as yet able to agree to the conclusions therein arrived at. I have not seen a white ♀ of the thetis group from Burma, nor a yellow ♀ of the *bulis* group from N. of the Karen Hills. More material is still wanted to clear up this genus.

(5) As may have been expected the genus *Amblypodia* (late *Arhopala*) (H. 49) has given a lot of trouble and here again Mr. Riley has helped me with dissections, thereby clearing up the *camdeo* group. I have sunk Bethune

H.94. Liphyra.—*(contd.)*

Baker's *nicevillei* and *oberthuri* to *silhetensis* and *alaconia*, respectively. I find that *atrax=aida*, *DeN*, and *mindanensis*, *BB.*: the type of *alea*, *Hew* is lost, but Mr. Riley and I are satisfied that it is synonymous with *selta*, *Hew. constanceæ*, *DeN*, appears to be a race of the very variable *alea* from the Andamans and Mr. Ollenbach has presented a pair of this variety to the B. M. I cannot see that *perissa* and *lounguva* can be maintained as species distinct from *agelastus* and *asopia*.

(6) *Everes parrhasius rileyi*, *Godfrey*, is I think a synonym of *assamica*, *Tytler*. (H17.3). *Strymon saitua*, *Tytler*, of *mackwoodi* (H 39.2) and *Tajuria tyro*, *DeN* of *isæus*, *Hew*. (H. 63.13).

(7) The following are new names: *Amblypodia adatha regia* (H. 49.23). *Surendra todara karennia* (H. 50.4). *Spindasis vulcanus tavoyana* (H. 56.2). *Pratapa icetas extensa* and *mishmia* (H. 59.5). *Tajuria yajna ellisi* (H. 63.4) *Hypolycaena thecloides nicobarica* (H. 83.2). *Rapala suffusa rubicunda* (H. 88.6). *chandrana grotei* ♀ vars *albidus* and *rubidus* (H. 90.2).

(8) The following are MS names: *Sinthusa virgo* ♀ v. *confusa* (H. 89.1) of Major-General H. C. Tytler. *Spindasis elwesi* (H. 56.12) of Mr. N.D. Riley.

(9) The following are new to the Indian Empire :—

(*a*) Obtained by Mr. G. E. R. Cooper in Mergui:—*Poritia philota* (H. 2,2). *Simiskina pediada* (H.3): *pharyge* (H. 3.3). *Logania sriwa* (H. 7.1). *Lycaenopsis cossaea distanti* (H. 20.11 B). *Amblypodia agesilaus* (H. 49.15A): *amphimuta*. (H. 49.15B). *cooperi* (H. 49.38). *Drina maneia* (H. 55.2). *Purlisa gigantea* (H. 69).

(*b*) Obtained by Mr. F. Mackwood in Mergui: *Lycænopsis haraldus ananga* (H. 20.1). *Amblypodia karennia* (H. 49.7). *Rapala pharitimus pheretimus* (H. 88.12).

(*c*) Obtained by Col. C. H. Haswell, R. E.:—*Polyommatus iolas* (H. 24 4).

(*d*) Obtained by Messrs. Ollenbach and Field, *Amblopala avidiena* (H.43B)

(*e*) Obtained by Major-Genl. H. C. Tytler:—*Lycæna astorica* (H. 23.8).

(*f*) Obtained by Mr. O. C. Ollenbach: *Azanus urios* (H. 32.3). *Callophrys chalybeia* (H. 38.3).

(*g*) Obtained by myself and from miscellaneous sources—*Lycæna pylaon indica* (H. 23.4). *Polyommatus poseidon poseidonides* (H. 24.3). *Jamides lugine purpura* (H. 31.10). *Heodes phœnicurus* (H. 35.5). *Amblypodia dispar* (H. 49.6). *ariana* (H. 49.19). *adatha regia* (H. 49.23). *pryeri* (H. 49.30). *paralea* (H. 49.37) : *corinda acestes* (H. 49.46).

(*h*) Obtained by Major F. M. Bailey:—*Thecla bieti irma* (H. 42.2)

(*i*) Capt. N. D. Riley has recently (N. Z. 1925) pointed out the differences between *acamas* and *epargyros*: he has transferred these two species, as well as *lilacinus*, from *Spindasis* (H. 56) to a new genus *Apharitis*, distinguished by having an ill-developed lobe and by the tail at v 2 being half as long as the tail at v 1, instead of equal to it.

(*j*) The genus *Thamala* (H. 78) requires more study: *miniata* is probably conspecific with *marciana*, *Hew* and there are certainly two races, perhaps two species flying in Burma.

(To be continued)



INDIAN SPIKENARD.

Nardostachys jatamansi. (After Royle.)

ON THE ANTIQUITY AND THE THERAPEUTIC USES OF THE INDIAN SPIKENARD

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(*With a plate*)

Its Antiquity.—A very remote antiquity is assigned to the use of the spikenard as a valuable drug and as a perfume. Among the ancients, it long maintained its reputation as the principal aromatic ingredient of many precious ointments. Its use as a medicine in Asiatic countries extends back into the dim past. The medicinal virtues of *Jatamansi* were known to the Hindus long before the Christian era. The spikenard was highly esteemed by the Romans and Syrians for its fragrance and was much used by them in perfuming their baths. Frequent references to the spikenard and its use as a cosmetic are found in the Bible. It is strongly believed that the essential oil yielded by this plant formed an aromatic adjunct to the ointment of spikenard alluded to by St. John xii. 3.—'Then took Mary a pound of ointment of spikenard, very costly and anointed the feet of Jesus. . . . . and the house was filled with the odour of the ointment'; and by St. Mark xiv. 3.—'There came a woman having an alabaster box of ointment of spikenard very precious; and she broke the box, and poured it over his head.' The spikenard was in great demand at Jerusalem and at Rome, and was sold, according to Pliny, at 100 denarii [1] per pound. The word 'nard' occurs in the Song of Solomon. The plant is mentioned by Theophrastus [2] in his *History of Plants*. Dioscorides, the famous writer on *Materia Medica*, who flourished in the first century or about the beginning of the second century of the Christian era, describes three kinds of Nardin, viz., the first kind having two varieties, (*a*) Syrian and (*b*) Indian, also called Gangites, from the River Ganges which flows from the foot of the mountains where the plant grows, the second kind is called 'Celtic', and the third 'Mountain nard'. Pliny (A.D. 79) remarks that the leaf nard or spikenard held the first place in Rome among the aromatic ointments of his day; and he observes (xii. 26) 'Leaf nard varies in price according to the size; for that which is known by the name *hadrosphærum*, consisting of the larger leaves, sells at 40 denarii per pound. When the leaves are smaller, it is called *mesosphærum*, and is sold at 60. But that which is considered the most valuable of all, is known as *microsphærum*, and consists of

[1] Denarius is a silver coin of ancient Rome, worth about 7¾*d.* English, first coined 269 B.C.

[2] Circa 372-287 B.C.

the very smallest of the leaves, it sells at 75 denarii per pound. All these varieties of nard have an agreeable odour, but it is most powerful when fresh. If the nard is old when gathered that which is of a black colour is considered the best'.[1] It is said that the spikenard referred to in Mark[2] was valued at 300 denarii per pound (Pliny). Ptolemy (A.D. 151) describes the plant under the name of 'nardus' and Galen (A.D. 130–200) under the name of 'Nardostachys'. The plant is mentioned by Horace who remarks (II, vii, 89) that spikenard was one of the most treasured ingredients of the ointments and perfumes of the Roman Empire.

Although the word 'nard' is mentioned by the early Greek writers, Theophrastus, Dioscorides and Galen, and among the Romans by Horace and Pliny, it is in reality a Persian word signifying a part of a vegetable. The Arabs have borrowed the word 'nard', but used it in the sense of a 'compound medicinal unguent'. The Arabic word 'Senbel' has long been substituted as a synonymous name. The word 'Sumbul' which signifies in Arabic vocabulary an ear or spike was always considered by Arabian authors as synonymous with the Nardos of Ptolemy and the Nardostachys or spikenard of Galen.

Under the name 'Sumbul' four separate articles are described (1) Sumbul-hindee, (2) Sumbul-roomee, called also Sumbul-ukletee and Narden-ukletee, evidently the Nardin of Dioscorides, said also to be called Sumbul-italioon, i. e., Nard which grows in Italy; (3) Sumbul-jibullee or Mountain Nard and (4) Sumbul-farsee which is a bulbuous plant and probably a kind of hyacinth (Dr. Royle).

Sumbul-hindee is the plant with which we are concerned. The Persian lexicographers give the following synonyms:—*Arabic*, Sumbul-ool-teeb or fragrant nard; *Greek*, Narden; *Latin*, Nardoom; *Hindee*; Balchur and Jatamasee. The Mussulman physicians describe Jatamansi of the Hindus under the name of Sumbulu'l Hind and distinguish it from their Sumbul-i-Roomee or Ukletee (*Valeriana celtica*), the fragrant root of which is much used in Turkey and Egypt as a perfume. The author of *Makhzen-el-Adwiya* compares Jatamansi root to the tail of a Sable. The Sumbul of India is described by Mussalmans as a 'herb without flower or fruit' (perhaps only the drug is referred to) like the tail of an ermine, or of a small weasel, but not quite so thick and about the length of a finger. It is darkish inclining to yellow, and very fragrant; it is brought from Hindusthan and its medicinal virtue lasts 3 years. (Sir We Jones). The spikenard is referred to as a valuable drug under the names Mamsi and Nalada in the *Bower Manuscript* (8th century).

Identification.—Much difficulty was experienced in botanically determining the spikenard of the ancients. On account of the inaccessible habitats of the plant and the consequeut difficulty in procuring living specimens and also of the philological confusion in the terms nard and spikenard, it long eluded the researches of the investigators. It was through the laborious researches of Sir William Jones that the spikenard was correctly identified with 'Jatamansi' of the Hindus. A distinction is usually drawn between

[1] Schoff, *Periplus of the Erythrean Sea.*

[2] St. Mark xiv. 3.

the nard and the spikenard. Nard has been generally supposed to be a grass. Linnaeus described nard as a graminaceous plant and a species of *Andropogon*. For a long time spikenard was erroneously identified with *Andropogon jwarancusha*. In many botanical works of Europe, the spikenard was long marked as 'unknown.' Although Linnaeus described 'nard' as a kind of grass he expressed his doubt as to the proper systematic position of the true spikenard. Kœnig described Indian nard as a kind of grass, but he was not certain as to what the Greek writers understood by the nard of India. *Andropogon schoenanthus*, a sweet-scented grass, a native in the West Punjab, Beluchisthan, Central India, Arabia and Persia, was once supposed to be the source of Indian spikenard. The spikenard was even mistaken for its highly fragrant odour for *Cetaca* or *Pandanus* which 'is an incomparable plant, and cultivated for its odour, which it breathes so richly, that one or two spikes, in a situation rather humid, would be sufficient to diffuse an odoriferous air for a long time through a spacious apartment; so that the natives in general are not solicitous about the living plants but purchase the spike at a great price'. It was sometimes confounded with a species of *Cyperus* or with a kind of *Pimenta* (a species of *Myrtle*). But the elaborate researches of Sir William Jones embodied in his classical paper on the 'Spikenard of the Ancients' published in the *Asiatic Society's Researches* dispelled all doubts and settled all disputes as to the identification of the Indian spikenard with Jatamansi of the Hindus. It has been proved beyond doubt that the spikenard and Jatamansi are one and the same plant. The word 'spikenard' owes its origin to the resemblance of the drug to a spike, when it is dried and not to the configuration of its flowers. The fibrous part above the root looks like a spike and was long mistaken for it. The stachys or spike which is the characteristic of the inflorescence of *N.o. graminæ* perhaps gave rise to this wrong notion. 'The dried specimens which look like the tails of ermines, rise from the ground, resembling ears of green wheat both in form and colour, a fact which perfectly accounts for the names *Stachys*, *Spica*, *Sumbul*, and *Kushah*, which Greeks, Romans, Arabs and Persians have given to the drug, though it is not properly a spike.' (Sir W. Jones.)

Distribution.—The plant which is the source of Jatamansi or Indian spikenard is a native of the Alpine Himalaya and usually grows at great elevations (11,000–15,000 feet). In the parts of the Himalayas visited by Dr. Royle, it was found on such lofty mountains as Kedarkanta and Shalma which are elevated at 9,000 feet and which remain covered with snow for nearly six months. Ptolemy fixes its native soil in the most remote and hilly parts of India near Nepal, Morang and Bhutan (Sir W. Jones). In the mountainous region, west of the Indus near Nysa, Curtius Rufus, at the time of Alexander's invasion of India (about 326 B.C.) saw the crags frequently overhung with thickets of laurels and spikenard. Nysa was perhaps the city which Ptolemy calls Nagara or Dionysopolis or Nagarahara of Sanskrit, an ancient capital, the ruins of which have been traced at a distance of four or five miles west from Jellalabad. The place was also called Udyanpura or the City of

Gardens. The plant was also found at Rhadamarkotta, identified by Saint Martin with Rangamati, an ancient capital situated on the western bank of the lower Brahmaputra (Ptolemy—about the middle of second century A.D.). Yule mentions Rangamati as Rangamritica. Aristoboulos says that the Gadrosian desert (on the Beluchistan coast) yields an abundance of sweet-scented roots of nard which the Phœnicians collected; and much of it was trodden down by the army of Alexander on its homeward march and the sweet perfume thus crushed out of it was from its great abundance diffused far and wide over the country. It is now believed that the nard alluded to above is not the true spikenard but a kind of odoriferous grass (probably a species of *Andropogon*). It is interesting to find the mention of spikenard among the few aromatic substances described by Theophrastus as being brought from India. Cosmas Indicopleustes mentions that spikenard is found at Sindu which is on the Indian frontier (sixth century A.D.). Strabo (A.D. 21) mentions that India, like Arabia and Ethiopia, produces cinnamon, spikenard and other aromatics. Marco Polo, a Venetian, in the thirteenth century describes the spikenard as the produce of 'Bengala.' [1] Garcia d'Orta, for many years, during the sixteenth century, Physician to the Viceroy's Court at Goa, speaks of the spikenard as procured from Mandu and Chitor in Central India. It seems likely that he confused Andropogon with Nardostachys, as *Andropogon Schœnanthus* (an odoriferous grass) is found to grow luxuriantly at those localities. A similar confusion with regard to the native soil of this Himalayan plant is made by Linschoten in the account of his voyage to the East Indies.

Spikenard as a Commercial Commodity.—India, in the remotest antiquity, was highly famed for the variety and richness of its peculiar products which were well known to and highly esteemed by all the most ancient and civilized nations. The valuable products of India offered sufficient inducement to distant nations to establish commercial intercourse with India and to visit India or its shores. So varied and so precious were the Indian products that, in ancient times, India became the cynosure of the eyes of all nations and became the ultimate object of those long and arduous journeys and circuitous and adventurous voyages of antiquity. The earliest historical and commercial records incontestably prove the antiquity of the commerce of Indian products. Indian aromatics and spices, pearls and precious stones, cotton and wool formed early articles of export in ancient days. Egypt was the seat of the highest civilization in the remotest antiquity and was much frequented by the Greeks who derived their arts and sciences in the first instance from Egypt. There was extensive commercial intercourse between ancient Egypt and India and the trade between India and Egypt was in the hands of the Arabians and Phœnicians. It is said that more than seventeen centuries prior to the Christian era the Ishmaelites from Gilead used to carry the spices and

[1] W. Marsden, *Travels of Marco Polo*, Book II, ch. xlv.

aromatics of India to Egypt for a market.[1] The Indian products in ancient times reached Caubul, Persia and Babylon by the north and up the Euphrates or across Arabia to Syria, Palestine and Egypt. Ancient historical records show that the products of the East reached the West by the Red Sea, Arabia and Egypt and by the Euphrates through Palmyra to Syria.

The spikenard was a peculiar Indian product known to ancient commerce. It was highly praised on account of its sweet fragrance and medicinal virtues and was in great demand in Egypt, Arabia, Rome and Jerusalem. It was sold by the Indians to the Persians and Arabs from whom the Syrians and Romans used to receive it. It was a very costly article and was extremely dear at Jerusalem and Rome and was sold, according to Pliny, at 100 denarii per pound at Rome. The spikenard referred to by St. Mark in the Bible was valued at more than 300 denarii per pound (Pliny). (A denarius = 7¾*d*.). At the time of Periplus (A.D. 40–70) spikenard was shipped in considerable quantity to Nelcynda, where the Romans found it. Nelcynda was the port probably in the back-waters or thoroughfares behind Cochin, very near the modern Kottayam. Among the articles of trade mentioned in the *Periplus*, we find spikenard as a vegetable product exported from India through Scythia and through Poclais. We find the mention of spikenard as an aromatic product among the articles subject to duty at Alexandria.[2]

Cosmas Indicopleustes[3] tells of Ceylon and its trade in the sixth century A.D. In his account of the trade of Ceylon 'the great island of the ocean, situated in the Indian Sea; which is called Sielediba' he mentions that Spikenard is found at Sindu which is 'the beginning of India; for the River Indus, which empties into the Persian Gulf, separates Persia from India' and is one of the best-known market-towns of India. Marco Polo[4] in the thirteenth century describes spikenard as the produce of Bengala, to purchase which the merchants from various parts of India resort thither. Dr. Royle[5] remarks that the roots of Jatamansi, no doubt the spikenard of the ancients are brought down in large quantities from the Himalayas to the plains, when they are distributed over every part of India. Atkinson[6] states that its roots are sent down to the plains to the extent of about twenty maunds a year. The article is hardly in demand in these days and practically there is no export out of India. The bazaar price of Jatamansi, which was once a very costly article, has now come down to a few annas per pound.

Exact Botanical Determination—It has been definitely ascertained that the product 'Jatamansi' or the Indian spikenard is derived from the plant, *Nardostachys jatamansi* DC. Sufficient proofs have been adduced by Sir W. Jones in his valuable and elaborate

[1] Remark of Dr. Vincent in Prl. Disq. to Transl. of Arrian's *Periplus of the Erythrean Sea*.
[2] Rescript concerning Eastern Trade in the digest of the Roman Law.
[3] *Christian Topography*, Book XI.
[4] *Travels of Marco Polo*, Book II, ch. xlv.
[5] Dr. Royle, *Illustrations of the Botany*, etc.
[6] Atkinson, *Gazetteer of the Himalayan Districts*.

researches on the Indian spikenard to establish the fact that the spikenard of the ancients, the nardus of Ptolemy, the Indian sumbul of Persians and Arabs, the Jatamansi of the Hindus are one and the same plant which is synonymous with *Nardostachys jatamansi* of modern botanists. Sir W. Jones and Dr. Roxburgh named the plant *Valeriana jatamansi* but the plant figured by them (as shown in the plates accompanying their papers) represents *V. wallichii* DC, a plant of the same natural order but found at a much lower attitude on the Himalaya. Although Sir William was mainly instrumental in exactly determining the plant, he failed to procure a specimen of true *Jatamansi*. 'It is most probable that the wrong plant was purposely sent to Sir W. Jones, in place of the true *Jatamansi*, which appears to have been so highly valued by the Bhutan authorities that strict orders had been given forbidding the exportation of living plants from that country. Dr. Wallich and Dr. Royle independently detected the imposture, and the true plant was sent home and described by Don in his *Prodromus Flor. Nep.* under the name of *Patrinia jatamansi*. It was afterwards removed by DeCandolle to the genus *Nardostachys*.' (J. F. Duthie).

Sir William Jones and Dr. Roxburgh obtained specimens of *Valeriana wallichii*, the plant which was wrongly identified by them with *V. jatamansi* and was supposed to be the source of Jatamansi root of commerce. This error, however, was subsequently rectified by Dr. Wallich and Dr. Royle, and *Nardostachys jatamansi*, DC. is now authoritatively recognized as the source of the Indian spikenard or Jatamansi. In this connection Sir J. D. Hooker remarks 'The name *V. jatamansi* is hence to be suppressed.' [1]

Spikenard in Botany of to-day.—The plant belongs to *Valerianeæ* which is a small natural order consisting of only 300 species and is distributed over all cool and temperate regions except South Africa and Australia. This order is found at different elevations (11,000-17,000 feet) on the Himalayas, proceeding along Caucasus to the Himalayas. It is not seen in the plains of India, but one species, *V. villosa* is found to occur at Dehra Dun (Dr. Royle). *V. celtica* occurs in the mountains of Austria.

Description of the plant.

Nardostachys jatamansi, DC.

Habitat.—Alpine Himalaya (altitudes 11,000–15,000 feet) extending eastwards from Garhwal, and ascending to 17,000 feet in Sikkim. Occurs in Nepal, Bhutan and Sikkim. It is found to occur at Rálam and Milam at altitudes 12,000–13,500 feet, and also in China.[2]

Syn.—*Patrinia jatamansi*, Don; *Valeriana jatamansi*, Wall.

Vern.—Hind. Jatamasi, bal-chhar; Beng. Jatamansi; Bomb. Sumbul; Arab—Sumbulu'l-hind; Pers. Sumbuluttib; Sans, Jatamansi. It is sometimes called Bhutakeshi (demon's hair). In the Deccan it is often called Billi-lotan, cats being supposed to be fond of the smell of the root of this plant.[3] In Sanskrit it is known under various names—'*Tapasvini, Jatamansi, Jatila, lomasha, mishi.*'—*Amarkosh.*

[1] Sir J. D. Hooker, *Flora of British India*, vol. iii.

[2] Strachey, *Catalogue of Kumaon Plants*. (Based on the collections by Strachey and Winterbottom within province of Kumaon and in adjoining parts of Garhwal and Tibet during 1846–49).

[3] Valerian oil is frequently used by the Society's Collectors for trapping the smaller *Felidæ*.—*Eds.*

It is an erect perennial herb. Rootstock—long, woody, covered with reddish-brown fibres, the remains of the petioles of withered leaves. Radical leaves, longitudinally nerved, slightly pubescent, narrowed into the petiole; cauline, one or two pairs sessile, oblong or subovate. Flowers-bracts, oblong, usually pubescent; calyx-limb, 5-lobed; Corolla-tubular, somewhat hairy within, lobes 5, spreading; the corolla tube enclosing 4 stamens; ovary—inferior, 3-celled, 1-ovuled, two of the compartments of the ovary being empty; style-liner; Fruit-obovate, 3-celled, 1-seeded, the two barren cells smaller than the fertile, covered with white hairs, crowned by the ovate, acute often dentate calyx-teeth.

Parts used—(1) Rootstock and (2) Oil.

The drug.—The drug Jatamansi which is manifestly the spikenard of the European druggists appears in the form resembling the tail of a sable. It consists of a short portion of the rootstock about the size of a man's little finger, of a dark grey colour, clothed by fine yellowish-brown fibres cohering in a bundle. The fibres are the remains of the withered petioles of the radical leaves and are matted together, the whole presenting the appearance of a matted lock of hair, the Sanskrit name *Jatamansi* having a reference to this resemblance. 'The radical leaves, rising from the ground and enfolding the young stem, are plucked up with a part of the root, and being dried in the sun or by an artificial heat, are sold as a drug which from its appearance has been called spikenard.' (Sir W. Jones). Sometimes the entire plant is collected before the radical leaves have unfolded themselves from the base of the stem and is sold as a drug.

Adulteration.—Pliny mentions a kind of nard growing in the vicinity of the Ganges, which is condemned as utterly bad. It bears the name of Ozænitis and emits a fœtid smell. It is now considered as a variety of Andropogon. Sometimes 'the nard is adulterated with a plant called pseudo-nard which grows everywhere and has a leaf unusually thick and broad and a sickly colour inclining to white. It is further adulterated by being mixed with its own root to give it additional weight—a purpose for which gum and the litharge of silver are also employed, and sometimes antimony and cypirus or at least cypirus bark. Its purity is tested by its lightness, the redness of its colour, the sweetness of its smell and more particularly the taste, which parches the mouth, while at the same time the flavour is most delicious.' (Pliny).[1]

The odour of the drug is heavy and peculiar, the taste bitter and aromatic. It is remarkable for the presence of an essential oil.

Chemical composition:—

Oil.—The oil of Spikenard is obtained from *N. jatamansi*. Kemp (1884) distilled 56 lbs. of Jatamansi and obtained three fluid ounces of the oil having an optical rotation of—19·5 in 100 mm. and the sp. gr. 0·9748 at 82°F. 100 lbs. of the root, subjected to distillation with water by Messrs. Kemp and Co. (1890) yielded 15 oz. (fifteen ounces) oil and a faintly acid distillate. The oil is pale yellow in colour; and 'a fine violet or bluish colour is produced as with oil of Valerian, by mixing a drop or two of the oil with about twenty drops of carbon bisulphide and a drop of

[1] J. W. M'Crindle, *Ancient India*.

strong nitric acid. With $H_2 SO_4$ the oil gives a reddish brown colouration. On boiling the oil acquires a darker hue and a greenish fluorescence' (Dymock quoting J. G. Prebble). In the East it is of much value as a perfume, but in western countries its use is practically replaced by that of oil of Valerian.

Oil of Valerian—is usually obtained from the root of *Valeriana officinalis*, B. P. by distillation. For this purpose the Dutch and Thuringian herb was mostly used in Europe ; but nowadays the oil is mainly extracted from the Japanese root (the variety *agustifolia*). The Japanese root yields from 6 to 7 per cent of oil, whereas the European root yields only 1 per cent. The oils in both cases are quite similar and show the same properties. The sp. gr. of the oil from European variety is ·930 to ·960 and the oil from the Japanese variety known as Kesso oil, has a sp. gr. ·985 to ·995. *Valeriana celtica*, growing in the Swiss Alps and the Tyrol yields an essential oil of sp. gr. ·960 to ·970, the yield being about 1 per cent. The oil is mainly used for medicinal purposes and to a certain extent in soap perfumery. (E. J. Parry).

Valerianic acid :—Free Valerianic acid does not occur in the fresh root but is generated from the volatile oil on exposure to the air. It is an oxidation product. It is an oily liquid, of a characteristic sweet taste used in preparing various valerianates, as valerianates of iron, zinc, ammonium and quinine. (Khory and Katrak).

Dye :—' Mc. Cann states that the rootstock of this plant is used in Lohardaga (Bengal), as an auxiliary in dyeing along with Kamalagundi (*Mallotus phillippinensis*). (J. F. Duthie).

Therapeutics :—The medicinal virtues of the spikenard or Jatamansi have long been known and appreciated in Arabia, Persia and India. It is generally agreed that the nations of the East were the first to use the drug medicinally. It has long been used and highly valued in Indian medicine being mentioned by Susruta and in the *Bhavprakash* and other ancient Sanskrit works on Medicine. Susruta prescribes the drug as a remedy for epilepsy. It is also referred to in Charaka, the oldest Sanskrit work on Hindu Medicine and probably almost contemporary with Susruta. There it is stated that the clothings of a new-born baby are to be disinfected by fumigating them with Jatamansi and other aromatic substances.[1] In *Sanskrit Raj Nighantu* it is described as cold, bitter, aromatic and as a remedy for morbid heat and biliousness.

> ' Suravi Kasháyá Katu Sitalá Kafahrit
> Bhutaghni Dáhaghni Pittaghni Cha.'[2]

It is also regarded as a remedy for leprosy and erysipelas.

> ' Tikta Kasháyá medhyá Kántidá Balyá
> Svádurhimá tridoshá raktadáha *bisharpa*
> *Kushthaghni* Cha.' [3]

[1] *Charaka*, Swárirsthan, chap. 8 (55). [2] *Raj Nighantu*.
[3] *Bhaba Prakash*.

If it is used to anoint the body, it soothes the system and bring down the temperature of the body in fever, thus acting as febrifuge.

'Tadanoolepanam Jwaraghnam rookshatághnam Cha'.[1]

It is generally used by Hindu physicians as a nervine tonic and stimulant. In India it is much employed as an aromatic ingredient in the preparation of medicinal oils and *ghritas*. It is regarded as one of the most important medicines in the Hindu Pharmacopœia.

Numerous references to the medicinal use of the spikenard are seen in the Bower Manuscript[2] where it is described under the names of Mámsi and Nalada. As is usual in Hindu medicine, it is rarely given alone, but enters as a chief ingredient in a number of complex prescriptions, each of which is supposed to possess some special virtue. Mámsi is used as an ingredient in the preparation of medicines for the diseases of the eyes and for ailments caused by the derangement of bile.[3] It is said to be useful as an antidote for poison, especially to remove the effects of spider's poison.[4] It is employed in making the Haridrá Powder of the Asvins which is regarded as a cure of indigestion, retention of discharges, costiveness, etc.[5] The same drug described as Nalada is used in the preparation of Asvagandhá Oil, along with many other medicines as a remedy of apathy, dumbness, lameness, stammering, paraplegia, etc.[6] It forms an ingredient in the formula for the cure of hemorrhage.[7] It is prescribed, with other medicines in the diseases of the mouth and in the most excruciating earache.[8] It is employed as the chief ingredient in the preparation of a valuable medicinal oil, 'The Siddhártha Oil, devised by Narayana.'[9] This oil is regarded as a remedy for the lame, in short, for those suffering from rheumatic diseases and distorted bones. It is truly called *Siddhártha* or 'efficacious' as it is recommended as a cure of almost all the ills that flesh is heir to, and is said to promote the life of man.

Arab and Persian physicians consider the drug as very useful in various disorders of the digestive and respiratory organs and recommend it as a nervine tonic in hysteria. It is popularly believed to promote the growth and blackness of hair. It is said to be useful as an expectorant, and as deobstruent, stimulant and diuretic.

Ainslie observes that in Lower India the Vytians prepare from this drug an aromatic and soothing liniment which is applied to the head. Jatamansi is also used by them internally as a purifier of the blood. O'Shaughnassy finds Jatamansi, from his experience,

[1] *Rajballav*.

[2] Bower Manuscript (translated by Hoernle) is named after its discoverer, Major-General H. Bower, C.B. It 'fell into the hands of that officer, early in the year 1890, in Kuchar where he had gone on a confidential mission from the Government of India'. Kuchar is in Khotan in Eastern Turkistan on the Caravan route to China. The Manuscript in question is a very ancient *Puthi*.

[3] Bower Manuscript, vol. i, 91, 107.

[4] *Ibid.*, vol. i, 97.

[5] *Ibid.*, vol. ii, 96.

[6] *Ibid.*, vol. ii, 345, 354.

[7] *Ibid.*, vol. ii, 419.

[8] *Ibid.*, vol. ii, 535, 1073 *a*.

[9] *Ibid.*, vol iii, 40.

a perfect representative of Valerian and recommends it as a good substitute.[1] The drug has acquired a considerable reputation in European medicine too.

Valerian is used as a stimulant and antispasmodic for the treatment of hysteria, epilepsy, St. Vitus' dance and other nervous affections. In moderate doses, if continued for some time, it may improve the appetite and move the bowels. When taken in very large doses (2 drachms at a single dose) it acts as a powerful irritant of the gastro-intestinal tract causing eructations, vomiting, colic and diarrhoea, attended with a sense of heaviness and heat in the abdomen, and perspiration or frequent passage of urine. In smaller doses its action is chiefly confined to the nervous system producing exhilaration of spirits, and rendering the mind tranquil and active. Sometimes it produces heaviness and pain in the head attended with a sense of confusion. If long continued, it may lead to melancholia. In full doses it stimulates the heart and often promotes sexual powers.[2] Although Valerian is often employed in the treatment of hysteria it is not regarded as a cure for the disease but acts as a most valuable palliative in hysteria, in its various manifestations, its pain and its headache. It is especially useful in the case of weakly females of excitable temperament. In all convulsive affections, and in mild cases of mental derangement or cerebral congestion and cerebral anæmia, it is found to be beneficial as an efficient palliative. In all these cases Valerian acts like asafœtida or musk. Ammoniated tincture of Valerian is often successfully administered in nervous headache. In cases of flatulence, accompanied with palpitation of the heart, Valerianate of ammonium is sometimes prescribed along with a carminative tincture. It is efficient in relieving infantile colic. (Dymock).

It is sometimes found to be beneficial as a vermifuge, and is recommended to be administered by enema as a remedy for ascarides of the rectum. It is found to be beneficial in cases of dysmenorrhœa and diabetes insipidus. 'Bouchard claims that when the urine contains an excess of urea (azoturia) or of sugar (glycosuria), Valerian diminishes the amount of solids discharged and thus acts as a conservator of tissue and of force (Stille and Maisch).'[3] It is sometimes prescribed in mild forms of delirium tremens following any injury or surgical operation.

Valerianic acid.—'Given to rabbits in doses of from one to three drachms, Valerianic acid renders the heart's action more rapid, but feebler, the respiration is hurried at first and then slower; and death usually takes place in three or four hours, preceded by prostration and convulsions. If death occurs speedily, the gastric mucous membrane is pale but if delayed it may be congested; the kidneys are apt to be congested and the urine bloody. . . . Valerianic acid, applied to the human skin, produces a white spot, followed by irritation and redness, and upon the tongue it may cause the epithelium to exfoliate.'[4]

[1] *Bengal Disp.*, p. 404.
[2] Khory and Katrak, *Materia Medica*.
[3] *Pharmacographia Indica*.
[4] *Ibid.*

NEW THYSANOPTERA FROM SOUTH INDIA.

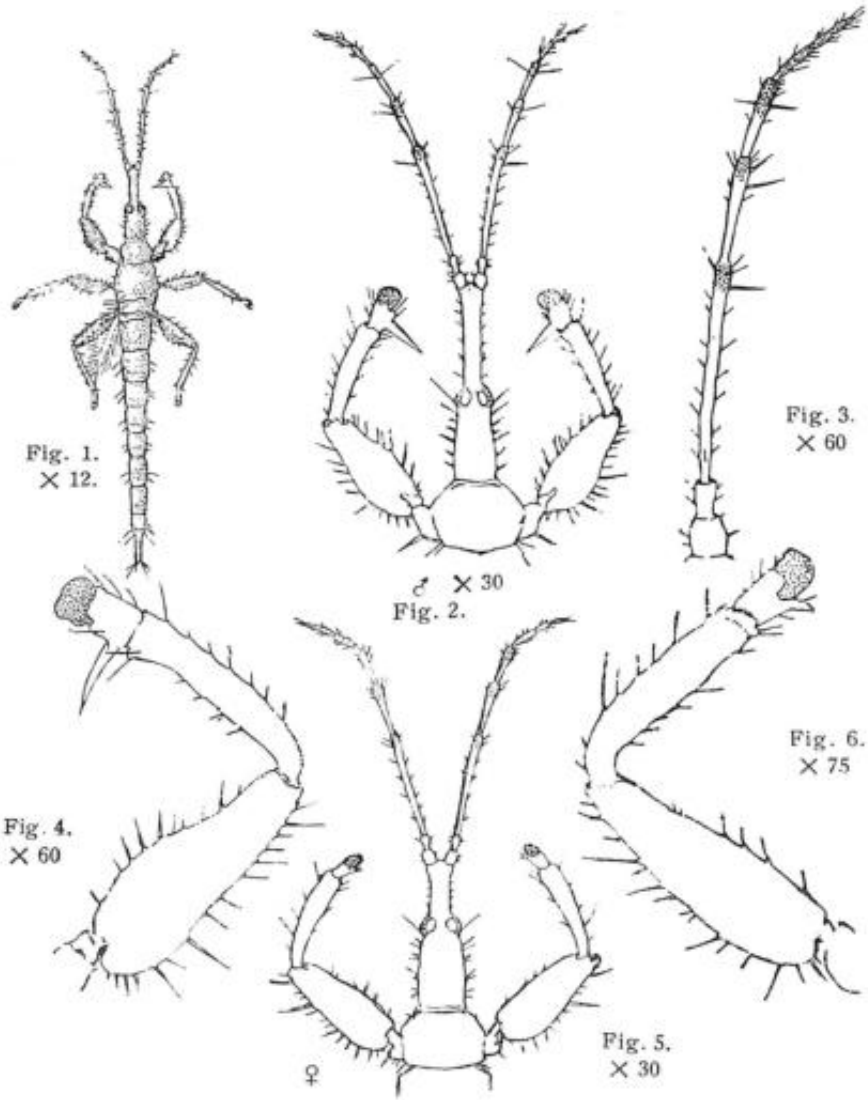


Fig. 1. × 12.

♂ × 30
Fig. 2.

Fig. 3. × 60

Fig. 4. × 60

Fig. 5. × 30
♀

Fig. 6. × 75

Kleothrips subramanii Ramakrishna.

Fig. 1. Male insect × 12.
,, 2. ,, ,, anterior region × 30.
,, 3 ,, ,, antenna × 60.
,, 4 ,, ,, right foreleg × 60.
,, 5. Female anterior region × 30.
,, 6 ,, left fore leg × 75.

Oil of Valerian.—Lessens the excitability of the spinal cord and even paralyses it and also produces numbness in the brain. '2 cgm. (1/3 gr.) injected under the skin of frog have been found capable of preventing tetanic spasms after a like injection of 5 mgm. (1/12 gr.) of Strychnine. Given alone to these animals (rabbit and frog) hypodermically it impairs mobility and sensibility (Dymock). The oil is very efficient in the coma of typhus fever (Khory and Katrak). Oil of Valerian dissolved in ether is sometimes administered by inhalation in nervous headache or in cerebral congestion. The oil is used to a considerable extent on the continent of Europe as a popular remedy for cholera, in the form of cholera drops (E. J. Parry).

Jatamansi is still regarded as a valuable medicine in India and is much used by Ayurvedic physicians.

TWO NEW THYSANOPTERA FROM SOUTH INDIA

(*With a plate and a text figure*)

BY

T. V. RAMAKRISHNA AIYAR

The two forms of 'thrips' noted below do not appear to have been recorded till now and are therefore described as new species. The first one is described as a species of the genus *Kleothrips*, Schm. of which there are no previous records from India, and the second as a species of *Leeuwenia* Ky. ; of this latter, however, Bagnall has described three Indian species, two *L. coriaceous* and *L. indicus* from Dehra Dun and Moulmein, and the third *L. eugeniae* from Kodaikanal, the last from material submitted by the writer. The very interesting fact with regard to the species of *Leeuwenia* described so far from different localities is, that most of them have been found on species of the plant *Eugenia*.

IDOLOTHRIPIDÆ

KLEOTHRIPS SUBRAMANII (*new species*)

Male.—(Macropterous.) (See Fig. 1) Length 6 to 8 mm. General colour dark brown to black ; the junctions of the abdominal segments and patches on the basal region of head and on the thorax appear reddish brown ; this is particularly so in some specimens. The bulged-out portions of the eyes, of a light greyish brown colour. *Antenna :* the first segment and the basal two-thirds of the second dark brown ; the distal third of the second light reddish brown and the sixth, seventh and eighth dark greyish brown ; the third, fourth and fifth segments yellowish white covered with greyish brown at the distal region. In the third the greyish patch is found only at the extreme distal end, while in the fourth and fifth this colour covers a third to half of the segment towards the distal region ; in the fifth the greyish colour is of a dark hue and resembles the colour of the distal segments.

Fore femora dark brown, of a lighter tinge at its junction with the coxa. Fore tibia and tarsus (except the distal portion which is dark) reddish to yellowish brown, the lateral margins of the tibia dark, and the tarsus and tarsal tooth of a distinctly lighter colour approaching yellow. Intermediate and hind femora dark brown ; the tibia also of same colour but with the basal and distal regions yellowish brown. Wings clear with the cilia having light brownish tinge. The Cephalic spines and bristles dark, those on legs and antennæ light to dark reddish brown, and those at the sides of the abdomen and at the end of the tube are of a yellowish brown colour.

Head :—The vertex before the eyes very strongly produced carrying the two antennæ far forwards ; the produced portion from before the eyes to the base of the antennæ is 1·25 times as long as the portion behind the eyes and five times as long as the breadth of head across eyes. (See Fig. 2) The head is broadest at the base close to the prothorax and narrowest just in front of the eyes. The vertex is distinctly narrower than the basal region and its sides are more or less parallel but diverge a little at the extreme anterior end where the antennæ are attached ; as such the vertex is broadest just behind the bases of the antennæ. On both margins of the head from behind the base of the antennæ right up to the prothorax are numerous spines and bristles, but

those on the vertex are not so conspicuous as those on each genal margin behind the eyes ; on each side of the vertex there are from 8 to 12 small sharp bristles and of these the basal two, one on each side in front of the eyes are the most prominent. Behind the eyes on each side of the head there are five or six well-developed sharp and conspicuous spines some of which arise from short warts. In addition to these there is a very long and slender supra-ocular bristle projecting forwards and outwards above the eyes. Some of these cephalic bristles often break off while handling and are not therefore complete in many specimens.

Eyes prominent and bulging out ; about 1/10 the length of the whole head. Anterior ocellus situated in the middle of the base of the vertex just in front of the eyes, the other two not clearly seen.

Antennæ (See Fig. 3) length 2–2·125 mm. 1 1/3 times as long as the whole head. The first and the second segments short stout and more or less cup-shaped with a few sharp bristles at the sides. Third segment very long, considerably longer than every other segment. The third, fourth and fifth each bears a prominent long bristle at the distal end directed outwards ; in the fifth there is a similar one at the same region directed inwards. The sixth has a pair of similar bristles at its middle one on each side. Besides these, there are smaller bristles and hairs in all the segments and groups of sense cones in the distal ones. The terminal segment which is not acutely pointed has a hair at its tip.

Prothorax.—·26 times as long as head and including the coxæ it is 1·875 times as wide as long ; in shape more or less hexagonal and provided with a few bristles ; the bristle at postero-lateral margin is sharp and conspicuous ; there are only one or two small ones on the antero-lateral margins. The posterior angle of the coxa also bears a prominent bristle parallel to the one on the postero-lateral margin of the prothorax.

Legs.—(See Fig. 4) Fore femora broad and swollen, broadest just before middle and then narrowing towards tibia ; both margins well supplied with several long and short sharp spines ; those along the outer edge more numerous and some of them are strong and rise from warts—about a dozen such spines at the outer and about 8 or 10 along the inner margin. Fore tibia with the inner margin distinctly curved, broadest just before its junction with tarsus ; at this point the inner edge forms a small conical projection bearing two or three transparent hairs. The tibia bears only a few inconspicuous bristles and that along the outer margin. The tarsus has a prominent long basal tooth rising at right angles from its inner margin ; the tooth is as long as the tarsus itself.

The intermediate and hinder legs are normal in structure, the femora are not swollen or unusually broad, the tibiæ not short and curved, nor do the tarsi bear any tooth ; there are, however, bristles conspicuous along the outer margins of the femora and tibiæ.

Wings.—Uniformly broad, with the marginal cilia long and numerous. About thirty accessory hairs on hind margin near apex. The wings do not extend beyond the 5th abdominal segment.

Abdomen.—Long and gradually narrowing towards the tube measuring over 2/3 of the whole body, breadth of 8th segment half the breadth of the abdomen at base just behind last leg. Tube 1 1/3 times as long as eighth segment, breadth at tip 2/3 of that at its base with half a dozen long bristles at the tip. The abdominal segments have each a group of three yellowish white bristles on each lateral margin ; some of those on the 9th segment are particularly long.

Measurements of holotype male : Total length 7 mm.

Head.—Length 1·442 mm. ; length of produced portion of head in front of eyes ·756 mm. ; length of eyes ·126 mm., length of basal portion of head behind eyes ·560 mm., breadth across eyes ·28 mm., in front of eyes ·154 mm., behind eyes ·266 mm., at base of head ·315 mm. Prothorax length ·364 mm., width including coxa ·770 mm. Abdomen greatest breadth ·630 mm. Tube, length ·525 mm., breadth at base ·105 mm., breadth at apex ·70 mm.

Antenna total length ·1,953 mm.

Antennal segments				
Length in (μ)	I. 140	V. 266		
	II. 105	VI. 140		
	III. 840	VII. 70		
	IV. 315	VIII. 77		

Female macropterous.—Length from 5 to 5·5 mm. General colour similar to male. In structure there are definite variations. The produced vertex in front of the eyes is not so long as in the male, the fore femora are not so broad and swollen, and the fore tarsal tooth is very much smaller and reduced to a small short and curved tubercular projection.

Head.—(See Fig. 5) About three times as long as breadth across eyes; the length of produced portion of head in front of eyes is only. ·75 of the length of the basal portion behind eyes, and is 1·1 times as long as breadth across eyes. Besides the long and weak supra-ocular bristle the usual cephalic bristles are present, though they are fewer and somewhat weaker than those in male.

Prothorax—2·34 times as broad as long with the usual bristles. *Legs.*—(See Fig. 6) Fore femora and tibia not so swollen and broad as in male and provided with fewer bristles, fore tibia not curved, fore tarsus with a small tooth-like curved projection at its inner margin very much smaller and weaker than the one in the male. Hinder legs normal with the usual bristles.

Abdomen.—Broader than male at base, 1·2 times as broad as Pterothorax. Tube is 1·8 times as long as eighth segment and ·6 times as long as head, bristles of ninth segment very long.

Measurements of allotype ♀ Total length 5·5 mm. *Head*, length ·826 mm. length of vertex before eyes, ·308 mm., of eyes ·112 mm. and of basal portion behind eyes ·406 mm., breadth across eyes ·266 mm., in front of eyes ·133 mm., behind eyes ·259 mm., and at base of head ·322 mm. *Prothorax*, length ·315 mm., breadth with coxa ·595 mm. *Abdomen* greatest width ·735 mm., length of eighth segment ·280 mm., Tube length ·490 mm. *Antenna* total length, 1·197 mm.

Antennal segments, length in (μ)

I.	105	V.	168
II.	77	VI.	105
III.	420	VII.	56
IV.	189	VIII.	77

Described from about ten specimens of each sex. Collected from galleries in the leaves of the palmyra palm (*Borassus sabelliformis*) damaged by the caterpillar *Nephantis serinopa*, a serious caterpillar pest of palms in South India, in the Chingleput District, South India. They were collected on three different occasions by my colleague, T.V. Subramanyam, after whom I have named the interesting species. Mr. Subramanyam says 'Though this "thrips" was collected from *Nephantis* attacked leaves on all the occasions, the economic relation between the two is not yet clear. One specimen was noted to lay 18 eggs on the palmyra leaf. The peculiar habit of brooding over the eggs was observed for a whole day after egg laying. On the second day the eggs get a brownish tinge and on the following day they hatch. The young larva has the body tapering at each end. I could not rear out the nymph any further, as I was not able to find out the actual food of the insect.'

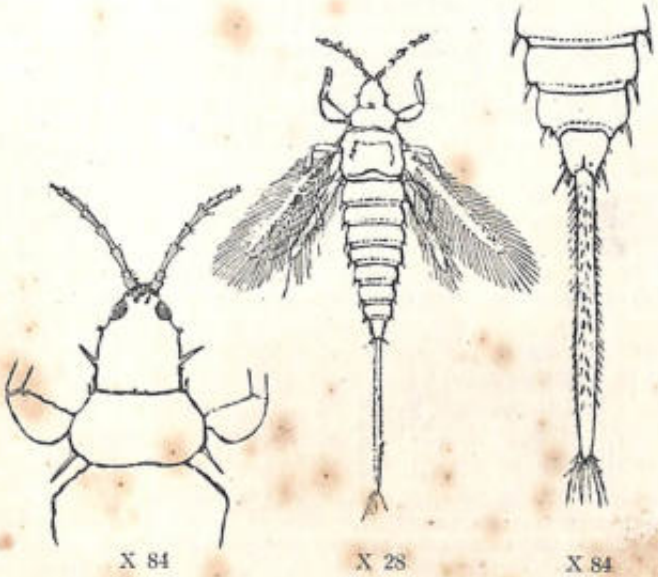
Pre-adult nymph of male has the body bright red and the wing rudiments and limbs transparent shining white, eyes and apex of tube dark.

The insect is without doubt an undescribed form and I have made it out to be a species of *Kleothrips* Sch. Dr. Karny to whom specimens were submitted for specific determination is of opinion that the insect is quite different from all species of *Kleothrips* known to him, that it closely resembles his genus *Acrothrips* and may even be a new genus allied to these two genera, because of the extraordinary length of the vertex of the head and the abnormal length of the third antennal segment. I have, however, described it as a *Kleothrips* for the present, and as far as I could make out is distinct from the few known species described till now by Schmutz, Karny, and Hood. This appears to be the first record of a species of *Kleothrips* from India, the few previous records being from Ceylon, Malayasia, Africa and Australia.

HYSTRICOTHRIPIDÆ.

LEEUWENIA KARNYI Ramakrishna (*new species*)

Length including tube 3 to 4 mm. General colour dark to light chocolate brown. Eyes dark, ocelli brown, pigment reddish brown. First segment of antenna concolourous with head, second of a light brown and third to eighth clear pale yellow. The median dorsal region of head, all the femora and the front tibiæ of a more or less lighter brown than the rest of the body. The genal and prothoracic spines, the lateral abdominal spines and the bristles at apex of tube transparent light yellowish brown. Wings infumated along middle with a light brown patch. Cilia dark brown.



X 84 Fig. 2 | X 28 Fig. 1 | X 84 Fig. 3

LEEUWENIA KARNYI Ramakrishna

Fig. 1—Adult Insect X 28.
Fig. 2—Anterior region X 84
Fig. 3—Hind region X 84.

Head.—1·25 times as long as wide, broadest at the base, the sides gradually narrowing towards eyes ; eyes large and prominent, oval, ½ as long as the whole head, and, the breadth across the eyes ⅔ of that at base ; ocelli clear, the hind ones placed at the anterior edge of the vertex just below the base of the antennæ and on a line with the anterior edge of the eyes, the front ocellus overhanging at edge of the vertex. Cheeks behind the eyes finely crenulated with one conspicuous spine on each side midway between the eye and the base of head ; there are in addition a few very minute isolated setæ arising out of the crenulated cheeks, especially just behind the eyes. Antennæ, nearly 1·75 times as long as head, first and second joints short and stout, the first equal in length to the last, third longer than the fourth, fourth equal in length to seventh and eighth together ; the fourth, fifth and sixth are broader distally. Mouth cone broadly conical extending beyond the middle of prosternum.

Thorax.—Prothorax—about ¾ as long and 1·5 times as broad as head ; short anteriorly directed spine at the antero-lateral angle and a stout long one directed backwards sideways at each posterior lateral angle, the latter rises

from a tubercle and is slightly longer than the one in each cheek. These spines get broken and are not visible in many prepared specimens.

Legs.—Fore femora flattened and with crenulated edges, fore tarsus unaimed, hind legs normal. *Wings* moderately broad and reaching to 7th segment of abdomen ; no accessory hairs on post margin.

The body surface on the head, thorax and the fore femora clearly reticulated showing numerous small cellular spaces.

Abdomen.—Stout built, the surface at the base reticulate ; at base 1·5 times as broad as the prothorax and gradually narrowing to tube. The abdominal segments are distinctly transversely produced and each has a strong conspicuous spine at the postero-lateral angle on each side ; these spines are directed backwards and are tuberculate at base. The spines of the 2nd and 3rd segments small, whereas those of the 6th, 7th and 8th are very prominent ; on the 8th and 9th segments there are one or two extra bristles near the above. Tube a little more than four times as long as head and slightly shorter than all the other abdominal segments together ; breadth almost uniform throughout; fringed with setæ but they are weaker and fewer than in *gladiatrix*, Ky., a little more than a fifth of the tube at the apical end without any setæ.

Measurements of holotype. Total length including tube 3·8 mm.
,, ,, of head. ·336 mm.
,, ,, eyes. ·105 mm.
,, ,, Prothorax. ·210 mm.
,, ,, tube. 1·4 mm.
Breadth across eyes. ·230 mm.
,, at base of head. ·294 mm.
,, of prothorax. ·420 mm.
,, of base of abdomen. ·630 mm.
Breadth of tube at base ·091 mm. Breadth of tube at apex ·063 mm.
at middle. ·077 mm.

Antenna total length. ·581 mm.

Length of segments in (*u*)

I.	42	V.	91
II.	56	VI.	84
III.	112	VII.	56
IV.	98	VIII.	42

Described from ten specimens collected by me on leaves of *Eugenia jambolana*, Bangalore, January 1924.

Although in some features this species approaches Karny's *gladiatrix* from Java and Bagnall's Burmese form *indicus*, it is distinctly different. It is also quite different from *L. eugeniæ* recently described by Bagnall from South Indian specimens I submitted to him a few years ago. From *gladiatrix* it differs by the weaker setæ on the tube, in *eugeniæ* the tube is weaker than in this form and very sparsely clothed with short setæ. Karny's *aculeatrix* and *caelatrix* have the tube wider in the middle and covered with numerous conspicuous setæ. His *seriatrix* also has the tube covered with longer setæ. In *indicus* the tube is longer than the other abdominal segments and the wing retaining spines very poorly developed. The distinctive features of this species are the conspicuous single spine on each cheek and the transversely drawn out abdominal segments with the strong tuberculated spine at the posterior-lateral angle of each segment. Specimens were examined by Dr. Karny and he concurs with me in the opinion that it is a new species. I take the privilege of naming this species as a mark of my regard to this well-known authority on Thysanoptera.

BIRDS NESTING WITH A CAMERA IN INDIA

PART V

BY

CAPT. R. S. P. BATES

(continued from page 609 of this volume.)

(With 5 plates.)

Ever since my arrival in India my ambition has been to depict, by means of the camera, the wonders of its immensely-varied avifauna. But, as the reader will readily understand, the difficulties in the way of the bird-photographer in this country are many; especially so in the case of the photographer who can only devote a very limited amount of his time to the task. True, the East has certain advantages over the West, as for instance the ease and cheapness with which one can move one's apparatus by means of that poor down-trodden human beast of burden, the Indian coolie. At home the ordinary mortal can only take out a very condensed equipment, as it generally means carrying it on one's own back, whereas here the quantity is only limited by the number of coolies one can afford to pay. In Kashmir when out in camp I invariably had an immediate following of three trekking along with me, consisting of two coolies carrying my two half-plate cameras, and their sheaths for a couple of dozen plates, a quarter plate reflex, and a case of lenses consisting of a Zeiss convertible, a Ross telecentric, and a Zeiss telephoto lens. The latter incidentally I have never used, although I certainly ought to have employed it on the Sooty Flycatcher's nest, the small photo of which appeared in the first of these articles. This nest was overlooked from an immense boulder at a distance of a few yards. These two men also carried my food for the day as an added burden, as well as sundry articles for use in constructing 'hides.' The third member was a shikari, who has now developed into an ardent egg-collector. He was of great use in looking for rests and of course carried my gun. I was thus enabled to travel unencumbered, my sole equipment being a pair of binoculars, a small folding hatchet and chisel clipped on to my belt and a long 'khud' stick. Nevertheless I fear the disadvantages of the climate very much outweigh the advantages, except of course in the hills, whither however this luckless mortal can only betake himself for but a short part of the year. In the plains the grilling heat of the summer renders the use of the 'hide' almost an impossibility. Can any one imagine the inside of a stuffy little tent about three feet square in a shade temperature of anything up to 110° or even more? The sequel to a couple of hours so spent I think I can well foresee; a hospital ward, hushed voices, and later a firing party. Developing is another difficulty during the summer months, since out in the

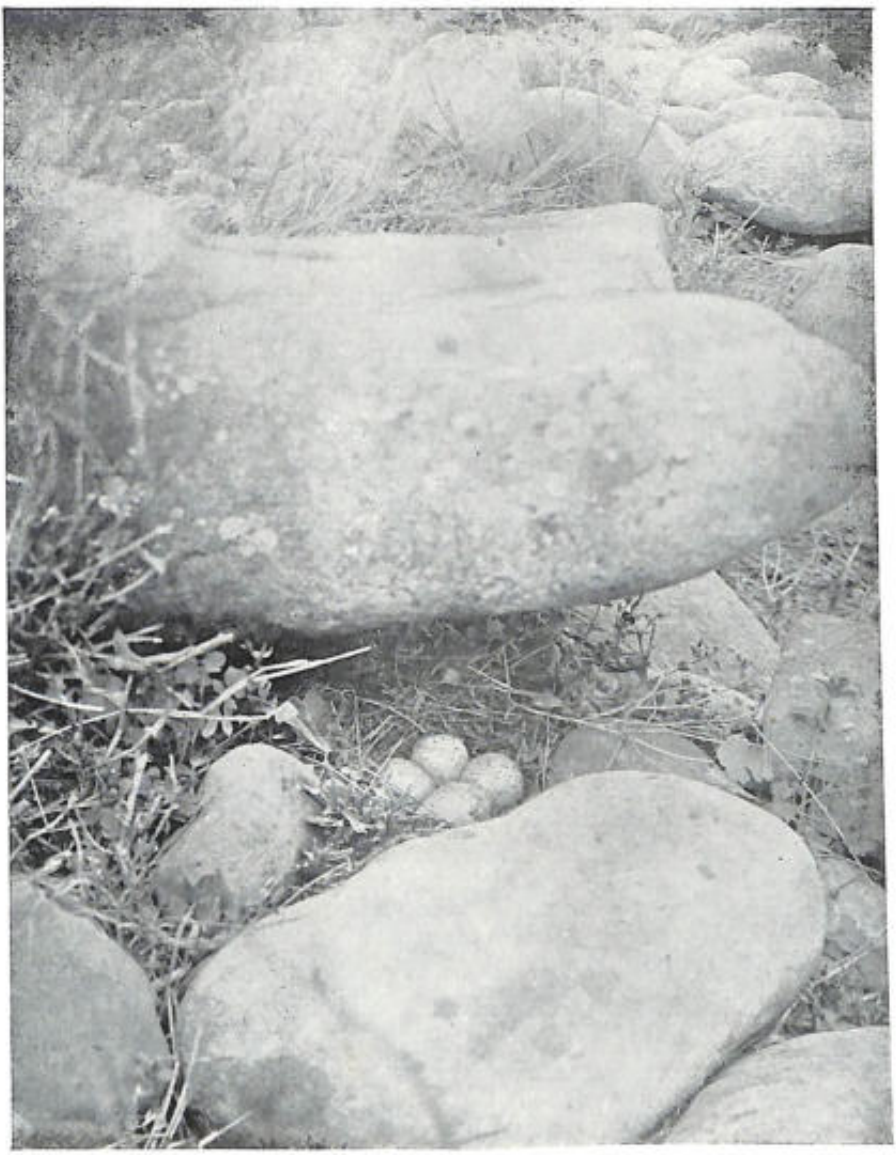
blue one cannot procure tons of ice with which to cool one's solutions, and I well remember once losing a whole batch of excellent negatives in Rajputana, seeing them melt away before my very eyes before they could be dried.

There are of course other means to be employed in obtaining records of the birds themselves besides using a 'hide' as for instance the distant release, and the reflex camera, but both these are very limited indeed in their scope of application. The first method entails disturbing the bird after each exposure, and I have never yet discovered a device of this nature, which worked really satisfactorily. As regards the use of the reflex I have been in possession of a really suitable one for some time now, and have as yet produced but one entirely satisfactory negative with it, that is using it legitimately as a super hand-camera. Still I have great hopes, as I cannot conceive of a more certain method of obtaining good results amongst nesting colonies of water-birds, such as Egrets, Cormorants, Painted Storks, etc., than the reflex, and I am consequently looking forward to the coming breeding season of these birds with considerable eagerness.

On the occasion of my second visit to Kashmir, the climate of that glorious country being all that could be desired, rendering the use of a 'hide' both possible and pleasant, I determined to see what I could do with a tent I had ordered to be made at a Cawnpore firm and forwarded to that very well known personage in Srinagar, Mr. Samad Shah, to await my arrival.

Being India, of course the order of things was reversed, and it appeared that I was expected to waste my leave awaiting the arrival of the tent. I struck, with the result that I reached Bandipur on the shores of the Wular lake on 22nd May, with nothing more suitable than one of those large umbrellas usually associated with surveyors. As a matter of fact it turned out to be invaluable and under the circumstances I could not have had anything better, although the next time I go to this particular spot, I shall take with me a collapsible canvas box, which I am having constructed with the outside camouflaged to represent a boulder. This I think will simplify matters considerably, as building a 'hide' from sods or stones, or even putting up and camouflaging the usual type of tent, is apt to waste valuable time, and the two former being immobile all the resultant photos can only be taken from the one standpoint. Of course nothing can be more suitable than a hide constructed from the very material in the vicinity of the nest, as harmonization is often half the battle. Also a 'hide' of a fixed shape cannot always be employed, so such a box in the outfit would only be supplementary to the ordinary hiding tent.

I had the houseboat towed laboriously up the Madmatti as far as it could be got, and then set off along the river bank to see what I could find in the couple of hours of daylight which still remained. Rounding a bend only a few hundred yards above the boat, I came in sight of a small patch of stones on the opposite side of the river, in the middle of which two stranded logs lay one across the other with a small heap of brushwood lodged against them. My eye at once caught the movement of a Jerdon's Little Ringed



THE COMMON SANDPIPER

(*Tringa hypoleuca*)



HODGSON'S PIED WAGTAIL

(*Motacilla alba hodgsoni*)



THE COMMON SANDPIPER

(*Tringa hypoleuca*)

Plover (*Charadrius dubius jerdoni*) between these logs and the water's edge, and watching it carefully through the glasses, I saw it settle down in a slight depression only a couple of yards from them. As luck would have it, this turbulent river was here broader than usual, so I was able to ford it, and, on reaching the spot, I found a nest containing but one quite fresh egg, only after a considerable search however, as the egg so blended with the shingle amongst which it lay, that unless one looked straight at it, it literally melted into its background.

With the assistance of the shikari whom I had taken out with me I pulled down the upper log and laid it parallel to the other one, thus making an excellent foundation for a 'hide' to use when the bird commenced sitting. As a matter of fact next morning the egg had disappeared. Why I wonder?

A little further up I found a Hodgson's Pied Wagtail's (*Motacilla alba hodgsoni*) nest with large young ones in it. It was inside a wide cavity under the overhanging bank of the river, and would not have made a good photograph. Their nests are excessively common in May and I was certain to find other and more suitably placed ones, so I left them in peace and went on beyond the little village of Dachhgam to where there are large patches of stones and shingle on either side of the river, on which I knew from my experiences there the year before, that the Jerdon's Little Ringed Plovers breed in considerable numbers. Nor was I disappointed on this occasion, as I soon spotted many of them pottering about, some undoubtedly attending to young ones.

I then followed out my usual procedure; walked boldly into the middle of a large patch to disturb any birds which might be sitting, and then retreating about a hundred yards, I took up a convenient position screened from view by a tree trunk, and got out the glasses. Very soon I noticed a bird making its way back across the stones in short runs, halting between each little advance to spy out the land. At length it appeared to have reached its objective, and to have settled down. I now set off towards the spot, never taking my eye off it for an instant; yet, when I arrived there, nothing whatever could I see beyond endless stones. The bird had slipped away of course the moment I left the shelter of the tree, running in a series of short zigzags until it reached the river bank, and was now whistling plaintively from the opposite side of the river whence it had betaken itself on my nearer approach. I repeated the performance a second, and yet a third time, and was almost on the point of giving up the search, when I discovered that I was standing within six feet of a nest of four eggs. At times I must have been within an ace of treading on it. It is really almost unbelievable how one can fail to pick out these eggs from their surroundings. A more striking example of protective colouration it is impossible to cite. The birds, too, blend extraordinarily well with the stones, and even with binoculars it is most difficult to keep them in view, except when they are actually moving. This nest turned out to be in practically the identical spot, in which I took a nest the previous year on the very same date.

This time there were no convenient logs, so I impressed two

villagers into my service, and in a very short time we had raised a low circle of stones eight or nine feet from the nest, and about two and a half feet high. Just roomy enough inside to take myself cross-legged and my camera.

Returning next morning, I was gratified to make out the bird sitting quite peacefully on the nest. I was soon inside the 'hide' with the half-plate camera in position. Samad Shah's khaki umbrella made a perfect roof to the sangar, and when covered with a few leafy branches did not look a bit terrifying. I was really very comfortable and quite cool, the chinks between the stones providing quite good ventilation as well as the requisite peep-holes. The only difficulty was that the pole of the umbrella impeded my movements somewhat, as I had to sit with a leg on either side of it, and work with it just in front of my nose the whole time.

I was engrossed placing slides and other paraphernalia in more convenient positions, when, glancing through a chink I had purposely left open as my main spyhole, I was surprised to find that the bird was already seated calmly on its eggs. She must have returned the very moment my minions had left the stones. I had expected a considerable wait, as we had been working around the sangar for a good half hour, and it certainly must have looked a much more formidable structure than it did before our advent. She sat quite still and broadside on, only looking to right or left every few seconds, so I was very soon at work.

The click of the shutter had no effect on her at all, but in changing the plate holder, I inadvertantly knocked it against the umbrella pole. The sudden rap made her jump off the eggs in a bit of a hurry, but she only ran a couple of yards, then, seemingly thinking better of her cowardice, turned round and walked slowly back to the nest, close to which she stood for a moment, eyeing the 'hide' with a certain amount of distrust before settling down on the eggs again. She never seemed to notice the camera at all; partly I suppose, because it was well back in the shadow, the walls of the sangar being about 18 inches thick; and partly because I was only using the back components of the lens in order to get a larger image. As I was using a Zeiss convertible lens with a between-lens shutter, only the black shutter-leaves presented themselves to her. After two or three more exposures she entirely ignored the slight noises I was making in changing plates and resetting the shutter. In fact the more I made the stiller she became, which of course was all the better for me. I supposed, wrongly as it happened, that far from ignoring these sounds, as time went on, she was growing more and more suspicious and so listening the more intently; and I felt certain that it would take very little indeed to make her quit the nest. Some species, many of the Thrushes for instance, obviously behave in this manner. Yet on the other hand it is patent that with many other birds, suspicion only tends to make them move the more. Their heads go twisting round in every direction and they become so restless that it is almost impossible to get unmoved negatives of them.

I now bethought myself of trying to obtain a negative or two of

the bird standing over the nest, and with this purpose in view I lightly tapped the umbrella post to induce her to get up. To my surprise she never moved: a hiss produced no result: I mewed like a cat: I whistled: I spoke: I shouted: I went through my entire repetoire of popular ditties in the hopes that she might turn out to hate rag-time as much as I do: all to no purpose. She sat like a rock, evidently being quite used to subterranean noises, even of the strangest character. In despair I moved the camera, and pushed out a corner of the red focussing cloth. She went off like a streak: I feared for good and all, so, instead of replacing the half-plate, I leisurely rigged up in its place a quar.er plate reflex, which, I am sorry to say, I had also brought out with me. The entire batch of plates, which I had bought for this camera in Murree on my way up, turned out to be bad, and I exposed half a dozen on her in most excellent positions, before I closed down operations, not one of the resultant negatives of course turning out satisfactory.

Incidentally she had returned just as the reflex was ready, and had posed most beautifully for the first exposure, standing just behind the eggs looking down admiring them. I could have gone on exposing plates on her all day, making as much noise as I liked. Such behaviour on the part of so wily and shy a bird is almost unbelievable, but, as I have remarked elsewhere, birds vary in temperament as enormously as do human beings, and it is quite on the cards that the next Jerdon's Little Ringed Plover, on which I experiment, will be too shy to put in any appearance at all. I have since had further experiences of the same sort and it is now quite plain to me that to a great extent with birds 'only seeing is believing.' The evidence of hearing may arouse their suspicions but it is not enough, and as time goes on they pay less and less attention to the noises from the inside of the hide. It is not until they have the actual evidence of sight that suspicion turns to fear and that they can appreciate the presence of danger. I find that after being in the 'hide' for a time one can often talk and make as much noise as one likes, but if one accidentally or intentionally hits the sides of the tent so that movement becomes apparent the bird will leave the nest like a flash in an absolute panic. In the dark room, besides discovering that the quarter plates were all spoilt by damp, I was rather annoyed to find that the half-plate negatives were all pretty badly under-exposed. As the day had been an excellent one for photography, there being a thin film of cloud, just sufficient to soften the shadows somewhat, this was rather mystifying, until it dawned on me that I had completely overlooked the fact that I had been using only half the lens, and had stopped down the aperture, as if I had had the complete lens in use. Accordingly the next morning I returned once more to my scene of operations—only to find an empty nest. These eggs, too, had disappeared? I strongly suspect that the shikari was the culprit. He probably thought that I had finished with the nest. In Kashmir large numbers of Terns' eggs are taken by the villagers. In fact it is a marvel to me that the Terns manage to breed at all. Hence I see no reason why they should not also

have discovered that these Povers' eggs too, are a great delicacy. The gentleman in question of course denied all my accusations.

On the way back to the boat for tiffin I investigated an Eastern Jackdaw's (*Corvus monedula sæmmeringii*) nest in a hole in a high bank just opposite the village. I seem to remember taking eggs from this very hole the year before. This time it contained four young ones. I tried to get a photo of the parent birds entering it, using a distant release, but they objected strongly to the bright lens of the camera, and would not approach anywhere near it. In a tree close to the house boat was a Rufous-backed Shrike's (*Lanius schach erythronotus*) nest, containing five eggs.

The next day I left the boat, and moved up the river as far as Sonarwain. I was now keen on trying my luck with Common Sandpipers (*Tringa hypoleuca*), as on the islands, and to a lesser extent along the banks of this river, these birds breed most profusely. The islands, to which I have referred, are most numerous, and vary in size from little stoney patches a few yards long to well-covered stretches up to two or even three hundred yards in length. They are generally clothed with a sufficiency of low brushwood and soft undergrowth. Stranded logs and driftwood are dotted along their edges, the stones of which are continually moistened by the drifting spray from the boiling waters of the torrent. To reach many of the islands is an arduous and somewhat hair-raising task, as one would have a pretty rough time of it, should one loose one's balance and get swept off one's feet. We used to link arms, and work our way across in a string of three or four. We could then help one another over the difficult bits. The roar and swirl of the water used to half hypnotise me, and at times I really and truly felt it quite an effort to concentrate my mind on the task of standing up against the buffeting of the powerful current.

To show to what an extent the Sandpipers patronize these islands, I remember that in the previous year on one small island only about 40 or 50 yards long we found four nests, and during a morning spent in going from one island to another, we found so many that we didn't trouble to keep count of them. As far as I recollect the majority of these nests were above Sonarwain, and on this occasion I only found one with eggs below that place. There were plenty of birds about however, and I noticed a good many scratches. This nest could not have been in a better situation for my purpose, so after its discovery I did not take so much trouble in looking for others, which probably accounts, of course, for their seeming scarcity as compared with the previous year. As before we built a small sangar of stones, but this time only six feet away from the nest, and left it till the following day for the bird to get used to it.

Continuing up stream, I came across two nests of the Kashmir Roller (*Coracias garulla semenowi*), both containing fresh eggs; one three; the other four. These were both in cavities in the river bank, and in one the eggs could be plainly seen without enlarging the entrance, as it was merely a large chamber about a foot deep and



THE COMMON SANDPIPER
(*Tringa hypoleuca*)



JERDON'S LITTLE
RINGED-PLOVER
(*Charadrius dubius jerdoni*)



JERDON'S LITTLE
RINGED-PLOVER
(*Charadrius dubius jerdoni*)



THE INDIAN PIED KINGFISHER
(*Ceryle rudis leucomelanura*)



HODGSON'S PIED WAGTAIL
(*Motacilla alba hodgsoni*)



THE KASHMIR ROLLER
(*Coracias garrulla semenowi*)

nine inches wide with a slightly narrowed doorway. The eggs lay on the bare sand, amongst which I noticed many small particles of the hard parts of those large flying beetles. As I expected, Hodgson's Pied Wagtails proved very common, and I lit on no fewer than four nests before tiffin; two with eggs and two with young. I completely failed as regards Indian Pied Kingfishers (*Ceryle rudis leucomelanura*). They were numerous along the lower reaches of the river, and at this very time in the previous year I found two nests with fresh eggs. As I badly wanted a half-plate photo of a nest of these birds, I was rather disappointed not to be able to repeat the performance this time, especially as I also wanted to see whether fish bones are always made use of, as the eggs in the one and only nest I have ever opened up were on quite a thick layer of small bones, which, by the way, are plainly visible in the photograph. A coolie brought me one of these birds, which he had actually caught in its tunnel, which however contained no eggs. When I took it from him it snapped at my hand, so to test its strength I let it nip one of my fingers. I very quickly regretted it too as the edges of its bill were decidedly sharp, and it hung on so firmly, that had I attempted to slide my finger out without first prizing its mandibles open, it would certainly have cut through the skin. As it was the flesh felt bruised for some time afterwards. Incidentally it made no attempt to transfix me with the sharp point of its dagger-like bill, which I should have thought would have been a much more suitable means of attack for such a bird. At the bridge at Sonarwain I met with the little Plumbeous Water-robin (*Rhyacornis fuliginosa*). From here onwards they are quite common along with their near relative the White-capped Redstart (*Chaimarrornis leucocephala*). Below this point I have never seen either of these pretty little birds.

On this day I got one very interesting photograph of two young Jerdon's Little Ringed Plovers. I was walking over a large patch of stones, across the middle of which there flowed a tiny stream. Hearing a very agitated plover about fifty yards off on the opposite side of the beck, I looked round to see what the trouble was, just in time to see two baby plovers struggling through the water. They gained the other side, and started off to where the mother bird was still plaintively calling to them, but as soon as I approached, they hid behind a stone little larger than themselves. During the whole time I was operating upon them with the camera, they never moved a muscle, but, as soon as I turned my back to go my way, they scrambled off towards their perturbed parents.

After tiffin I built a rough 'hide' close to a Grey Wagtail's (*Motacilla cinerea melanope*) nest in the roots of a bush on a small island just above the bridge, and from this I exposed the entire contents of another box of quarter plates. These incidentally were as bad as the others, so after this I gave up all idea of using the reflex at all. The bird was inordinately tame, and after I had made a couple of exposures, I demolished the greater part of the hide, and sat almost in full view of her. She continued to sit quite peacefully for a number of exposures, but when I completed the demolition process, she seemed to think that I had carried

things a bit too far, and leisurely walking off the eggs, refused absolutely to pose any longer.

The following morning I went down to try conclusions with the Sandpiper. The umbrella was fitted on top of my sangar as before, and well covered with leaves, branches and grass, and I prepared to await the arrival of my victim. I had only about quarter of an hour to wait, but soon realized that here was a very different personage from the Jerdon's Little Ringed Plover. Never still for an instant, she was possessed of the most acute hearing, and glanced to right, left or behind her at the slightest sound, continually bobbing her head, as if suffering from a severe attack of the hiccoughs. I began to despair of getting good negatives, as I wanted to give exposures of at least half a second. However, she seemed to quieten down a bit after ten minutes or so, so I determined to press the release immediately after one of her habitual hiccoughs, and trust to luck. She seemed to me to be off her nest almost before the shutter had opened, but as a matter of fact this turned out to be the best negative of all. Although she had left so abruptly, I could see her standing at the water's edge only about three yards off, evidently thinking things over, and almost before I had had time to change the plate, she was on the way back.

I now made a horrible discovery. A piece of black cloth, draped across the window of the sangar just below the level of the lens, had fallen outwards, and she was certain to see my hand the moment I attempted to reset the shutter. However I had to risk it, and it would be interesting to see what she would do. She was now at the nest again, but away she went the moment my fingers appeared by the lens. Nevertheless within ten minutes she was back at her post once more, but this time facing the spot whence the terrifying apparition had emerged. The noise of the shutter alarmed her, but she remained sitting, until my hand once more appeared on the scene. This time it was over twenty minutes before she dared to come back, and after a third exposure and its attendant reappearance of my hand, she gave way to her fear and refused absolutely to come anywhere near.

I have often wondered what her thoughts were, when the top of what I presume she took for a more or less inoffensive heap of brushwood and stones, probably harbouring a snake at most, suddenly heaved up, and gave forth that much feared and clumsy animal a human being ; for, when I lifted the umbrella and stepped out from my cramped quarters, she was standing on a stone in the water about fifteen yards away. Four days later, when I again passed the spot, I was very gratified to make her out still sitting on her eggs, beside a tumbled-down ' hide.'

I moved my tent next day further up stream, to where the hills close in on either side, and the river is narrowed down to a boiling torrent sweeping round and over high boulders, whose ledges and clefts provide perfect situations for nests of the Himalayan Whistling Thrush *(Myiophoneus horsfieldi temminckii)* and the Indian Brown Dipper *(Cinclus pallasii tenuirostris)*. Plumbeous Water-robins and White-capped Redstarts are here commoner than ever. Hodgson's

Pied Wagtail does not appear to come up as far as this, but the Grey Wagtail is plentiful. These latter are pretty early breeders, and at the end of May I failed to obtain fresh eggs. I discovered one soiled and three perfectly neat and clean nests of the Himalayan Whistling Thrush, but was unable to find one with eggs, and as regards the Brown Dipper I was even more unsuccessful, as but one decidedly ancient nest was all my search could reveal.

My one and only discovery here was a nest of the Plumbeous Water-robin with four well incubated eggs in it. It was in deep shadow and in rather an awkward position, being in the main fork of a willow, and about six feet off the ground. However a bank rose abruptly fairly close to it, so I decided to test the outcome of a brain-wave that had occurred to me after the unfortunate experience with the Sandpiper. Fortunately I did not expect to produce good photographs. Still I did obtain one passable negative, but it certainly is not worthy of reproduction.

I possess two half-plate cameras; one with an ordinary Thornton-Pickard shutter—my favourite one; the other with a 'Koilos' shutter, and I had found that I could screw in the lens and shutter of the latter camera on the inner side of the panel, and so inside the camera, so I cut a small hole in the bellows, through which I pushed the antinous release, and packed black tape round the hole to make certain that no light could get through to fog the plate. In this way after focussing, I had only to fold back the focussing screen, and I could see exactly what I was doing in the way of setting the shutter and the lens aperture, as I had the whole 'works' facing me. After the first exposure on the Sandpiper I had wanted to alter the exposure, but was unable to do so, as I could not possibly see what I was doing. Another advantage of this arrangement was that there was nothing bright and terrifying to startle the bird, there being merely a small black circle 'the shutter' (when using one half of the lens only) in the middle of a plain wood panel.

The experiment began just on nine o'clock in the morning with the lens and shutter in their ordinary position, and before I had been five minutes in the hide, the female flew up to the edge of the nest. She spotted the lens immediately and flew down to a boulder in mid-stream, before I had had time to press the release, even if I had wanted to, which I did not, as I think it tends to allay whatever suspicions the bird may have, if one waits a bit and lets her settle down. Until 11·30 o'clock she kept up a continual plaintive wail, occasionally flying up into the tree and approaching to within a foot or so of the nest, but never actually daring to come out into full view of the camera. During all this time I only saw the male once. For about ten minutes he added his voice to the lament, and then flew unconcernedly up stream again.

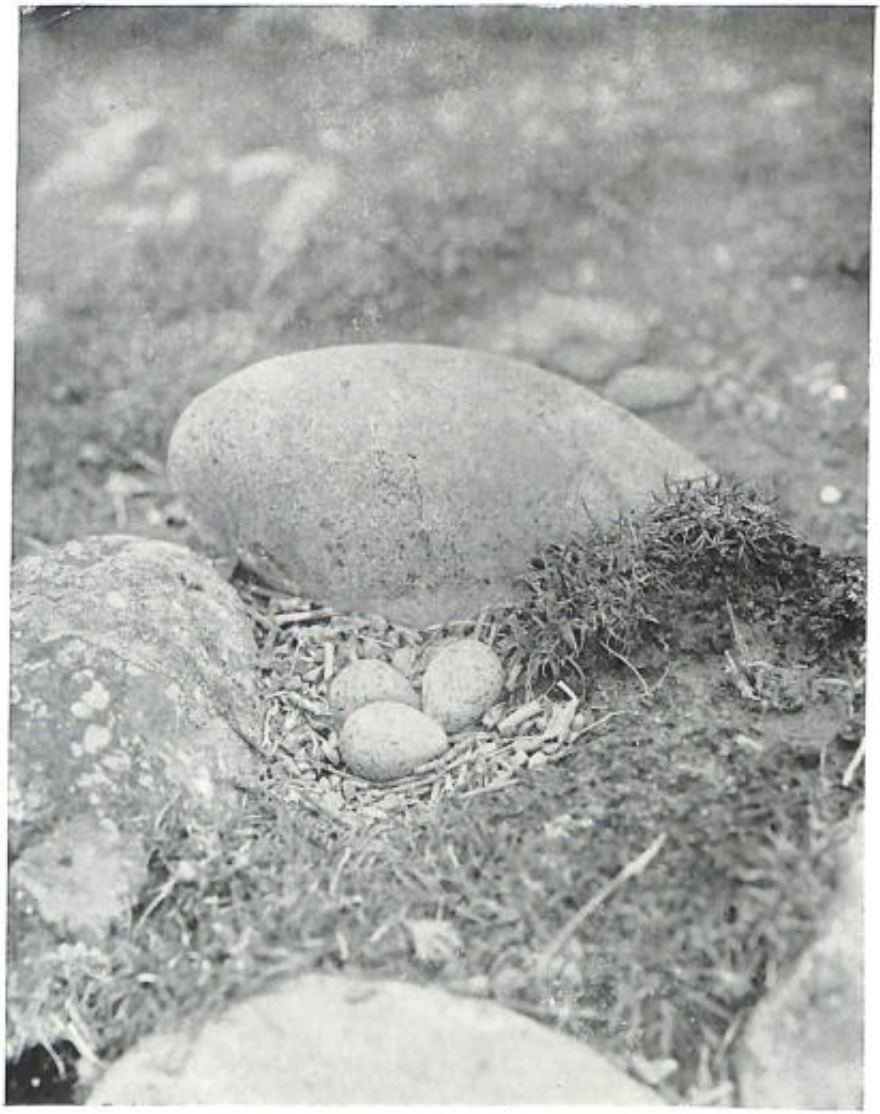
I then changed the lens and shutter round, screwing them on inside the bellows as I have described, and lo! and behold the next time she flew up into the tree she straightway hopped onto the nest and settled down on the eggs. Either the click or the movement of the shutter itself startled her, and she went off again, and could not pick up courage to come to the nest for another half hour. It

took me a whole hour to get off three exposures on her, and altogether I was sitting in that 'hide' for three and a half hours. Still I am quite certain that I could have sat there the whole day with the works in their ordinary position, and would then have been compelled to give up in the evening without having exposed a single plate. Thus the experiment was really quite a success. It made all the difference to me inside the hide, as I could see absolutely what I was doing, and could alter the exposure or other gadgets without ever moving the camera, and risking giving my presence away, and the absence of anything startling facing the nest undoubtedly made a great difference to the bird's behaviour. In fact I think had I started off with the shutter reversed, I would have been able to get as many negatives as I wanted, as those two and a half hours of anxiety must have made her very jumpy.

In the afternoon, feeling a bit limp after my morning's work on the Water-robin, I lazed outside my tent, writing up my diary. The tree, under which I was seated, was frequently visited by two or three Himalayan Black Bulbuls (*Microscelis psaroides psaroides*), and after an hour or so of their raucous voices, I had serious thoughts of shouting for my gun. I have met with few more noisy and less musical birds than these, and with their untidy plumage they are veritable street arabs amongst birds. I could occasionally hear the hoopoe-like voice of the Himalayan Cuckoo (*Cuculus optatus*) higher up the forest clad hillside, and once or twice the familiar Asiatic Cuckoo (*Cuculus canorus telephonus*) reminded me of its presence. In the evening one of the latter actually came down to my camp for a few minutes. I had two Himalayan Jungle Crows' (*Corvus coronoides intermedius*) nests within a couple of hundred yards of me, one of which was not more than fifteen or twenty feet up in a slender pine, and I was quite pleased to see these black bullies and arrant egg-stealers being thoroughly mobbed by a pair of ferocious Himalayan Black Drongos (*Dicrurus macrocercus albirictus*), which, judging by their aggressiveness, most probably had a nest in the vicinity, though I was unable to spot it.

An Indian Hoopoe (*Upupa epops orientalis*) was frequently visiting the patch of grass on which my tent was pitched, and flying off with the grubs he extracted therefrom to a wall about a hundred yards away, over which he disappeared at exactly the same spot on every occasion. I thought that there must be a nest in the base of the wall on the far side, but it turned out to be in a hollow trunk just beyond. There was a small entrance hole about two feet from the ground, and facing the wall, and from this were emitted loud squeaks at each visit of the parent bird. That evening I built a small sangar only four feet from the tree, using the stones of the wall for this purpose.

Next morning, when I awoke, it was raining hard and so dark that it was obvious that photography was out of the question. However I had made arrangements to set off for the boat at midday and did not want to alter my plans, as I had already fixed everything up for a lengthy trip into the Lolab, which, as it happened, I never completed, as I went down with a bad dose of fever. I therefore had myself roofed into the 'hide', setting up the



JERDON'S LITTLE RINGED-PLOVER

(*Charadrius dubius jerdoni*)

camera in case it cleared, but mainly with the idea of noting the behaviour of the birds.

The proximity of the 'hide' and the round black patch of the shutter impressed the Hoopoe so little, that he arrived the moment I was left alone. He did not enter the nest however, the food being taken from him at the entrance, but whether by a young one or the female I could not ascertain.

However after his third or fourth visit a fully-fledged young one poked its head out of the hole, and for about half a minute surveyed the outer world. Then a few moments later a bird flew out, too quickly for me to be able to see whether it was an adult or one of the young ones, but I rather think it must have been the female, as a few minutes later both adult birds appeared on the scene, and one of them immediately went in, the other flying away again after first transferring a grub to the birds inside. After this the old procedure was restarted. It looks therefore as if the male did all the grub hunting, while the female superintended the feeding of the youngsters within. This is not always the case however, as last April while on parade I noticed a nest high up in a crevice in a banyan tree. On this occasion both birds were equally industrious in hunting for their offsprings' food, and in twenty minutes between them they visited the nest no less than twenty-one times, after which they rested from their labours. There was no transferring of food from one adult to the other, but both entered the nest irrespective of the other's whereabouts. Judging from their antics, their chief prey appeared to be small grey grasshoppers which abounded on the sandy parade ground.

As the weather had not cleared by about ten o'clock, and it was, if anything, darker still, I decided to push off, but exposed two plates giving as long an exposure as the movements of the bird would permit, but, as I expected, they were so underexposed as to be practically useless. Incidentally the bird took not the slightest notice of the snap of the shutter.

Thus ended my first experiences in the use of a 'hide'. I cannot say the camera results were very satisfactory, but I certainly learnt a lot, and in consequence have since been more successful. Of the many lessons I imbibed, two stand out well above the others. The first that far longer exposures are required than one would ever suspect, so in order to cut them down as much as possible one should use the largest stop one can afford to: the other, that, in the case of a sitting bird at any rate and provided one is careful, one can give exposures of considerable length without undue risk of getting a moved image, as, even if the bird is startled, it seems to take quite an appreciable time before its brain can communicate with its muscles so to speak and put it in motion. In bird-photography, when the subject is close to the camera, one has to remember that the long bellows extension makes an appreciable difference in the length of the exposure required. In talking of the near proximity of the subject to be photographed it also behoves me to mention here that one can make a great mistake by trying to approach too close up. There are distinct limits, which are not only bounded by the fact that the nearer the 'hide' the shyer the

subject is likely to be. It is far better to get a small but entirely sharp image which can subsequently be enlarged to almost any degree, than to get a large image half of which will probably be out of focus owing to the fact that to stop down the lens to get the necessary depth of focus will unduly prolong the exposure beyond the bird's capacity for stillness. Another point of considerable importance is that most birds undoubtedly fear the bright lens, probably mistaking it for the eye of some outlandish animal, so as it often cannot be done away with by having the shutter in front of it, it should certainly be shaded as much as possible. Lastly, it is obvious that birds very rapidly become used to noises from inside the hide, so, once the bird has shown itself to be used to the noise of the shutter, one may not be too fearful of the sounds one is bound to make at times changing plates, and so forth. This fact really should be quite patent to any one. Trees and bushes are for ever creaking and rustling in a breeze, and if every bird left its nest in a panic at the slightest noise in its vicinity, it would indeed have a thin time of it.

Just before I reached the boat, I saw a Tickell's Thrush (*Turdus unicolor*) carrying material to a nest it was building in a willow close to the path. It was obtaining its material from an old nest in another tree about 50 yards away. I also noticed an Indian Oriole (*Oriolus oriolus kundoo*) building almost at the very top of an enormous chenar, and a Rufous-backed Shrike sitting on a nest on a branch overhanging the path.

NOTES ON SNAKES COLLECTED IN BURMA IN 1924

BY

COLONEL F. WALL, C.M.G., K.H.S.

In response to an appeal to various residents in Burma I obtained 323 snakes during 1924, representing 57 species. These include four new to Science, viz., *Natrix bitæniata*, *Natrix gilhodesi*, *Natrix nigriventer*, and *Natrix clerki*; a new colour variety of *Calliophis macclellandi*, viz.—*concolor*; further the collection adds to the list of the Burmese anguifauna four more species, viz.—*Natrix nuchalis*, previously known from China, *Rhabdops bicolor*, *Nerodia modesta* and *Ptyas nigromarginatus* previously known from Assam.

I take this opportunity of thanking those who have assisted me in advancing our knowledge of the fauna of this province. The Rev. Father Gilhodes rendered signal service in procuring 104 specimens from the Kachin Hills, an area little exploited, and his material has been specially interesting as the fauna so closely approximates to that of the Western Chinese hills. He has been responsible for adding two species new to Science. Mr. Clerk also worked for me in the Kachin Hills, and obtained one new species and many specimens that had previously been considered very rare. Mr. P. M. R. Leonard procured many very valuable specimens from the Northern Shan States, including one new species. Major Rodrigues acquired many interesting specimens in the Southern Shan States. Working as he did in a locality that had been previously exploited by the late Colonel Bingham, it was hardly to be expected that he would find a new species. His material however was valuable in confirming and amplifying the work of his notable predecessor. Captain Treston, I.M.S., succeeded in throwing much light on the local species at Myitkyina. Captain Wilkinson and Assistant Surgeon O'Reilly contributed to our knowledge of the snakes in and about Mandalay.

Names of localities are spelt in accordance with the latest maps of the Geological Survey of India.

Family—TYPHLOPIDÆ

Typhlops diardi Schlegel

Fourteen examples of this common snake were acquired, all of which were quite typical except one large adult twelve inches long, which was a uniform pale grey in colour. As far as I could judge this was not due to impending desquamation. I referred to a similar variety from Assam in my paper on this snake in this Journal (vol. xxv, p. 381) and proposed the name *cinereus* for it.

Dr. Malcolm-Smith (Jour. Nat. Hist. Soc. Siam., vol. 6, p. 53) suggests that *T. tephrosoma*, a similarly coloured snake described by me from the Khasi Hills, Assam, should be regarded as *T. diardi* as he has found typical *diardi* in Siam with 28 scale rows. This view is probably correct.

FOES. Two specimens measuring 96 and 288 mm. (3⅞ and 11½ inches) were recovered from the stomach of a Macclelland's coral snake (*Calliophis macclellandi*).

BREEDING. (a) *Genitalia*. One male specimen had the claspers extruded. These organs are duplicated as in other snakes. Each clasper is cylindrical, with a 'raphé' running from behind outwards to the tip, which is swollen and thrown into folds like a rosette. There are no recurved processes such as one sees in Colubrine and Viperine species.

(b) *Season*. Three females measuring 275, 305 and 342 mm. (11, 12 and 13½ inches) were egg-bound. The first killed on the 10th of June contained 7 eggs, the second killed on the 30th of June showed 3 follicles obviously impregnated, and the third killed in July contained 8 eggs.

GROWTH. One female was exceptionally large measuring 417 mm. (1 foot, 4½ inches).

DISTRIBUTION. This species which is so common in the plains of Burma as far north as Fort Hertz, Putao District, occurs up to over 5,000 feet. Eight specimens were sent to me from Huton in the Kachin Hills (4500 feet). Venning obtained it in the Chin Hills at Minkin (5,600 feet). Also taken at Taunggyi, Southern Shan States (5,000 feet).

Family—BOIDÆ

Sub-family—PYTHONINÆ

Python molurus (Linné)

One small female (?) specimen came in from Myitkyina, measuring 915 mm. (3 feet), the tail 112 mm. (4½ inches). This was killed between the 1st and 24th of June. The ventrals numbered 259 and subcaudals 68 of which the last 8 were entire.

DISTRIBUTION. Probably occurs throughout Burma. Localities actually known to me are Arakan (near Akyab); Pegu District (Pyinbongyi); Magwe District (Minhla); Myitkyina; Tennasserim District (Tavoy); North Shan States (Maymyo).

Family—ILYSIIDÆ

Cylindrophis rufus (Laurenti)

Two specimens were sent in from Bhamo, and Mandalay. A freshly-killed specimen was black with an ultramarine fluorescence in reflected light. The dorsal bars were faint orange anteriorly and deep orange posteriorly. The anal region was bright canary, and the tail brilliant orange beneath. One of these was killed in a house at night.

The eye in life is completely black so that the shape of the pupil is not visible.

DISTRIBUTION. An uncommon species occurring in the basin of the Irrawaddy from Bhamo to Ava and its tributary the Tsamon river (Pyawbwe); the Pegu river (Pegu); the Sinthe river (Pyinmana) and in the Tenasserim District. It occurs also in the hills up to about 5,000 feet. North Shan Hills (Maymyo); South Shan Hills (Taunggyi).

Family—XENOPELTIDÆ

Xenopeltis unicolor Reinwardt

All the thirteen specimens received came from Myitkyina, all collected between the 1st of June and 15th of November.

FOOD. Two had recently fed. One of these contained two full grown munias (*Uroloncha punctulata*) and the other the remains of what appeared to be a callow young shrew.

BREEDING. None showed any evidences of impregnation.

GROWTH. Two young killed between the 24th of August and the 15th of November measured 317 and 342 mm. (12⅜ and 13⅜ inches). The largest specimen was a female which taped 818 mm. (2 feet 8¼ inches).

LEPIDOSIS. The ventrals ranged from 182 to 189 and the subcaudals from 24 to 25.

DISTRIBUTION. It appears to be restricted to the basin of the Irrawaddy from Myitkyina southwards, and to river basins further east. Has been recorded from Myitkyina, Ava, Tharawaddy, Prome, Pegu, Rangoon, Bassein, Tenasserim District (Tavoy, Mergui).

Family—COLUBRIDÆ

Polyodontophis collaris (Gray)

Five specimens from the Kachin Hills (Huton 4,500 feet). Three of these contained skinks (*Lygosomata*?) in the stomach.

Natrix bitæniata sp. nov.

A small snake sent to me by Mr. P. M. R. Leonard from Kutkai, North Shan States (4,500 feet) which I at first took to be a specimen of *Rhabdophis parallelus* Boulenger, proves to be a very distinct species. I prepared the skull of a similar specimen from Sinlum Kaba, Kachin Hills (6,000 feet), and find that the

maxillary dentition is syncranterian, whereas in *parallelus* from the Khasi Hills, Assam the dentition is diacranterian. An examination of all the specimens, identified as *parallelus* in the Bombay collection and the Indian Museum, shows that those collected in the Eastern Himalayas and the Assam Hills agree with *parallelus* in dentition, whereas the specimens from Burma (Kachin Hills and North Shan Hills) and all those collected by Anderson in the Yunnan Expedition of 1868, conform to the type of *bitæniata*. Reference to Boulenger's Catalogue (vol. i, page 223), shows the author based his description of *parallelus* on six specimens from Sikkim, the Khasi Hills, Sanda on the upper Irrawady (1,500 feet; Lat. 24° ·30, Long ·95°), and the Hotha Valley, Yunnan, the two latter specimens being collected by Anderson during the Yunnan Expedition. It seems probable that the two last will be found to conform with *bitæniata*, and that the remaining four only should be retained as types of *parallelus*. For many years I have been puzzled to know why Boulenger placed *parallelus* in the subgenus *Tropidonotus* (=*Natrix*), as my skulls from Khasi Hill and Sikkim specimens show the maxillary dentition to be diacranterian and conforming to the dentition of the genus *Rhabdophis*. The explanation seems to be that when examining the dentition he had before him one of Anderson's specimens.

I have now seen ten specimens of *bitæniata*, seven of which are Anderson's Yunnan examples in the Indian Museum. I have notes on eighteen specimens of *parallelus* from the Eastern Himalayas, and Assam Hills.

I have critically examined, side by side, Anderson's seven examples with several specimens of *parallelus* from the Eastern Himalayas, and the Assam Hills. They are surprisingly alike. I can find no constant character in the lepidosis to distinguish one from the other, and the few differences in markings are trivial. Were it not for the marked difference in the maxillary dentition, nobody would suppose them different.

The differences noted by me are :—(1) In *parallelus* there is a dark præocular streak sometimes extending to the rostral. There is no such streak in *bitæniata*. (2) The postocular streak in *parallelus* is not so broad, or so well defined as in *bitæniata*, and is interrupted at the gape, i.e., not connected with the lateral black body stripe. In *bitæniata* the postocular stripe is continuous with the lateral body stripe. (3) In *parallelus* the blackish lateral body stripe on the 3rd and 4th rows above the ventrals, is not so well defined or conspicuous as in *bitaeniata*. As regards lepidosis, in *parallelus* the anterior temporal shields are usually single, in *bitæniata* usually two.

Lepidosis. *Rostral*, just visible above, depth about three-fifths the breadth. *Internasals*, a pair, truncate anteriorly; the suture between them subsequal to that between the praefrontals. *Præfrontals*, a pair; the suture between them about two-fifths the length of the frontal. *Frontal*, greater than its distance to the end of the snout; breadth, a shade more than twice that of the supraocular at mid orbit. *Loreal*, one. *Praeocular*, one. *Postoculars*, three. *Temporals* 2+1. *Supralabials*, 8; the 1st and 2nd touching the nasals, 3rd, 4th and 5th the eye; 6th and 7th the lower temporals. *Posterior Sublinguals*, rather longer than the anterior; divergent posteriorly; touching the 5th, 6th and 7th infralabials; partially separated by two small azygos scales and one pair, after which is a narrow 1st ventral. *Costals*, two heads-lengths behind the head 19, midbody 19, two heads-lengths before the vent 17. Keeled to the penultimate row in mid body. Emarginate apically. No. (?) apical facets. *Ventrals*, 164. *Anal*, divided. *Subcaudals*, 86 pairs.

In a ♂ from Sinlum Kaba the anterior temporals are single, ventrals 172, and subcaudals 92. In another from Sinlum Kaba the anterior temporal is single, the 4th and 5th infralabials only touch the eye, the ventrals are 160 and subcaudals 83.

Dentition.[1] *Maxilla*, 23 teeth; syncranterian, anododont, coryphodont. *Palatine*, 17; feebly kumatodont. *Pterygoid*, 30 to 34; feebly scaphiodont. *Mandibular*, 28 to 29; anododont, feebly kumatodont.

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[1] The teeth in three skulls of *Rhabdophis parallelus* in my collection from Sikkim are as follows:—*Maxilla*, 18 to 21; diacranterian. The cranterian teeth not twice the length of the preceding. *Palatine*. 14 to 16. *Pterygoid*, 20 to 26. *Mandibular*, 24 to 27.

DISTRIBUTION. *Burma* North Shan Hills (Kutkai); Kachin Hills (Sinlum Kaba); Upper Chindwin (Sanda). *China*. Yunnan.

Natrix gihodesi [1] Wall

Nineteen specimens of this snake, recently described by me in this Journal (vol. xxx, p. 587) were sent to me by the Revd. Father Gilhodes from Huton, Kachin Hills.

LENGTH. The largest specimen proved to be a female 486 mm. (1 foot 10¾ inches), tail 182 mm. (7¼ inches).

LEPIDOSIS. *Praeoculars*, five specimens had two on each side. *Postoculars*. There were two only on the left side in one specimen and two on both sides in another. *Supralabials*, the 4th and 5th were confluent in one specimen making a total of 8, the 4th and 5th only touching the eye. *Ventrals*, 146 to 157. *Subcaudals*, 92 to 108. The 2nd entire in one specimen.

FOOD. One contained a frog in the stomach.

BREEDING. Three examples proved to be egg-bound, the eggs being of such a size as to make it fairly certain that the species is oviparous. One killed in June contained one elongate egg, 31 mm. (1¼ inch) in length. One killed between July and October contained two eggs, and one killed between October and December two eggs, 26 to 28 mm. long (1 to 1¼ inch). The smallest dam taped 434 mm. (1 foot 4¾ inches). It would appear from the growth of specimens given below that the species is sexually mature when two years old.

GROWTH. In the months October to December one specimen 218 mm. (8¾ inches) long was killed which is obviously this year's production. Four others ranging between 380 and 442 mm. (15 and 17½ inches) represent young of 1923, showing that the species about doubles its length in the first year of life. Another specimen 575 mm. (1 foot 10¾ inches) in length, probably represents one hatched in the year 1922.

DENTITION. From one skull in my collection. *Maxilla*, 26 teeth; syncranterian, anododont, coryphodont; the last 3 teeth enlarged but not twice the length of the preceding. *Palatine*, 14 to 16; anododont, isodont. *Pterygoid*, 25 to 27; anododont, feebly scaphiodont; the teeth except posteriorly about the same size as the palatine, *Mandibular*, 28 to 30; anododont feebly kumatodont.

Natrix nuchalis (Boulenger)

I described, as a new species in this Journal, a snake under the name of *N. leonardi* (Journ. B. N. H. S., vol. xxix, p. 466). Mr. Parker writes to me from the British Museum that he has compared this with the type of *N. nuchalis*, and several other specimens of the latter from the Tonkin Hills in China, and thinks that my *leonardi* cannot be separated from Boulenger's *nuchalis*.

LEPIDOSIS. I received one specimen from Sinlum Kaba, Kachin Hills, which differed from my type of *N. leonardi* in having the scale rows 19 two heads-lengths behind the head, 17 in midbody, and 15 two heads-lengths before the vent, as compared with the type where the rows numbered 17, 17 and 15. Miss Procter who preceded Mr. Parker examined my type of *N. leonardi* and while remarking on its affinities to *nuchalis* noted that the scales in my *leonardi* are strongly keeled, whereas in *nuchalis* they are feebly keeled. Mr. Parker found in some of the Tonkin specimens alluded to, the scale rows numbered 19, 17, 15. There appears therefore to be no doubt that my *leonardi* cannot be retained as a species distinct from *nuchalis*. The ventrals in my specimen number 149, and the subcaudals 48. It has two postoculars and two anterior temporals on the left side. The supralabials are 6. The 5th is a very long shield which appears to be a confluence of two. However this is a constant feature, not an aberrant one, as surmised in my original description, where I

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[1] Mr. Parker writing to me from the British Museum doubts whether this species is entitled to rank as such, distinct from *N. khasiensis*. However there can be no doubt in my mind. I have one skull of *khasiensis* from Shillong, Khasi Hills. The maxilla holds 22 to 23 teeth, the palatine 16, the pterygoid 25 to 26, and the mandibular 31 to 32.

recorded these shields as 7. It is a female measuring 580 mm. (1 foot 11 inches) the tail 112 mm. (4½ inches).

DISTRIBUTION. A local hill snake which appears to be confined to an altitude above about 5,000 feet since no specimen was included among the 104 snakes received from Huton (4,500 feet) in the same Hills.

Natrix clerki sp. nov.

A single specimen of a snake which I consider deserves specific rank as a new *Natrix*, was sent to me by Mr. Clerk from Sinlum Kaba, Kachin Hills.

This is a ♂ measuring 565 mm. (1 foot 10⅝ inches), the tail 170 mm. (6¾ inches.)

LEPIDOSIS. *Rostral*, just visible above. *Internasals*, a pair; the suture between them equal to that between the praefrontal fellows; truncate anteriorly. *Praefrontals*, a pair. *Frontal*, length greater than its distance to the end of the snout. *Loreal*, one. *Praeocular*, one. *Postoculars*, three. *Temporals*, 1 + 2. *Supralabials*, 8; the 1st and 2nd touching the nasals, 3rd, 4th and 5th the eye, and the 6th and 7th the anterior temporal. *Posterior Sublinguals*, rather longer than the anterior; divergent posteriorly; touching the 4th and 5th infralabials. Separated posteriorly by one azygos and a pair of scales and succeeded by a narrow first ventral. *Costals*, two heads-lengths behind the head 19, midbody 19, two heads-lengths before the vent 17. Keeled to the last row in midbody. Emarginate apically, No. (?) apical facets. *Ventrals*, 175. *Anal*, divided. *Subcaudals*, 106; divided.

COLOURATION. Blackish-olivaceous dorsally to the edges of the ventrals. A series of ill-defined light roundish spots on the 5th row above the ventrals and the adjacent halves of the 4th and 6th rows, continued to the base of the tail. Belly yellowish anteriorly, merging to pale salmon posteriorly, suffused more deeply laterally; with an occasional small dark round spot on the edges of the ventrals. Head blackish-olivaceous. A short mesial light streak just behind the parietals. A light well-defined V on the nape beginning behind the gape. First 5 supralabials with black posterior borders A black postocular stripe to the sides of the neck. Chin immaculate.

Nerodia piscator. (Schneider)

Thirty-three specimens from Myitkyina, Mandalay, Maymyo and Huton. The usual variety is one with large black spots. Olive specimens with a light chequering were received from Maymyo and Huton.

Nerodia modesta ? (Günther)

I received one specimen of a snake I refer with some doubt to this species.

LEPIDOSIS. *Internasals*, narrowed anteriorly. *Loreal*, present. *Praeoculars*, two. *Postoculars*, three. *Temporal*, one anterior. *Supralabials*, 9; the 1st and 2nd touching the nasals, 4th, 5th and 6th the eye, and the 7th and 8th the anterior temporal. *Costals*, 19 two heads-lengths behind the head, 19 in midbody, 17 two heads-lengths before the vent. Keeled to the penultimate row in midbody. *Ventrals*, 147. *Anal*, divided. *Subcaudals*, 84 (tail broken), divided.

COLOURATION. Darkish brown. A dorsal yellowish ill-defined lateral stripe on the 5th and 6th rows above the ventrals, with lighter spots incorporated. A series of blackish ill-defined spots below the light stripe and a less distinct series of blackish spots above the light stripe. Belly yellow with a squarish black spot near the edge of each ventral, forming a stripe from throat to tail tip. Head dark brown with pale vermiculations, and a pair of pale spots, one on each side of the interparietal suture. Supra and infralabials with blackish sutures. An ill-defined short yellowish temporal streak to the side of the neck.

LENGTH. 310 mm. (1 foot and ⅛ of an inch), tail, broken; 87 mm. (3½ inches.)

HABITAT. Huton, Kachin Hills. This adds another species to the Burmese anguifauna.

DENTITION. *Maxilla*, supports dubiously 28 teeth, anodontd, syncranterian, coryphodont. (In my only skull of *modesta* from Cherrapunji, Khasi Hills, Assam, the maxillary teeth number 22.)

Rhabdophis stolatus (Linné)

Twenty-two specimens from Myitkyina, Bhamo, Mandalay, Rangoon, Maymyo, Kutkai and Huton.

All the specimens from Maymyo were of the vermilion variety, and several of those from Mandalay, and Bhamo.

HABITS. One was killed at Bhamo in a bungalow at night.

FOOD. A frog found in the stomach of one.

BREEDING. One egg-bound ♀ from Mandalay killed in August or September contained 5 eggs about 25 mm. (one inch) long. Mrs. Swithinbank found eggs in her garden in Rangoon which hatched out about three weeks later. On September 27 one broke its shell at 10-15 a.m. another at 1-15 p.m. a third at 2-10 p.m. and a fourth at 2-20 p.m. The first left its egg at 4 p.m. but the rest remained within their eggs, being found outside them on the following morning.

Rhabdophis subminiatus (Schlegel)

Twenty specimens from Huton, Kachin Hills; Kutkai, Tawongnga, and Maymyo in the North Shan States, Taunggyi in the South Shan States, and Maungdaw near Akyab.

HABITS. Two of these were captured alive. They erected themselves and flattened the fore body making a great demonstration of anger, but refused to bite on provocation.

DISTRIBUTION. This common species is universally distributed in Burma. It is a somewhat uncommon snake in the plains, but a common one in the Hills up to 6,500 feet. Blyth records it from Arakan. I have records from Maungdaw on the coast above Akyabe and Myitkyina; Tharawaddy District (Rangoon). Pegu District (Pegu, Tadungu); Thaton District (Thaton, Shwegun); Amherst District (Kawkareik); Kachin Hills (Huton); Chin Hills (Haka); Pegu Yomas (Hinyachaung); North Shan Hills (Maymyo, Kutkai, Tawongnga), South Shan Hills (Taunggyi).

Rhabdops bicolor (Blyth)

A single adult specimen was sent to me from Huton, Kachin Hills. This adds another snake to the Burmese anguifauna. It was previously only known from the Khasi Hills in Assam, and from Yunnan.

COLOURATION. The specimen, a recently killed one, is olivaceous-green dorsally, to the edges of the ventrals. The scales are narrowly edged with black, forming interrupted linear stripes except on the two lowest rows where the black, is modified to a mottling. The belly is uniform canary yellow. The head is olivaceous, this hue extending beneath the chin, and becoming a mottling on the posterior sublingual shields.

LEPIDOSIS. The ventrals number 188, and the subcaudals 57 (the tip of the tail slightly deficient). The lateral scales in the anal region are not tuberculate.

DISTRIBUTION. This is a hill snake living at an altitude above about 4,000 feet. Only recorded in Burma from the Kachin Hills.

Plagiopholis blakewayi Boulenger

Nine specimens 6♂ and 3♀ were received from Sinlum Kaba, Kachin Hills.

COLOURATION. The dorsal colour varies considerably. Some specimens are a blackish brown, others a rich lustrous terracotta. Many of the scales are edged with black, others in the flanks have their lower borders, where overlapped, white, or salmon-pink, in the ruddy specimens. A black zig zag line borders the ventrals. The belly is dirty yellowish in the dark specimens, and dull salmon in the ruddy examples. A sparse and irregular mottling of fine black spots, very variable in extent, is seen on the belly. A more or less conspicuous black arrow head on the nape. Ruddy spirit specimens when skinned are found to have tinged the tissues a salmon-pink.

LEPIDOSIS. There are several notable features in the scaling of this species. *Supralabials*, number 5 only, of which the 1st and 2nd touch the nasals, the 3rd the eye, and the 4th or 4th and 5th the anterior temporal. *Loreal*, absent except in one specimen. *Posterior temporal*, a single shield. *Infralabials*, the 1st do not touch, so that the mental forms a considerable

suture with the anterior sublinguals. *Costals*, in 15 rows in the whole length of the snake. The lateral scales in the anal region of males are strongly keeled, in their anterior halves, as one sees in males of the genus *Aspidura*.

Ventrals, ♂ from 126 to 130, ♀ from 126 to 132. *Anal*, entire. *Subcaudals*, ♂ 23 to 27, ♀ 21.

LENGTH. The longest ♂ measured 398 mm. (1 foot, 3¾ inches) ; the longest ♀ 362 mm. (1 foot, 2¼ inches.)

FOOD. One that had recently fed contained an earth worm in the stomach, and this explains the semi-liquid mud found in the intestines of other specimens.

GROWTH. One juvenile specimen taped 127 mm. (6 inches.)

DENTITION. From two skulls in my collection. *Maxilla*, 18 to 20 teeth ; anododont, syncranterian, feebly kumatadont. *Palatine*, 15 to 20 ; anododont, isodont. *Pterygoid*, 21 to 23 ; anododont, isodont. *Mandibular*, 25 to 26 ; anododont, scaphiodont.

DISTRIBUTION. The fact that so many specimens were obtained at Sinlum Kaba at an altitude of 6,500 feet, while none came in from Huton (4,500 feet) in the same hills out of one hundred and four specimens seems to indicate that it is confined to what one may call an Alpine elevation. The type and another examined by me were obtained at Taunggyi in the South Shan Hills (5,000 feet).

Trirhinopholis nuchalis Boulenger

Thirteen specimens were sent in, eleven from Huton, Kachin Hills ; and two from Kutkai, North Shan Hills.

COLOURATION. These specimens vary in their prevailing colour very much as does the last species. Some are blackish brown dorsally, others of a ruddy brown tinge. Many of the scales are edged with black, and many have white or pinkish yellow edges which overlapped, producing a variegation. The belly is yellowish-salmon finely peppered with black spots. There is also a lateral series of irregularly distributed squarish or oblong black spots. The head is olivaceous-black to the edge of the lip. A conspicuous black arrow head on the nape, its apex reaching the tip of the parietal shields. Some of the infralabial sutures black.

LEPIDOSIS. *Loreal*, present, *Supralabials*, 6 ; the 1st and 2nd touching the nasals, 3rd and 4th the eye, and the 5th the anterior temporal. The 5th is an unusually large shield. *Posterior temporals*, 2. *Infralabials*, the 1st do not meet, so that the mental forms a considerable suture with the anterior sublinguals. *Costals*, in 15 rows in the whole body length. The lateral scales in the anal region of males are keeled as in the last species. *Ventrals*, ♂ 127 to 131, ♀ 138 to 141. *Anal*, entire. *Subcaudals*, ♂ 23 to 29, ♀ 22 to 27. 2nd and 3rd entire in two examples, 2nd, 3rd, and 4th in one.

LENGTH. The largest ♂ measured 474 mm. (1 foot 6⅝ inches), and the largest ♀ 293 mm. (11½ inches).

FOOD. Many specimens had recently fed and all contained earthworms in the stomach, and much semi-liquid mud in the intestines.

DENTITION. From three skulls in my collection. *Maxilla*, 19 to 23 (24 ?) teeth ; anododont, syncranterian, feebly kumatodont, *Palatine*, 15 to 19 ; anododont, feebly scaphiodont. *Pterygoid*, 21 to 29 ; anododont, scaphiodont. *Mandibular*, 24 to 27 ; anododont, feebly kumatodont.

DISTRIBUTION. It has usually been recorded from hills about 4,000 feet and over East of the Chindwin in the North, and East of the Tsamon and Sittang rivers further South. Foot hills in Katha District (Mansi) ; Kachin Hills (Huton, Sima, Sinlum Kaba) ; Ruby Mines District (Mogok) ; North Shan Hills (Kutkai) ; South Shan Hills (Taunggyi) ; Hills in Toungoo District (Thaudaung 3,500 feet) ; Karen Hills, exact locality not recorded, but probably from a range between the Salween river and its tributary the Pawn which averages 4,000 feet. It will almost certainly be discovered in the Tenasserim Hills as Malcolm-Smith records it from Ratchaburi, two miles east of the Tenasserim border.

Lycodon aulicus (Linné)

Twenty specimens from Mandalay, Myitkyina and Rangoon.

BREEDING. Two females 412 and 480 mm. (1 foot, 4¼ and 1 foot, 7 inches) killed in Mandalay between August and October were egg-bound and contained 3 eggs each.

Lycodon fasciatus (Anderson).

Ten specimens from Maymyo, Kutkai, Taunggyi, and Huton.

LEPIDOSIS. *Ventrals*, these range between 203 and 215. *Subcaudals*, 78 to 85.

FOOD. One had swallowed a skink, and another contained the tail of a lizard (skink ?) in the stomach.

DENTITION. From four skulls in my collection. *Maxilla*, carries 9 to 11 teeth ; oinododont, diacranterian, anisodont. The first 4 teeth progressively increase, the 5th is equal to the 4th, and is followed by a short edentulous space. The praecranterian series number 2 to 3, and are isodont. Cranterian 2, subequal and larger than the praecranterian. *Palatine*, 13 to 15 ; anododont, isodont. *Pterygoid*, 19 to 29 ; anododont, scaphiodont. *Mandibular*, 15 to 17 ; oinododont, anisodont. The first 4 or 5 progressively increase in size, the 5th (4th) is as long as the 4th (3rd) and succeeded by a short edentulous space. The postnodal number 10 to 12, and are scaphiodont. This species connects the genus *Lycodon* with *Dinodon*. It agrees with other *Lycodons* in having 2 instead of 3 cranterian teeth but it resembles *Dinodon* in having 6 to 7 praenodal teeth instead of 4 to 5. The praecranterian series resemble those of *Dinodon* in numbering 2 or 3 instead of from 4 to 12 as in other species of *Lycodon*.

DISTRIBUTION. It is a hill snake occurring at an altitude above 3,000 feet. Katha District (Mansi) ; Kachin Hills (Sima, Huton) ; Chin Hills (Haka) ; Ruby Mines District (Mogok) ; North Shan Hills (Maymyo, Kutkai) ; South Shan Hills (Taunggyi).

Ptyas nigromarginatus (Blyth)

One specimen was obtained at Huton, Kachin Hills. This species adds another to the Burmese anguifauna. It was previously known from the Eastern Himalayas, Assam Hills and Yunnan.

The specimen was a small one measuring 348 mm. (1 foot, $1\frac{3}{4}$ inches).

Ptyas mucosus (Linné)

Only four specimens were sent in from Mandalay and Maymyo. This is due to the fact that I asked various collectors to send in nothing more than a yard long.

Zamenis korros (Schlegel)

One juvenile female specimen was sent in from Huton, Kachin Hills, measuring 368 mm. (1 foot, $2\frac{1}{2}$ inches).

LEPIDOSIS. *Ventrals*, 191, *Subcaudals*, 139.

Coluber prasinus Blyth.

Five examples were received from Huton, Kachin Hills.

LEPIDOSIS. *Ventrals*, 197 to 209. *Subcaudals*, 105 to 111.

GROWTH. One, apparently a hatchling with patent umbilicus, killed between July and October measured 315 mm. (1 foot, $\frac{3}{8}$ of an inch). Another killed between October and December measured 334 mm. (1 foot, $1\frac{3}{8}$ inch).

ECTOZOA. The hatchling was infested with scarlet mites (*Microtrombidia* ?) attached between the costals and ventrals.

DISTRIBUTION. This is a hill species occurring above about 4,000 feet. Recorded from Putao District (Gauri, Lat. 27°·31, Long. 97°·46); Katha District (Mansi) ; Kachin Hills (Huton) ; Ruby Mines District (Mogok) ; South Shan Hills (Taunggyi) ; Chin Hills (Haka).

Coluber porphyraceus Cantor

Five examples came in from Sinlum Kaba, Kutkai, Maymyo and Taunggyi.

DISTRIBUTION. A hill snake occurring usually above about 3,000 feet. Recorded from Chin Hills (Haka, Tiddin, Falam) ; Manipur ; Katha District (Junction of the Mu and Kodan tributaries of the Chindwin) ; Kachin Hills (Sinlum Kaba) ; Ruby Mines District (Mogok) ; North Shan Hills (Kutkai, Maymyo) ; South Shan Hills (Taunggyi, Pwehla, Loilem) ; East of Salween river.

Coluber radiatus Schlegel

Five specimens from Huton, Mandalay, and Taunggyi.

GROWTH. A young specimen 368 mm. (1 foot, 2½ inches) was killed in Mandalay between September and November, and another 398 (1 foot, 3¾ inches) at Huton between October and December.

DISTRIBUTION. This is a common species throughout Burma in the plains, and ascends the hills up to about 5,000 feet.

Coluber leonardi Wall.

Two fine specimens were sent in from Sinlum Kaba.

LENGTH. One specimen measured 780 mm. (2 feet, 6¾ inches), the tail 118 mm. (4¾ inches).

LEPIDOSIS. *Praefrontal*. Confluent with the praeocular on the right side in one example. *Loreal*, wanting as in the type. *Ventrals*, 208 and 225. *Subcaudals*, 53 and 51.

DENTITION. From one skull in my collection. *Maxilla*, carries 16 to 17 teeth; anododont, syncranterian, feebly kumatodont. *Palatine*, 10; anododont, feebly kumatodont. *Pterygoid*, 12 to 13; anododont, scaphiodont. The low number of teeth is unusual in Indian species of this genus. *Oxycephalus*, has 12. *cantoris*, *hodgsoni*, *helena*, *melanurus*, *porphyraceus*, *prasinus*, *radiatus*, and *tæniurus* have from 15 to 30 teeth. *Mandibular*, 21; anododont, scaphiodont.

VERTEBRÆ. As in other Indian species of the genus, the hypapophyses disappear in the second eighth of the body.

DISTRIBUTION. Has only been found in Burma in the Kachin Hills (Sinlum Kaba, whence I have seen four examples). There is a specimen in the Bombay collection from Assam exact locality not on record.

Dendrophis pictus (Gmelin)

Four specimens from Huton, Kachin Hills and Hsen-wi, North Shan States. This is a fairly common snake in Burma, occurring throughout the plains, and up to an elevation of about 4,500 feet.

Dendrelaphis subocularis (Boulenger)

One ♂ specimen from Huton.

LENGTH. 805 mm. (2 feet, 7¾ inches), the tail 232 mm. (9¼ inches).

LEPIDOSIS. *Ventrals*, 168. *Anal*, divided. *Subcaudals*, 103.

DENTITION. From two skulls in my collection. *Maxilla*, carries 16 to 18 teeth; anododont, syncranterian, kumatodont. *Palatine*, 11 to 13; anododont, feebly scaphiodont. *Pterygoid*, 18 to 22; anododont, scaphiodont. *Mandibular*, 17; anododont, kumatodont.

DISTRIBUTION. Has only once before been recorded from Burma, viz., from Bhamo. This record probably means Bhamo District, and the specimen is probably from the Kachin Hills.

Oligodon herberti Boulenger

Two fine examples from Huton, both females.

LENGTH. 490 mm. (1 foot, 11⅛ inches). The tail 65 mm. (2⅝ inches).

LEPIDOSIS. *Internasals*, absent. *Nasal*, entire. *Loreal*, absent. *Postocular*, One. *Costals*, 13 in the whole body length. *Ventrals*, 212. *Subcaudals*, 35 and 38. Not angulate.

FOOD. A material in the stomach of one suggests yolk of eggs, but no egg cases were found.

BREEDING. One killed between July and October contained five eggs, in the oviducts, about 18 mm. (¾ of an inch) long.

DENTITION. From one skull, in my collection, *Maxilla*, supports 7 teeth; anododont, syncranterian, strongly coryphodont. An edentulous space anteriorly that would take about two teeth. *Palatine*, 2 to 3; an edentulous space anteriorly. Teeth small. *Pterygoid*, completely edentulous. *Mandibular*, 9; anododont, feebly kumatodont. No edentulous space anteriorly.

DISTRIBUTION. Evidently a hill snake occurring above about 4,000 feet. Recorded from Ruby Mines District (Mogok); Kachin Hills (Huton, Sinlum Kaba).

Oligodon hamptoni Boulenger

A female example from Sinlum Kaba.

LENGTH. 486 mm. (1 foot, 7½ inches).

LEPIDOSIS. *Internasals*, absent. *Nasal*, entire. *Loreal*, absent. *Postoculars*, 2. *Supralabials*, 5, the 1st only touches the nasal, the 2nd and 3rd the eye, and the 4th the temporal. *Costals*, 15 in the whole body length. *Ventrals*, 175, not angulate. *Subcaudals*, 30.

FOOD. Two flaccid soft-shelled eggs (of lizard ?), were found in the stomach, and four empty egg cases in the upper intestine.

DENTITION. From one skull in my collection. *Maxilla*, carries 8 teeth; anodontant, syncranterian, strongly coryphodont. An edentulous space anteriorly that would support 3 or 4 teeth. *Palatine*, 5; an edentulous space anteriorly and posteriorly. *Pterygoid*, 6; a long edentulous space anteriorly and posteriorly. *Mandibular*, 12 to 13; anodontant feebly kumatodont. No edentulous space anteriorly.

DISTRIBUTION. Evidently a hill species occurring above about 5,000 feet. Has been recorded from the Ruby Mines District (Mogok); Kachin Hills (Sinlum Kaba).

Oligodon torquatus (Boulenger)

Thirteen specimens 6 ♂ and 7 ♀ all from Myitkyina.

LENGTH. All of these which were collected between the 1st of June, and the 15th of November ranged between 229 and 275 mm. (9⅛ and 11 inches). The largest ♂ measured 265 mm. (10⅝ inches), and the largest ♀ 275 mm. (11 inches).

LEPIDOSIS. *Nasal*, entire. *Ventrals*, subangulate; ♂ 149 to 157, ♀ 156 to 161. *Subcaudals*, ♂ 30 to 32, ♀ 25 to 28.

FOOD. One example contained a soft-shelled egg (of lizard ?) in the gullet. One contained a large brown hairy 'spider in the stomach which in life with legs outspread would have been probably one and a half inches across. Three contained brown crickets 'in gastro', one of these having swallowed three. Two contained a Scolopendrum in the stomach, which Mr. Baini Pershad, Acting Director of the Indian Museum, has had identified as an *Otostigmus*, probably *rugulosus*.

DISTRIBUTION. Appears to be a very local snake confined to the Valley of the Irrawaddy between Myitkyina and Bhamo. It is evidently common at Myitkyina as thirteen specimens out of fifty-five proved to be this species.

* *Oligodon violaceus* * (Cantor)

Two specimens a ♂ from Taunggyi, and a ♀ from Thandaung. The former conforms to variety *multifasciatus* (Jan.). The latter to *cinereus* (Günther).

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* I received two specimens of *Oligodon* from Thandaung, both so much alike in colouration and lepidosis (except the costal rows) as to justify some doubt as to whether the two species *violaceus* and *cyclurus*, could any longer be regarded as distinct. I presented both to the British Museum, and Mr. Parker wrote in reply 'I must confess I am somewhat uncertain as to their true nature. A comparison with the descriptions in Boulenger's Catalogue certainly leads one to believe that the specimen with 19 scale rows is *cyclurus* whilst that with 17 is *violaceus*. I have also compared the two specimens with numerous examples of both species from the collection, and find that the specimen A (19 rows) resembles *cyclurus* in all respects excepting a trifling difference in the caudals (35 instead of 37); specimen B (17 rows), however agrees more nearly with *violaceus*, differing from *cyclurus* in the number of scale rows, the shape of the loreal and parietals and the number of subcaudals. The two species appear to one to be very closely related, if they are really specifically distinct, the one apparently constant character which separates them is the number of scale rows.' I have one skull of *violaceus* from Samaguting, Assam (C 17. V 131. S 34) and four *cyclurus*, three from Burma and one from Sikkim. All have 19 scale rows. The only differences I can find in these skulls are (1) in *cyclurus* there is a short edentulous space at the back of the palatine which is not present in *violaceus*. (2) There is a short

LEPIDOSIS. *Nasal*, divided in the ♀, semi-divided in the ♂. *Ventrals*, angulate; 165 in the ♂, 181 in the ♀. *Subcaudals*, 30 in the ♂, 35 in the ♀.

FOOD. In the Taunggyi specimen I found an unbroken snail shell about 10 mm. (⅜ of an inch) in diameter, the occupant in a much digested state.

DISTRIBUTION. Occurs throughout Burma in the plains, ascending to about 5,000 feet into the hills. Recorded from Arakan Hills; Rangoon; Insein; Mingladon; Tenasserim; Toungoo Hills (Thandaung circa 3,500 feet); North Shan States (Kunchoung); South Shan Hills (Taunggyi. 5,000 feet); Katha District (Katha. Mansi).

Oligodon theobaldi (Günther)

Twelve specimens, including 6 ♂ and 6 ♀, all from Mandalay.

LEPIDOSIS. *Ventrals*, angulate; ♂ 163 to 173, ♀ 169 to 177. *Subcaudals*, ♂ 39 to 41, ♀ 27 to 37.

HABITS. A cat was found confronting one in a verandah at night.

FOOD. A much digested gecko was found in the stomach of one, and a brown cricket in the stomach of another.

GROWTH. One measuring 112 mm. (4½ inches) was killed between the 25th of August and the 15th of November. The largest ♂ measured 395 mm. (1 foot, 3¾ inches). The largest ♀ was 380 mm. (1 foot, 3 inches).

GENITALIA. The claspers of one were found to be cylindrical organs beset with minute recurved processes.

BREEDING. Three proved to be egg-bound, one containing two, one three, and one five eggs. These were killed between August and October.

DISTRIBUTION. A snake of the plains. It is an uncommon snake except at Mandalay where twelve examples were taken out of forty-eight snakes received. It seems to be restricted to the valley of the Irrawaddy, and further East from Shwebo in the North to Tenasserim in the South. Has been recorded from Shwebo; Yeu; Mandalay; Myingyan. Meikila; Minhia; Thayetmyo; Toungoo; Pegu; Rangoon; Tenasserim.

Oligodon albocinctus (Cantor)

Four specimens three ♀ and one not sexed from Huton.

LEPIDOSIS. *Ventrals*, not angulate; 187 to 204. *Subcaudals*, 49 to 58.

FOOD. One contained a mouse in the stomach, one a large brown cricket and a third a flacid soft-shelled lizard's (?) egg.

DISTRIBUTION. This is an uncommon snake in Burma occurring only in hills between about 2,000 and 6,000 feet. Has been recorded from Kachin Hills (Sima, Sadon, Huton); Chin Hills (Haka) and Arakan Hills. I have had a specimen this year (1925) from North Shan Hills (nr. Maymyo).

Oligodon purpurascens (Schlegel)

Two specimens from Maymyo, and Lashio.

COLOURATION. The Maymyo specimen conforms to variety (B) of Boulenger's Catalogue (vol. ii, p. 220), and is intermediate between varieties A (b) and A (c) of my paper on the genus *Oligodon*, in this Journal (vol. xxv, p. 329). The Lashio specimen accords with variety (F) of Boulenger's Catalogue and variety *O. p. maculatus* of my paper. It has twelve large, dark, bisected, dorsal spots on the body, and three on the tail. Belly immaculate.

LEPIDOSIS. *Costals*. In the Maymyo specimen 19; in the Lashio 21. *Ventrals*. In the Maymyo specimen 177; in the Lashio 191. *Subcaudals*. In the Maymyo specimen 42; in the Lashio 43.

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edentulous space in the front of the pterygoid in *violaceus* which is not seen in *cyclurus*. In my paper on the genus *Oligodon* in this Journal (vol. xxv, p. 305 *et seq*) I also reported another difference (pp. 333 and 334) viz., that in *cyclurus* the parietal bone does not contribute to the orbital ring whereas in *violaceus* it does. This is a mistake, the parietal does not contribute to the orbital ring in either species.

At present the only external character which separates the two is the number of scale rows.

DISTRIBUTION. This is a common species throughout the plains of Burma, and occurs in hills up to an altitude of 5,000 feet. Has been recorded from Diamond Island ; Rangoon ; Mingledon ; Pegu ; Watiya ; Shwegun ; Tenasserim Province (Moulmein, Tavoy, Mergui) Chin Hills (Haka) ; South Shan States (Kalaw, Taunggyi) ; North Shan Hills (Lashio, Maymyo), Karen Hills.

Oligodon splendidus (Günther)

One female specimen from Mandalay.

LEPIDOSIS. *Ventrals*, 187. *Subcaudals*, 39.

BREEDING. This specimen proved to be egg-bound, but the date of its capture is not on record. The eggs numbered two, and were large, measuring 35 × 12 mm. (1⅜ × ½ an inch).

DENTITION. From two skulls in my collection. *Maxilla*, supports 10 to 11 teeth ; anododont, syncranterian, strongly coryphodont. No edentulous space anteriorly. *Palatine*, 7 to 9 ; anododont, feebly kumatodont. No edentulous space anteriorly or posteriorly. *Pterygoid*, 8 to 15 ; anododont, feebly scaphiodont. An edentulous space anteriorly, and posteriorly. *Mandibular*, 13 to 14 ; anododont, kumatodont. No edentulous space anteriorly or posteriorly.

DISTRIBUTION.[1] A snake of the plains, occupying a restricted area in the valley of the Irrawaddy between Shwebo and Pakokku, and the lower parts of its tributaries, the Chindwin, and Tsamon rivers where it is not uncommon. Recorded from Rybu Mines District (1,000 feet) ; Shwebo ; Monywa ; Sagaing ; Mandalay ; Kyaukse ; Pakokku ; Pyawbwe ; Yamethin.

Liopeltis doriæ (Boulenger)

One specimen from Huton, 295 mm. (11¾ inches) long, the tail 57 mm. (2¼ inches).

LEPIDOSIS. *Costals*, in 15 rows in the whole body length. *Ventrals*, 184. *Anal*, entire. *Subcaudals*, 74. *Supralabials*, 8 ; the 3rd divided into an upper and lower part ; the upper part of the 3rd, the 4th and the 5th touching the eye.

DENTITION.[2] From one rather poor skull in my collection. *Maxilla*, carries 29 to 30 teeth ; anododont, feebly kumatodont. *Palatine*, 25 to 26 ; anododont, feebly kumatodont. *Pterygoid*, 33 ? ; anododont, feebly kumatodont. *Mandibular*, 30 to 31 ; anododont, feebly kumatodont.

DISTRIBUTION. Apparently a rare snake confined to hills above about 4,000 feet. Once before taken in the Kachin Hills. Recorded also from Manipur, Assam, and Yangtse Valley, China.

Liopeltis frenatus (Günther)

Two adult specimens from Huton, one ♀ and one unsexed.

LEPIDOSIS. *Ventrals*, 152 and 158, *Subcaudals*, 96 and 98.

DENTITION. From three skulls in my collection. *Maxilla*, supports 19 to 21 teeth ; anododont, isodont. *Palatine*, 12 to 14 ; anododont, isodont. *Pterygoid*, 13 to 17 ; anododont, coryphodont. *Mandibular*, 21 to 27 ; anododont, scaphiodont.

DISTRIBUTION. A rare hill snake occurring usually above about 4,000 feet. Only once previously taken in Burma. Has been recorded from the foot of the Hills in the Katha District (Mansi) ; Kachin Hills (Huton, Sinlum Kaba).

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[1] This amends the distribution in my paper on *Oligodon* in this Journal (vol. xxv, p. 331), and my Hand List (vol. xxix, p. 631) in which some of the Districts cited are incorrect.

[2] The dentition is very different from four other species placed in this genus by Boulenger, of which I have skulls, viz., *calamaria*, *rappi*, *frenatus*, and *major*. The maxillary teeth in these four range between 19 and 26, the palatine 11 to 20, the pterygoid 13 to 24 and the mandibular 18 to 27. I have not seen a skull of Cope's *tricolor* so am unable to compare it with the type of the genus.

Series—OPISTHOGLYPHA.

Sub-family—HOMALOPSINÆ.

Hypsirhina plumbea (Boie).

One juvenile specimen from Mandalay.
LENGTH. 212 mm. (8½ inches).
LEPIDOSIS. *Ventrals*, 137. *Subcaudals*, 29.
DISTRIBUTION. An uncommon water snake occurring in lakes and rivers. The specimen now recorded came from the moat around Fort Dufferin. Has been recorded from Meiktila where there is a lake, Pyawbwe on the Tsamon river and Rangoon.

Hypsirhina enhydris (Schneider)

Eleven specimens from Mandalay. 7 ♂, 5 ♀, and one uncertain.
LEPIDOSIS. *Costals*, two heads-lengths behind the head 23, midbody 21, two heads-lengths before the vent 21 in all the specimens. The scales reduce from 23 to 21, one or two heads-lengths before midbody by a fusion of the 3rd and 4th rows above the ventrals. *Ventrals*, ♂ 161 to 171, ♀ 159 to 163. *Subcaudals*, ♂ 74 to 78, ♀ 59 to 64.
BREEDING. A male and a female, both adults, were found in company on 10th May. A female measuring 642 mm. (2 feet 1½ inches) came into Sergeant Murray's quarters about 9 p.m. one night in Mandalay in August 1923. The Sergeant struck it, and after the blow, the snake proceeded to give birth. Seven young were born before she died, and two unborn young were found in sacs within her subsequently. The brood comprised five males and three females, one with a damaged tail being unsexed. The males measured from 201 to 206 mm. (8 to 8¼ inches). The females measured from 185 to 193 mm. (7⅜ to 7¾ inches). The genitalia of the unborn male were not extruded.
DENTITION. From three skulls in my collection. *Maxilla*, supports from 17 to 20 teeth; diacranterian. The praecranterian set anododont, feebly coryphodont. Cranterian. A pair of subequal, grooved, obliquely-set teeth rather longer than the last praecranterian. *Palatine*, 10 to 11; anododont, isodont. *Pterygoid*, 20 to 24; anododont, strongly scaphiodont. *Mandibular*, 23 to 25; anododont, feebly kumatodont. I could discover no fœtal tooth in the born and unborn young.
DISTRIBUTION. A common water snake in Burma living in rivers, inland waters and marshes. Has been recorded from Bassein Rivers (Ngathaing-gyaung); the Irrawaddy River (Mandalay, Sagaing, Prome, Thayetmyo); Rangoon River (Rangoon, Hmawbi); Pegu River (Pegu); Bassein River (Bassein); Sittang River (Toungoo); West of the mouth of the Salween River (Thaton); Tavoy River (Tavoy).

Homalopsis buccata (Linné)

One specimen from Victoria Lake, Rangoon.
LEPIDOSIS. *Costals*, two heads-lengths behind the head 41, midbody 41, two heads-lengths before the vent 33. *Ventrals*, 161. *Subcaudals*, 69.
BREEDING. This specimen measuring 798 mm. (2 feet, 7½ inches) proved to be egg-bound, and my donor says it was killed about two months before he sent it. This would be early March. It contained seven elliptical eggs about 28 × 15 mm. (1⅛ × ⅝ of an inch), which appeared to be sterile.
DENTITION. From four skulls in my collection. *Maxilla*, carries 11 to 12 teeth; diacranterian. The praecranterian series anododont, kumatodont, fluted on their outer and inner faces basally. The cranterian number two, obliquely-set, and deeply grooved on their anterior faces; little longer than the last praecranterian. *Palatine*, 9; anododont, isodont. *Pterygoid*, 17 to 21; anododont, scaphiodont. *Mandibular*, 14 to 17; anododont, kumatodont, fluted basally on their outer and inner faces.
DISTRIBUTION. Lower reaches of the Bassein, Rangoon and Salween Rivers and adjacent lakes.

Hurria rhynchops (Schnieder)

One specimen from Rangoon.

Sub-famliy—DIPSADOMORPHINÆ.

Dipsadomorphus multimaculatus (Boie)

One female specimen from Rangoon.

LEPIDOSIS. *Ventrals*, 240. *Subcaudals*, 97.

FOOD. Enormously distended with a large lizard (*Calotes versicolor ?*).

BREEDING. Contained seven small eggs in the oviduct. Date of capture not on record.

DENTITION. From three skulls in my collection. *Maxilla*, diacranterian. The praecranterian series 10 to 11 ; anododont, feebly kumatodont. Cranterian 2 ; subequal ; deeply grooved on their anterior faces ; obliquely placed ; not twice as long as the posterior praecranterian. *Palatine*, 6 ; anododont, scaphiodont. *Pterygoid*, 8 to 12 ; anododont, scaphiodont. *Mandibular*, 14 to 18 ; anododont, strongly kumatodont.

DISTRIBUTION. A common snake in the plains of Lower Burma, and the Southern part of Upper Burma, ascending to an altitude of about 5,000 feet. Seems to be restricted to the valleys of the Irrawady river, South of Mandalay, the Salween river and intermediate streams. Has been recorded from Mandalay ; Thayetmyo ; Maungmya ; Pegu ; Rangoon ; South Shan States Taunggyi (5,000 feet) ; Fort Stedman (3,000 feet) ; Moulmein.

Dipsadomorphus hexagonotus (Stoliczka)

Two specimens from Mandalay and Maymyo.

LEPIDOSIS. *Costals*, in 19 rows two heads-lengths behind the head 19 in midbody, 15 two heads-lengths before the vent. *Ventrals*, 239 and 233. *Subcaudals*, 101 and 102 ? (damaged).

FOOD. A large lizard of the genus *Calotes* in the stomach of one.

DENTITION. From two skulls in my collection. *Maxilla*, diacranterian. The praecranterian series 9 to 11 ; anododont, kumatodont. Cranterian 2, subequal ; deeply grooved on their anterior faces ; obliquely set. *Palatine*, 6 ; anododont, feebly kumatodont.

Pterygoid, 8 to 10 ; anododont, scaphiodont. *Mandibular*, 14 to 15 ; anododont, kumatodont.

DISTRIBUTION. An uncommon snake in the plains of Burma ascending to about 6,500 feet elevation. Haka (Chin Hills) ; occurs in the valleys of the Chindwin, Irrawady, Sittang and Salween rivers from Bhamo and their surrounding hills. Has been recorded from Bhamo ; Katha ; Kunchoung ; Mandalay ; Meiktila ; Thayetmyo ; Pegu ; Rangoon ; Nathaing-gyaung ; Bassein ; Hakai ; North Shan Hills (Maymyo) ; South Shan Hills (Taunggyi) ; Kawkareik in Tenasserim ; at the Western foot of the Dawna Hills.

Boiga cynodon (Boie).

One specimen from Myitkyina.

LEPIDOSIS. *Costals*, two heads-lengths behind the head 23, midbody 23, two heads-lengths before the vent 15. *Ventrals*, 251. *Subcaudals*, 118.

DENTITION. From three skulls in my collection. *Maxilla*, Diacranterian. Praecranterian teeth 10 to 11 ; anododont, kumatodont. Cranterian 3 ; scaphiodont ; deeply grooved on their anterior faces ; obliquely set. *Palatine*, 5 to 6 ; anododont, kumatodont. *Pterygoid*, 8 to 10 ; anododont, scaphiodont. *Mandibular*, 19 to 20 ; anododont, kumatodont.

DISTRIBUTION. An uncommon species occurring in the plains. Has been recorded from Myitkyina; Thayetmyo; Toungoo; Rangoon; Burma—Siam Hills; Mergui.

Psammodynastes pulverulentus (Günther)

Five specimens from Kutkai and Huton.

BREEDING. A female 515 mm. (1 foot, 8$\frac{3}{4}$ inches) long, killed at Kutkai on the 8th of October contained five eggs in the oviducts.

DENTITION. From three skulls in my collection. *Maxilla*, diacranterian. Praecranterian teeth 10 to 11 ; anododont, anisodont ; first three progressively increasing, 4th and 5th subequal and about twice as long as the 3rd, succeeded by 5 to 6 isodont teeth. Cranterian, 2 ; obliquely set ; deeply grooved on their anteriorfaces ; twice or more than twice the preceding. *Palatine*, 8 to

11; anododont, kumatodont. *Pterygoid*, 21 to 23; anododont, scaphiodont. *Mandibular*, oinododont, anisodont. Praenodal. The first 2 or 3 progressively increase in length, the next 2 are subequal, large, and about twice the preceding. Postnodal, 13 to 15; feebly kumatodont.

DISTRIBUTION. Rather an uncommon snake occurring in the plains throughout Burma, and ascending the hills to about 6,500 feet. Haka (Chin Hills). Has been recorded from Kindat; Chin Hills; Katha; Mogok; Ruby Mines District; Wumbeza; Toungoo District; Pegu; Rangoon; Huton; Kachin Hills; Kutkai; North Shan Hills; Moulmein; Tavoy; Mergui Archipelago.

Dryophis prasinus Boie

One specimen from Huton.

DISTRIBUTION. A fairly common denizen of the plains throughout Burma, ascending hills to about 5,000 feet elevation. Has been recorded from Mansi at the foot of the hills in the Katha District; Shewbo District (Yeu); Toungoo; Pegu District (Pegu, Tadangu); Rangoon; Bassein; Maungmya; Kachin Hills (Huton); South Shan Hills (Taunggyi); Burma—Siam hills.

Dryophis mycterizans (Linné)

Six specimens from Mandalay and Maymyo.

DISTRIBUTION. A common snake throughout Burma, ascending hills to an altitude of 5,000 feet (Taunggyi). Has been recorded from Bhamo District; Shwebo District (Shwebo, Yeu); Mandalay; Myingyan District (Pagan); Toungoo; Pegu District (Tadangu, East of the Yomas); Tharrawaddy District (Shwegyin); Rangoon; North Shan Hills (Maymyo); South Shan Hills (Taunggyi).

Chrysopelea ornata (Shaw)

Fifteen specimens from Mandalay, Lashio, and Rangoon.

HABITS. Lieut. Kurup gave me a specimen he killed in Rangoon which he says leapt from a tree and alighted close to him. He estimated the height of the leap as between twenty and twenty-five feet. He says the snake was extended in its volplane until it reached the ground. Some coolies were in a tree opposite trimming the branches and the snake was probably disturbed by them. Lieut.-Colonel Bell told me of a specimen that jumped from a tree in his compound, and alighted near him but he did not see the whole leap. This was apparently disturbed by a little owl that was in the branches above.

LENGTH. A small specimen, evidently a hatchling from Mandalay measured 225 mm. (9 inches).

DISTRIBUTION. A common snake in the plains of Burma, ascending hills to at least 5,000 feet (Taunggyi). Has been recorded from Sandoway; Mandalay; Thayetmyo; Prome District (Shwedaung); Tharawaddy District (Shwegyin); Toungoo; Pegu District (Pegu, Tadangu); Rangoon; Moulmein; Tavoy; Mergui; North Shan Hills (Lashio); South Shan Hills (Taunggyi).

Series—PROTEROGLYPHA

Bungarus fasciatus (Schneider)

Two specimens from Myitkyina and Taunggyi.

DISTRIBUTION. A common species in the plains, ascending the hills to about 5,300 feet. Has been recorded from Myitkyina; Sagaing; Ruby Mines District; Meiktila District (Meiktila, Pyawbwe); Toungoo; Tharawaddy; Pegu; Rangoon; Moulmein; Tavoy; South Shan States (Taunggyi).

Bungarus multicinctus Blytho

One specimen from Namkham.

LENGTH. A fine female specimen measuring 790 mm. (2 feet, 7½ inches), the tail 130 mm. (5¼ inches).

LEPIDOSIS. *Ventrals*, 219. *Subcaudals*, 55.

BREEDING. This contained four large eggs in the oviducts measuring 31 × 7 mm. ($1\frac{1}{4} \times \frac{5}{16}$ of an inch). This was encountered on the night of the 3rd of April.

DISTRIBUTION. A distinctly uncommon snake in Burma, confined to the plains. Has been recorded from Lower Chindwin (Monywa); North Shan States (Namkham); South Shan States; Meiktila; Toungoo; Rangoon.

Bungarus magnimaculatus Wall and Evans

One female specimen from Mandalay.

LEPIDOSIS. *Ventrals*, 216? *Subcaudals*, 47.

DISTRIBUTION. An uncommon snake occurring in the Irrawaddy Valley from Shwebo to Minbu, and the lower reaches of its tributaries the Chindwin and Tasmon rivers. This corresponds to the dry zone where the annual rain fall is less than fifty inches. Has been recorded from Shwebo; Mandalay; Monyawa; Minbu; Meiktila and Pyawbwe.

Naia hannah (Cantor)

One from Taunggyi, and the heads of three others from Taunggyi, Maymyo and Mandalay (killed in the neighbouring jungle).

LEPIDOSIS. *Costals*. Two heads-lengths behind head 15, midbody 15, two heads-lengths before vent 15. *Ventrals*, 243. *Subcaudals*, 87.

BREEDING. I owe special thanks to Mr. Plunkett, I. F. S., for a very valuable note on the breeding of this snake. When beating jungle for game in April, a great clamour among the beaters announced something unusual had been encountered. On proceeding to the spot he found two large snakes wreathed together. He shot first one and then the other, and when examined after death they were found 'in copula,' and still united. They were dragged apart, and he amputated the male organ and preserved it in spirit. It appears to be the diramic organ of one side. This he presented to me and I have transferred it to the British Museum. The organ is so markedly different from specimens of these organs in the Cobra (*Naia naia*) in my cabinet collection, as to justify *N. hannah* being placed in a distinct genus. Each limb of the organ is about 152 mm. (6 inches) long, from the point of bifurcation to the extremity. A *raphé* passes up the posterior part. The basal four-fifths is surrounded by prominent transverse, somewhat imbricate, folds resembling the gills of a mushroom. Most of the folds extend uninterruptedly right round the organ, others are discontinuous. In the distal fifth the folds are broken up to form a sort of honeycomb. The male measured 3,685 mm. (12 ft. 1 inch) and the female 3,125 mm. (10 ft. 3 inches).

DISTRIBUTION. This is a fairly common snake in the plains and hills throughout Burma, and ascends to an altitude of 6,500 feet (Sinlum Kaba). Has been recorded from around Mandalay; Meiktila District (Mount Popa); Thazi Hills (east of Yamethin); Magwe District (Sun Choung river, Minhla); Toungoo District (in the hills); Tharawaddy District (Shwegyin); Pegu; Rangoon; Moulmein; Kawkareik on the western foot of the Dawna Hills; Kachin Hills (Sinlum Kaba); Chin Hills (Haka); Ruby Mines District (Mogok); North Shan Hills (Lashio, Maymyo); South Shan Hills (Tuanggyi, Kalaw).

Naia naia (Linné)

Seven specimens from Myitkyina, Mandalay, Taunggyi.

VARIETY. All conform to variety *fasciata*. One (with 19 scale rows) from Mandalay appeared at first sight an anocellate specimen but when pegged out six small blackish spots on the left side and three on the right are so distributed as to suggest the usual elliptical mark of *fasciata*.

LEPIDOSIS. *Costals*. One had 19 scale rows, and the rest 21.

DISTRIBUTION. A very common snake in the plains throughout Burma, ascending the hills to an altitude of at least 5,000 feet (Taunggyi).

Calliophis macclellandi (Reinhardt)

Six specimens from Maymyo and Huton.

COLOURATION. The four specimens from Maymyo conform to variety *C. m. macclellandi*; the two from Huton constitute a new variety for which I propose the name *concolor*. It is a uniform rich brown dorsally, with no trace of the black transverse bars, typical of *C. m. macclellandi*, or of the vertebral

stripe of *C. m. univirgatus*. Ventrally it has the large black irregularly-shaped spots, typical of *C. m. macclellandi*. The head is adorned with the usual ivory-white band bordered anteriorly and posteriorly with black.

HABITS. One was encountered one evening in Maymyo. It escaped quickly into a bamboo clump. Captain Donelly seized it by the tail, and pulled it out, but narrowly escaped being bitten by a determined snap of its jaws.

FOOD. This specimen had just swallowed a Diard's blind snake (*Typhlops diardi*), 288 mm. (11⅓ inches) long, which lay fully extended in the gullet and stomach. Another smaller specimen of the same snake 85 mm. (3¾ inches) long, lay similarly extended in the stomach.

DISTRIBUTION. A fairly common hill species occurring above about 3,000 feet. Has been recorded as follows. *C. m. macclellandi* :—Chin Hills (Haka), Ruby Mines District (Mogok) ; North Shan Hills (Maymyo) ; Pegu Yomas, South Shan Hills. *C. m. gorei*, Kachin Hills (Sinlum Kaba). *C. m. concolor* :—Kachin Hills (Huton).

Family—VIPERIDÆ

Vipera russelli (Shaw)

One specimen from Mandalay.

DISTRIBUTION. A very common snake in the plains of Burma and universally distributed.

Trimeresurus monticola (Günther)

Two specimens from Taunggyi.

LENGTH. One of these is the largest on record. It taped 977 mm. (3 feet 2½ inches) ; the tail 118 mm. (4¾ inches).

DISTRIBUTION. A rather uncommon species confined to the hills above about 3,000 feet. Has been recorded from Myitkyina District (Hpimaw) ; Chin Hills (Haka) ; Ruby Mines District (Mogok) ; Toungoo District (Thandaung) ; South Shan Hills (Taunggyi) ; Dawna Hills (Mount Mulehyit).

Trimeresurus gramineus (Shaw)

Five specimens from Huton, Maymyo, and Taunggyi.

DISTRIBUTION. A fairly common snake in the plains of Burma, ascending the hills to about 5,000 feet (Taunggyi). Has been recorded from Bhamo ; Shwegyin ; Rangoon ; Maungmya ; Moulmein ; Tavoy District (Egaya) ; Mergui and the Archipelago ; Kachin Hills (Huton) ; Chin Hills (Haka. Falam) ; North Shan Hills (Maymyo) ; South Shan Hills (Taunggyi).

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY)

BY

T. R. BELL, C.I.E., I.F.S. (Retd.)

(*Continued from page 588 of this Volume*)

PART XXXV

Sub-family (6)—PAMPHILINÆ

This group consists of the genera *Pamphila* with two species only found in the Himalayas and northwards to Amurland and in Burma with eleven others purely palæarctic. *Taractrocera* with eight species in British India and thirteen others in the Malayan Sub-region; *Ampittia* with two species, one Indian, one Burman; and *Aëromachus* with five Indian and two others, the one from China, the other from the Philippines; also *Ochus* with a single species from the N.W. Himalayas to Sikkim and Burma. The genera that are of interest here are *Taractrocera*, *Ampittia* and *Aëromachus* (as represented by Swinhoe's genus *Machachus*); the first of four species that come into these papers; the second of a single species and the third containing two. The species of *Taractrocera* are *mævius* (F.); *ceramas* (Hewits); *nicevillei*, Watson and *oberthüri*, Elwes and Edwards. *Ampittia* is represented by *dioscorides* (F.) formerly known as *maro* (F.)

Taractrocera mævius is an unmistakable species; *T. ceramas*, *nicevillei* and *oberthüri*, all three from S. India, are very doubtfully distinct and are probably only climatic varieties. *Machachus jhora* (de N.) and *indistincta* (M.) may possibly be different from each other.

Imago.—These are all insects of small size living near the ground where they fly over the grass and low herbage with a weak, somewhat fluttering flight, settling often and frequently with the wings more or less parted and spread, showing the upperside; especially do they do this when basking in the sun; they all effect grass lands and, even in jungle country, are chiefly found in clearing where the grass grows. They all feed upon the juices of low-lying flowers such as Vetches and small *Acanthaceæ* that are found amongst the grass. They rest at night on dead grass-stems, dry leaves and twigs, always near the ground and keep the wings closed over the back at that time. Most of the species are black or very dark brown with many grey or yellow markings on both wings on the uppersides, but *Ochus* and *Aëromachus* may occasionally be nearly immaculate. On the undersides of the wings the colours are much the same although differently disposed.

Antennæ.—These are short with a stout, blunt club without apiculus of any kind.

Palpi.—Prominent, well separated; second joint roughly scaled, third erect or conical, prominent, sometimes slender.

Fore tibiæ.—With epiphyses except in *Pamphila*.

Hind tibiæ.—With two pairs of spurs (again excepting *Pamphila* which has only one pair).

Fore wing.—Cell less than two-thirds length of costa ; vein 12 ends on costa before end of cell ; vein 5 from below middle of discocellulars ; 3 from before end of cell ; 2 from beyond middle.

Hind wing.—Vein 7 from before end of cell ; discocellulars and vein 5, faint ; 3 from close to lower end of cell, 2 from beyond the middle of cell.

Egg.—Dome-shaped, rather higher than half the breadth ; minutely pitted on the general surface, shining, with a faint cellular network of extremely fine, obscure lines (*Taractrocera*, *Pamphila*) or meridionally ribbed in *Ampittia* and *Aëromachus*. Colour very light-yellow, sometimes blotched red.

Larva.—Of normal shape, the skin translucent, showing the white tracheal tubes through or not ; body surface covered with minute, whitish, erect, simple hairs not visible to the naked eye except against the light: the head round-triangular or semi-elliptical in shape and naked ; the colour is light-green with a pulsating, dorsal, darker longitudinal line as well as lateral and spiracular whitish line or darker green with still darker dot-spots and subdorsal, dorso-lateral and subspiracular, white, longitudinal lines.

Pupa.—Moderately stout with moderate constriction at segment 5, a well-developed cremaster ending in a tiny point on each side at extremity, the free end between them fringed with simple hairs without hooks or the cremaster-end rounded and set with weak little hooked shafts ; there are well-developed expansions to the spiracles of segment 2 of various shapes ; the head has two points on the frons in *Ampittia*, a horny plate resembling a lappet in *Taractrocera* and is convexly rounded in *Aëromachus* in which genus segment 5 has a small point directed forwards on front margin in the dorsal line under which the body-string passes, the surface of the pupæ is minutely haired when examined under a strong lens. The colour is green of some shade.

Habits.—The butterflies rest with their wings closed over their backs, but bask with them partially opened ; they are all insects of grass lands and fly low down above the surface of the earth in a half-fluttering sort of way though they can go fast enough when necessary ; they do not fly for long distances and are often seen feeding at flowers growing on the ground. They sit more than fly although they occasionally play about with each other on the wing. At night they sleep close to the ground. The eggs are laid on grass-blades, on stalks and occasionally on a dead leaf, dead stalk and such like objects that are to be found amongst the grass. The larvæ live on the undersides of the blades but often go down to the roots and are rather given to wandering as is only to be expected where they cannot get away from their food. They all make cells of a kind, some cylindrical by joining both edges of the blade together at the tip or by turning over an oblong piece from the edge, or by turning over the tip at right angles to length of blade like the larvæ of many moths of the genus *Rivula* (in this case the cell is more triangular). *Ampittia* pupates quite in the open, lying along a grass stalk with tail-attachment and body-band ; *Aëromachus* pupates on the underside of a grass-blade in the hollow made by drawing the edges together but not joining them—as is the habit in the genus *Parnara*.

Genus 22.—Taractrocera.

Imago.—All small butterflies of a dark-brown colour on the uppersides, both wings heavily marked with grey or yellow spots which in some species may run into bands or even patches.

Antennæ.—Short, about half costa of fore wing ; the club short, broad, in the form flattened, concave disc.

Palpi.—Upturned ; second joint densely scaled ; third rather long and slender, erect, pointed, reaching above vertex.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa well before end of cell; upper discocellular very short, middle and lower ones erect, the lower slightly shorter; 5, therefore, from below middle and is curved down somewhat at its base; 3 from a little before lower end of cell; 2 a little before the middle; wing short triangular, costa very slightly arched, outer margin evenly convex, shorter than hinder margin; cell less than two-thirds l ength of costa.

Hind wing.—Vein 7 a little before end of cell, discocellulars bent somewhat inwards, faint; 5 not traceable; 3 from close to lower end of cell; base of 2 close to base of 3, hardly one-eighth removed from end of cell; costa and outer margin evenly rounded.

Egg.—Dome-shaped, shining, the surface covered with microscopical, superficial cell-like network of lines. Colour very pale-yellow, immaculate or blotched.

Larva.—Light-green covered all over with tiny darker-green dots, the bases of the microscopical hairs with which the body is covered; a dark, pulsating, dorsal, longitudinal line and signs of a subspiracular, yellowish one; a shining-black collar to segment 2. Head rather broadly semi-elliptical in shape, shallowly bilobed; surface rugose-cellular, covered with appressed, fine hairs with a large clypeus; some of the hairs round free edge of anal segment much longer than the generality.

Pupa.—Fairly stout with the front square, the eyes being prominent though rather ventral; a large semi-circular raised disc-like surface on frons; the cremaster ending in two short points with a fringe of straight hair between them instead of hooked shaftlets. Surface of body covered with tiny, erect, reddish hairs except on wings and thorax—these hairs not in any way obscuring the surface of course. Colour that of a bone, very pale-yellowish.

Habits.—Eggs laid anywhere practically amongst the grass. Larva makes a longitudinal cell at point of grass-blade by drawing the edges together. Pupates in such a cell, generally a close fit and always with some excreted cereous powder as a covering. For detail see under the species below.

The species are all Indian and Malayan. There are altogether 21 known. Of these 8 occur within the limits of British India including Burma. They are *Taractrocera mævius* (F.), *ceramas* (Hewits); *niceévillei*, Watson; *oberthüri* (Elwes and Edwards); *danna* (M.); *samadha*, Frühstorfer; *quinta*, Swinh.; *atropunctata*, Watson. *Danna* comes from the N. W. Himalayas; *samadha* from Burma; *quinta* from Burma and Assam; *atropunctata* from Burma and Hongkong. The other four all come from S. India and, for *mævius* only, the rest of India as well and Ceylon and Burma.

211. Taractrocera ceramas (*Hewits*.). (Pl. M. figs. 74 ♂, 74*a* ♀)—Male *Upperside* dark-brown with small orange spots. Fore wing with eight spots, one in the cell, three conjoined from near the costa before the apex, two in the middle of the disc and too close to the outer margin below the apex. Hind wing with two pairs of spots in the disc; one pair in the middle, the other near the apex. *Cilia* of both wings pale-brown. *Underside*: Fore wing blackish-brown, the spots as on upperside but paler and duller in colour and there is a dull orange streak between the costa and subcostal vein. Hind wing paler, markings as above but with an additional spot at the end of the cell and the entire wing more or less covered with minute, orange scales. Antennae black, the lower half of the club white at sides, the shaft with white dots: palpi, head and body concolorous with the brown of the wings; beneath palpi grey, the abdomen with obscure grey bands. Expanse up to 25mm.

The above description is taken from Swinhoe's *Lepidoptera Indica*, vol. x, pp. 116–117. He gives it quite separately from that of *Taractrocera niceévillei*, Watson, the next immediately following and says

that it is found (the species) in ' South India ' ; specifying as localities where it has been taken ; ' The type is marked Nilgiris ; we have both sexes from Ootacamund ; Evans records it from the Palni Hills, Aitken from Igatpuri; Elwes from Travancore and Malabar.' He figures the species on Plate 784, figure 2 male, 2a female and 2b the underside. In both the sexes there is a spot on the upperside of the hind wing about half way across the disc at the upper end of the cell and outside it more or less and this spot is not mentioned in the description.

Compare with the above the description of *Taractrocera nicévillei* immediately following :—

' Male. *Upperside* rufous-brown with rather large, more or less quadrate, orange spots. Fore wing with an elongate spot at end of cell divided into two by the fold and a short adjoining streak above it ; a spot near the costa before apex divided into three by the veins ; a spot outside, its upper, inner end often touching the lower, outer end of the other spot ; two spots in the middle of the disc with two or three spots below it decreasing in size, all joined together into a discal based. Hind wing with a lunulate spot at the end of cell that is often indistinct and three discal spots, the middle one outside the others and largest, the upper one small, the lower one generally divided into two by vein 3. *Cilia* of both wings grey with an inner, dark band. *Underside* like the upper. Fore wing with the costa narrowly suffused with orange and a marginal row of obscure, dull-orange spots from apex to end of vein 2. Hind wing with the discal spots larger than on upperside, consequently all more or less conjoined ; an additional spot at the end of cell ; the wing sparsely covered with minute orange scales and indications of some obscure, small, orange spots on the outer margin. Antennæ black, ringed with white with a white patch at the base of the club beneath ; palpi grey beneath; brown above : head and body above and below concolorous with the wings ; abdomen with whitish segmental bands on the underside. Female like the male, but with all the orange spots much smaller as a rule and more separated from each other than in the male ; and, in the fore wing, the spots joined hind-wards to the two spots in the middle of the disc are often wanting.'

The expanse of *Taractrocera ceramas* is given as up to 25mm. ; of *nicévillei* as up to 28mm.

On comparing a long series of the Kanara species, both caught and bred, it is found that these spots on the wings are very variable, they may be small or they may be large, some of them may even be entirely wanting. There is one specimen with only the very top part of the outermost discal spot on the upperside of hind wing present without a sign of any other markings whatever. On the forewing the spot in interspace 2 immediately below that in interspace 3 may be exactly equal in size to that of interspace 3 or may be larger and the spots below it may be present, quite separated from each other or they may be conjoined into a band or they may be totally wanting ; the costa may be ochreous or not, it generally is ; the marking at the end of the cell may be very bold or it may be quite small. The underside may, on the hind wing, be much suffused with orange or it may be less, the markings may be very clear or they may be blurred; the area along the hinder margin behind vein 1, that is the abdominal fold, may be very black or it may be suffused with orange. Finally, some of the orange spots may even be whitish or grey, especially on the upperside of hind wing. The *cilia* usually more or less grey above although, even there, often orange in places: while below they are orange always, although,

above and below, the brownish, basal band is there. The markings of the antennæ may be grey or orange in different specimens.

Under the circumstances, as *Taractrocera nicevillei* is from Kanara and the type is from Bombay, taken by Colonel Swinhoe, and apparently exists nowhere else and the insect is very variable in every particular that is supposed to separate it from *ceramas*, it is not likely to be specifically distinct and is probably only a local variety if it is even that.

There is still another species *Taractrocera oberthüri*, named by Elwes and Edwards from Trichinopoly, a single female; and Swinhoe states there are two males from the Anamally Hills in the British Museum. This is, according to the pictures in *Lepidoptera Indica*, much more heavily marked than either *ceramas* or *nicêvillei;* but the material upon which it was based, a single female, appears to be very inadequate in view of the variations in specimens from Kanara.

In the form *nicêvillei*, the imago has the ochreous costa of the fore wing on the upper side due to orange scales; and there are also some similar scales from base for a short way out in the cell, others forming an obscure streak along inner margin from base outwards sometimes as far as half the length of that margin; there is a fringe of fuscous hairs along the inner margin too. On the hind wing there are some longish, decumbent hairs in cell and below it reaching to about middle of disc.

The early stages of the Kanara form given as *Taractrocera nicêvillei* in *Lepdioptera Indica* are given below.

Egg.—Dome-like in *shape*, more than half as high as broad. *Surface* extremely minutely tuberculate-frosted covered with very superficial, extremely finewalled, hexagonal cells under the microscope, each cell about 0·033mm. in diameter; the whole shining. *Colour* very light yellow immediately after it has been laid; soon becoming largely red blotched, the blotching consisting of an irregular band of considerable width round the broadest part and a big blotch on apex. B: 0·8mm.; H: 0·5mm.

Larva.—This larva is rather of the *Udaspes* or *Notocrypta* type in general shape; it lies hunched with the segments 2–5 highest of the whole body; the head, however, is rather larger in proportion than in the larvæ of those two genera, the neck or segment 2 is rather thicker; the anal end has segment 13, a transverse piece of about one-third the length of 12; segment 14 is large, very broadly and bluntly semi-elliptical in shape, convex transversely and tumid round the margins, rather rough tuberculate—this segment remains intact when the skin is cast, that is it is then as broad and as long as ever on the end of the shrivelled rest; the claspers, pseudolegs and true legs are all short and rather weak, the transverse section of the body is circular from segment 2 to segment 12; segment 13 is shallower and segment 14 is flattened ventrally much more than the others and considerably over-reaches and overhangs the anal claspers. The *head* is large compared to segment 2 and is as high and broad as segment 3 at front margin; it is broadly semielliptical in shape, rather thin and has a very slight, shallow sinus on vertex; the surface is rugose-reticulate, the 'threads' of the reticulation occupying much less space than the hollows and being shining while the hollows are dull, covered with appressed, short, light, hardly visible hairs and with some much longer, erect, shining hairs about mouth opening; the true clypeus is narrow, about half the height of the face (rather less) and lozenge-shaped with the lower end truncated at labrum, the apex acute; the false clypeus broad outside it, also acute at apex, nearly mucronate, about two-thirds the height of the face; the labrum is small, transversely lozenge-shaped, reddish; the ligula is of medium size with a large triangular sinus that is both deep and broad, the colour black; the antennal basal joint is black, the second light; the mandibles are dark, the eyes black;

the colour of the head is black or very dark brown with the false clypeus soiled-white and a soiled-white, narrow band or broad line starting from the edge of the mouth-cavity and running up to the front vertex of each lobe where it is joined to another soiled-white, equally broad, straight line which has its origin on the margin of the false clypeus at the height of the apex of the true clypeus ; the true clypeus is also really soiled-white but darker than the other marks and its dorsal line only is black. *Surface* of body is dull, covered with minute, conical, brown tubercles from each of which springs an erect, fine, conical, light hair about as long as the distance between two adjacent tubercles and the distance between two tubercles is about four times the diameter of one of them ; there are a few erect hairs more than twice the length of these on each segment, but it is not sure that these are symmetrically arranged—any way there seems to be one dorsolateral on each ; on the anal segment there are a lot of still longer erect hairs all over the tumid border as well as a dorsolateral one on each side in the middle—some of these are as long as half the length of the whole segment ; each segment is transversely impressed parallel lined in the posterior half, parallel to the hinder margins as usual ; there seem to be about five such lines to each. *Spiracles* very small and nearly round, slightly raised, light yellowish ; those of segment 2 much larger and those of segment 12, perhaps, slightly smaller than those of segment 2. *Colour* of larva is light glaucous green dotted all over with darker green round dots ; a darkish purple, dorsal line and signs of a similar dorsalateral one as well as a thin, yellowish, subspiracular line ; the ventrum not glaucous ; the anal segment darkish on dorsum anteriorly ; segment 2 with a shining black collar from spiracle to spiracle ; feet whitish ; true legs very light yellowish, L : 20mm. ; B : 3mm.

The black collar of segment 2 is broken narrowly in the dorsal line, the spiracles are broadly oval ; there are about 15 rows of tubercles to one segment-length which is about 2·25mm. ; that is each tubercle is about 0·15mm. from the next.

Pupa.—The body of the pupa is cylindrical in shape, very slightly fattest in the middle, from the shoulders to segment 9 inclusive, after which it gradually thins down to the broad, blunt end, segment 13 being distinct, transverse and less than half the length of segment 12—a narrow, transverse ring—which is the same length as 11, but the pupa has the dorsal line sloping considerably from 11 backwards while the ventral line is throughout more or less straight except at the very end where the anal segment 14 is bent down somewhat and of a peculiar shape : it is very little narrower than segment 13, very nearly as long dorsally as segment 12 but very short ventrally so that its hinder face slopes in ventrally, its dorsal surface being flat (very slightly convex) and transversely broad-oblong, divided from the lateral faces by a strong, prominent ridge on each side, these ridges diverging slightly backwards and each ending in a short tooth or point, the free margin (end of pupa) between them quite straight ; the *head* is also somewhat peculiar : it is broad with the vertex fully exposed and dorsal, twice as long as the narrow, oblong segment 2 with straight margins behind it, sloping with segment 2 at an angle of about 30° to the longitudinal axis of pupa, the frons at right angles to that axis with a peculiar, circular, slightly rugose, generally black disc or plate in its centre, this plate gradually rising from the surface and free in its anterior quarter (pointing downwards), the eyes prominent and somewhat ventral ; the shoulders evenly rounded, well-developed ; the thorax with its first third with the same dorsal slope as segment 2, gradually becoming parallel to the longitudinal axis, the segment nearly as broad as long, the hinder margin a somewhat pointed quarter-circle meeting the wings in a broadly rounded angle of nearly 90° ; segment 4 about half the length of 5, thorax a little less than 4, 5 and 6 together ; the segment-margins well marked the bevilled edges of segments 8–11 flat ; the proboscis reaches free beyond the wings to the end of segment 9 ; the antennæ are short and club-shaped at ends reaching only about half way towards end of wings. *Surface* not particularly shining, with a clothing of little reddish, erect or semi-recumbent, short hairs everywhere except on the segmental membranes, wings, shoulders and a large portion of the dorsal, posterior part of thorax, head and segment 2, these hairs not obscuring the surface anywhere ; fringe of hair at posterior and anterior margins of eyes and a conspicuous row of longer, stiff bristle-like hairs along the posterior margin of anal segment that are as long as that segment itself,

about 20 or 25 in number, simple, reddish, pointing straight back. *Spiracles* of segment 2 are indicated by each a large oval, convex, red plate or rising, about as long as segment 2 is long, with a plushlike, grey bloom on the surface in certain lights; the rest small, narrow ovals, yellowish in colour. *Colour* is yellowish dead-bone with the cremastral (anal) segment red-brown of a bright shade, the wings somewhat lighter than the general body-colour and the head and segment 2 slightly soiled. L: 13mm.; B: 3mm.

Habits.—The egg is laid as a rule on the underside of a blade of grass; but, occasionally, practically anywhere; on the stem, on a dead leaf fallen amongst the grass, etc. The little larva emerges therefrom in three to five days according to weather and warmth of the sun; it eats the shell and then proceeds to the tip of a grass-blade and makes a house by joining the edges of the leaf together, often quite a long cell for such a tiny thing. It coats the inside with silk although not very thickly and lies along the midrib. This method is persisted in throughout its life, making the house somewhat larger when big of course. It feeds, at night and in dull weather often also during the day, at first close to the cell, later wandering quite a lot. It is active and runs out of the cell sometimes, when disturbed, quite quickly; also, if the disturbance is continued, falls to the ground and curls up, feigning death. When about to pupate, the larva makes a cell often of a withered leaf, closing both the ends with silk, one rather lightly through which the butterfly will emerge, the other tightly; the pupa is no way attached inside and is covered with a waxy, white powder which also clothes the walls of the cell. The pupa is a close fit and the cells are often found, detached from anything, on the ground amongst the grass. Occasionally several dead leaves are used to make the pupal cell. One lot of caterpillars were obtained in October and had ceased eating by about the 25th of that month. These remained as caterpillars in a pupal cell until February 12 of the next year when they pupated. The butterfly appeared in about a week afterwards.

The head of the egg-larva measured 0·45 mm. × 0·55 mm.; was black, shining-smooth, semi-elliptical with a single row of tiny pits along the dorsal line and sides of clypeus; a very few erect hairs about the mouth. In the second stage the head was 0·65 mm. by 0·7 mm.; the same as in preceding stage short, erect hairs on surface; eyes glassy. Third stage 0·925 mm. by 1 mm.; nearly black, shining, reticulate-rugose with similar hairs to last stage. Fourth stage 1·6 mm. by 1·4 mm.; more rugose, the hairs longer, stronger, downcurved, black, about 0·05 mm. apart and as long (0·05 mm.). Final stage 1·75 mm. by 1·5 mm. with details as above described.

The food of the larva is grass of any species as long as it is not too hard and big; rice is quite an ordinary thing to find it upon. The habitat of *Taractrocera nicévillei* is S. India and it is commonly to be found in the grassy glades in the jungles of N. Kanara District, as well as in the neighbourhood of forest both on the coast (on the hills near it at a height of 1,000′—some are not more than a mile or two from the sea-shore) and above the ghats at 1,000′ and upwards. It is probably a butterfly of heavy rainfall absent from the Plains. The insect never rises high off the ground, is not very

partial to sunlight and may be found flitting just above the tops of the grasses settling at frequent intervals on a blade or stem, often even on the bare ground ; frequently in the basking position with the front wings slightly opened, the hind wings more opened still. Two individuals will often play with each other in the air, circling at a low elevation within a small area ; the ordinary flight is of the usual skipping or jerking variety from which the family has got the name of Skippers.

The figures of the male and female, No. 74 and 74*a* respectively on the coloured plate M are quite good but as usual a trifle too red.

212. Taractrocera mævius (*F.*)—(Pl. M., figs. 76, 76*a*).—Male. *Upperside* olive-brown with white markings. Fore wing with a short streak on and above the median vein (the bottom of the cell) in the middle of the cell ; another above it at upper end of cell with two (or one) short streaks between it and the costa, sometimes connected together ; a series of spots in two parts across the disc, three conjoined from the costa near the apex in interspaces 6, 7 and 8 and four commencing with one near the base of interspace 3 separated by the vein from another nearly in the middle of interspace 2 separated again from the third and fourth that form an inwardly oblique band in the two interspaces below ; these last four spots quadrate and slightly excavated on outer side ; two more spots beyond towards margin in interspaces 4 and 5. Hind wing with a series of small spots in almost a straight line in the middle of the disc, four in number in interspaces 2, and 4, 5, the latter slightly outwards ; another above and further in in interspace 6 and two at end of cell ; the ones at the end of cell and the other single, uppermost spot may be extremely faint at times. *Cilia* of both wings grey with white tips, more prominently white towards tornal angle of fore wing and in hinder part of hind wing. *Underside* with the colour similar, almost as dark as on upperside with the markings similar but, on the hind wing, there is a bar across end of cell and spots in interspaces 6 and 7 beyond. Antennæ black ringed with white, the club with a white basal patch on underside ; head and body concolorous with wings ; abdomen with white, segmental bands.—Female. *Upperside* like the male but somewhat paler, the spots larger and more prominent. *Underside* with the markings as on the upperside. Fore wing with the costal and apical portions whitish, the veins below the costa and at the apex white ; a narrow, white outer, marginal band and a black, marginal line. Hind wing entirely suffused with white, all the veins pure white. Expanse up to 27mm. or slightly more ; the males smaller (Swinhoe, *Lepidoptera Indica*).

In a large series bred in the Dharwar District, Bombay Presidency, there is a short ochreous band of scales from base of fore wing along the costa over cell and a very pale blue scale-band along the inner margin from base to half way with another, shorter, above vein 1, and there is a sparse fringe of grey hairs along inner margin. On the upperside of hind wing there are some long, grey hairs decumbent in cell and more numerous ones below cell from base to quite three-quarters way to outer margin. Underneath on both wings there are ochreous scales, the hind wing being covered with them ; all the veins have white scales along their whole length on the hind wing and apical portion of fore wing ; the abdominal fold of hind wing is sprinkled with white scales only. The hairs of the patagia are tipped with yellow where they abut on the costal yellow band of fore wing, the palpi are clothed with brown and yellow scales above ; the third joint being black. Numbers of the females have the spots on fore wing yellowish, all the males have them white.

Egg.—Dome-*shaped*; rather higher than half the breadth. *Surface* is shining somewhat, covered with a network of lines under a strong lens under the microscope they are minute, thin-walled, low cells of about 0·025mm. diameter; on the top is a smooth space; circular, darker than the rest. *Colour* that of a dry bone. B: 0·925mm.; H: 0·6mm.

Larva.—The *shape* is that of any of the genera *Telicota*, *Halpe*, etc. The head rather small for the larva though, as usual, large for segment 2; on the whole body is thickest about middle though little thicker there than at segment 4 or segment 11; the anal flap is large and a short semi-ellipse in shape, overhangs the anal claspers by a considerable amount, is flattened a good deal on the dorsal aspect, is not particularly thickened round the edge and is quite as broad as segment 13 for half its length; segment 13 is a transverse band about one-third the length of segment 12. The *head* is a little broader than segment 2 and a good deal higher, somewhat deeply—though not very considerable—bilobed, the lobes somewhat moderately broadly rounded, the sinus on vertex separating them triangular and inclined to be broad; the general shape is more than half a short ellipse; the face is moderately convex; the clypeus is large, reaching more than two-thirds of the height of the head—this may be the false clypeus and then the true clypeus is not distinguishable easily—and the sides of the clypeus are outwardly somewhat convexly-curved; the surface is finely honeycombed-rugose and covered with minute, short, simple hairs which are only visible under a lens, the colour is black-brown with the false clypeus outlined somewhat diffusely and not very narrowly soiled yellow-white; inside this, again, the true clypeus is triangular, higher than broad by a good deal (perceptible as clypeus in certain good lights I see now) and may be outlined also thinly soiled yellowish-white; besides these markings there is a similar white band running up the face parallel to the central or dorsal line, subdorsal on each side to vertex of each lobe where it turns sharply down again to nearly reach the eyes separating the face from the cheeks; the subdorsal band does not go further than the upper part of the white bordering of the false clypeus; there is a soiled yellow-white, rather large spot below and behind the eye curve; the labrum is very narrow and not long, glassy in colour; the ligula roundly kidney-shaped and soiled red-brownish; the antennal joints light; the mandibles dark-tipped; the eyes dark. The *spiracles* are small, roundish, light brownish-yellow, those of segment 2 oval and much larger, those of segment 12 only slightly larger: all very slightly raised. *Surface* of body is dull, covered all over with minute, short, erect, simple hairs with a few on each segment slightly longer; the hairs round the anal flap-edge much longer, especially some four or six of them, light in colour. Colour light opaque-looking yellowish-green with a dark-green, pulsating dorsal line and a lateral less dark-green shade. L: 20mm.; B: 3mm.

The transverse, thin, impressed, parallel lines towards the hinder part of each segment are also here as usual. Segment 2 has a broad-linear, shining, chitinized, black collar from over spiracle on one side across dorsum to the same place over the opposite spiracle. Ventrum green; prolegs ditto; true legs shining green with black extreme tips. The body colour is punctuated, so to speak, by little darker green dots which indicate the bases of the little body-hairs; segments 2, 3, 4 have these dots still smaller and blackish.

Pupa.—It is somewhat of the *shape* of those of the genera *Halpe*, *Telicota*; rather long and slim with the front end broadly blunt and very slightly convex, the anal end narrowly blunt, the sides parallel, the shoulders slightly broader than the head and the segment 2 (which are of the same breadth one as the other), a very slight constriction between shoulders and head; the breadth the same practically from shoulders to segment 8, afterwards thinning very gradually to segment 11, more rapidly, then, to anal extremity; segment 13 a complete band, half the length of the segment 12; the cremastral segment transverse oblong a little longer than segment 13, the posterior side (extremity of pupa) rounded and ledge-like between the posterior corners which are each thickened (with the lateral side) and produced out backwards into a short, conical pointed tooth, the two teeth diverging from each other or from dorsal line of pupa; underneath this ledge, indeed from ventral surface thereof, proceeds a fairly dense fringe of simple hairs all along its length, these hairs golden orange and directed straight backwards and all about the same length as the segment or nearly as long; the *head* frons is perpendicular to the

longitudinal axis of the pupa and very slightly convex with, at its lower edge, in the dorsal region, a curious little lappet which covers the base of the ligula : this lappet shaped like three-quarters of a circle and free (though, of course, rigid) round the edge (the rounded part) though continuous with frons at base (the base or origin, the upper or posterior part), the breadth of this lappet about half that of the whole frons, though only one quarter of the whole breadth of front of pupa ; the vertex of head short, slightly inclined towards longitudinal axis of pupa and composed of an anterior simple half and a posterior half divided into two lateral, oblong strips, one on each side of dorsal line continued to the base of antennæ on each side and coming to points where they meet in the dorsal line—which is all, both the lappet and these strips, a characteristic arrangement or development ; thorax with the front margin straight, the whole segment evenly rounded, of moderate length, the front slope at about 30° to longitudinal axis, the apex or highest point about the middle of the segment with a very slight and gradual fall to the hinder margin which is a parabolic curve with somewhat excessively diverging arms (or an equilateral triangle with the apex broadly rounded) meeting the wing lines in a broadly-rounded angle of about 45° so that segment 4 is largely exposed in the lateral region on each side though of normal length in the dorsal line ; the proboscis reaches free beyond the ends of wings as far as the posterior margin of segment 9 and beyond to the middle of segment 10. *Spiracles* of segment 2 large, longly oval, considerably convex bodies or surfaces on the front marginal surface of segment 3 which is gently produced forwards for the purpose of accommodating them : the colour being golden-orange-brown ; all the other spiracles are very small and oval, slightly raised and light brownish-yellow in colour. *Surface* of pupa dull, slightly and finally aciculate-scratched transversely and covered very sparsely with small, short, erect, reddish, pointed hairs, these hairs (none of them are easily seen except with lens) longer and stronger on the upper and lower 'eyelids,' less strong laterally on posterior and anterior thorax, laterally on segment 4 and ventrally on the lateral portions of abdominal segment, especially segment 14. The *colour* is livid very light yellow—the colour of a fresh bone, the lappet on head-frons brown, the tail points and ledge red-brown. L : 13 mm. B : 3 mm. The pupa is covered with a slight cereous powder ; white.

Habits.—The eggs are always laid singly on the blades of grass, either on the upper surface or on the under. The little larva eats the shell completely and immediately proceeds to make a cylindrical cell either at the side of the blade by turning over the edge or at the tip by doubling the leaf and fastening the edges together. The cell always is a tight fit for the larva and is only changed when necessitated by the gradual growth. The growth is not rapid. Eggs were laid at the end of July and beginning of August ; on August 4 there were some small larvæ on the grass ; none of these pupated until September 4 so that one month is about the period for complete growth. The pupation takes place in a tight cell made of a blade or blades of grass which is close-fitting and well-closed ; the grass may be withered or not but not dry and hard. Practically any grass is eaten by the larva. The butterfly is common in Dharwar in the grass-lands round about. It is found also locally below-ghats : in Bhatkal near the coast and round Gokarn. Not seen in Karwar. It flies low and rather weakly over the grass, resting often on the ground or on a low leaf, basking in the sun with its wings half open ; it rests at night amongst the grass or under the shade of bushes on their leaves ; it visits flowers frequently and never flies very far at a time, nor high. It is not scarce in the grass lands on the open country above the Western Ghats. Swinhoe gives its habitat as India, Ceylon and Burma.

The distribution he gives as follows :— ' In our collection from Mhow ; Poona ; Ranikhet ; Maymyo, Upper Burma and Trincomali in Ceylon ; recorded by Elwes from Sikkim ; Calcutta and Ganjam ; by Hannyngton from Kumaon ; by de Rhé-Philipe from Lucknow and Masuri ; by Aitken and Comber from the Konkan ; by Fergusson from Travancore ; by Moore from Kangra ; by Doherty from Kumaon and by Adamson from Toungoo and Moulmein ; it is widely spread all over India, Burma and Ceylon but is very local.'

The figures of the male and female butterfly on Plate M, numbered 76 and 76*a* respectively are not bad ; but, again, they are much too red ; the underside of the hind wing of the male should have the veins white as well as the spots.

Genus 23.—Ampittia.

Imago.—Small butterflies of the aspect of *Taractrocera* but the males with the yellow developed into large patches divided into large conjoined spots by the black veins ; the undersides of hind wings more yellow with black spots than black (or brown) with yellow spots and the abdominal fold concolorous with the rest, not blackish as in *Taractrocera*. There are two species, one *dioscorides* (F.) and *maroides*, deN. The latter is from Burma and Perak and is not easily distinguishable from *dioscorides*, if it is, indeed, a different species.

Antennæ.—Short, about half the length of costa of fore wing ; the club moderated, straight, blunt.

Palpi.—Upturned, densely clothed; third joint erect, its tip, which is bluntly conical, reaches over vertex of head.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa well before end of cell ; upper discocellular very short but distinct in almost a straight line with the middle and lower, the last somewhat shorter than the middle one, vein 5 therefore slightly nearer 4 than to 6 ; vein 3 from a little distance before end of cell in the male, from close to end in female ; 2 from a little beyond middle ; cell less than two-thirds the length of costa, shaped like an elongated triangle, lower margin somewhat inwardly curved from base of 2, bent upwards from 3 to the end. Wing short and broad ; costa very nearly straight, apex angular ; outer margin very convex, a little shorter than hinder margin. Male with a short, glandular streak on upperside immediately below origin of vein 2 but not touching either 2 or 1.

Hind wing.—Vein 7 emitted one-third from upper end of cell, curved up at its base, the outer margin of cell inwardly curved from origin of 7 to end which is rounded ; discocellulars faint ; 5 not traceable ; 3 from very close to end of cell ; practically touching it ; 2 from less than one-fourth before end ; costa and outer margin evenly rounded.

213. Ampittia dioscorides. (*F.*)—Male. *Upperside* bright golden-yellow ; costal line black, after margin with a broad, even, black band, very slightly but squarely bulged inwards at the hinder angle ; a broad, black band on the hinder margin with two golden-yellow spots in it, one a little before middle, the other a little beyond middle ; a black band running up from the middle of hinder marginal band to costa one-third before apex, throwing out a cross-band from above its middle and joining the marginal band ; in some speci-mens this discal band is disconnected from the costa from the cross-bar. Hind-wing blackish-brown with an irregular-shaped, short, broad, discal, golden-yellow band, composed of spots divided by the veins, the two central ones elongated, the lower ones small. *Cilia* brown, touched in parts with golden-yellow, especially at anal angle. *Underside* : Fore wing as above but the extreme outer margin is more or less golden-yellow. Hind wing with the ground-colour golden-yellow, most of the wing covered with minute, brown scales ; the discal patch as above, edged with pale-brown and a series of pale-brown, submarginal spots all round the wing from base to anal angle. Antennæ black ringed with yellow ; the club yellow on the underside and at

tip ; palpi, head and body brown above, palpi and head marked with yellow ; beneath all yellow.—Female. *Upperside* : dark-brown. Fore wing with a yellow spot at end of cell and a discal series of yellow spots ; two, sometimes three, divided by the veins, from near the costa one-sixth from apex and two in the middle of the disc in interspaces 2 and 3 with another small, in interspace 1 ; an indistinct series of submarginal, yellowish spots on upper half of wing. *Underside* : paler. Fore wing has the spots as above, but larger ; a yellow, subcostal streak from base to beyond middle. Hind wing with many minute, yellow scales in parts, a discal series of yellowish spots and a submarginal series. Expanse up to 25mm. (Swinhoe, *Lepidoptera Indica*.)

The description is not very good. In bred specimens there is, on the upperside of fore wing in the male, an orange streak along the inner margin, and a streak above it from base to one-third of the way out instead of a broad, brown band ; there is also a thin orange line parallel to outer margin in the middle of the broad marginal, brown band reaching from costa just before apex to vein 4 ; the *cilia* have orange brown interspaces as broad as the orange ones at ends of veins, the basal half all brown. There is a brown fringe of hairs along the inner margin. The antennæ have the club with a dull-orange tip ; on the hind wing upperside there are some long yellow hairs in the cell, decumbent and a line of similar ones along vein 1. *Underside* : hind wing orange with a series of brown, largish spots between the veins just inside the margin, all of them powdered with orange scales ; the discal orange markings of upperside showing through and outlined by brown powdered with orange scales ; a large brown spot in interspace 7 and a somewhat smaller one above it in interspace 8, the absolute base of wing also brown. In the female all the male markings are present but so reduced in size as to give the insect the appearance of a *Taractrocera nicevillei* ; and they are more yellow than orange. The males are really very like *Padraona gola* to look at.

Egg.—The shape is that of a dome, rather unusually high. *Surface* shining and sculptured with 24 meridional ridges from base up to more than three-quarters the height where they lose themselves ; the top obscurely, minutely reticulate-lined, even slightly concave. *Colour* light-yellow becoming light-green some time after it is laid. B : 0·9 mm. ; H : 0·6 mm.

Larva.—Of the usual *shape*, thickest in the middle, fining to both ends ; circular in transverse section except head and anal segment ; the latter rather longly semi-elliptical, sloping at about 30° to longitudinal axis of body and somewhat flattened ; the head about as broad as middle of segment 3, broader than segment 2 and slightly higher. *Head* nearly round but slightly higher than broad with a triangular clypeus which is higher than broad, reaches more than one-third way up the face ; outside it is the false clypeus reaching more than half way up, also triangular and slightly curvilinear, the sides convex outwards ; the apex acute ; the surface is shallowly cellular-rugose, covered with extremely short, erect white hairs, all of the same size or length and light in colour ; only visible under a lens and then only when looked at sideways ; the labrum, ligula and antennal joints and the ground colour of the head rather soiled yellowish white with two reddish longitudinal stripes on each lobe and yellowish white mandibles with dark-brown tips ; eyes dark and light : some the one, others the other. *Spiracles* soiled white, small, broadly oval, somewhat convex, those of segment 2 much larger, those of segment 12 a little larger. *Surface* as usual with this type of skipper, covered all over with minute, erect, rather densely disposed hairs which are white in colour and all of one length, visible only under the lens ; those on the anal segment reddish and more visible, those round the margin of that segment a good deal longer and white. *Colour* grass green with a broad longitudinal, subdorsal, white stripe, a dorsolateral and supraspiracular, narrow white band

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Palpi.—Upturned, densely clothed; third joint erect, its tip, which is bluntly conical, reaches over vertex of head.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa well before end of cell ; upper discocellular very short but distinct in almost a straight line with the middle and lower, the last somewhat shorter than the middle one, vein 5 therefore slightly nearer 4 than to 6 ; vein 3 from a little distance before end of cell in the male, from close to end in female ; 2 from a little beyond middle ; cell less than two-thirds the length of costa, shaped like an elongated triangle, lower margin somewhat inwardly curved from base of 2, bent upwards from 3 to the end. Wing short and broad ; costa very nearly straight, apex angular ; outer margin very convex, a little shorter than hinder margin. Male with a short, glandular streak on upperside immediately below origin of vein 2 but not touching either 2 or 1.

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tip ; palpi, head and body brown above, palpi and head marked with yellow ; beneath all yellow.—Female. *Upperside* : dark-brown. Fore wing with a yellow spot at end of cell and a discal series of yellow spots ; two, sometimes three, divided by the veins, from near the costa one-sixth from apex and two in the middle of the disc in interspaces 2 and 3 with another small, in interspace 1 ; an indistinct series of submarginal, yellowish spots on upper half of wing. *Underside* : paler. Fore wing has the spots as above, but larger ; a yellow, subcostal streak from base to beyond middle. Hind wing with many minute, yellow scales in parts, a discal series of yellowish spots and a submarginal series. Expanse up to 25mm. (Swinhoe, *Lepidoptera Indica.*)

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Larva.—Of the usual *shape*, thickest in the middle, fining to both ends ; circular in transverse section except head and anal segment ; the latter rather longly semi-elliptical, sloping at about 30° to longitudinal axis of body and somewhat flattened ; the head about as broad as middle of segment 3, broader than segment 2 and slightly higher. *Head* nearly round but slightly higher than broad with a triangular clypeus which is higher than broad, reaches more than one-third way up the face ; outside it is the false clypeus reaching more than half way up, also triangular and slightly curvilinear, the sides convex outwards ; the apex acute ; the surface is shallowly cellular-rugose, covered with extremely short, erect white hairs, all of the same size or length and light in colour ; only visible under a lens and then only when looked at sideways ; the labrum, ligula and antennal joints and the ground colour of the head rather soiled yellowish white with two reddish longitudinal stripes on each lobe and yellowish white mandibles with dark-brown tips ; eyes dark and light : some the one, others the other. *Spiracles* soiled white, small, broadly oval, somewhat convex, those of segment 2 much larger, those of segment 12 a little larger. *Surface* as usual with this type of skipper, covered all over with minute, erect, rather densely disposed hairs which are white in colour and all of one length, visible only under the lens ; those on the anal segment reddish and more visible, those round the margin of that segment a good deal longer and white. *Colour* grass green with a broad longitudinal, subdorsal, white stripe, a dorsolateral and supraspiracular, narrow white band

or line and a spiracular, thin, yellowish line ; the true legs, ventrum prolegs green ; the whole dorsal surface (as distinguished from the ventral) slightly glaucous except the dorsal broad line which is the only really grass green part. L : 22mm. ; B : 3mm.

There is a small, deep-black dot or spot dorsolaterally on segment 2 which is the only mark of any importance besides the longitudinal white stripes already mentioned in the description above.

Pupa.—A little, green pupa formed on the stem low down, the head always pointing down. It is abnormal in having a short frontal process on each side of dorsal line of the *head* which springs from the dorsolateral region and is directed out sideways in front of the eye the upper hinder margin of which it just over-reaches ; it is directed also slightly forwards away from the frontal surface and is triangular flattened anteriorly and posteriorly, with somewhat broken edges, and the outer surface is roughened : the two together, seen from above, looking like a short pair of horns with a wide sweep. The *shape* of the pupa is nearly circular in transverse section from the thorax to segment 13, the ventrum slightly flattened, the greatest breadth at the shoulders whence it gradually thins to the strong, triangular, broadly round-topped, somewhat down-curved cremastral segment which is nearly as long as segments 11, 12 together, rather thin through with the dorsum mostly occupied by a longitudinal depression which is triangular in transverse section : the suspensory hooklets small and at the extremity spread out fan-wise ; the highest point is the apex of the thorax whence (from just behind the shoulders) the dorsal slope to frons is a straight line at an angle of about 45° to the longitudinal axis of the body ; the head-vertex forms the front base of this slope, and it has its hinder margin curved convexly towards segment 2 ; segment 2, immediately following it is about the same length, with its hinder margin straight ; the thorax is smoothly rounded, rather humped, the shoulders hardly at all prominent, the hinder margin of the segment a more or less parabolic curve meeting the wings in a rather broad, deep, rounded angle of somewhere about 44° ; segment 4 in dorsal line slightly shorter than segment 5 ; segment 13 very short ; segment 12 half the length of segment 11 ; the proboscis alone but none of the legs or antennæ reaches the ends of the wings. *Spiracles* of segment 2 are indicated by, each, a rather large, very slightly-raised, flat, opaque-white, semicircular space on the surface of segment 3 immediately behind each ; the rest are small, nearly round, slightly raised, yellowish. The *surface* of the pupa is shining, very finely and shallowly transversely aciculate and granulate, perceptible only under the lens—except the frontal processes which are as above described. The *colour* is grass-green, light and slightly glaucous, with the white markings of the larva ; the thorax, head and wings hardly glaucous ; there is a minute lateral and dorsolateral, shiny-smooth dot just behind the front margin of segment 2. L : 26mm. ; B : a little over 3mm.

Habits.—The butterfly lays its eggs singly upon the leaves of the rice. The little larva eats from the edge of the leaf and lives in a cell made at first by joining the edges of the leaf at the point, when more grown by turning over the top of the blade at right angles to the length of it, coating the inside with silk. Pupation takes place in the open ; the pupa is attached, head down, by the tail and a body-band to a rice-stem just over the surface of the water. Twenty-five eggs were dissected out of a female. The butterflies are generally found round the rice-fields in Kanara in the monsoon months but also elsewhere in open spaces where there is grass. The larva was first discovered in N. Kanara District on rice and the first pupa was also found in a rice-field in the position just noted. That was in the year 1894. Many more butterflies have been bred since those days and the pupa always is formed along a stem in the same way even when there is no water. They are weak fliers and flit about over the rice in much the same way those of the genus *Taractrocera* do over grass ; sitting in the same way to bask on the leaves with the wings partly open to the sun. At night they rest

with them closed over the back. The habitat is given by Colonel Swinhoe as Sikkim, S. India, Ceylon, Burma, Malacca, Annam and Sumatra (*Lepidoptera Indica*, vol. x, p. 126; figures are given on Plate 786 of the male upperside No. 1, male underside No. 1*b*, female upperside 1*a* and underside 1*c* together with larva and pupa No. 1*d*); the distribution is alluded to as follows :—'The type of *dioscorides*, a female, came from Tranquebar and is in the Museum at Copenhagen; the type of *maro*, in the Banksian cabinet in the B.M. from Ceylon; we have both sexes from Hue, Annam; Trivandrum; Madras and Ceylon; Evans records it from the Palni Hills; Fergusson from Travancore; Betham from the C. P.; Watson from the Chin Hills, Beeling and Pegu; Moore from Mergui and Ceylon; de Nicèville from Sikkim; Davidson, Bell and Aitken bred it in Kanara; we give copies of Davidson's original drawings of larva and pupa.' He says positively that there is no difference between *dioscorides* and *maro*.

Genus 24.—Aeromachus.

This is divided into two by Swinhoe; one genus he calls by the original name and reserves for those species that, in the male, have a sex-mark; the other he has christened *Machachus* for those which have none. The only species that concerns us here comes into this latter. Swinhoe has two species of *Aëromachus* named *stigmata* (M.) and *dubius* (El. and Ed.), the former from N. W. Himalayas, Sikkim and Assam; the latter from the Palni Hills, Peermade, Travancore. In *Machachus* he places three called *jhora* (deN.), *kali* (deN.) and *indistincta* (M.) from, respectively, Sikkim, Assam and Burma; Sikkim and Burma; S. India, Ceylon, Burma, Java, Sumatra.

Imago.—These are the smallest of Indian Skippers, varying from 20mm. to 25mm. in expanse. They all have the uppersides of both wings immaculate brown except for, in some, on the fore wing, a postdiscal series of always small, whitish dot-spots between the veins from interspace 2 to interspace 8, this series forming an absolutely even curve. The undersides are generally somewhat lighter with the postdiscal series of spots showing through and a similar series on the hind wing.

Antennæ.—With the club robust, blunt (at least in the Kanara species understood to be *jhora* from Swinhoe's description) at the end, although conical.

Palpi.—With the second joint pressed closely against the face, third joint porrect, not particularly short, conical.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ends on costa before end of cell; 5 from below middle of discocellulars, 3 from before lower end; 2 from about one-third before end; cell less than two-thirds length of costa; costa slightly, evenly curved; apex well pronounced; outer margin convex and shorter than hinder margin.

Hind wing.—Vein 7 from before upper end of cell; discocellulars and 5 faint; 3 from close to lower end; 2 from beyond middle.

Egg, larva, pupa, habits.—See below under *jhora*, the only species for which they are known.

214. Aeromachus jhora, *Swin.*; **indistincta** (*M.*).—*Upperside*: uniform olive-brown without any markings; in some individuals there are faint indications of some discal and submarginal markings. *Cilia* concolorous with the wings, the tips paler. *Underside* paler; a small whitish spot at end of cell, sometimes absent; an indistinct, whitish, outwardly-curved, discal band, thin and from near the costa half way down the wing; the upper and outer portions of the wing covered with minute, white scales. Hind wing entirely covered with minute, white scales; traces of a whitish, outwardly-curved, discal band, a very faint series of submarginal spots a little darker than the ground colour. Antennæ black, ringed with white; the club whitish on the underside, all except the tip; palpi, head and body above concolorous with the wings, whitish on the underside. (Swinhoe in *Lepidoptera Indica*, vol. x, p. 196. Figures are given on Plate 802 of the same book, No. 5 of the male, 5*a* of the female, 5*b* of the underside).

Egg.—The *shape* is that of a somewhat elongated hemisphere or dome. *Surface* is shining, minutely pitted under the microscope and having 19 meridional tuberculate ribs which do not reach the bottom and lose themselves at about two-thirds the way up in knobs ; these ribs have the intervals between them cross-rayed, the intervals between the cross-rays being 0·02mm. ; the ribs are 0·01mm. thick and the greatest breadth between them is ten times that or 0·1mm. (this is of course at their lower ends) ; there are four tiny tubercles to each 0·05mm. length of rib. *Colour* slightly soiled-whitish or very pale honey-yellow with, sometime after laying, an irregular, blotchy, blood-red band round the middle and some separate ring-spots, also a patch on vertex made up of ring-spots and blotching of red. B : 0·65mm. ; H : 0·4mm.

Larva.—Is very similar to those of *Ampittia dioscorides*. The caterpillar's *head* is half-elliptical in shape, higher somewhat than broad with the surface rough-cellular and some hairs about the lower part round mouth-opening, the colour being green with yellow mandibles. The *shape* of the body is subcylindrical, thickest in middle or about segment 5 when at rest ; segment 2 not as broad as head, the neck still narrower ; anal end flattish, broadly rounded at extremity with some hairs on the free margin. *Surface* dull, under the lens covered with minute, erect hairs ; the segments all well marked. *Spiracles* very small disc-like, yellow, very round ; those of 2 much the largest. *Colour* light-green, glaucous-looking with darker green dots, the hair-bases ; a darkish dorsal, longitudinal line, a white, lateral, distinct, longitudinal line and an indistinct, subspiracular one ; two yellow bodies, one on each side of dorsal line, showing through the skin in the male. L : 19mm. ; B : 2.5mm.

Pupa.—Much the same *shape* as that of *Ampittia* ; the head square in front, eyes prominent, the frons with a short beak or conical boss or snout, porrectly pointing out in front ; thorax convex-humped ending somewhat abruptly behind ; segment 2 long, convex transversely, less inclined to the longitudinal axis of the body than front of thorax ; no constriction at 5 ; under the lens segment 4 is somewhat lower than 3 and 5 is again ever so little higher than 4, the front margin being provided in the dorsal line with a little point that is directed over 4 and under which passes the body-band that serves to keep the pupa against the surface it is fixed to by the tail ; wings very little thickened along inner margins behind the rounded shoulders ; the outline is straight on dorsum from thorax-end to cremaster ; circular in transverse section from shoulders to 13 ; segments 13 and 14 are exactly the same width to end of cremaster which is a thin, oblong piece with the extremity rounded and set with fine, white hairs. *Surface* set with extremely minute, erect hairs under the lens ; segments distinct. *Spiracles* small, oval, whitish, that of segment 2 with a rather large, broad, flush, yellow mark like a note of exclamation. *Colour* dark, semitranslucent green with a fine subdorsal and lateral, longitudinal, white line and an obscure spiracular one. L : 14·2mm. ; B : 2·9mm. ; snout 0·1mm. long.

Habits.—The eggs are laid on dead blades of grass or green ones, generally on the undersides. The larva makes a loose cell by joining the edges of the blade in a slovenly way, lying on the underside of the blade. It pupates in an open cell similar to those *Parnara* makes by just drawing the edges of the blade together but not joining them. The pupa is attached by the tail and a body-band. The hairs at the end of the cremaster of the pupa must have minute-hooked tips to fasten into the silk-pad. The butterflies are weak fliers, frequenting grass in the open places in the jungles but are difficult to see owing to their small size and to their comparatively fast flight. They rest on the ground or on leaves, etc., close to it ; never rise any distance from it and are fond of flowers upon which they feed, choosing such as grow amongst the grass, mostly leguminous. As a sort of example of the vicissitudes that attend the pursuit of breeding butterflies in India the following extracts from a diary of 1918 may perhaps be of some interest :—

Monday, September 9.—A dull morning ; it had been raining all the night

Walked and bicycled down the 1,500′ to the foot of the Gund Plateau and the remaining twelve miles or so to Sulgeri on the Kalinadi River. Collected various plants. . . . After we got in to the bungalow we went down to the river and looked in the grass for *Aëromachus indistincta* and after a bit, found there were a lot of them about—they are so small that, at first, before we became accustomed to them, we hardly saw one ; they fly fast and in long jerking, deviating way ; settling rather rarely except occasionally on flowers in the grass ; they do not often sit. Later on about 1 or 2 p.m., however, they settled much oftener and M. managed to catch three after vain efforts with a tumbler and a finger bowl, stalking them with great care and popping the thing over them on the ground. The servants brought no butterfly net with them so I sent back for one and a cage and to-morrow we hope to get a lot to breed from.

Tuesday.—After breakfast went out with the net that had arrived and managed to catch seven *Aëromachus* to put in the cage with grass for them to lay on. Hope to catch more to-morrow. The catching of these butterflies and determining plants took us until tea-time after 4 p.m.

Wednesday.—Got back to the bungalow at about 11 a.m. and found. Ibrahim had caught two *Aëromachus*. He had taken all the morning over it. So we set to work and caught fourteen in half an hour which we put into the cage. Then we had breakfast sandwiches, hard-boiled eggs, buns and cold coffee. After which we packed up everything. It was after 1. Went to Kadra in the afternoon.

Friday 13.—In the evening examined all the grass in the cage in which we had put the *Aëromachus*. They were all dead except one. There were, however, eight eggs laid by them. Leaving Karwar to-morrow for Dharwar and shall take an egg to describe ; leaving the others to be looked after here by Taku and Waman.

Thereafter Dharwar, Poona, Bombay, the influenza epidemic and a bad attack of that followed by dysentery brought the time up to November 20. On October 10 or about that date two or three butterflies of *Aëromachus* came out of pupæ resulting from the eggs laid in September. No more ; for Waman and Taku, the boys looking after breeding operations in Karwar, had got influenza and, although not badly, they were so frightened because of the reports of deaths everywhere in the Presidency that they neglected everything and, it appears, stayed at home in the village, lying down.

In the specimens caught that September and other captured since in N. Kanara District, many have the discal series of white scale dots on the fore wing (they are not semihyaline at all) very distinct while others have it absolutely wanting ; some have a white dot at the end of cell on the upperside of fore wing also. On the underside of the fore wing the discal series consists of one each in interspaces 1 to 8, the one in the first being sometimes hardly visible—on the upperside there are generally only the last 5 ; there is an indistinct series, submarginal, of three spots in interspaces 5, 6 and 7 : in the hind wing, similarly, the discal series consists of one in each of the same interspaces 1 to 8 with a submarginal series of 5 and a single one at end of cell. The fringe of hair along inner margin of fore wing is very slight ; the long decumbent, brown hairs in cell on upperside of hind wing and below cell are also very few.

Swinhoe informs us that the habitat of the butterfly is S. India, Ceylon, Burma, Java and Sumatra and that the type came from Salween, Moulmein, that Moore records it from Mergui ; Elwes from Bernardmyo, Tavoy in Burma and from Java ; de Nicéville and Martin from Sumatra ; Adamson from Toungoo ; Hampson from the Nilgiris, de Nicéville from the Palni Hills, Davidson, Bell and Aitken bred it at Karwar but unfortunately did not figure the larva and pupa ; and that he has it in his collection from the Ataran Valley in Burma and from Sumatra.

There are seven extra Indian species of the genus *Aëromachus* coming from Japan, W. China, Amurland (*inachus*, Ménétriés); from Thibet (*catocyaneus* Mabille) ; from Moupin, E. Thibet (*piceus*, Leech) ; W. China (*chinensis*, El. and Edw.) ; W. Java (*javanicus*, El. and Edw.) ; the Philippines (*musca*, Mabille) ; and from Shanghai, Ichang (*nanus*, Leech.)

A FEW DAYS AFTER URIAL OF THE PUNJAB

By Lt.-Col. R. W. Burton, I.A. (Retired)

The Urial of the Punjab (*Ovis vignei punjabensis*) is to be found in several localities, readily accessible to the sportsman in need of a few days holiday, and the pursuit of this handsome variety of the wild sheep of Asia can afford excellent sport and can, at the same time, furnish a handsome trophy—as an addition to the collection of heads of Indian large game.

Early in December 1920, the writer was able to avail himself of a few days' leave for a much coveted shoot in the Kala Chitta Range; and, at the same time, to see something of the wonders of the ancient city of Taxila, now under excavation by the Archæological Department of the Government of India.

On the way to Taxila, the motor car was stopped in a deep cutting above which is an obelisk erected to the memory of General John Nicholson. It occupies a fine commanding position and is visible for many miles. In the cutting on one side of the road is a fountain for drinking water and opposite to it are stone slabs, inscribed in English and Urdu, to the memory of the famous soldier. Proceeding along the Peshawar road, and turning off past the Railway Station of Taxila, the car took me to within half a mile of a large stupa the masonry work of which is of three kinds, dating to different periods, the earliest being about 300 B.C. Some of the stucco figures on this stupa are still in fair preservation. From this place, by a drive of some three miles, a visit was made to a monastery excavated out of the hill side. These buildings were, at the time of my visit, the most interesting and in the best preservation of all those hitherto exposed to view. The small carved figures surrounding the pedestals of some of the sculptures are very grotesque though wonderful in execution, illustrating in a most amusing way the strenuous efforts of men, monkeys, elephants, camels, oxen and other animals, in supporting the structure. Many of the sculptures are very beautiful with marked Grecian features.

Others of the widely scattered excavated buildings were seen, as also the extensive excavation, then under progress and by now no doubt greatly advanced, by which a whole city is being laid bare. The main street is about twenty-five feet wide, the side streets being some ten to fifteen feet in width and at right angles to the main road of the city. The rooms of the houses strike one as extraordinarily small. The earthenware pipes by which the city received its water-supply can be seen, much as they existed 2000 years ago. But all this is not urial shikar, and those of our readers who have seen these wonderful ruins at a later period of their exposure to modern eyes, and have also for reference a copy of Sir John Marshall's most interesting and informing handbook

concerning this ancient city, will rapidly pass by these few very inadequate notes regarding it.

On arrival at the small wayside railway station, from which my shooting ground was not far distant, I was greeted by the news that on the previous evening dacoits—probably trans-Indus Pathans—had raided the railway station. The station buildings, including the quarters of the station master and his assistant, were seen to be completely gutted. The assistant was seated amidst the charred remains of furniture, busily ticking away at his telegraph instrument. The dacoits, having completed the work of collecting everything of any value to themselves, had piled all the furniture, drenched it with kerosine oil, and set the place on fire. The women of the two households had been obliged to make over all their gold and silver ornaments, but had not been otherwise molested. The old station master had received a punch in the chest from the butt end of a pistol.

The place was full of police, and I was escorted to the small bungalow, situated on rising ground some three hundred yards away, where I was to pass the night. When the gang, which consisted of only three or four men, was busy on the railway premises, one of their number went to this bungalow, occupied that afternoon by an Indian official who was travelling, on transfer, with his family. The young ruffian—he was said to be only about eighteen years of age—entered into amicable conversation with the official, and having learned all he could enquired whether a pistol was carried. The reply being in the negative he promptly produced his own weapon. Having obtained a large sum of money and all the ornaments of the women, he brutally shot the unfortunate man in three places, and made his way back to his companions. All this took place in broad daylight, the setting sun going down on the blazing buildings. The blood of the victim was fresh on the whitewashed walls, the plaster of which was scarred by bullets. Fortunate for me that I had not arrived twenty-four hours earlier: weapons in locked cases are not of much avail against the sudden appearance of a determined ruffian armed with a revolver. This gang was not, I believe, brought to book on this occasion; but met with just deserts at a later period in consequence of further murderous outrages in the Attock District.

The next day an early start was made. The camp was found ready pitched at the foot of the hills, and two local shikaris, father and son, produced the usual assortment of chits. In the afternoon the rifle—·375—had to be tried at various distances, as a new batch of cartridges loaded with a—to me—new kind of powder (Moddite) had to be brought into use. It was found that the hundred yards sight was good for any distance up to 250 yards and more. This had been found to be the case with other cartridges in many parts of the hills and plains, especially with cartridges of foreign manufacture. Small bore rifles are mostly considerably over-sighted. Moddite proved quite satisfactory, but it is best to try and keep to one kind of powder and one maker. Every new batch of cartridges should, however, be tested with a few trial shots.

Leaving camp early next morning half-an-hour's walking found us—myself, the two *shikaris*, and a tiffin cooly—working along the lower slopes of the rocky and scrub-covered hills. Soon after daybreak—the rifle sights were as yet scarcely visible—a hissing sort of whistle, the alarm note of the urial, drew our attention to a couple of rams with horns of about 20 to 25 inches. They were above us and soon made off uphill.

After that first view of game, until leaving the hills at four in the afternoon, we were seldom out of sight of and must have seen over a hundred animals. Of all these, many of course being ewes, only about half a dozen had good heads: by which I mean horns of well over 30 inches. It was a great pleasure to watch these handsome game-like sheep with their reddish brown coats, dark saddle backs, and long beards. Unfortunately the rutting season was past, so those exciting battles between the rams could not be watched.

At one time, early in the day, I was within sixty yards of a fine fat fellow with fair horns. He was standing on his hind legs feeding on the leaves of a thorny tree. It was interesting to watch him, and those of his companions who were visible among the scattered thorn and privet bushes of the ravine. Suddenly they took alarm and galloped off up the opposite hill side. A slant of wind no doubt. Such a stampede! A number of them stood on a spur and gazed in our direction, presenting quite a small forest of horns. They were only a hundred yards away and stared for quite a long time.

About twelve o'clock a halt for 'lunch' was made. Packing up was nearly done when the old *shikari* hastily signalled to me. A number of urial were coming up the slope from the valley below and would soon top the ridge to our side. Almost before the rifle could be got ready the first comers arrived amid much clattering of stones. Several sheep of both sexes appeared, paused to stare, and dashed off up the ravine. Then came a ram with horns of massive appearance. Evidently he was the owner of a fine head. He halted exactly where the other animals had paused and a quickly-sighted right shoulder shot at 120 yards dropped him where he stood. This was a somewhat fortunate shot, as my right eye is not in class A 1, but for very quick shooting it must needs be trusted. A great aid to quick aim is a tin funnel, fitted over the backsight, by means of which it is in constant shadow and all glare cut off. This was the best head of the trip, and the owner of it was named '*Itifak*' on account of his chance appearance on the scene. The horns presented almost a perfect circle, the tips touching the hair of the cheek bones. Right horn 34½ inches, left 33 inches, the circum ference at the base being 10½ inches. The beard was mostly white and the photograph taken was an excellent one.

After this, within half an hour, another good head should have been secured. The sun being in my eyes, and the beast in shadow, a miss was scored over the top of his back. Perhaps, also, I was a bit too hurried as the urial were on the move. One must sometimes make excuses for such happenings.

During the past few days there had been a very keen wind and I

must at some time have exposed myself without being aware of it. All day there had been a feeling of being chilled and this, in spite of a warm vest, flannel shirt, cardigan waistcoat and puttoo coat! A rising temperature and aching legs warned me to be off to camp which was reached about five o'clock. Suitable treatment enabled me to shake off the threatened attack of fever, so fears of the shoot being cut short proved unfounded. In the evening the younger *shikari* brought me a pigeon, minus its head, which I identified as the Indian Stock Dove. He had killed it with a stone. A number of these birds were round about camp, also some coveys of chukor.

Next morning all the aches and pains were gone and a start was made by seven o'clock. A bitterly cold wind was blowing from the north, where snow-covered hills could be seen in the far distance. By half-past eight four rams, all about 25 inches, were seen and after that until past midday, nothing but one small ram and some ewes. Probably most of the animals were sheltering among the bushes and in the ravines. Gradually we made our way to the highest part of this portion of the range, where there is a white rock called 'Chitta'. The whole range bears the name of Kala Chitta. The old *shikari* says there is a black rock at the other end of this range of hills, hence the name: may be so. Soon after leaving 'Chitta' some urial were sighted far below, down the slopes of a wooded ravine, and the telescope disclosed that the gentleman of the party was a white-bearded old fellow the possessor of what seemed to be a perfect head of 32 or 33 inches. The line of approach was down the reverse side of a very rocky and precipitous ridge, and we eventually found ourselves a bit above the patriarch who was on the opposite ridge, about 200 yards away, and partly hidden by a bush. Our descent of the hill had not been entirely noiseless and the animals were evidently on the alert. There was no time to be lost, so a sitting position was quickly gained under cover of a small rock. The shot went over or else the beast was killed, as he instantly disappeared: but I knew it must have been a miss. The strenuous climb down had made me shaky. After going to see whether, by any chance, the animal had been hit, we rested for a while and a much-needed meal was discussed. The next move was to work across the neighbouring ravine to another ridge. From there the keen-eyed shikari drew attention to a white speck far up the hill and the telescope disclosed to view another patriarch, quite possibly the same beast recently missed. He was a long way off in a small open space among the shrubs with which the hill side just there was thickly covered. Viewed through the telescope he made a handsome picture. He was lying down with head erect, facing exactly towards me, his horns forming a perfect circle on either side while his long white beard was very conspicuous. It was this patch of white among the green which gave him away: a younger animal, with a black beard, would probably have escaped notice.

Leaving a man on the watch and giving him a whistle, we recrossed the ravine to make our way up the reverse side of the spur to that on which the former animal had stood when I missed him.

Then one of the men was sent higher up to disturb the ram, as it was hopeless to attempt to get near him where he lay. The *shikari* and I also climbed higher up to a place where the valley was fairly clear of bushes. No warning whistle came to us from below, but we had hardly got there, and I had only just selected a place on the steep hill side on which to sit, when a clatter of stones announced an animal travelling at speed and a ewe was seen to cross the bed of the ravine and make her way diagonally across the opposite slope of the hill. This gave the probable line of retreat for the remainder. Soon some other ewes appeared and then the ancient one. He crossed the *nala* out of sight, going fast, but halted—a fatal pause—in an open space on the opposite side of the valley. A good and quick shot from the left shoulder took him at 200 yards through his right shoulder. Stone dead, he slithered down the slope until fetched up by a small shrub. So much was he dead mutton that he could not be *hallaled*. He proved to be a very old animal, several teeth gone, hair turning white on shoulders and rump while his beard was quite white. The saddle on his back was very clearly marked. Horns 31 inches only. They had seemed bigger than that. However he was a fine trophy and well deserved. '*Dada*' was the quite appropriate name given to him by the men.

The third day new ground was tried and many urial were seen. Early in the morning a good beast was missed. The approach was not too easy : it was necessary to crawl some distance and be careful to keep in shadow of bushes as no animals have more keen eyesight than the ever-watchful wild sheep. The twigs of green privet stuck in my sun topee enabled a sitting position by side of a bush to be slowly gained. Alas ! I had omitted the morning routine of wiping out the oiled barrel and a high miss was the inevitable result—the ram gave no second chance. On the shot being fired two other rams ran back towards me and walked across our front at close range, without detecting us, as we crouched crouched motionless admiring their stately paces. The next valley was bare of cover, containing only a few small gatherings of sheep with no shootable ram among them. A long climb took us to a high ridge, on the other side of which was a deep and precipitous ravine. Urial could be seen some distance away ; but the wind was wrong, and the only thing to do was to send a man round and above to give them his wind and so enable the telescope and field glasses to get to work. This was done and from where merely a few animals lying down had been seen a long procession of sheep now came into view. There were some fair heads in this large flock of nearly a hundred animals, but none of outstanding size. One of the ewes was obviously a tame sheep strayed who now ran bleating loudly with her wild sisters. Slowly following the long procession—the '*Rissala*' the men called it—appeared two splendid looking rams. Evidently but little alarmed, they branched off by themselves and lay down, out of shot, under a thorny tree. After a wait of over an hour some urial came from below and, going upwards, climbed towards the big fellows who had meanwhile got up and, with frequent halts, were coming along towards them and so nearer to us. When the lower party, slowly

pacing, suddenly caught sight of the heads of the veterans, or, perhaps, merely heard the slight noise of their movement, they got a great scare and wildly bolted in the opposite direction. The two old gentlemen came quietly on. Foolishly becoming nervous as to the distance, which, owing to the deep and wide intervening ravine was not easy to judge, I put up the 200 yards leaf and twice went over the back of the larger one of the pair. There was not much to choose between them. He turned uphill, and the third shot, aimed much lower, got him through the body and pulled him up short; a fourth bullet broke his neck. The man up the hill came flying down, at such a pace as only these hill men can attain, his knife glittering in the rays of the sun, now getting low in the sky, and on reaching the ram called out that he was dead. '*Hallal karo, Hallal karo*' yelled the three men with me and this was done amid great reverberating shouts of '*Allaho Akbar*' from our side. This patriarch also had an almost wholly white beard. His horns were 32 inches being very symmetrical and massive. The tips were worn and not broken. He was ironically named the '*Sipah Salah*' on account of his having taken up a strategic position, with his 'Adjutant-General' in attendance. This was the suggestion of the man added to our party this day and who had done some military service.

We were far afield, camp was not reached until dark and the unfortunate '*Sipah Salah*' was pronounced by the village mullah to be unlawful meat as he had no breath in him when *hallaled*. This was certainly the case as his neck was broken: but if blood flows that should suffice. However the strict Muhammadans of this part of the country will not allow even that small latitude in the matter. This mullah had a fine voice and it was most impressive to hear his sonorous call to prayers ringing out over the country side, especially in the early hours of the coming day.

This long day's work over the knife-edged rocks and rough stony hills completely finished the new rope soles with which the shoot was commenced. I took to the *chapli* of the country after this, and also when in the Salt Range where the going is even worse than in the Kala Chitta Hills.

There was said to be an albino ram in this part of the range, 'white as your handkerchief' the shikari described him. Much to my regret he was not seen. On the way back to camp that day we came down a rocky ravine which somewhat reminded me of an immense gorge lately seen in a side valley of the Sutlej River, far up on the Tibet border, where huge pieces of the hill side had been displaced by a recent earthquake: so said the local people. Telling the men of this they enquired the cause of earthquakes which was explained to best of my ability. I was then informed that the mullah's explanation was that a big bull supported the earth on his horns, one horn at a time, and the earthquake occurred when he got tired, which was at very long intervals, and had to change the weight from one horn to the other! Perhaps the jovial fellows were pulling my leg.

The fourth day of this most enjoyable outing was a day of misses; very suitably, *four* misses! A fine ram was found at about

eleven o'clock and missed at some 220 yards : a down hill shot. Later on a real good head was seen. After a long stalk, very skilfully conducted by the younger *shikari*—the old man was bowled over by raging toothache—a shot was obtained on the opposite side of a ravine, at a beast which I took to be the animal we were after. The lad said I went over him. Just after firing this shot there was a slight noise behind us and there were half a dozen rams with *the* big one among them ! They were watching curiously, wondering no doubt why we were crawling about, and made off rapidly to quickly disappear among the many rocks and bushes. The big ram was not again seen. Much ground was covered and yet another miss at a good ram. Still over the top says the shikari. On the way to camp the remains of an urial, evidently killed some days previously by a panther, were found. Doubtless the few panthers which inhabit those hills take full toll of these wild sheep and are seldom in want of a meal.

Discouraged by want of success we slowly picked our way by descending paths. The bearer of a shootable head was spied far down the hill and the stalk resulted in yet another miss ! my ' little Mary ' was somewhat uneasy and may be that affected my shooting during this day. A number of good heads had been seen ; the best of them about 33 inches.

It seems however, that the real reason why there was no success in that day's shikar was, that we met an old woman on leaving the village in the morning ; and one of the coolies saw a hare. With two such bad omens how was it possible for the rifle to hit anything ? Had a jackal been seen matters would have been entirely different ! In Kashmir also it is considered very unlucky if women are met when men are setting out for shikar.

On the last morning, the fifth day of the shoot, a fox was seen ; not good, but later on a jackal crossed our path and this counteracted the former malign influence so we soon sighted urial. The stalk was not difficult as there was an icy wind and the animals were all sheltering from it in a ravine. The only ram of any size proved to be certainly under 30 inches. A stone thrown down the hill side moved these animals and also some others which had been lying up, unseen, on our side of the ravine. They soon came into view. One ram appeared to bear a good head and the shot, taken tail on at 120 yards, took him at the place aimed at, the centre of the left buttock, travelling forward to the chest, and he only moved a couple of yards. This time the meat was ' lawful ' ; very much so quite judging by the shambles the men made of the place. An old beast he was, turning grey as to beard, but not, a ' patriarch'. His horns were very much broken at the tips, and also at the bend, probably in fighting, and as he was evidently something of a bruiser they named him ' *Pahlwan* '.

Four heads 34½″, 33″, 32″ and 30″ had been obtained, enough indeed, and no more could be shot. The old shikari, who had hunted urial of these hills for thirty years, told me he only once saw a head of 36 inches, and that in 1918. Anything of 32 inches and over is quite good, and I was fortunate in the heads I secured. Protection appears to have come into force about twenty years ago, and to

have been much needed, as urial were becoming scarce. The men said there was a good deal of poaching going on in some parts, also grazing of cattle and goats, so disturbing to the sheep, but that the forest guards were powerless in the matter. That can be readily imagined. The people of these parts are not of the most law-abiding in the land. On a later occasion I again visited this locality but saw no heads better than that of '*Pahlwan*'; perhaps the sheep had moved ground, or the grey-beards been shot by other sportsmen.

The urial of the Salt Range are smaller animals than those of the Kala Chitta Hills both as to bulk of body and size of horns. I saw nothing there over 26 inches. Probably the more arid nature of the country and the inferior feeding has something to do with the matter. Animals were not plentiful and as strict protection as it is possible to attain seemed indicated, in the block I was shooting in at any rate, and probably in the other blocks as well. This was in 1923. Chinkara with heads running to 13 inches are to be found in the Salt Range and in some places chukor, see-see, and grey partridges are plentiful. The walking is atrocious.

On my way from camp to railway station, the old *shikari* accompanying me as I was taking him to a doctor who would extract the offending tooth,—a chinkara with horns 11½ inches in length afforded a somewhat difficult stalk which ended in a successful shot at about 180 yards. A few others were seen, all of them very wild, and so the blackened ruins of the station were gained by sun down and this most pleasant and successful outing came to an end.

My train was due to leave at 4 a.m., and I had a somewhat restless night on the station platform, one of my awakenings being due to the rumbling arrival of a bullock cart bringing the coffin containing the mortal remains of the unfortunate victim of the dacoity. He had died that morning and his body was being conveyed to his native place in the same train by which I was to travel, a coincidence which occasioned sundry sober reflections as to what 'might have been.'

INDIAN DRAGONFLIES

BY

MAJOR F. C. FRASER, I.M.S., F.E.S

Part XXII

(With one plate and 3 text-figures.)

(*Continued from page 663 of Vol. XXX.*)

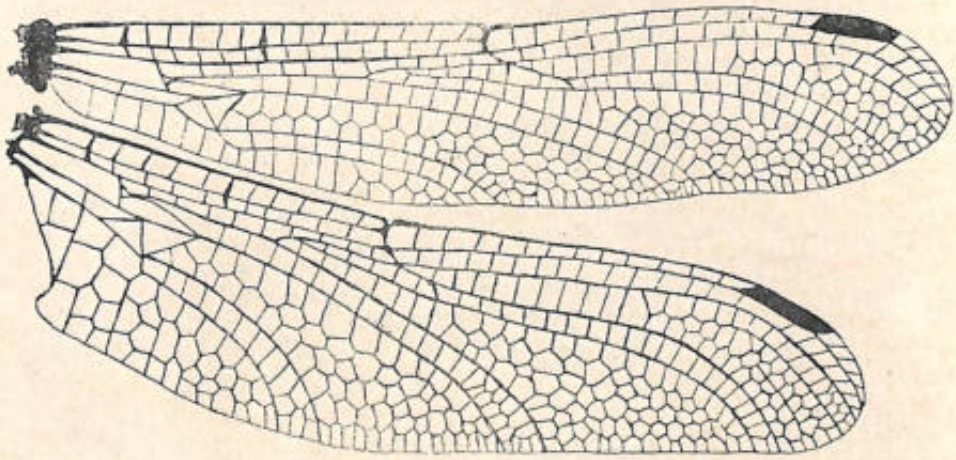


Fig. 1—Wings of *Heliogomphus promelas* (Selys.) Male

Genus—HELIOGOMPHUS Laid

Insects of moderate build, limited to the Oriental Region, all very similar in appearance, coloured black marked with bright greenish yellow.

Venation moderately close; wings long and narrow, base of hindwing oblique, approaching that of *Anisogomphus*; pterostigma small, less than one-third the length of distance between node and distal end of pterostigma, rarely braced and then only imperfectly so; basal incomplete antenodal nervure absent; arc usually between the second and third antenodal nervures or more rarely opposite the second; sectors of arc approximating to each other immediately after their origin, and in some wings, of individual specimens, actually fused for a short distance as in the *Libellulinae* (but there is always a short separation after their origin); 1 to 2 cubital nervures in all wings; only a single row of postanal cells in the forewing, 3 to 4 in the hind; first postanal cell of hindwing always entire, small, not nearly extending to proximal angle of subtrigone; 5 to 6 traversing nervures between *Mi-iii* and *Miv* in forewing, 3 to 4 in the hind; forking of *Mi-ii* and *Miii* in both wings unsymmetrical; only a single row of cells between *Mi* and *Mia*; 3 to 4 rows of cells in discoidal field at level of node in the forewing; only two rows of cells posterior to *Cuii* in the same wing, this nervure being flat or only slightly pectinate; trigone moderately elongate, its costal border in the hindwing nearly twice the length of base, entire in all wings.

Head very narrow from before back, very wide from side to side, almost Zygopterous in shape, that of the female especially, bearing a strong resemblance to a female *Pseudophaea*.

Legs rather long, hind femora extending to apical border of segment one, or slightly overlapping segment two; in the female armed with two rows of rather widely spaced, evenly-sized, rather elongate spines. (Somewhat similar to those of *Indogomphus*.) In the male, the femora armed with rows of very minute, very closely set spines.

Abdomen of male tumid at segments 1 and 2, thin and cylindrical from three to the proximal end of seven, the apical half of the latter and segments 8 to 10 evenly and rather widely dilated laterally and dorso-ventrally. Abdomen of female cylindrical and of even width throughout.

Genitalia prominent, vesicle rather large, hamules small. Vulvar scale small and rudimentary. Anal superior appendages lyrate, inferior cleft.

Distribution. Assam, Burma, the Western Ghats of India, Ceylon, Java, Indo-China and Borneo.

Genotype.—*Heliogomphus nietneri* (Selys).

Heliogomphus nietneri (Selys) (*Leptogomphus nietneri*) (*Gomphus nietneri* and *Anisogomphus? nietneri*) Bull. Acad. Belg., (2), xlvi, p. 449 (1878); Kirby, (*Anisogomphus nietneri*), Cat. Odon. p. 69 (1890); Will. Proc. U. S. Nat. Hist. Mus., vol. xxxiii, p. 295 (1907); Laid. Rec. Ind. Mus., vol. xxiv, pp. 379-380 (1922); Fras. Rec. Ind. Mus., vol. xxvi, p. 416 (1924.)

Male. Abdomen 35 mm. Hindwing 30 mm.

Head. Labium pale yellow, middle lobe bordered with brown; labrum glossy black marked with two moderately broad, closely apposed, bright citron yellow spots; face black, frons traversed by a broad stripe of greenish yellow which slightly overlaps the foreborder; vertex black, occiput yellow in its anterior third, black posteriorly, depressed, its crest slightly elevated, fringed with short black hairs.

Prothorax black with a broad anterior collar of greenish yellow.

Thorax coal black marked with greenish yellow as follows:—A slender mesothoracic collar, slightly interrupted at its middle, a narrow oblique antehumeral stripe not confluent below with the collar, nor extending up as far as alar sinus, pointed below, squared above; a small upper humeral spot. Laterally the sides greenish yellow marked with two broadish black stripes, the anterior one the broader, the posterior nearly terminal. Beneath pale yellow. (The position of the hinder stripe as given by Selys seems to me rather doubtful and is more probably situated along the lateral suture.)

Legs black, femora brown within and outward at the base.

Wings hyaline, costal border finely yellow; 2 cubital nervures in the forewing; anal border of hind very oblique; pterostigma yellow, 2·5 to 3 mm. slender, over 3½ cells, not braced; membrane absent; nodal index 16/17 antenodals, 14 postnodals.

Abdomen with large rounded oreillets on the second segment, bearing minute black denticles along the hinder border. Abdomen black marked with bright yellow as follows:—Segment one with a triangular dorsal spot, segment two with a bilobed dorsal spot, 3 to 7 with only the dorsal carina finely marked, but segments 6 and 7 with larger basal spots, the sides of segments 1 and 2 broadly yellow, 3 to 8 with baso-lateral spots tapering apicalward, 8 and 9 with apico-lateral spots, 10 unmarked.

Anal appendages. Superior 1·5 mm. long, rather longer than segment 10, white turning to brown at the tips, flat and very broad as seen from above, converging at extreme base, turning at first out and then in, so as to enclose a minute foramen, the tips nearly touching, an outer tooth near the base, expanding immediately after this and with the extreme tip turned up and out. Laterally the appendage thickened at its middle, truncate at the end, the tip rising almost perpendicularly. The two appendages are lyrate and may be likened to the curling horns of a cow.

Inferior appendage only about half the length of superiors, broadly cleft and forked, the tips of its branches projecting latterally from beneath the superiors.

Habitat. Ceylon in montane or submontane areas such as Rhambodah. The type, a male, is the only specimen known of this insect, but I have a single male in my collection from Kallar, South India, which seems to fall midway between this and the next species to be described. Type in the Hagen collection.

Heligomphus promelas (Selys) (*Gomphus promelas*) Bull. Acad. Belg. (2), xxxv. p. 759 (1873) ; Kirby (*Aeshna promelas*), Cat. Odon., p. 68 (1890) ; Will. Proc. U.S. Nat. Hist., l.c., p. 305 (1907) ; Laid. l.c., p. 398 (1922) ; Fras. l.c., pp. 416–417 (1922), and p. 473 (1924), (*Heliogomphus pruinans*).

Male. Abdomen 42 mm. Hindwing 32 mm.

Head black marked with yellow ; labium yellowish brown ; labrum black marked with two basal greenish yellow spots whose opposing borders are concave ; mandibles greenish white ; face black, the frons marked above with a greenish white transverse stripe ; occiput black, depressed ; eyes bottle-green.

Prothorax black, the posterior lobe, a geminate spot in front of it, and an anterior collar yellowish green, beneath pruinosed white.

Thorax black on the dorsum, greenish yellow on the sides marked as follows :—A complete metothoracic collar, short antehumeral stripes not quite reaching the alar sinus above and not nearly reaching the mesothoracic collar below, parallel with the middorsal carina. Laterally the two sutures mapped out in black. Beneath and below pruinosed white, especially in very adult specimens.

Legs black, the hind femora armed with a row of very closely-set, very small spines.

Wings hyaline, occasionally slightly enfumed ; pterostigma blackish brown, very rarely braced and then only poorly so and not usually in more than one or two of the wings ; only a single cubital nervure to all wings ; costal side of trigone of hindwing twice as long as the basal ; nodal index $\frac{11-15}{12-11}\frac{15-12}{12-12}$, other points as for genus.

Abdomen black marked with pale greenish yellow as follows :—A narrow middorsal stripe extending from segment 1 to 5, thickest on 2 where it may be lobulated, a large lateral spot on segment 1 and a similar, but larger one, on segment 2 which envelops the oreillett, small baso-lateral spots on segments 3 to 6, growing progressively smaller as traced from segment to segment, 7 with a ring occupying about its basal third, lastly an occasional dorsal spot on segment 8, remaining segments entirely black.

Anal appendages lyrate as for genotype. Superiors black at base, pale green to yellow at apices, which curl first in, then out and up. Inferior black.

Genitalia : lamina very depressed, deeply bifid, hood-shaped ; inner hamules narrow, stillete-shaped, pointed ; outer much more robust, elongate, the inner side of apex curling slightly up ; vesicle of penis black, globular, rather prominent, its upper border narrowly but rather deeply notched.

Female. Abdomen 39–42 mm. Hindwing 35–38 mm.

Very similar to the male but more robust. Occiput simple, depressed. The antehumeral stripes rather longer and sometimes confluent at a point with the mesothoracic collar. The yellow spots on the sides of abdomen more extensive, those on 3 to 6 extending from base to the transverse suture and on 3 to 5 continued after a short interruption as an elongate spot which does not quite reach the apical border of segments. On segment 6 there may be a vestigial medio-lateral spot.

Legs with longer spines on the femora. Vulvar scale triangular, extending for about one-third the length of segment 9, glossy black.

Wings usually distinctly saffronated at the extreme base, broader, nodal index $\frac{12-15}{13-11}\frac{15-11}{12-13}$. Anal appendages black with inner yellow stripe.

Distribution. Nilgiris, Coorg and Kanara. I described this species from a single pair taken at Burliyar, Nilgiris, South India, 1,500 ft., 29, vii. 21, under the name of *H. pruinans*. Subsequently whilst endeavouring to place *Gomphus promelas* Selys, which was described from a single female from 'Madras', I was struck by the extreme improbability of such a species being taken at sea-level, and conjectured that the Presidency and not the city had been meant for the locality given.

Knowing that most of the types of Odonata coming from the presidency had been taken in the Nilgiris, I read over the description with all female Gomphines coming from the Nilgiris and found that it compared exactly with *H. pruinans*.

As the old Ghat Road by which all Madras civilians travelled to the Hills, traversed the bed of the Burliyar river at the spot where I had taken *H. pruinans*, I have little doubt but that the type of *promelas* was taken at the same spot.

The insect is comparatively rare in the Nilgiris, but is equally common in Coorg, especially in the river running through Hallery Estate, six miles from Mercara, 3,000 ft. It also breeds in the upper course of the Sampaji river, Mangalore Ghat.

Heliogomphus ceylonicus (Selys) (*Gomphus ceylonicus*), Bull. Acad. Belg. (2) xlvi, p. 455 (1878); Kirby, Cat. Odon. (*Aeshna ceylonica*), p. 68 (1890); Will. l. c., p. 305 (1907); Laid. l. c., p. 399 (1922).

Male. (Female unknown) Abdomen, 41 mm. Hindwing 39 mm.

The close resemblance of this species to the female of *promelas*, and the unbraced character of the pterostigma places it without doubt in genus *Heliogomphus*. Although clearly very closely related to other species, it differs in so many respects that it deserves to retain its specific rank.

Head, labium pale brown; labrum black marked with two basal yellow spots; base of mandibles yellow; ante- and post-clypeus black, the latter with a medial yellow spot and another on each side against the eyes; frons black with its crest broadly yellow; upper surface of head black including the occiput, which is fringed with long, black hairs, is slightly raised in the middle in a small, triangular obtuse point and has six teeth near the eyes, finally a rough tubercle behind. Back of eyes glossy black with a spot of bright yellow at the middle. (Prothorax undescribed.)

Thorax black marked as follows:—A broadly interrupted mesothoracic collar, narrow, oblique antehumeral stripes not extending as far as the alar sinus above or the mesothoracic collar below, a small upper humeral spot. Laterally greenish yellow marked by two narrow-black stripes on the lateral sutures. All these stripes confluent below at the trochanters.

Wings hyaline; pterostigma large, broad, pale yellow (possibly teneral), 3–4 mm. long, over 3–4 cells, unbraced; nodal index 14-16/16-14.

Abdomen shaped as for genus, black marked with yellow as follows:—A fine middorsal line running from segment 1 to 6 tapering apicad on segments 1 and 2, finer on remaining segments and not extending quite to apex of segment 6. Segment 6 with a broader and basal marking. The sides of 1 and 3 broadly yellow, 4 to 9 with small baso-lateral spots, a larger one on each side of 7.

Legs black, armed as for genus.

Anal appendages and the conical protuberance between them black. Distribution. Ceylon. A single female from the Rhambodah Pass, collected by Mr. Nietner. Selys remarks that the species is closely related to *promelas*. The differences between this and other species are tabulated below.

Heliogomphus walli sp. nov.

Female. (Male unknown). Abdomen 38 mm. Hindwing 36 mm.

Head, labium dark yellow, the lobes tipped with brownish black; labrum black with two large triangular yellow basal spots; rest of face, frons and upper surface of head black save for a narrow yellow stripe on crest of frons, which is narrowly interrupted at its middle. Occiput simple, naked; back of eyes glossy black, unmarked with yellow.

Prothorax black, a narrow anterior collar yellow.

Thorax black marked with yellow as follows:—A very deep mesothoracic collar not interrupted at its middle, very short oblique antehumeral stripes widely separated from the alar sinus above and from the mesothoracic collar below; no upper humeral spot. Laterally the sutures narrowly mapped out in black.

Wings hyaline, very palely enfumed; pterostigma blackish brown, over 4½ to 5 cells, poorly braced in two wings, unbraced in the others; nodal index $\frac{13\text{-}16|17\text{-}14}{13\text{-}11|12\text{-}12}$; 2 cubital nervures in three of the wings, 1 in the other (hindwing); sectors of arc fused for a short distance at origin; three rows of postanal cells in hindwing.

Legs black, hind femora dark yellow, paler within, armed as for genus.

Abdomen black marked with yellow as follows :—Segment 1 with a broad triangular apical spot on dorsum and the lower part of the sides from level of oreillet ; 3 to 6 with the middorsal carina finely yellow and a broadish yellow stripe on the ventral border, which is interrupted slightly by the transverse suture on segment 4, more widely so on segments 5 and 6, segment 7 similar, but both dorsal and lateral stripes considerably broader, the baso-lateral part of stripe expanding into a spot ; remaining segments unmarked.

Anal appendages pale yellow, small, conical.

Vulvar scale barely one-third the length of segment 9, triangular, slightly bifid at apex, black. (A few eggs attached to it are pale yellow, narrow, oval and with rounded ends.)

Distribution. A single female collected by Col. F. Wall, I.M.S. at Nalande, Ceylon, 10. ix. 24. Type will be deposited in the B. M.

Closely related to *ceylonicus*, *nietneri* and *promelas*.

Heliogomphus selysi, sp. nov. (*Leptogomphus nietneri*) Selys, *Odonates de Birmanie*, Ann. Mus. Civ. Genov., xxx. (1890) ; Laid. (*Heliogomphus nietneri*), l. c., pp. 379, 380 (1922).

Male. (Female unknown). Abdomen 32-35 mm. Hindwing 28-30 mm.

Head, labium dark yellow ; labrum glossy black with two small triangular basal whitish green spots ; bases of mandibles greenish yellow ; rest of face, frons and upper surface of head black save for a transverse stripe of yellow on crest of frons constricted at its middle.

Occiput simple, low, slightly convex, fringed with short hairs.

Prothorax black, a geminate spot in front of posterior lobe, a small lateral spot and a narrow anterior collar of yellow.

Thorax black, marked as for *promelas*, the mesothorocic collar usually finely interrupted.

Legs black, armature of femora as for genus.

Wings hyaline ; nodal index 11-16/15-12 ; 2 cubital nervures in all wings ; pterostigma short, over 4 to 5 cells, dark brown.

Abdomen black marked with greenish yellow as follows :—A fine dorsal stripe from segment 1 to 6, becoming very obscure on segment 4, and variably present or absent on 5 and 6. Laterally segments 1 and 2 including the oreillets broadly yellow, a baso-lateral spot on segment 3, remaining segments unmarked.

Anal appendages. Superior yellow or in some specimens blackish brown at the base, pale yellow thereafter, the outer tooth at the base more robust than in *promelas*. Inferior black, as for *promelas*.

Distribution. The type is a male from Leito, Burma, collected by Mr. Fea and now in the Selysian collection. A pair belonging to the same species in the Indian Museum Collection, Calcutta, collected by Dr. Kemp (No. H7977/Hi), from the Garo Gills, Tura, Assam, 1,500 ft., have been described by Laidlaw, who expresses doubt as to whether they are really conspecific with *nietneri*. Mr. T. Bainbrigge Fletcher has also taken this insect on the Gauhati road near Shillong, Assam, 1000 ft., 2. viii. 19. This species appears to be the sole representative of its genus in Northern India and Burma ; it is easily distinguished from all others by the total absence of abdominal markings after segment 4. In the following table, the specific points of all five species are shown:—

Heliogomphus nietneri (Selys). Upper humeral spot present which character it shares with the next species ; 2 cubital nervures, and well-marked lateral abdominal stripes as far as segments 8 or 9.

Heliogomphus ceylonicus (Selys). Upper humeral spot present, a lateral spot on the postclypeus (only present in this species), and the mesothoracic collar broadly interrupted.

Heliogomphus selysi sp. nov. Has the transverse stripe on crest of frons constricted at its middle, the mesothoracic collar interrupted, no lateral yellow markings after segment 3 and no markings whatever after segments 5 or 6, lastly there are 2 cubital nervures in all wings.

Heliogomphus promelas (Selys). Mesothoracic collar interrupted or entire, antehumeral stripes very long, longer than in any other species of the genus and occasionally even confluent below with the mesothoracic collar, lastly segment 7 with a broad basal yellow ring (only present in this species).

Heliogomphus walli sp. nov. Has the lateral abdominal markings very well developed as far as segment 7, none on segments 8 or 9, the meso-thoracic collar unusually deep and broadly confluent, the hind femora dark yellow, paler within (the only species in which the legs are not entirely black), 2 cubital nervures in most wings, lastly the transverse stripe on crest of frons interrupted (the only species in which it is so.)

Genus—MICROGOMPHUS SELYS.

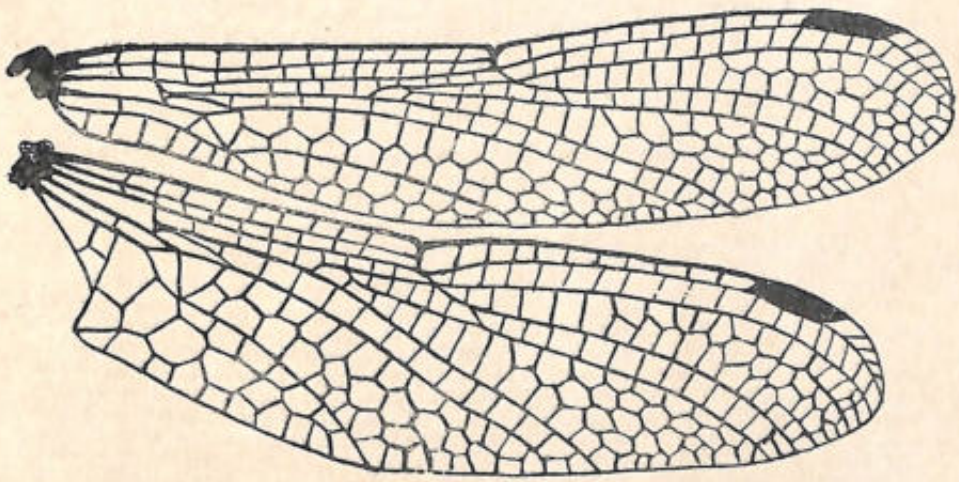


Fig. 2.

Fig. 2. Wings of *Microgomphus torquatus* (Selys) male.

Insects of small size, the smallest within the family *Gomphidae*, breeding in streams in submontane areas in the oriental region.

Venation. Wings of moderate length, narrow : reticulation close ; base of hindwing very oblique, shallowly excavate ; costa uncoloured ; pterostigma braced or only poorly so, about one-fourth the length of distance between the node and distal end of pterostigma ; incomplete basal antenodal nervure absent : arc between the first and second antenodal nervures ; sectors of arc approximated immediately after their origin ; 1 cubital nervure to all wings ; 1 row only of postanal cells in forewing 2 to 3 in the hind ; first postanal cell in hindwing entire, extending basad for only about half the length of subtrigone ; 5 to 6 transverse nervures between *Mi-iii* and *Miv* in forewing, 3 to 4 in the hind ; forking of *Mi-ii* and *Miii* unsymmetrical in all wings ; 1 row of cells between *Mi* and *Mia* ; 3 rows of discoidal cells in forewing at level of node ; *Cuii* slightly pectinate, one or two rows of cells between it and hinder margin of wing in the male, 2 in the female ; trigone of hindwing subequilateral, costal and basal sides almost equal, proximal side often slightly but distinctly angulate—this character also being shared by the trigone of the forewing ; all trigones entire.

Head narrow from before back, transversely elongate, but not to the extent seen in *Heliogomphus*.

Legs slim, moderately long, overlapping base of second segment, armed in the male with rows of very closely-set, very minute, evenly-sized spines (serrate), in the female with robust, widely-spaced, rather long, sub-equal spines (pectinate.)

Abdomen tumid at the base, very slim and cylindrical from 3 to the apical end of segment 7, slightly widened and dorso-ventrally expanded from the apical half of 7 to 10.

Anal appendages. Superior chelate, rather widely divaricate, with an inner branch which gives them the chelate appearance, longer than segment 10 ;

inferior variable, slightly or much shorter than superiors, slightly bifid at apex or subtriangular with subacute apex.

Genitalia. Hamules rather long, vesicle of penis tumid, approaching that of *Cyclogomphus* but not nearly so exaggerated. Vulvar scale well-defined, triangular, extending for nearly half the length of segment 9, the extreme apex bifid.

Distribution. Throughout the oriental region, in regions of heavy rainfall, in montane and submontane areas only. Within Indian limits from the Western Ghats and west of the Deccan, Burma and Assam.

Species of this genus are arboreal by nature, but they often descend to settle on rocks in the bed of their parent streams, from which, when disturbed, they rise to the branches of trees high overhead. Settled in such situations, their shagreen colour renders them remarkably inconspicuous. Flight although short, is swift.

Genotype.—*Microgomphus chelifer* Selys. (Malaysia.)

Microgomphus torquatus (Selys) *Cyclogomphus torquatus*, Bull. Acad. Belg., xxi (2), p. 63 (1854) ; Kirby (*Cyclogomphus torquatus*), Cat. Odon., p. 69 (1890) ; Mon. Gomph., p. 108 (1857) ; Will (*Cyclogomphus torquatus*) l. c. p., 297 (1922) ; Laid. (*Microgomphus torquatus*) l. c., pp. 380-383 (1922) ; Fras. l. c., p. 474 (1924).

Male. Abdomen 22-24 mm. Hindwing 21 mm. (Pl. fig. 4.)

Head. Labium yellow ; labrum greenish yellow, the base and front border narrowly black, the basal marking produced as a triangular mark in the middle line ; frons, bases of mandibles, ante and post-clypeus greenish yellow, the frons with a broad black transverse stripe where it joins the postclypeus and sending downwards a short oblique submedial prolongation on the postclypeus at either side ; vertex and occiput black, the latter with a low, slightly concave crest which is bordered with about ten minute spines.

Prothorax black with an anterior collar, a small medial spot on the posterior lobe and a larger spot on each side yellow.

Thorax black marked with yellow as follows :—A complete mesothoracic collar which is confluent with a fine line of yellow on the lower part of the middorsal carina, a very oblique fusiform antehumeral stripe not confluent with the mesothoracic collar, nor reaching the alar sinus above. An upper humeral spot which splits the humeral black above so as to form an upright black 'Y'. Laterally greenish yellow marked by a black stripe on the posterior suture, which is joined at its middle by a narrow oblique black line descending from beneath the forewing and is thus converted into a second black 'Y'.

Legs black, the hind femora striped on the extensor surface with greenish yellow which tapers apicad, hind femora armed as for genus.

Wings hyaline ; pterostigma pale brown between black nervures, unbraced, over four cells ; three rows of postanal cells in forewing ; nodal index $\frac{9\text{-}12}{9\text{-}10}\ \frac{12\text{-}8}{9\text{-}8}$.

Abdomen black marked with bright greenish yellow as follows :—Segment 1 with an apical spot on middorsum, narrowly confluent with a broad lateral fascia along the apical border of segment, segment 2 with a middorsal bilobed spot not quite reaching the apical border, the sides broadly yellow including the large oreillets, the subdorsal black curving down behind the oreillets, segment 3 similarly marked, but the lateral yellow usually finely divided by the black transverse suture, 4 and 5 with broad basal rings occupying about one-third the length of segments, a longitudinal oval spot on the middorsal carina at the middle of each segment, segment 6 similar but the dorsal spot absent, the basal ring on the sides overlapping the transverse suture for a short distance, segment 7 with its basal half or more yellow, this colour extending nearer the apical border on the sides than on the dorsum, segment 8 very similar to 7 allowing for the difference in length and breadth of the segments, segment 9 with only a small ventro-lateral medial spot, 10 unmarked.

Anal appendages as for genus, superiors yellow tipped on the outer side and bordered beneath with black, conical, tapering to a fine point, rather longer than segment 10, furnished with fine finger-like branches on the inner side, which spring from a point slightly basal to middle of appendage and

converge inwards until their apices meet slightly before the level of the apex of superior appendages. Inferior black shorter than superiors, subtriangular, the apex markedly bifid, the two branches turning rather abruptly outward. (Fig. 3. 2.)

In many specimens the superior appendages have a minute but distinct spine present on the outer side near the apex, but it does not appear to be at all constant.

Genitalia : lamina black depressed deeply notched in a rounded arch ; inner hamules slim, spine-like, shorter than outer which are robust, parallel-sided, with the outer corner acutely spined and project back and down from the genital sac, yellow at base, black at apex ; lobe of penis bulbous black, deeply notched, very prominent.

Female. Abdomen 27 mm. Hindwing 23 mm.

Closely resembles the male, but more robust and larger. Occiput shallowly concave, with 4 to 5 minute black spines bordering it on either side of the middle line.

Lateral markings of abdomen more extensive, segments 4 to 6 with a long oval spot on the middle of each side. The middorsal oval spot on segment 5 absent ; segment 7 with the lateral yellow finely divided by the black transverse suture, 8 with the basal ring interrupted on the middorsal carina.

Anal appendages very small, yellow, conical, pointed.

Wings saffronated at the bases ; nodal index $\frac{9\text{–}13\,|\,12\text{–}8}{8\text{–}10\,|\,9\text{–}9}$; two rows of cells between *Cuii* and the hinder margin of forewing.

Vulvar scale bright yellow, triangular, half the length of segment 9 bifid for half its length, the branches closely apposed.

Distribution. The western parts of the Deccan, Poona and Satara. The type, a female in the Selysian collection, probably comes from the former locality, where I have found it rather common during the wetter months of the year. Males may be seen resting on stones or rocks in the bed of the Byrobah Nullah and also in the neighbouring canal and Mullah River, or they may be beaten up from evergreens bordering these streams.

Microgomphus souteri Fras. (*Microgomphus torquatus souteri*) l.c. p. 474 (1924). (Pl. fig. 5.)

I had regarded this species as a subspecies of *torquatus*, but now, with more material available, see that the differences are so broad that the relationships must be much wider than I at first thought them to be.

Male. Abdomen 29 mm. Hindwing 24 mm.

Head. Labium pale yellow ; labrum glossy black with two large triangular greenish white spots nearly confluent at the middle of labrum and separated from the front border by a narrow stripe of black ; anteclypeus greenish white ; postclypeus and front of frons glossy black, the lower outer part of the former greenish white continuing the colour of the anteclypeus as a transverse stripe, which traverses the whole face at that level ; upper surface of frons greenish white, vertex and occiput black, latter slightly concave, fringed with yellow hairs but no minute spines visible ; eyes bottle green.

Prothorax black with a broad greenish yellow anterior collar.

Thorax black, markings differing from those of *torquatus* as follows :— The mesothoracic collar slightly interrupted in the middle, the middorsal carina unmarked with yellow bellow, no upper humeral spot, antehumeral stripes narrower and shorter, finally the black stripe on the postero-lateral suture is broader, and usually so broadly confluent with the shorter oblique stripe that the enclosed yellow ground colour is generally blotted out. Legs entirely black.

Wings not differing from those of *torquatus*, but reticulation closer and nodal index higher $\frac{9\text{–}15\,|\,16\text{–}11}{12\text{–}11\,|\,11\text{–}11}$.

Abdomen black marked with greenish yellow as follows :—Segment 1 with a narrow apical border, 2 with a broad basal ring, which includes the oreillets and a short apico-lateral spot not always present, 3 to 6 with narrow basal rings occupying about one-sixth of the segments, 7 similar

but the ring occupying the basal third and laterally overlapping the transverse suture, 8 to 10 unmarked.

Anal appendages as for genus but differing markedly from *torquatus* as follows :—The inner branches are much longer, in that they not only spring from the appendages much nearer the base, but extend also beyond their apices. The small outer spine near the apex of superior appendages is much more noticeable. Inferior appendage more robust, slightly longer than in *torquatus* (Fig. 3. 1.)

Genitalia similar to that of *torquatus* but the apex of outer hamules curling forwards.

Female. Abdomen 28 mm. Hindwing 25 mm.

Very similar to the male, its markings differing in the same respects as does the female from the male of *torquatus*, thus there are lateral oval spots on segments 4 to 6 but much smaller than in *torquatus*, and segments 8 to 10 are without markings. The basal marking on segment 7 is strictly limited behind by the transverse suture.

Distribution. Confined to Coorg and South Kanara. Types in the B. M., paratypes in Mr. C. A. Souter's and my own collections. Habits similar to the last. Breeds in the Sampaji and Hallery rivers, Coorg, and I have also taken it on the Kibribetta stream, 2,000 to 3,500 feet.

The differences between this species and *torquatus* are so numerous and marked that it is hardly necessary to point them out, but it will suffice to mention that in the former the face is largely black, whilst in *torquatus* it is largely yellow, in the former also the abdomen has the abdominal markings much more restricted, the upper humeral spot absent and lastly the inner branch of the superior appendage springs from nearer the base and extends beyond the appendage.

Microgomphus burmicus sp. nov. (Pl. fig. 6.)

Male. Abdomen 31 mm. Hindwing 28 mm.

Head : labium pale whitish green, the middle lobe with its base and free border blackish brown ; labrum black with two large rounded whitish green spots situated at the outer corners (a very unusual situation for this marking) ; bases of mandibles greenish white and a transverse stripe of the same colour at middle of anteclypeus ; rest of face and upper surface of head glossy black except for the crest of frons which is greenish white, finely divided at its centre by a narrow isthmus of black. Occiput concave at its centre with a slight angular projection at its outer ends.

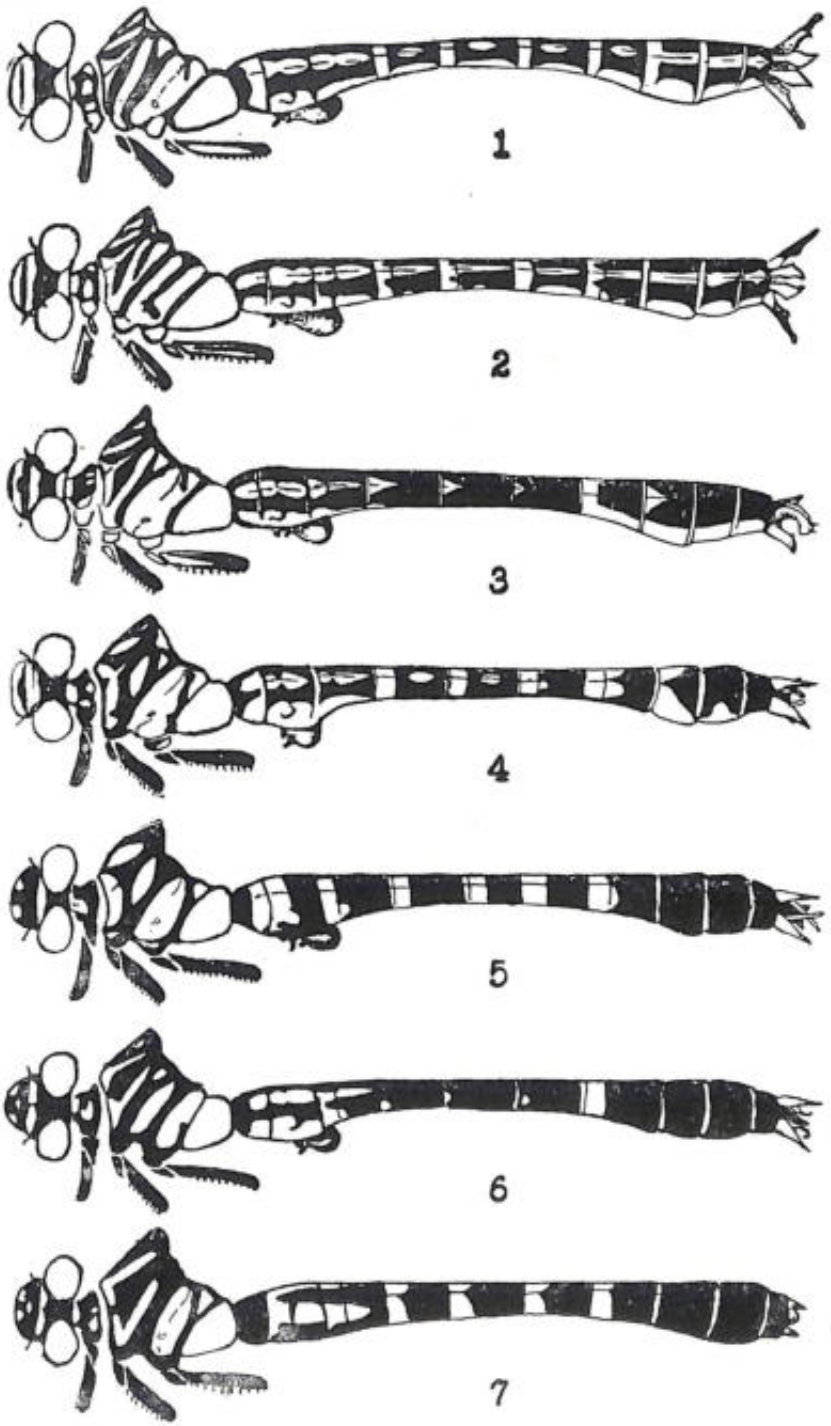
Prothorax black marked with greenish yellow as follows :—Very oblique broad antehumeral stripes which run from near the alar sinus and which are broadly confluent with an interrupted mesothoracic collar below, finally a small upper humeral spot ; the sides broadly greenish yellow marked with a broad black stripe on the first lateral suture and a short vestigial remnant of a similar stripe on the lower part of the second suture (another unusual type of marking).

Legs entirely black, armature as for genus and sex.

Wings hyaline, very palely enfumed ; pterostigma dark brown between black nervures, over four cells, short, unbraced, or the brace poorly developed and arising from the costa a short distance from the pterostigma ; nodal index $\frac{12\text{-}16}{12\text{-}12}\frac{17\text{-}11}{12\text{-}11}$; three rows of postanal cells in hindwing, two rows of cells between *Cuii* and the hinder margin of forewing, other details as for genus.

Abdomen black, marked with greenish yellow as follows :—Segment 1 with the sides broadly and a medial stripe on the middorsal carina, which is flanked by a broad black stripe subdorsally, segment 2 similar, the lateral yellow including the oreillet, the dorsal yellow on the carina tapering apicad and expanded at the level of transverse suture ; 3 with the middorsal carina finely yellow and a large ventro-lateral basal spot on each side, 4 to 6 with small triangular basal spots on each side, 7 with a broad basal yellow ring occupying the basal fifth, remaining segments unmarked. Segment 9 shorter than 8, and 10 shorter than 9.

Anal appendages as for genus, superiors very robust, widely divaricate, tapering to a point, greenish white tipped with black. From the middle of the inner side, a slim pale yellow branch springs and inclines inwards to meet its fellow from the opposite side, the extreme apex of each branch strongly



INDIAN DRAGONFLIES.

1. *Cyclogomphus ypsilon*, ♂
2. *C. wilkinsi*, ♂
3. *C. gynostylus*, ♂
4. *Microgomphus torquatus*, ♂
5. *Microgomphus souteri*, ♂
6. *M. burmicus*, ♂
7. *M. liliputians*, ♀

recurved outwards. The fusion of these branches with the main appendage is demarcated by a fine groove, so that it is easy to understand that an increase in the size and robustness of the branch with a corresponding atrophy of the distal part of the appendage, would result in the evolution of the lyrate appendages of *Heliogomphus* (from which genus *Microgomphus* is hardly separable and not at all on venational grounds). Inferior appendage triangular, not bifid as long as superiors, black (Fig. 3. 3.).

Genitalia : hamules broad, short, tipped by a small spine ; vesicle of penis bulbous, globular, black.

Female of the same size as male, very similar to the male in its markings, but these, on the abdomen, more extensive. On segments 3 to 6 a large triangular baso-lateral spot which extends to the transverse suture, beyond which, and only narrowly separated from the basal spot, is a narrow stripe extending almost to apex of segments. In one specimen there is also a minute basal lateral spot on segment 8.

Thorax and prothorax pruinosed white beneath, in adults.

Anal appendages short conical, pale greenish white.

Legs entirely black, armature as for genus and sex.

Wings palely enfumed in the adult, slightly saffronated at the base in tenerals ; nodal index $\frac{13\text{-}15|16\text{-}12}{12\text{-}13|12\text{-}12'}$ $\frac{11\text{-}16|15\text{-}10}{10\text{-}12|11\text{-}10}$, other details as for genus.

Distribution. One male and two females collected by Col. F. Wall, I.M.S., at Maymyo, Northern, Shan States, Upper Burma, 19-26. vi. 24 and 10. vii. 24. This species is remarkable for its large size (the largest known of the genus) and for the two unusual types of markings found on the labrum and sides of thorax. The two rows of cells between *Cuii* and the hinder margin of the forewing is clearly a response to the need of a greater wing area to support a weightier insect, and brings the venation of *Microgomphus* into line with that of *Heliogomphus*, insects of similar size to this particular species. The relationship of the superior appendages to this genus has already been commented upon above.

Microgomphus lilliputians, sp. nov. (Pl. Fig. 7.)

Female. (Male unknown.) Abdomen 20 mm. Hindwing 18 mm.

Head : labium pale yellow spots ; bases of mandibles yellow, ante and post-clypeus black, the former with a central oval spot, the latter with a yellow spot on each side against the eyes : frons with the crest traversed with yellow, rest of head including the occiput black, latter simple, sinuous, a little notched at its middle.

Prothorax with a small spot on the posterior lobe and a larger at the sides, otherwise black.

Thorax black marked with bright yellow as follows :—An interrupted mesothoracic collar, oblique antehumeral stripes which are broadly confluent with the mesothoracic collar and form with it inverted '7' s ; laterally greenish yellow marked on the postero-lateral suture by a thick black stripe, which by joining an oblique black shorter stripe, running from beneath the forewing, forms a black 'Y.'

Legs entirely black, spines on hind femora rather widely-spaced and more robust than usual in the genus.

Wings hyaline, saffronated at the bases, this probably an expression of their tenerality, reticulation rather close for so small an insect, trigones and subtrigones all angulated where joined by secondary nervures, sectors of arc apposed for a long distance, especially in the hindwings, discordal field in the forewings beginning with a single row of cells and continued as such for a distance of 3 rows, *Cuii* in forewings with only a single row of cells between it and hinder border (and only 6 cells in length), only 2 rows of cells in postanal area of hindwing : pterostigma brown, unbraced in two of the wings, poorly so in the others, over 3 cells ; nodal index $\frac{7\text{-}12|11\text{-}7}{8\text{-}8|9\text{-}7}$.

Abodmen black marked with yellow as follows :—Segment 1 wholly black, 2 with broad subdorsal longitudinal stripes confluent over the base of segment and finely divided transversely by the transverse suture, 3 with a continuation of these stripes which do not however extend as far as the apical border, 4 to 7

with broad basal rings extending as far as the transverse sutures, remaining segments unmarked.

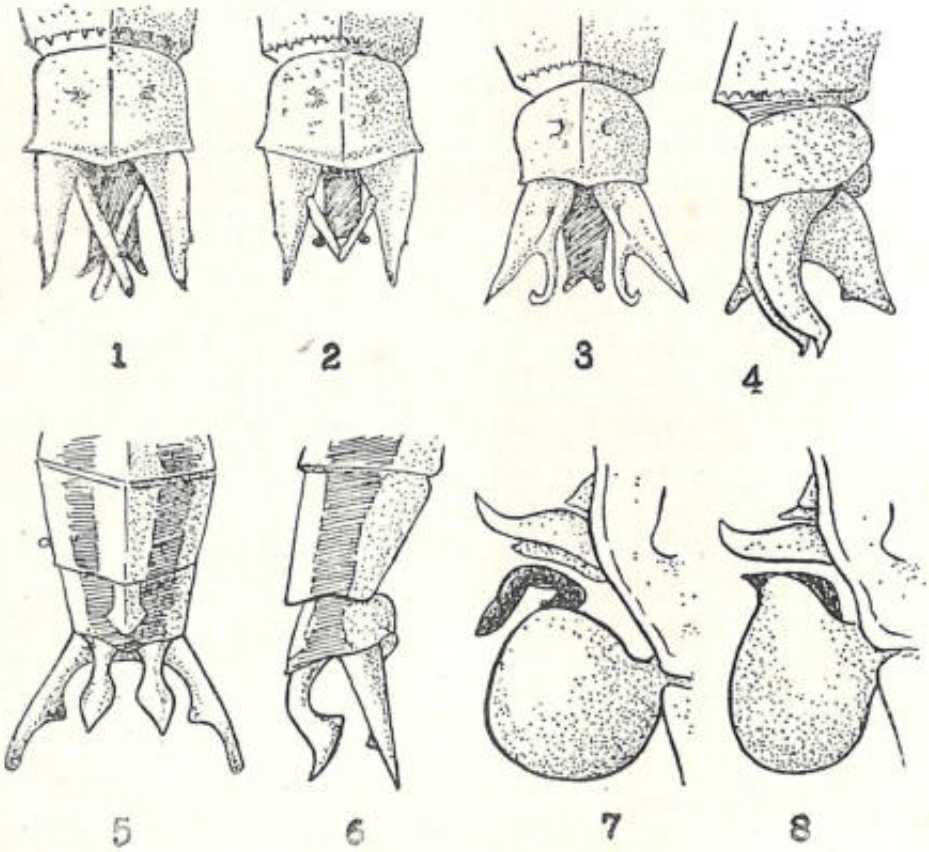


Fig. 3. 1. Anal appendages of *Microgomphus souteri* Fras, seen from above. 2. The same of *M. torquatus* (Selys). 3. The same of *M. burmicus* sq. nov. 4. Dorso-lateral view of anal appendages of *Cyclogomphus gynostylus*, male, sq. nov. 5. Anal appendages of *C. wilkinsi* sq. nov. seen from above. 6. The same seen from the side in profile. 7. Genitalia of *Cyclogomphus wilkinsi*, lateral view. 8. The same of *C. ypsilon* Selys.

Anal appendages small conical, yellow tipped with black.

Vulvar scale rudimentary.

Distribution. A single female from Tenasserim, Lower Burma, 18. iv. 23.

This species, which is the smallest known Gomphine, closely resembles *Tetrathemis platyptera* in size and general appearance, and in several respects, in its neuration also, thus the discoidal field beginning with a single row of cells. The only species likely to be confounded with it, is *Microgomphus chelifer* from the Malay Peninsula, which is somewhat larger, has a higher nodal index, the lateral thoracic stripe simple and not 'Y' shaped. The two are closely related and may even be conspecific. *M. lilliputians* is the only species in which the discoidal field of forewing begins with a single cell and it is the only female which has only one row of cells between the hinder margin of forewing and *Cuii* (in so far as I have examined). Just as we notice an increase in this latter area in the male of the former species *M. burmicus* to accommodate its greater weight, so here we see a corresponding decrease in response to the lessening need for a large wing area.

Microgomphus verticalis (Selys) (*Cyclogomphus verticalis*) Bull. Acad. Belg. (2) xxxvi, p. 501 (1873) ; Kirby, Cat. Odon. pp. 296–297 (1907).

Female. (Male unknown) Abdomen 27 mm. Hindwing 25 mm.

Similar to *M. torquatus*, differs only by the markings being less extensive, especially of the face, which is largely black.

Labrum with the yellow entirely enclosed as two large spots ; ante and post-clypeus black with a medial spot of yellow and another on each side against the eyes. Frons similar but the vertex marked by a small yellow spot between the eyes.

The short description given by Selys, meagre as it is, clearly shows this species, which he classed as a *Cyclogomphus*, is really a *Microgomphus*, and that it is closely related to, if not conspecific with *torquatus*. The whereabouts of the type is unknown, but it was said to be in the Moore collection, and is given as from ' India '.

(*To be continued*)

NOTE ON A NEST OF THE COMMON INDIAN HORNET *VESPA CINCTA* FABR.

BY

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[*Read at the twelfth meeting of the Indian Science Congress held at Benares, and published with permission of the Director, Zoological Survey of India.*]

(*With a plate.*)

The nest with which the present note deals was recently acquired by the Zoological Survey of India, and is now being exhibited in the public insect gallery of the Indian Museum. It is believed to be one of the largest, if not the largest, specimen of its kind so far recorded.

The nest was found attached to the stem of a small Bael tree (*Aegle marmelos*) in a garden in South Intally, Calcutta. It was fixed at a height of about 4 feet from the ground, and was full of hornets of the species *Vespa cincta* at the time. So far as can be ascertained the hornets started building this nest in spring last year (1924). It was first noticed in March, and being no larger than a *bael* fruit was mistaken for it; in May it was the size of a man's head, and towards the end of October had attained its maximum size—over 3½ feet from top to bottom.

The nest was principally attached to the tree-trunk on one side near its (nest's) base, but it was also fixed to a fairly stout branch at its apex. Besides this several small branches passed right through the nest and gave it a fair amount of additional support.

The nest, as seen in the accompanying illustration (fig. 1) is perfectly pear-shaped. It is about 109 cm. long from apex to bottom, and over 64 cm. at its greatest breadth near the base. The outer envelope with its striking pattern of incomplete concentric circles completely encloses the nest, except at two nearly circular openings on the two sides near the base. Both of these serve for ingress and egress of the hornets, and the smaller of the two is seen in the reproduction.

The envelope, as is usual in the family *Vespidae*, is made of some papery material, which is believed to be a mixture of chewed wood and some glandular secretion. In nests of most hornets the envelope is made of some extremely soft and delicate material, but in the present case it was hard enough to stand a fair amount of rough weather. The present nest no doubt stood successfully the full force of the Calcutta monsoon for a whole season, and was in a perfect weather-proof condition at the time of its discovery.

On breaking open the envelope (fig. 2) on one side we see tiers of combs lying horizontally one above the other, and

NEST OF THE COMMON INDIAN HORNET *Vespa cincta* Fabr.

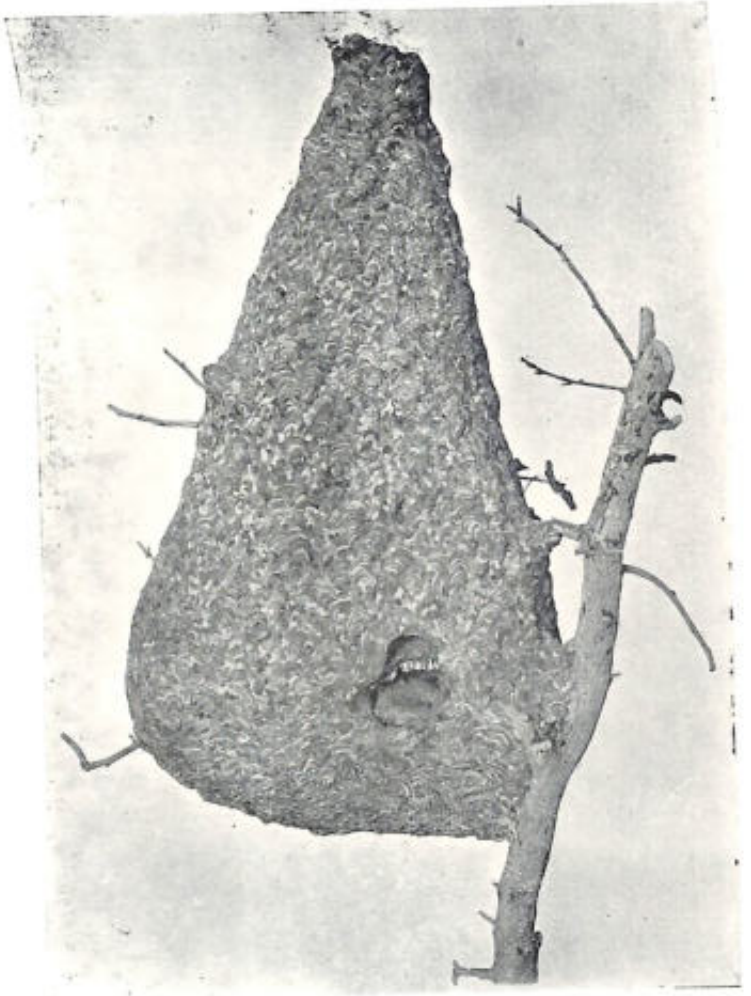


Fig. 1.



Fig. 2.

(For explanation see end of article.)

supported by short vertical pillars formed in between respective tiers. The combs consist of a very large number of cells and are the habitations of thousands of adults and young members of this vast colony. The lower three or four tiers of combs are seen to be full of larvae and pupae, while the upper ones which appear deserted, are evidently used by the adults. The cells housing the pupae are covered at their mouths with silken caps. The combs are not attached to the envelope, but there is a large amount of space left between the two, so that access is available to each comb all round. The envelope, especially in its upper parts, is several layers thick, and in its structure contains a net-work of air-pockets which give the appearance of tunnel-like passages connecting the upper tiers with the general space round the basal combs. I am unable to say whether these passages are used by the hornets or not, but as, on killing the colony with potassium cyanide, several of them were found lying dead in these passages, it is quite possible that they form at least a secondary means of communication.

Vespa cincta is a common species in the plains of India, but is not quite so common as the smaller *V. orientalis*. The latter is known to build very large nests, but, so far as I am aware, no large nest of the former has so far been recorded. *V. cincta* generally lives in thick forests, and is said to build its nests in the holes of large fig and other forest trees.

De Saussure,[1] the monographer of social wasps, has classified them according to the architecture of their nests. The classification is far from satisfactory, but is still the only standard work of its kind. I do not propose going here into the details of this classification, but according to de Saussure *V. cincta* would come in his principal class *Stelocyttares*, sub-class *Calyptodomes*. These wasps have nests which are characterized, among other things, by the possession of an envelope, which is not attached to the combs, and by the combs being supported on one another by vertical pillars. The sub-class *Calyptodomes* has two types depending upon the nature of the envelope. In the first the envelope is 'foliacée, composée de feuillets concentriques' while in the second the envelope is 'celluleuse'[2] *V. cincta* with its nest having an envelope formed of several leaf-like layers would seem to belong to the first category. There is still another division based upon the mode of attachment of the nest. When the nest is supported by a central pedicle the term 'rectinides' is applied, but if the support is lateral the nest is 'letérinide.' There are still further sub-divisions, but it would be useless to discuss them here.

Savin[3] has quite recently written an interesting note on the nests and habits of some American social wasps. The paper, though it contains some good photographs of Vespid nests, deals chiefly with the common yellow wasp *Polistes*.

[1] De Saussure, *Monographie des Guêpes Sociales*, pp. cc. and 256, pls. i-xxxvii, Paris and Geneva (1853-1858).
[2] De Saussure, *op. cit.*, p. lvii.
[3] Savin, *Nat. Hist.*, xxv, pp. 81-86 (1925).

In the end I would like to express my appreciation of the way in which Mr. R. Hodgart, the energetic collector of the Zoological Survey, in spite of the risk involved in it, managed to bring this very interesting nest to the Museum intact.

Explanation of Plate

Both the figures are from direct untouched photographs of the nests.

1. Complete nest, showing the smaller opening for the entrance and exit of the hornets.

2. The same, with a part of the envelope removed on one side to show the air pockets in the upper portion and the tiers of combs in the lower. The vertical pillars between the various tiers are also visible.

AN ANNOTATED LIST OF THE THYSANOPTERA KNOWN FROM INDIA AND CEYLON

BY

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In 1919 the writer published a small note [1] on Indian Thysanoptera, and it may be gathered from it that prior to 1912 hardly anything of importance was known or on record regarding the Indian representatives of the group Thysanoptera, in spite of the fact that the group is one of the major divisions into which insects are divided and that members of this group are very commonly met with all over India; and naturally therefore, practically no attention appears to have been devoted to the scientific or economic importance of these insects in India. In fact the Indo-Ceylonese region practically remained a *terra incognita* to Thysanopterists till the year 1912. Prior to this period we have only two records, one of two Indian forms described by Newman [2] in 1856, viz. *Idolothrips halidayi* and *Phlœothrips anacardii* collected on a species of *Anacardium* in Mysore, and another in 1909 by Kieffer ('*Cecidothrips*' from Trichinopoly, S. India) in 'Marcellia' VII. In his monograph of the order mostly including European forms, Uzel [3] has just copied the two descriptions of Newman without any further record from India, but adding one species from Ceylon *Phlœothrips stenomelas*, Wlk., the description of which is also copied from that of Walker (A. M. N. H. 1859). In 1912 Mr. Bagnall the eminent English Thysanopterist described [4] an interesting species of thrips *Panchætothrips indicus* from material collected and sent to the Indian Museum by the Madras Revenue Board in 1889. From the year 1913 onwards our knowledge of Indo-Ceylonese forms gradually began to increase as may be found from the series of systematic papers [5] on the group published by Bagnall since then. However, all forms recorded by him up to 1919, are only North Indian and Ceylonese ones, and none from South India. With regard to South India a regular collection and a study of the bionomics of South Indian Thysanoptera might be said to have commenced in 1915 when the material of 'Paddy thrips' collected by the writer and forwarded to the Imperial Bureau of Entomology, London, was described by Mr. C. B. Williams [6] as a new species *Thrips* (Bagnallia) *oryzae*. Since then all records from South India refer to material brought together by the writer and mostly collected by himself. In 1916 a small lot of South Indian forms was forwarded to Mr. J. D. Hood, the well-known American expert on the order, and he published in 1919 a paper [7] based on that material, and this may be regarded as the first connected paper on South Indian Thysanoptera. Meanwhile, Mr. Bagnall also kindly undertook to help, and material was submitted to him in 1919. Though he has not been able to work out the whole lot sent to him, he has been publishing descriptions of some new forms from the material, on and off since 1919. As to Ceylonese forms of the order, a fairly good number have been described by Bagnall in his

[1] On our present knowledge of 'the Indian Thysanoptera and their economic importance.' pp. 618–22. Report of the 3rd Entomological Meeting at Pusa in 1919-20.

[2] Transactions of the Entomological Society, London, 1856.

[3] Monographie der Ordnung Thysanoptera by Heinrich Uzel, Koniggratz, 1895.

[4] Records of the Indian Museum, p. 257, Vol. VII, 1912.

[5] Bagnall's serial papers on the group began with paper No. 1 in 1913 and No. XIV appeared in December 1924; all in the Annals and Magazine of Natural History, London.

[6] p. 353, Bulletin of Entomological Research, Vol. VI, London, 1915.

[7] 'On some new Thysanoptera from South India by J. D. Hood, pp. 90 103. Insecutor Insectiæ Menstruus,' xii, 1919, Washington.

serial papers in the Annals. The only connected paper on ceylonese forms, however, is that of Karl Schmutz [1] in 1913 ; the descriptions and synonymy in this paper have, however, been somewhat severely criticized by other workers, chief among them being Dr. Karny, the famous Austrian specialist on the group.

In this paper an attempt is made to catalogue the known Thysanoptera of India and Ceylon as a working reference list, and as a sort of preliminary preparation for detailed papers, whenever possible in future, on the systematics and bionomics of the Thysanoptera inhabiting the Indo-Ceylonese region.

All records as far as possible up to 1924 have been included here and it is believed the list is more or less up to date. The records include species so far known from the region divided among 47 genera. Of these about half a dozen are recently erected genera and all species except about half a dozen are new to science. Compared to the 3 or 4 forms alone that were known from the region in 1912, this addition must be admitted to be substantial. There is hardly any doubt that a good many new forms will be described from the author's unworked material [2] (a good portion of which is now with Dr. Karny in Java), while numerous unexplored tracts of the country are sure to contain novelties awaiting the discovery of enthusiastic workers.

Now that the importance of this order of insects, both from the scientific and economic aspects, is beginning to be realized, it is hoped, that these insects might receive the attention they really deserve, and it is believed that this list, with all its inevitable shortcomings, may serve some useful purpose, at least to those who might contemplate working at this group. The author is greatly indebted to Messrs. Hood, Bagnall, and Dr. Karny for the help received from them, and particularly to Dr. Karny for the valuable suggestions and encouragement ever since the author had the honour of his acquaintance.

The arrangement followed in the list is more or less based on the synoptical tables of Dr. Karny. It may not be out of place here to append Dr. Karny's [3] synopsis of the major sub-divisions of the order, since that appears to be the most recent and perhaps, up-to-date classification. Though the greater portion of Karny's arrangement is that of Hood, [4] the former has made some deviations. The translation [5] of the German synopsis was made by the author himself with the help of Hood's tables, but it is not unlikely there may be some errors.

Key to the sub-divisions and families of

THYSANOPTERA

I. Female with an ovipositor formed of two pairs of gonapophyses from 8th and 9th abdominal segments. Terminal abdominal segment seldom tubular, that of female longitudinally divided beneath and usually conical, that of male usually bluntly rounded, never tubular. Wings microscopically pubescent ; forewing with marginal vein and at least one longitudinal vein reaching tip.

Sub-order.....TEREBRANTIA

A. Ovipositor curved upward. Wings broad and rounded at tip. Body not depressed. Antennæ nine jointed.

Super family.....AEOLOTHRIPOIDEA, Hood.

Includes only one family—AEOLOTHRIPIDÆ, Uzel.

[1] K. Schmutz-Zur Kenntnis der Thysanopterenfauna von Ceylon, pp. 991–1091 with 6 plates in Sitzber. Akad. Wiss. Math. Nat., Kl., Vienna, 1913.

[2] Dr. Karny has now prepared a monograph on this material submitted to him and it is being published. The paper includes 50 records, with four new genera, and eighteen new species.

[3] Thysanopetera—Uebersichtstabelle. Karny, pp. 231–61. ' Treubia, vol. I, livr. 4, 1921.

[4] An outline of the sub-families and higher groups of the order Thysanoptera by J. D. Hood, pp. 53-60, Proc. Biol. Socy., Washington, XXVIII, 1915.

[5] Since submitting this paper to the press, the author has seen a translation of Dr. Karny's full synopsis in the Bulletin (No. 168 of the Florida University, Published December 1923) on N. American Thysanoptera by J. R. Watson.

B. Ovipositor curved downward. Wings narrower and almost always pointed at tip. Body more or less depressed. Antennæ six to eight jointed (exceptionally nine jointed).

Super family.....THRIPOIDEA, Hood.

(*a*) Antennæ nine segmented, without apical stylus, 3rd and 4th segments enlarged and conical without sense cones but with sensory band at apex. Fore tarsus with claw like appendage.

Family.....HETEROTHRIPIDÆ, Bagnall.

(*a*¹) Antennæ six to eight segmented, usually with an apical stylus of one or two segments, rarely the 6th segment with a transverse line making the antenna appear nine segmented. Segments 3 and 4 not conical, usually with sense cones, rarely with a sensory band at apex. Fore tarsus never with an appendage.

(*b*) Antennæ not moniliform, six to eight segmented always with a one or two jointed apical stylus, 3rd segment usually 4th always with sense cones, never with a tympanum like sense area on dorsum of apex. Pronotum without longitudinal dorsal sutures, anterior and posterior femora not enlarged. Tip of abdomen usually sharply conical. Ovipositor almost invariably well developed.

(*c*) Sixth antennal segment large, never small in comparison with fifth, generally the largest in the whole antenna.

(*d*) Last abdominal segment of female conical, not well chitinized, seldom stronger than the preceding segments, bristles on segments 9 and 10 not very long or stout, never thornlike.

Family.....THRIPIDÆ, Uzel.

(*d*¹) Last abdominal segment of female cylindrical, very heavily chitinized bristles on 9 and 10 segments exceptionally long, stout and thornlike.

Family.....PANCHAETOTHRIPIDÆ, Bagnall.

(*c*¹) Sixth or sixth and seventh antennal joints small, styliform, minute in comparison with the fifth which is the largest in the whole antenna.

Family.....CERATOTHRIPIDÆ, Bagnall.

(*b*¹) Antennæ moniliform eight segmented, without apical stylus, third and fourth segments without sense cones, each with a tympanum like sense area on dorsum of apex. Pronotum with longitudinal dorsal sutures, anterior and posterior femora greatly enlarged. Abdomen blunt, ovipositor very weak, probably functionless.

Family.....MEROTHRIPIDÆ, Hood.

II. Female without ovipositor. Last abdominal segment in both sexes always continuous beneath, almost invariably tubular. Wings without pubescence forewing with at most a single abbreviated median vein.

Sub-order.....TUBULIFERA

A. Maxillary palpi 2 segmented. Antennæ eight, rarely seven segmented, middle coxæ more apart from each other than front and hind coxæ. Ninth abdominal segment not or rarely longer than the eighth. Terminal abdominal hairs rarely much longer than tube.

Super family.....PHLŒOTHRIPOIDEA, Hood.

(*a*) Last abdominal segment absolutely not tubular, greatly swollen, parabolic in dorsal aspect. Tergum of abdominal segments 2 to 9 transversely linear.

Family.....PYGOTHRIPIDÆ, Hood.

(*a*¹) Last abdominal segment slender, cylindrical or tubular, forming the tube. Tergum of abdominal segments 2 to 9 not transversely linear.

(*b*) Hind end of 8th abdominal segment without hook or cone-shaped projections.

(*c*) Tube (last segment) much shorter than the remaining segments together.

(d) The third segment of antenna with strong crest-like large sense cones at its distal part.
Family.....ECACANTHOTHRIPIDÆ,[1] Bagnall.
(d^1) Sense cone of third antennal segment not more strongly developed than in the other segments.
(e) Sense cone of antenna usually long and pointed ; near each there is an accessory cone or a long slender bristle in addition ; on this account the antennal segments are markedly swollen. The eyes are unusually large, close together, mouth cone pointed.
Family.....EUPATHITHRIPIDAE,[1] Bagnall.
(e^1) Sense cone of feeler not specially well developed, eyes smaller.
(f) Male without a tube like projection on each side of sixth abdominal segment.
(g) Head not produced in front of the eyes, vertext not sharply conical, rarely prominently overhanging base of antennæ.
Family.....PHLOEOTHRIPIDAE, Uzel.
(g^1) Head more or less produced in front beyond the eyes, vertex conical, usually over hanging base of antenna, bearing the anterior ocellus at its extremity and usually with a strong bristle in front of the eye.
Family.....IDOLOTHRIPIDÆ, Bagnall.
(f^1) Male with stout tube like projection on each side of the sixth abdominal segment.
Family.....MEGATHRIPIDÆ, Karny.
(c^1) The tube greatly elongate, three or four times as long as the head, and nearly as long as all other abdominal segments together.
Family.....HYSTRICOTHRIPIDÆ, Karny.
(b^1) Hind end of 8th abdominal segment with a hook or cone-shaped process, the antennæ and tube short and thick.
Family.....CHIROTHRIPOIDIIDÆ, Bagnall.

B. Maxillary palpi one jointed. Antenna four to seven segmented. Hind coxæ more widely separated than the front and middle pairs. Ninth abdominal segment longer than the eighth. Terminal bristles of abdomen much longer than the tube.
Super family.....UROTHRIPOIDÆ, Bagnall.
Only one family.....UROTHRIPIDÆ Bagnall.

Dr. Karny's synopsis of Keys to the known genera is not added here as it is pretty long. The Keys in the same publication (Treubia Vol. I) and the same author's numerous Keys for distinguishing the described *spp.* of various genera found in the pages of Zt. fur. Wissen Insektenbiol, 1914–16, will be very useful to workers on this group.

LIST[2] OF INDO-CEYLONESE THYSANOPTERA

Sub-order—TEREBRANTIA

AEOLOTHRIPIDÆ

Aeolothrips, Haliday

A. fulvicollis, Bagnall, p. 253. A. M. N. H., iv, 1919. In *Verbascum* flowers, very close to *A. fasciatus*, L. (Imms. Coll.), Cawnpore.

[1] Hood considers that these two families erected by Bagnall are synonyms of Phlœothripidœ Uzel, and gives reasons, *vide* pp. 7-12. Psyche, xxiii, 1916.

[2] Only the more important references are given under each species ; the same is the case with regard to synonyms, localities and host plants.

THRIPIDÆ

Scirtothrips, Shull

S. signipennis, Bagnall, p. 22, A.M.N.H., xiii, 1914. Under leaf sheaths of banana.....Peradeniya, Ceylon.
S. dorsalis, Hood, p. 90. Ins. Incis. Menstr. April 1919. In shoots of castor and chillies.....Coimbatore. (Ramakrishna Coll.)

Pseudodendrothrips, Schmutz

P. ornatissima, Schmutz, p. 999, Sitzber. Akad. Wiss., cxxii, 1913. On *Macrocarpus integrifolia*.....Peradeniya. Ceylon.

Dendrothrips, Uzel

D. sexmaculatas, Bagnall, p. 401, A. M. N. H., xvii, 1916. Peradeniya. Ceylon.
D. indicus, Bagnall, p. 261, A. M. N. H., iv, 1919. In arrow-root leaves Taliparamba, S. India. (Ramakrishna Coll.)
Very near *sexmaculatus*, B. differing in colour of abdomen and wings.
D. bispinosus, Bagnall, p. 455, Bul. Ent. Res., xiv, 1924. On tea leaves .....Nilgiris. (Near *D. saltatrix*, Uzel.)

Rhipiphorothrips, Morgan

R. (*Retithrips*) *bicolor*, Bagnall, p. 290, A. M. N. H., xii, 1913. On vine .....Ceylon.
R. cruentatus, Hood, p. 94, Ins. Insc. Menst., April 1919. On grape vine leaves.....Coimbatore. (Ramakrishna Coll.)
On *Careya arborea*.....Ceylon. (Rutherford Coll.)

Selenothrips, Karny

S. (*Physopus*) *rubrocinctus*, Giard. Bull. Soc. Ent. France, p. 263, 1901, and also Trop. Agri., xxvii, 1906. Cacao thrips. (W. Indies). Noted also in mango in Florida.
=*S. mendax*, Schmutz, p. 994, Sitzber. Akad. Wiss., cxxii, 1913. On *Anacardium orientale*..... .....Peradeniya. Ceylon.

Heliothrips, Haliday

H. indicus, Bagnall, p. 291, A.M.N.H., xii, 1913. On onion, brinjal, and on indigo.....Sirsiah (Behar) and Surat (Bombay).
H. brunneipennis, Bagnall, p. 318, A. M. N. H., xv, 1915. On *Litsea* leaves .....Peradeniya. Ceylon.
H. minutissimus, Bagnall, p. 260, A. M. N. H., iv, 1919 in Violet flowers .....Surat.
H. hæmorrhoidalis, Bouche *var Ceylonica*, Schmutz, p. 992, Sitzber. Akad. Wiss., cxxii, 1913, on cacao ;.....Peradeniya. Ceylon.

Frankliniella, Karny

F. sulphurea, Schmutz, p. 1019, Sitzber. Akad. Wiss., cxxii, 1913; in flowers of *Thunbergia alata*.....Peradeniya. Ceylon.
For other *spp*. see below under *Physothrips*.

Taeniothrips, Serville

T. major, Bagnall, p. 216, A. M. N. H., xvii, 1916, in *Rhododendron* flowers.....Garhwal. N. India.

Physothrips, Karny

P. letroyi, Bagnall, p. 292, A. M. N. H., xii, 1913 ; in Tea flowers..... Darjiling ; also p. 63, Bull. Ent. Res., ix, 1918.
P. usitatus, Bagnall, p. 293, A. M. N. H., xii, 1913; in flowers of *Butea frondosa*. Allahabad, N. India ; *Frankliniella nigricornis* and *F. obscuricornis* of Schmutz, pp. 1020 and 1022 Sitzber. Akad. Wiss., cxxii,

1913 on coffee and *crotalaria* from Ceylon are according to Karny same as *P. usitatus*, Bagnall, *vide* p. 365. Zt. Fur. Wissen. Insekt, x, 1914.

P. longiceps, Bagnall, p. 220, A. M. N. H., xvii, 1916 in *Rhododendron*, flowers.....Garhwal. N. India.

P. (*Franklieniella*) *vitata*, Schmutz, p. 1023, Sitzber. Akad. Wiss., cxxii, 1913; in *Thunbergia* flowers.....Peradeniya. Ceylon.

P. setiventris, Bagnall, p. 61, Bull. Ent. Res., ix, 1918. On Tea..... Darjiling. N. E. India; also p. 305, Treubia, iii 1923.

P. brunneicornis, Bagnall, p. 218, A M. N. H., xvii, 1916, first noted from Japan. p. 206, A. M. N. H., 1918, on Rose. Darjiling.

P. peculiaris, Bagnall, p. 206, A. M. N. H., i, 1918 on Lucerne. Pusa. N. India, also p. 305, Treubia, ii, 1923.

P. minor, Bagnall, p. 393, A. M. N. H., viii, 1921; in leaves of *Ipomea staphylina*.....Maddur, and Coimbatore, S. India (Ramakrishna Coll.)

P. andrewesi, Bagnall, p. 394, A. M. N. H., viii, 1921. Darjiling.

P. flavidulus, Bagnall, p. 628, A. M. N. H., xii, 1923; in flowers of *Eriobotyia japonica*. Dehra Dun; also noted at Bhowali (Kumaon).

Thrips, Linnaeus

Thrips striatopennata, Schmutz, p. 1002, Sitzber. Akad. Wiss., cxxii, 1913. on grass; Nuwara Eliya, Ceylon.

T. florum, Schmutz, p. 1003 do. do. do. In *Cinnamomum* flowers.....Peradeniya. Ceylon.

(*T. magnipes*, Schmutz, p. 1006 and *T. rhodamnine*, Schmutz, from Ceylon on *clerodendron* and *Rhodamnia*, p. 1008 do. do. are contracted specimens of *T. flora*, Schmutz according to Karny, *vide* p. 109, Jour. Siam. Socy., xvi, 1923.)

T parva, Schmutz, p. 1004, Sitzber. Akad. Wiss., cxxii, 1913 in *Cinnamomum* flowers.....Ceylon.

T. longalata, Schmutz, p. 1009 do. do. do. on *Cinnamomum* and *Clerodendron* leaves.....Peradeniya. Ceylon.

T. sulphurea, Schmutz, p. 1011 do. do. In *Cinnamomum* flowers. .....Peradeniya. Ceylon.

T. nigriflava, Schmutz, p. 1012 do. do. do.

T. colorata, Schmutz, p. 1013 do. do. do.
(This is regarded by Karny as a colour *var* of *T. florum*.)

T. pallida, Schmutz, p. 1015, Sitzber. Akad. Wiss., cxxii, 1913..... .....Peradeniya. Ceylon (Some of the above *spp.* of Schmutz are regarded as synonyms of *florum*, Sch. by Karny.)

T. (*Bagnallia*) *oryzae*, Williams, p. 353, Bull. Ent. Res., 1915, on young paddy, Chingleput. S. India (Ramakrishna coll.); see also p. 109, Jour. Siam. Socy., xvi, 1922, noted in Java (Karny).

T. pallidulus, Bagnall, p. 424, A. M. N. H., xiii, 1924..... ...Pusa.

Rhamphothrips, Karny.

R. lineata, Schmutz, p. 997, Sitzber. Akad. Wiss., cxxii, 1913. Peradeniya, Ceylon. This is described by Schmutz as *Brachythrips*. See p. 295, Zt. f. Insekt, 1914, for Karny's note.

Dendrothripoides, Bagnall.

D. ipomeæ, Bagnall, p. 625, A. M. N. H., xii, 1923, in leaves of *Ipomea staphylina*.....Maddur, Mysore (Ramakrishna coll.)

Euthrips Targ-Tozz.

(Hood objects to the use of the name Euthrips [1]).

E. citricinctus, Bagnall, p. 270, A. M. N. H., iv, 1919. On Arrow-root leaves.....Taliparamba. South India. (Ramakrishna coll.); very close to Karny's *E. flavicinctus* from Java.

[1] On proper generic names for certain Thysanoptera of economic importance Hood, pp. 34-44, Proc. Ent. Socy., Washington, xiv, 1914.

E. flavicinctus, Karny, p. 115, Marcellia, xi, 1912, in galls of *Homalomena aromatica* in Java. See also p. 55, Bull der. Tard. Bot. Buitenzorg, x, 1913.
=Neophysopus medioflavus, Schmutz, p. 1017, Sitzber. Akad. Wiss., cxxii, 1913. *vide* Karny, p. 357, Zt. Fur. Wissen Insekt, 1915. Peradeniya. Ceylon.

Aptinothrips, Haliday.

A. rufus var. connaticornis, Uzel-Bagnall, p. 205, A. M. N. H., i, 1918, in Tea flowers.....Darjiling.

Perissothrips, Hood

P. parviceps, Hood, p. 92, Ins. Insc. Mens., vii, 1919, in shoots of *Ailanthus excelsa*. Coimbatore (Ramakrishna coll.) near *Chilothrips* and *oxythrips*.

Bregmatothrips, Hood.

B. Ramakrishnæ, Bagnall, p. 625, A. M. N. H., xii, 1923, inside tips of rolled up sugar-cane leaves. Palur. South India (Ramakrishna coll.)

Tryphactothrips, Bagnall.

Dinurothrips rutherfordi, Bagnall, p. 319, A. M. N. H., xv, 1915.
=*Tryphactothrips* do. Bagnall, p. 257. do. iv, 1919.
On *allamanda* leaves. See also p. 264. do. do. 1921. Ceylon. This is the type of Bagnall's genus.
T. octarticulata, Schmutz, p. 993, Sitzber. Akad. Wiss., cxxii, 1913. Peradeniya. Ceylon. This species is described by Schmutz as a *Parathenothrips*, Uz.
Bagnall is of opinion that 'Dinurothrips' should be placed near *Heliothrips* and not with *Panchætothrips*.

PANCHÆTOTHRIPIDÆ

Panchætothrips, Bagnall

P. indicus, Bagnall, p. 257, Rec. Ind. Mus., 1912, on *Curcuma longa*..... Madras, also on Arrow-root leaves, Taliparamba. S. India. (Ramakrishna coll.)

Sub-order—TUBULIFERA

ECACANTHOTHRIPIDÆ

Ecacanthrothrips, Bagnall.

E. sanguineus, Bagnall, p. 321, A. M. N. H., xv, 1915, and also p. 201. Rec. Ind. Mus., 1913.
= *Acanthothrips sanguineus*, Bagnall (1908)
= *ormothrips sanguineus*, Buffa (1910)
= *Do. steinsky*, Schmutz. (1913)
(See p. 277, 'Treubia,' iii, 1923, for these synonyms.) Under tree bark; recorded from Peradeniya, Ceylon,—and North India.

PHLŒOTHRIPIDÆ

Phlœothrips, Haliday

P. anacardii, Newman, p. 266, Trans. Ento. Soc., 1855, on *Anacardium*. Mysore.
P. stenomelas, Walker, p. 224, A. M. N. H., 1859.....Ceylon.

Liothrips, Uzel

L. ordinarius, Hood, p. 101, Insc. Mens., vii, 1919, in shoots of *Sesbania grandiflora*.....Coimbatore. (Ramakrishna coll.)
L. niger, Schmutz, p. 1080, Sitzber. Akad. Wiss., cxxii, 1913, Peradeniya. Ceylon; described as an *Ischyrothrips*. See also reference by Karny pp. 46 to 49, Treubia, ii, 1921.
L. sp. Kieffer, 'Marcellia,' 1905 in galls of *Quercus apicata*. North India.

Dolichothrips, Karny

D. varipes, Bagnall, p. 359, A. M. N. H., vii, 1921, on wild bush. Coimbatore. (Ramakrishna coll.)

Cephalothrips, Uzel

C. hispanicus, Bagnall, p. 629, A. M. N. H., 1923, in *Rhodhodendron* flowers. .....Garhwal, North India.
= *Malacothrips*, Bagnall. See p. 635, A. M. N. H. (9), xiv, 1924.

Hindsiana, Karny

H. apicalis, Bagnall, p. 323, A. M. N. H., xv, 1915, on jungle plant ; .....Almora, North India.

Haplothrips, Serville

H. tenuipennis, Bagnall, p. 210, A. M. N. H., i, 1918, on Tea bushes and rose. .....Darjiling. (Andrews coll.)
H. pictipes, Bagnall, p. 273, A. M. N. H., iv, 1919, on diseased pepper berries.....Talıparamba, South India. (Ramakrishna coll.)
H. terminalis, Schmutz, p. 1033. Sitzber. Akad. Wiss., cxxii, 1913, on bamboo.....Ceylon. See also ' Treubia,' ii, p. 32, 1921. Karny thinks this is probably a *Mesothrips*.
H. ceylonica, Schmutz, p. 1038, Sitzber. Akad. Wiss., cxxii, 1913, in *Crotalaria* flowers.....Peradeniya. Ceylon.
H. sovor, Schmutz, p. 1039. do. do. do. Ceylon.
H. ganglbaueri, Schmutz, p. 1034. do. do. do. Peradeniya. Ceylon.
H. sororcula, Schmutz, p. 1036. do. do. do. in *Crotolaria* flowers. .....Peradeniya. Ceylon.

A long note by Karny on this genus and some Ceylon spp. of Schmutz is found on p. 87, Zt. fur. Wiss. Insekt, xi, 1915.

Neoheegeria, Schmutz

N. fumipennis, Bagnall, p. 360, A. M. N. H., vii, 1921. Kurseong. Himalayas. (Gravely coll.)
N. citripes, Bagnall, p. 360. do. do. an *Abutilon indicum*.....Pusa.
N. indica, Hood, p. 96, Ins. Insc. Mens., vii, 1919, in *Ailanthus excelsa* shoots. Coimbatore. (Ramakrishna coll.)
N. zizyphi, Bagnall, p. 629, A. M. N. H., xii, 1923, on *Zizyphus rugosa*, Paresnath, Bengal.

Cecidothrips, Kieffer

C. bursarum, Kieffer, p. 165, ' Marcellia,' vii, 1909, from unknown plant galls. Trichinopoly, South India.

Cœnurothrips, Bagnall

C. affinis, Bagnall, p. 361, A. M. N. H., vii, 1921, among cotton. Ceylon.

Austrothrips, Brethes

A. cochinchinensis, Karny, p. 113, Jour. Siam. Socy., xvi, 1923. Very common in galls of *Calycopteris floribunda*. Western Ghats. (Y. R. Rao and Ramakrishna coll.)
Originally described by Karny from Siam collected in leaf galls of *Hymenodictyon parviflorum*. (See also p. 436, Agrl. Jour. India, July 24.)

Trichothrips, Uzel

T. (*Neosmerinthothrips*) *fructuum*, Schmutz, p. 1052, Sitzber. Akad. Wiss., cxxii, 1913.....Peradeniya. Ceylon.

Eumorphothrips, Schmutz

E. albicornis Schmutz, p. 1050, Sitzber. Akad. Wiss., cxxii, 1913, in *Cinnamomum* flowers.....Peradeniya. Ceylon.
(See pp. 145 and 147 of Zt. Fur. Wiss. Insekt, xi, 1915 for notes by Karny.)

Androthrips, Karny

A. flavipes, Schmutz, p. 1031, Sitzber. Akad. Wiss., cxxii, 1913, Ceylon.
A. flavipes, Bagnall, p. 27, A. M. N. H., xiii, 1914. Ceylon ; On *Memexylon*.
Under the same name the above two spp. are described by different authors and it is not known whether the two are synonymous. See p. 94, Zt. Fur. Wiss. Insekt, xi, 1915, where some differences are noted by Karny.

Aleurodothrips, Franklin

A. fasciapennis, Franklin-Bagnall, p. 324, A. M. N. H., xv, 1915, among scale insect sp.....*Aspidiotus lataniae*.....Ceylon, described by Franklin in 1908, p. 727, Proc. U. S. Nat. Museum., xxxiii.

Gynaikothrips, Zimmerman=Chromatothrips, Schmutz

G. karnyi, Bagnall, p. 28, A M. N. H., xiii, 1914, in marginal leaf galls of pepper.....Peradeniya. Ceylon.
G. mirabilis, Schmutz, p. 1041, Sitzber. Akad. Wiss,. cxxii, 1913. on *Pavetta hispida*.....Ceylon.
G. (chromatothrips) fasciata, Schmutz, p. 1044, Sitzber. Akad Wiss., cxxii, 1913. Peradeniya. Ceylon.
G. (chromatothrips) annulicornis, Schmutz, p. 1045 do. do. do.
G. (chromatothrips) plantaginis, Schmutz, p. 1047 do. Nuwara Eliya. Ceylon.
G. watsoni, Karny, p. 104, Ent. Mitteil., ix, 1920, Bentotta. Ceylon

Cryptothrips, Uzel

C. longus, Schmutz, p. 1054, Sitzber. Akad. Wiss., cxxii, 1913, on *Pavetta*. Ceylon.
This and another *C. pavethae* on p. 1055 above are described as '*Mesothrips*.' Karny considers them to be *Cryptothrips* and synonyms.

Arrhenothrips, Hood

A. Ramakrishnæ, Hood, p. 99, Ins. Insc. Mens., vii, 1919, producing galls in leaves of *Mimusops elengi*, Coimbatore. (Ramakrishna coll.)
Mr. Bagnall in his recent paper [1] considers this insect to be a *Mesothrips* close to *M. lewisi*, *B.*, though Karny disagrees with this view.

Mesothrips, Zimmerman

M. indicus, Bagnall, p. 365, A. M. N. H., vii, 1921, from *Sal* bark. Dehra Dun. N. India.
Mr. Bagnall in his recent paper describes the following *Spp.* of *Mesothrips* from this region.
M. brevis, B., p. 636, A. M. N. H., xiv, 1924, in pepper galls, Ceylon with *Androthrips flavipes*, Sch.
M. angusticornis, B., p. 638 do. do. on bushes, Peradeniya, Ceylon.
M. karnyi, B., p. 639 do. do. in pods of *Albizzia lebbeck* Dehra Dun, N. India.

Ischyrothrips, Schmutz

I. crassus, Schmutz, p. 1076, Sitzber. Akad. Wiss., cxxii, 1913, in *Bauhinia triandra* shoots.....Ceylon.
I. obscurus, Schmutz, p. 1074 do. do. do. do. Karny thinks this may be a *Mesothrips*.
I. niger, Schmutz, p. 1080 do. do. do. Peradeniya Ceylon.

[1] Annals and Magazine of Natural History, xiv, December 1924.

Dinothrips, Bagnall

D. sumatrensis, Bagnall, p. 11, Trans. Nat. Hist. Soc. Northuld, iii, 1908. For synonyms see ' Treubia,' iii, p. 293, 1923. See also p. 203, Phil. Jour. Soc., xvii, 1920. Burma. Philippines.
D. furcifer, Schmutz, p. 1026, Sitzber. Akad. Wiss., cxxii, 1913..... Peradeniya. Ceylon.

Diaphorothrips, Kerny

D. unguipes, Karny. p. 186, Ent. Mftteil., iv, 1920. Bentotta. Ceylon ; also p 299, Treubia, iii, 1923.

IDOLOTHRIPIDÆ

Dicaiothrips, Buffa

D. dalla-torrensis, Schmutz, p. 1067, Sitzber. Akad. Wiss. Vien., 1913 Ceylon ; referred to by Karny also, p. 65, Treubia ii, 1921, from Java.
D. proximus, Bagnall, p. 289. A. M. N. H., xiii, 1914, in *Crotalaria* pods. Ceylon.
D. greeni, Bagnall, p. 289, A. M. N. H., xiii, 1914, from decayed pods of *Phaseolus*.....Ceylon.
D. levis, Schmutz, p. 1072, Sitzber. Akad. Wiss., cxii, 1913. Peradeniya, Ceylon.
do. do. Karny, p. 189, Ent. Mitteil., ix, 1920. Puttalam, Ceylon.
D crassiceps, Bagnall, p. 399, A. M. N. H., viii, 1921.....Burma.
D. procer, Schmutz, p. 1063, Sitzber. Akad. Wiss., cxxii, 1913. Ceylon.
D. novus, Schmutz, p. 1066, Sitzber. Akad. Wiss., cxxii, 1913. Ceylon.
D. bruneitarsis, Schmutz, p. 1070. do. do. Peradeniya. Ceylon.

Gigantothrips, Zimmerman

G. tibialis, Bagnall, p. 364, A. M. N. H., vii, 1921, on *Caryea arborea*..... .....Ceylon.
G. spinosus, Schmutz, p. 1078, Sitzber. Akad. Wiss., cxxii, 1913, Ceylon. (This is described as an *Ischyrothrips* by Schmutz.)

Phoxothrips, Karny

P. breviceps. Bagnall, p. 380, A. M. N. H., xiv, 1914.....Simla.
Kleothrips, Schmutz = Dracothrips*, Bagnall (1914) near *Mecynothrips*.
K. gigans, Schmutz, p. 1058, Sitzber. Akad. Wiss., cxxii, 1913. On banana fruit.....Peradeniya. Ceylon.
K. ceylonicus, Bagnall, p. 290, A. M. N. H., xiii, 1914. Ceylon. (See p. 219, A. M. N. H., i, 1918 for synonymy.)

Idolothrips, Haliday

I. halidayi, Newman, p. 265, T. E. S. 1855 on *Anacardium. sp*.....Mysore.
I. Schenklingi, Karny, p. 189, Ent. Mitteil, ix, 1920. Puttalam. Ceylon.

MEGATHRIPIDÆ

Bactridothrips, Karny

B. serraticornis, Bagnall, p. 397, A. M. N. H., viii, 1921, described from one male only.....Pundaluoya. Ceylon.

HYSTRICOTHYIPIDÆ

Leeuwenia, Karny*

L. (*Paneurothrips*) *coriaceus*, Bagnall, p. 216, A. M. N. H., ix, 1912. .....Dehra Dun (N. India) ; see also p. 640, R.M.N.H., xiv., 1924.
L. indicus, Bagnall, p. 377, A. M. N. H., xiv, 1914 Moulmein, Burma.
L. engeniae, Bagnall, p. 640, A. M. N. H., xiv, 1924, on *Eugenia*. Kodaikanal, Pulney Hills.

* The author has since noted and described a new species of each of these genera in this Journal, see p. 788.

The following is a list of the new forms, described in the forthcoming paper of Dr. Karny on Indian Thysanoptera.

Terebrantia

1. Hydatothrips ramaswamiah, *n. sp.*
2. Tryphactothrips mundus, *n. sp.*
3. Ayyaria chaetophora, *n. gen* and *sp.*
4. Mycterothrips setiprivus, *n. sp.*
5. Anaphothrips oligochaetus, *n. sp.*
6. A. ramakrishnae, *n. sp.*
7. Stylothrips brevipalpis, *n. gen* and *sp.*
8. Ramaswamiahella? subnudula *n. gen* and *sp.*

Tubulifera

1. Rhynchothrips pallipes, *n. sp.*
2. Dolichothrips ochripes, *n. sp.*
3. Haplothrips ramakrishnae, *n. sp.*
4. Trichothrips hadrocerus, *n. sp.*
5. Eothrips floriiperda, *n. sp.*
6. Androthrips ramachandrai, *n. sp.*
7. Mesothrips melinocnemis *n. sp.*
8. M. apatelus, *n. sp.*
9. Ramakrishnaiella unispina, *n. gen.* and *sp.*
10. Gynaikothrips intercalcatus *n. sp.*

LIST OF REFERENCES CITED IN THE LIST

Bagnall, R. S. ... Transactions of the Natural History Society, Northumberland, 1908.
,, ... Records of the Indian Museum, Calcutta, 1912.
,, ... Annals and Magazine of Natural History from 1908 onwards.
,, ... Bulletin of Entomological Research, London.
Hood, J. D. ... Proceedings of the Entomological Society of Washington, xiv, 1914.
,, ... Proceedings of the Biological Society of Washington, 1915.
,, ... Insecutor, Insectiae Menstruns-Washington, 1913, 1919.
,, ... Psyche, Philadelphia, xxiii, 1916.
Karny, H. H. ... 'Treubia,' Buitenzorg, Java, vols. i to iii, 1921–24.
,, ... Philippine Journal of Science Manilla, xvii, 1920.
,, ... Entomologische Mitteilungen, Berlin, ix, 1920.
,, ... Journal of Siam Society, xvi, 1923.
Kieffer ... 'Marcellia.'
Newman ... Transactions of the Entomological Society, London, 1856.
Schmutz, K. ... Sitzungsberichte der Kaiser. Akademie der Vienna, cxxii, 1913.
Uzel, H. ... Monographie der ordnung Thysanopfera, Koniggratz, 1895.
Walker. G. ... Annals and Magazine of Natural History, London, 1859.
Williams, C. B. ... Bulletin of Entomological Research, London, 1915.

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS

BY

HERBERT STEVENS, M. B. O. U.

PART VII

(*Conclusion*)

(*With 2 plates*)

(*Continued from page 685 of this Volume*).

443. The Himalayan Brown Fish-Owl. Ketupa zeylonensis nigripes (Hodgs.).

This form is larger, and on the underparts somewhat paler. Wing 2-3c.m. longer than in the typical '*zeylonensis*.' Dr. Hartert gives the distribution Himalayas, exact distribution not known. Unknown to me, but a *Ketupa* was seen on a few occasions around Hathipota in the Eastern Dooars and could hardly have been referable to this form as it is only likely to be found above the base of the hills, though my largest ♂ (wing of 405) was obtained in the plains of Upper Assam. The wing measurement of typical '*zeylonensis*' is given 39–41·5 c. m. (Hartert).

444. The Tawny Fish-Owl. Ketupa flavipes (Hodgs.).

Recorded for the Lower Himalayas at elevations not exceeding 5,000'. The only specimen that I have seen in recent years is one secured in the Tista Valley by Mr. H. P. P. Barrett. This specimen is in the Darjeeling Museum.

445. The Forest Eagle-Owl. Huhua nipalensis (Hodgs.).

Recorded for the Himalayas at elevations not exceeding 7,000'.

Mai ('Khola') Valley, East Nepal, ♀ 14-4-12, wing 450, obtained along with a single youngster from the nest. The latter became quite one of the attractions to the *paharia* youths who frequented my camp, being accommodated during the day in the nook of a rock, with snug quarters at night, as it was wont to sit at the foot of my stretcher inside my tent, and invariably awakened me with a friendly chuckle. After many vicissitudes and trials from the penetrating cold of these high altitudes to the steamy heat (100° in the shade) of Calcutta in May, and a rough voyage home in the S. W. Monsoon; it was safely deposited in the Regent's Park Collection where for several years it was an inmate. Mr. G. E. Shaw had one in semi-captivity for many years. Turzum, ♀ 29-5-15, wing 441 (O. Lindgren). Sungma, ♂ 27-12-18, wing 438 (C. E. Brown), procured at mid-day whilst demolishing the remains of a Kalij Pheasant when disturbed by the beaters. Reported to me on a few occasions in the Rungbong Valley, where these two last specimens were obtained at elevations below 5,000'.

446. The Himalayan Scops Owl. Otus scops pennatus. (Hodgs.).

Obtained on one occasion only at Turzum, ♂ 29-10-18, at an elevation of 5,200' (O. Lindgren.), and seen at Gopaldhara on a few occasions at early daybreak and often suspected of being in the vicinity of the Bw., but it is a strictly nocturnal owl, difficult to locate. In this specimen the wing is 140. Coloration: a dark phase, scupulars buff and white mixed, 1st quill longer than the 8th; 4th quill longest and slightly longer than the 3rd. This bird is evidently referable to Hodgson's '*pennatus*,' but is darker than any specimens in the B. M. from Nepal. *O. s. sunnia* Hodgs., appears to be the bird which is scattered over the plains of Northern India. One very rufous specimen I have, was collected by Mr. C. B. Antram in the Luskerpore Valley in South Sylhet. In this example the 1st quill shorter than the 8th; 4th quill longest and more pronounced in length to the 3rd than in the previous example.

447. The Spotted Himalayan Scops Owl. Otus spilocephalus (Blyth).

Apparently generally distributed, though few specimens are actually secured. Obtained around Mangpu at 5,000', above the Tista Valley. (G. E. Shaw).

Nagri, Rungbong Valley, 3,700′, ♀ 11-1-12 (S. F. Boileau.) ; wing 150, ovaries well developed. This specimen agrees well with Assam birds which are very variable in coloration from russet-red to brown, 2 ♂♂ wing 142 4 ♀ ♀ wing 142-150, av. 147. Recorded for the Himalayas at elevations between about 3,000′ and 6,000′, but it occurred at lower limits in Upper Assam, being found at the base of the hills. Gopaldhara. Two youngsters brought in 7-7-23 which were safely reared to maturity.

448. The Himalayan Collared Scops Owl. Otus bakkamœna lettia (Hodgs.).

This Scops owl is the commonest nocturnal owl in well-wooded tracts in the Rungbong Valley, and is frequently heard though rarely seen. It appears to occur up to at least 5,000′. Gopaldhara, 4,720′, 24-4-16 ; three almost fully developed youngsters brought in. ♂ 8-7-20, juvenile. ♂ 26-4-21, juvenile ; from which it may be inferred the nesting season is a prolonged period. One specimen was deposited in March 1922 in the Regent's Park Collection.

449. The Larged Barred Owlet. Glaucidium cuculoides cuculoides (Vig.).

This common Owl is widely distributed on the Outer Ranges up to an elevation of over 7,000′. Obtained at Sonada, 6,600′, ♀ 8-2-17. Frequently seen in the Rungbong Valley in broad daylight in open tracts.

450. The Collared Pigmy Owlet. Glaucidium brodiei brodiei (Burton).

Recorded from the base of the hills to a considerable elevation in Sikkim. I have seen it in the deep valleys of the interior at low elevations, and it has been obtained at Gopaldhara around an elevation of 5,000′, where it is occasionally to be met with. The Paharias attribute a call to this Pigmy Owlet, though it is almost an impossibility to locate the quarter from which the sound emanates. On rare occasions I have heard it uttered well on into the morning and frequently at night under the foot-hills in Upper Assam. There is every reason to believe this ventriloquist is the culprit as there appears to be no other feasible explanation of the riddle.

451. The Brown Hawk-Owl. Ninox scutulata lugubris (Tick.).

The specimens obtained in the Tista Valley at an elevation of 2,900′ (G. E. Shaw.) may be referable to this race and not to *burmanica* Hume. Dr. Hartert gives the distribution : India from Rajputana to Bengal. Wing between 205-228, and whereas the exact distribution of *burmanica* is not known ; it is the breeding bird of the Naga Hills in Assam, Cachar and Burma.

452. The Osprey. Pandion haliaetus haliaetus (L.).

I have not been fortunate enough to have seen the Osprey in the Tista River where it is surely to occur. In January 1922, a fine bird was frequenting the Gorge and lower reaches of the Raidak River at the base of the hills ; when on more than one occasion, I had the opportunity of watching its methods of grasping captured fish.

453. The Cinereus Vulture. Ægypius monachus (L.).

Recorded distribution in the ' Himalayas as far east as Bhotan, and there can be no doubt this bird breeds in the Himalayas.'

454. The Black Vulture or Pondicherry Vulture. Torgos calvus (Scop.).

Occurs at frequent intervals in the Rungbong Valley, and may on occasions be seen above the station of Darjeeling where it reaches an altitude of over 7,000′ at all events.

455. The Eastern Griffon Vulture. Gyps fulvus fulvescens Hume.

Recorded as far east as Nepal and Sikkim.

456. The Himalayan Griffon. Gyps himalayensis Hume.

Recorded for the Himalayas from Cabul to Bhotan being confined to the mountains. In the precipitous rocky mountains on the west side of the valley, at an elevation of 10,000′ upwards, above Lachung, in March 1920 ; I daily observed a huge congregation of several species of vultures which were undoubtedly breeding. They were never seen away from these haunts around which they sailed in majestic fashion. Mr. A. F. R. Wollaston during the

Mount Everest Expedition mentions seeing it in the gorges of the main Himalayan Range, up to 14,000′, but not on the Tibetan plateau, where only *Gypaëtus barbatus grandis* occurred.

457. The Himalayan Long-billed Vulture. Gyps indicus tenuirostris Hodgs.

Recorded throughout the Lower Himalayas and near their base. Evidently occurs in Sikkim as Blanford quotes the Lepcha name.

458. The Indian White-backed Vulture. Pseudogyps bengalensis (Gmel.).

Recorded, "not found above moderate elevations in the Himalayas." It appears to ascend to *over 8,000′ on the Outer Ranges* at which elevation, a ♀ was obtained in the Mai 'Khola' in East Nepal on 24-3-12. This bird was knocked over by some youths, when on the ground, and brought into my camp at 10,160′, it was a juvenile with black bill and dark back. At varying periods, three other species of vultures were seen in some numbers, which in many cases appeared to be *Gyps himalayensis*, none were obtained with this exception as I must confess to an avowed aversion in the preparation of vultures' skins. Gopaldhara : I disturbed a single bird on my way home on the evening of 6-3-18 ; which had evidently settled for the night in a cryptomeria tree below the compound, 4,720′. I identified the vultures, which were breeding in January 1922 in the village of Kumargram in Eastern Bengal, to be this species, judging by their roaring though I failed to observe the white parts of the adult. For a better acquaintance with this group of birds, no more advantageous place for observation in the hills can be afforded than the municipal slaughter house at Darjeeling, where there is every chance of meeting with all the species that occur in the district. The whole surrounding ground is in occupation of vultures with kites and crows in attendance. The late Mr. J. L. Macintosh availed himself of this opportunity, and did not miss the humorous side of their habits in his description of their jaunts on the wire-ropeway which carries the refuse to its destination. It requires the enthusiasm of an ardent ornithologist but the results would justify the olfactory inconvenience.

459. The Bearded Vulture or Lammergeyer. Gypaetus barbatus grandis Storr. 'Lhema gida' Paharia.

There can be few more impressive sights in connection with any bird, than to be fortunate in seeing the majestic Lämergeyer proudly keeping ahead of an approaching storm, as the clouds roll along the ridge with an enveloping mist or whilst under more favourable circumstances, it soars at an intense height over the sublime depths of the valley below. They appear to have regular beats along the ridges and spurs, and at the close of the breeding season, extend over a wider area, as single birds may be seen as far out as Mirik or Kurseong, though I have no record of their descending to a lower limit than 4,800′ when on one occasion it was observed flying leisurely above my home on 29-6-18. I have seen it on the Outer Ranges, Phalut, 11,811′, 17-2-12. Sandakphu, 11,923′, 8-3-12 ; when one passed overhead several times in company with vultures, and on this and similar occasions its curiosity was so aroused as I reclined on the ground to bring it within measurable distance, when the rich ferruginous tint of the breast feathers, and piercing eye, heightened by the blood-red membrane were seen to perfection. I have never seen more than a solitary bird on any one occasion,[1] which trait in its habits, almost discounts any near relationship with the vultures. Mr. H. P. P. Barrett informs me, whenever it appears with the latter at their feeding grounds it keeps aloof from the common herd. One specimen he obtained had its gullet and stomach crammed with undigested bones. This well-known fact prompted me to test the extent of the Bungalow *chaukidar's* knowledge at Sandakphu in reference to its habits, and as the old man vividly described what he had witnessed ; I was content to let him have his final assurance that this bird was no ordinary '*Gida*.' It occurs frequently over Ghoom and was noted daily in the Lachung Valley in March, when an adult bird was wont to wend its flight down the valley. I have only once seen it settle in a tree and remain there for some

[1] I have since seen three birds soaring at an immense height over the Gopaldhara Bw. 7-5-23. This occurrence most likely pointed to adverse conditions in the weather in the high upper regions.

time. They seem to spend only brief intervals on the ground, when they are attracted to their favourite repast. One adult ♀ was obtained in this manner by trapping near Kurseong on 11-1-20, wing, 830. Soft parts: Iris pinky yellowish-white; sclerotic membrane, blood-red; bill horny, tip dark; tarsus plumbeous-grey, stippled with oxide of iron? Kalo Pokhari, camp, 10,160′, ♂ 24-5-12. This specimen was in extremely ragged condition; as it was in the so-called immature plumage; some years must elapse before the full adult garb is attained, otherwise this record nullifies the usual accepted data in regard to this phase being a mark of the young bird. To me it seems akin to a melanistic phase. This bird in its dark plumage and blackish-brown head in flight appeared like a huge *Ictinaëtus*. Wing abraded. Soft parts: Iris stone-yellow; sclerotic membrane, dull orange; gape, blue.

Mr. A. F. R. Wollaston records seeing this bird flying at a height of not less than 24,000, during the Mount Everest Expedition.

460. The Eastern Steppe Eagle. Aquila nipalensis nipalensis Hodgs.

Blanford gives the Lepcha name for this Eagle. Mr. G. E. Shaw appears to have obtained it at Mangpu at 3,860′. Probably occurs with more frequency in the Tista Valley than in the minor valleys on the west. As these large Eagles have so many different phases of plumage, and opportunities seldom come one's way in the well-wooded country of the Eastern Himalayas for observation, I am unable to fix the identity of a few aquiline birds which have come under my notice which at sight appeared to be referable to this species.

461. Bonelli's Eagle. Hieractus fasciatus fasciatus. (Vieill.).

It is with some diffidence that this fine Eagle is included in this list as, so far, I have seen no specimen from Sikkim, or the lower foot-hills, though this country is well within its recorded distribution. My observations point to its having some status, but until specimens have been actually obtained, its inclusion only rests on circumstantial evidence. The National Collection is represented by two specimens from Nepal (Hodgson and Scully) and one from the Bhotan Dooars collected in March 1875 by Mandelli. *Hieraaëtus pennatus* (*Gmel.*) by one Sikkim skin, dated 1872, in the Hume collection and one specimen from Nepal collected by Hodgson. My thanks are due to Mr. N. B. Kinnear for supplying me with this information.

462. The Rufous-bellied Hawk-Eagle. Lophotriorchis kieneri (De Sparre).

This grand bird is apparently confined to the Tista and Great Rangit Valleys, occasionally straying to the surrounding hills. Reported to me as known by a few careful observers, and within recent years has been obtained at Bannockburn Estate at 5,000′, ♂, 18-4-18 by the late Mr. E. A. Wernicke and a ♀ below Mangpu at 3,300′ on 31-8-20 by Mr. G. E. Shaw. Observed at Gopaldhara at about 4,000′ in the Rungbong Valley on 9-2-19 when the rich ferruginous underparts were prominent, and a wild resounding call was uttered on its taking flight.

463. The Indian Black-Eagle. Ictinaetus malayensis perniger (Hodgs.).

The Black-Eagle has recently been recorded at the foot of the hills at 500′ by Mr. C. M. Inglis. It is generally distributed at elevations of from 2,000′—10,000′, on the Outer Ranges and occurs in the Interior around Gangtok at 5,800′, in February and March. I have noted its appearances, which have attracted my notice, though excepting the period, when it is occupied in breeding; it is often to be seen leisurely quartering the wooded 'kholas' of the hill-sides. Gopaldhara, occasionally seen in January 1912. Observed the first week in July 1914. On 13-5-16, pursued Drongos (*Chaptia ænea*), several of which are addicted to mob it daily, as it appears on its rounds. Sandakphu, 11,923′, 1-3-12, several hereabouts. In flight it shows some resemblance to the laboured motion of the Marsh Harrier; this trait is more noticeable as it passes overhead than from a broadside aspect.

Four specimens examined: Rungbong Valley, Sungma, 4,500′, ♂ 29-9-14, (C. E. Brown), wing 572. Nagri, 4,300′, ♂ 11-2-16, wing 576. Gopaldhara, 6,000′, ♀ 4-11-19, wing 580 'worn'; a broad patch of white on the throat extending behind the ear-coverts with the chin and a gular stripe black, otherwise in the rich deep black plumage of the adult female. The gullet and crop

contained the carcases of six or more young field-mice. Balasan Valley, Pussimbing, 4,500′, circum. ♀ 15-12-15, wing 585.

Soft parts : ♂ Iris stone-brown ; cere deep ochreous-yellow ; base of bill greenish-yellow ; bill black ; tarsus ochreous-yellow ; claws black.

♀ Iris brown ; cere and gape gamboge-yellow ; bill basal half, yellowish-green, remainder bluish-black darkening towards the tip ; tarsus dark ochreous. ' *A Synopsis of the Accipitres* ' (Kirke Swann.) gives the measurement of the wing, as 550–600.

464. The Himalayan Hawk-Eagle. Spizaetus nipalensis nipalensis (Hodgs.).

This bold and aggressive eagle is the great terror of the country-side. It is generally distributed in the forested tracts at elevations of from 2,500′–10,000′ on the Outer Ranges. Often to be seen around Gopaldhara. Being a wary bird, it is difficult to obtain. Sungma, 4,500′, ♀ 10-1-12. Sandakphu summit, 11,800′, 8-3-12. This day, I was the witness of the manœuvres of a pair of these grand birds, as they were too wary to allow of a near approach, I had to be well content with the excellent view attained from a secluded vantage point amongst the rocks. At times they remained stationary in the clear atmosphere, hovering perceptibly against the wind, occasionally making some terrific dashes in a down-ward direction, closing the wings at each attempt ; in one instance this feat was performed by a single bird as it came to roost on the topmost, naked branch of a tall, commanding pine-tree ; but more frequently these acts were performed in combination, in true exuberance of spirits. Ambootia, 3,000′ approx., 18-4-15. I watched a prolonged bout in mid-air at a great height up, between a pair of these eagles endeavouring to seize a domestic pigeon, which eventually escaped after an exciting time to the accompanied shouts of the owner of the bird to which the eagles were oblivious. Nigali, 5,000′ approx., 28-1-16 ; a Kite (*Milvus lineatus*) was brought in to me with its throat ripped open by one of these eagles, the combat, which took place in mid-air, was witnessed by my informant. Gopaldhara, a large ' utis ' tree adjacent to the bungalow has been a favourite roosting place on more than one occasion and a date against this fact is 18-9-15*. Seen to take a Kalij Pheasant from the ground and carry it away with perfect ease. Three specimens examined : Ghoom, 6,500′, ♂ 18-1-19, wing 462 ; the whole of the lower parts from the chin to the under tail-coverts without streaks or bars. ♀ the pair to this male, is in a melanistic phase, with black head and bars on the tail well defined, throat and breast with heavy dark streaks, and the whole of the lower surface dark and barred throughout to the under tail-coverts, wing, 465. Rungbong Valley, 10-1-12, ♀ wing 432 ; this appears to be a younger ? bird but with crest fully developed, gular stripe on throat and streaks on breast well defined, lower parts pale with barring on the flanks, abdomen, thighs and under tail-coverts also prominent. Kirke Swann gives the wing measurement of this form as ♂ 450–460, ♀ 485–495. In my ' Notes on the Birds of Upper Assam ' I recorded a ♂ from Dejoo, N. Lakhimpur, 30-11-08, under this species which on further examination is referable to *Spizaëtus cirrhatus limnaëtus* (Horsf.), being the pale phase (*S. caligatus* Raffles). This species appears to be restricted to the Lower Himalayas along the base of the hills ; the wing in this specimen is 440.

465. The Crested Serpent Eagle. Spilornis cheela cheela (Lath.).

A common and generally distributed eagle. It occurs on the Outer Ranges and well into the Interior, where I have observed it around Singhik in the Tista Valley. Amongst the numerous occasions it has come under my notice, the following records have been duly noted. Gopaldhara, 4,720′, 7-4-19. * Turzum, 5,200′, one secured, minus one tarsus, on 25-7-17. (O. Lindgren.) 25-2-21, ♂ wing 495. Seeyok, ♂ 31-3-20, wing 493. Thurbo, ♀ 1-5-21, wing abraded.

Kirke Swann gives the wing measurement of this form as ♀ (Himalayas) 495–532, ♂ 500–510 and that of *S. c. albidus* (Temm.) ♂ (Assam) 430–443 ; ♀ 430. I find five ♂ ♂ measure (a) 405, (b) 455, (c) 460, and (d) 485 respectively whilst a single ♀ measures only (e) 415. Some of these low wing-measurements for Assam specimens are significant. Whilst the single female (e) refers to an adult in typical dark plumage, male (a) is in the pale phase ; throat entirely white, breast white with centre streaks, abdomen banded, head and nape showing a preponderance of white, upper surface fringed with white ; (c) is a

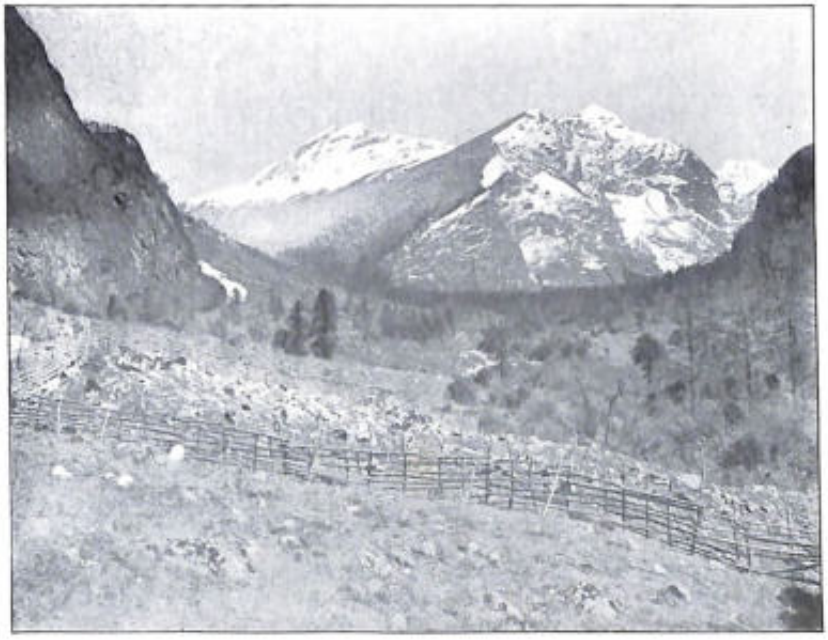


H. S. Photo.

CRAGS, NORTH-WEST OF LACHUNG VILLAGE.

Haunts of Vultures sp.?, *Pyrrhocorax graculus*, *Grandala cœlicolor*, &c.

7th March, 1920.



H. S. Photo.

LACHUNG VALLEY ABOVE THE VILLAGE.

Looking north. "An excellent example of a glacial valley."

Pines in foreground chiefly *Abies smithiana*, the Spruce of Hooker.

Haunts of *Pyrrhocorax pyrrhocorax*, *Columba leuconota*, &c., &c. 7th March, 1920.

still paler bird which almost discounts this phase of plumage being a mark of immaturity. Stuart Baker restricts *albida* to Southern India. Kirke Swann gives the distribution of this form.—E., C. and S. India from Assam to Travancore; whereas Kirke Swann restricts *rutherfordi* to Hainan Isl. and French Indo-China. Stuart Baker gives the distribution of this form.—Assam, Burma and Siam to Hainan Isl. My specimens show much disparity in size and thus best agree with the last-mentioned distribution.

466. The White-eyed Buzzard-Hawk. Butastur teesa (Frankl.).

The only record for this species is that of a ♂ obtained at Mangpu, 3,800′, on 19-2-21. (G. E. Shaw). A bird seen at Chungthang on 11-3-20* appeared to be referable to this *Butastur*, as it was not secured, this occurrence lacks substantiation. Blanford refers to this species as wanting in the Himalayas. The above record is apparently *an extension of its distribution area*.

467. Pallas's Sea Eagle. Cuncuma leucorypha (Pall.).

Obtained on one occasion in the Rungbong Valley at Sungma 4,500′, ♂ 16-6-19 (C. E. Brown.), wing, 585. Kirke Swann gives the wing-measurement of this species: ♂ 563–573; ♀ 600–618.

468. The Brahminy Kite. Haliastur indus indus (Bodd.).

Apart from a few birds occurring in the cold weather, there appears to be an influx into the hills of this kite on the advent of the S. W. Monsoon. Obtained at Turzum at 5,200′, ♂ 11-12-21. (O. Lindgren.) Gopaldhara, a single bird seen on 8-4-19, and a pair in evidence at Nigali, 5,200′, on 14-6-15. This kite ascends to 7,000′.

469. The Indian Kite. Milvus migrans govinda Sykes.

Recorded as 'found in the Himalayas up to an elevation of about 12,000′, but is uncommon above about 8,000′.' I have identified this kite from a few low elevation specimens, Nurbong, 2,000′, 18-3-14. I picked up a bird with a wing-measurement of only $13\frac{3}{8}'' = 350$, and I have received specimens from Thurbo in January 1916, and from Sungma, 11-5-15, wing, $19'' = 483$.

♂ Wing, 430–450. ♀, 460–480. (Kirke Swann.).

Blanford records this kite from Lachung, 8,000′ and Yumthang, 12,000′, (September). All the birds I saw in Lachung in March were referred to the next species.

470. The Black-eared Kite. Milvus lineatus (Gray).

The following information has reference to this large kite. I have neglected to obtain specimens, since a number were obtained in Assam. Balasan Valley, Namsoo, 2,000′. Observed in some numbers frequenting the river-bed in the first week in January 1912. Kalo Pokhari, Nepal-Sikkim Frontier, 10,160′, 29-3-12. Not much in evidence at these heights but a single pair seen to-day and a solitary bird on 1-4-12. Jalapahar, 7,500′ circ., 9-4-17. Numerous kites congregating hereabouts, disporting in a high wind on a bright afternoon. Lachung, 8,800′, 9-3-20. Numbers in evidence around the village. During the Mt. Everest Expedition observed in the Kharta Valley up to 17,000. (A. F. R. Wollaston). ♂ Wing 475–485; ♀ 500–530; tail 300–335. (Kirke Swann).

471. The Indian Black-winged Kite. Elanus cæruleus vociferus (Latham).

During the early summer in 1921 there appeared to be an extension of this kite into the hills, as both Mr. O. Lindgren obtained it at Turzum in May at 5,200′ in the Rungbong Valley and Mr. G. E. Shaw below Mangpu at 3,700′, ♀ 15-4-21; 3,800′, ♂ 16-4-21.

472. Montagu's Harrier. Circus pygargus (L.).

Evidently occurs sparingly in the Rungbong Valley during the 'cold weather.' Turzum, 5,200′ circ., ♀ 12-1-21 (O. Lindgren.), wing 338; both ovaries well defined. Iris brown; bill black; tarsus yellow; claws black. As will be noted from the wing measurement this bird is a diminutive specimen. ♂ Wing 350–370, (one 340 and one 380 mm.) ♀ wing 350—380 (one 335). *British Birds, vol. ii, p. 153*, Witherby.

473. The Pallid Harrier. Circus macrourus (S. G. Gmel.).

This harrier most likely occurs under favourable conditions in 'the cold weather.' On the west side of the Rungbong Valley, all harriers give the wooded tracts a wide berth, and on no single occasion, have I ever seen a bird on Gopaldhara ; yet they occur in the valley fairly frequently, but much more commonly on the bare, open ground around Pokharibong and Mirik.

474. The Hen Harrier. Circus cyaneus cyaneus (L.).

This harrier is probably the commonest of all the members of this genus, Rungbong Valley, Selimbong, ♀ 20-1-16, wing, 398. Iris gamboge-yellow ; this specimen is a fine adult bird. A female observed at Mirik, 29-3-20.

475. The Pied Harrier. Circus melanoleucus (Forst.).

I have seen it on a few occasions, and it has been reported to me at other times. It evidently extends into the hills, covering a wider area in 'the cold weather.'

476. The Long-legged Buzzard. Buteo ferox ferox (S. G. Gmel.).

This buzzard appears to be more common in the North-West, than in the Eastern Himalayas. Recorded for Sikkim, and I obtained it under the hills in Upper Assam. A further examination proves the specimen to be the typical form. It is quite impossible to distinguish between adults in the pale phase of this species and *Buteo japonicus* = *B. plumipes* (Hodgs.), unless they are available for comparison, when the former shows a more decided ferruginous coloration generally ; which is pronounced on the tail, the inner webs of which have a preponderance of white. Birds from the eastern limits of its range appear to have the naked portion of the tarsus in front reticulated and not scutellate as in European examples. Buzzards seen on several occasions on the Singile La Ridge during the winter of 1911–12, in particular near Phalut on 16-2-12 and 19-2-12, some of which were dark coloured birds, and at Sandakphu, 15-3-12, and Kalo Pokhari in March 1912 ; which latter records to refer to very pale birds may have in some cases been this species, though no definite certain indentification was possible, and this remark applies to birds seen on various occasions at much lower limits.

477. The Upland Buzzard. Buteo hemilasius Temm. & Schleg.

Dr. Hartert treats this buzzard as a race of *B. ferox* and *Buteo leucocephalus* and *Archibuteo strophiatus* (Hodgs.) are synonyms. Both these two latter birds have been recorded from Sikkim. On Sandakphu, 3-3-12, I saw a large bird with a dark head, inclined to black, breast distinctly ferruginous, tail much rounded ; as it soared overhead it uttered a plaintive, mewing cry. To all appearances it seemed too large for a buzzard but might have been this species. The few small birds in the gully below which, at the time, I was watching were a pair of Redstarts (*P. schisticeps*) a Wren (*T. nipalensis*) and several Cole-Tits (*L. rufonuchalis beavani* and *L. dichrous*), but these suffered no molestation, whilst busily occupied in and about the dwarf rhododendron bushes.

478. The Japanese Buzzard. Buteo japonicus (Temm. & Schleg.).

This is the *B. plumipes* (Hodgs.). Kirke Swann queries the Himalayas in his, distribution key. Rungbong Valley, Turzum, 5,000′ circ. ♂ 18-11-19, wing, 380. This example is in the stage of plumage which is probably referable to a not yet adult bird and has the zone on the abdomen, which Kirke Swann has very aptly compared with *lagopus*. Iris stone yellow (pale brown) ; ceregreenish yellow ; bill slaty-black ; tarsus scutellate in front, dull ochreous. Stomach contained remains of a mouse, some Orthoptera and a skink in the gullet. 5,200′, ♀ 16-2-21, an adult, wing, 412. Very similar to some specimens of *B. ferox* without the rufous markings, tail uniformly dark. Iris pale stone-brown ; cere greenish ochreous ; bill black ; tarsus reticulate in front, dull ochreous ; claws black. Stomach contained remains of a field-mouse and a chameleon. Lachung, 10,000′, ♂ 3-3-20, wing, 360 ; this example has the bare portion of the tarsus reticulate in front, and is in a melanistic phase of plumage throughout. Several buzzards were seen in this Valley, when on occasions they have been observed to descend with closed wings in a terrific swoop but which calmy ended by settling on a tree-stump or other

equally accommodating perching site. This buzzard is frequently to be seen in the Rungbong Valley during the 'cold weather,' and I saw a fine pair of birds at Mirik, which had taken up their quarters in a lofty tree adjacent to the swampy ground in the winter, 1921–22; when odd birds were to be seen around Gopaldhara, a specified date being 28-10-21. Blanford records it from Yumthang, 13,000′. (September).

479. The Siberian Goshawk. Astur gentilis schedowi Menz.

The only specimen that I have seen from these hills is a ♀ obtained on the 18-11-18 at Sungma, 4,500′ in the Rungbong Valley by Mr. C. E. Brown, to whom I am indebted for many interesting *Accipitres*. The wing of this example measures 337, tarsus 83. It is richly suffused with cream colour and heavily blotched on the underside so, is apparently in the immature stage of plumage. This bird was molested by a pair of Jungle-Crows, being driven from tree to tree. Iris bright golden-yellow; cere greenish-yellow; gape yellow; bill, bluish, shading towards tip into black; tarsus, lemon-yellow; claws black. Stomach contained only two small fragments of micaceous gravel, being absolutely empty of any food.

480. The Shikra. Astur badius dussumieri (Temm.).

The Shikra breeds at moderate elevations and is generally distributed. After an examination of my material from the Eastern Himalayas, I can detect no differences from extreme limits, which are not explained by *seasonal change*, and my conclusion is that all these birds must be relegated to one form. *A. b. poliopsis* (Hume.) is said to be darker grey above; with broader and brighter vinous bands below whilst *A b. dussumieri* is above lighter grey, below paler rufous in comparison with the typical form (Kirke Swann); there is apparently no difference in the size of these two forms, which are larger than *A. b. badius* (Gmel.).

Adult males, all very similar on upper side.

Sikkim Himalaya. Rungbong Valley, Turzum, 5,200′ circ., ♂ (*a*) 8-3-19. (O. Lindgren.), wing 182. Iris crimson; bill bluish at gape, sheath, horny bluish-black, deepening towards tip; cere bluish and yellowish on top of culmenal base; tarsus dull yellow; claws black.

Sungma, 4,500′, ♂ (*b*) 2-4-20 (C. E. Brown), wing 186; the palest example of all, gular stripe best defined. Iris orange-yellow; bill bluish at base, varying to the dark tip, cutting edge of upper mandible yellow; cere bluish-yellow; tarsus dusky-yellow; claws black; testes active. Stomach contained remains of *Leiothrix lutea calipyga*, identified by the bill, which was intact.

Upper Assam. Dibrugarh, Rungagora (Plains), ♂ (*c*) 4-7-03, wing 187. Iris crimson; the darkest example of all, traces of the bars indicated on the thighs, otherwise showing the white under tail-coverts as in the rest. Sibsagar, Komilabari (Plains), ♂ (*d*) 1st-13-9-04, wing 178, bars not as deep in colour as (*c*) but brighter than (*a*), identical with an example from the Luskerpore Valley, South Sylhet, month not noted, wing 190.

Immature males, all showing the rufous fringes to the feathers of the upper side, and bloched below.

Upper Assam. N. Lakhimpur, Dejoo, ♂ 23-7-04, wing 191, ♂ 5-8-04, wing 188; ♂ 10-8-07, wing, 192. Iris pale yellow; the darkest example in this series.

Sikkim Himalaya. Rungbong Valley, Gopaldhara, 4,700′, ♂ 5-8-20, wing 182. Iris pale yellow.

Adult females, all very dark on the under side with the head slaty in example (*h*) which is brownish-slaty in the rest; bars on thighs well defined in (*g*), only faintly indicated in (*h*); gular stripe most prominent in (*f*).

Sikkim Himalaya. Rungbong Valley, Gopaldhara, 4,700′, ♀ (*e*) 15-7-16, wing, 209, a breeding bird, tail in heavy moult. Sungma, 4,500′, ♀ (*f*) 7-8-17 (C. E. Brown.), wing 214, a breeding bird, tail in moult.

Upper Assam. Nth Lakhimpur, Dejoo, ♀ (*g*) 15-9-08, wing 216. ♀ (*h*) 21-10-08, wing, 214.

Immature females. *Upper Assam.* Nth. Lakhimpur, Dejoo, ♀ 2-8-04, wing 208. *South Sylhet.* Luskerpore Valley, ♀ wing 207. *Sikkim Himalaya.* Rungbong Valley, Gopaldhara, 4,720′, ♀ 18-9-21 wing 201. Iris pale yellow, cere greenish-yellow; bill black at tip, gape and basal half of lower mandible, bluish; tarsus dingy-yellow; claws black. This bird flew into the bungalow verandah at 3 p.m. in a bold endeavour to seize a caged barbet.

481. The Larger Crested Goshawk. Astur trivirgatus rufitinctus McClell.

Recorded for Sikkim, but apparently occurs more commonly farther to the east and is evidently a bird of low elevations. Mandelli obtained it breeding at Mantchu ? (Namchi) in May.

481 (*a*). The Larger Besra Sparrow-Hawk. Accipiter affinis Gurney.

This Sparrow-Hawk occurs, yet is apparently far from common. Turzum, 5,200′, ♀ 28-12-15. (O. Lindgren.) wing 203, tail, 156, this example is a fine adult bird. Gopaldhara, 6,000′, ♀ 5-11-19, wing 196 ; tail 138 ; this last example is an immature bird ; both specimens were obtained in the Rungbong Valley. A female observed in December 1911 near Thurbo at 4,600′ was certainly referable to this species.

482. The Indian Sparrow-Hawk. Accipiter nisus melanoschistus Hume.

An examination of my material is detailed, as it seems to me impossible to separate this form from *nisosimilis* as far as cold-weather birds are concern, ed. The measurements overlap and colour differences are an unstable guide due to age and seasonal change. The distribution of the two races appears to be not yet clearly defined, especially if the two forms intermingle in their winter limits ; if this is the case ; there must be some confusion in an exact determination.

Nepal-Sikkim Frontier, Kalo Pokhari, 10,160′, (*a*) ♂ 22-3-12, wing 204 ; tail 142 ; this example is an adult. Iris orange-yellow. Upper parts dark slaty, head still darker and the whole of the lower surface rusty-red, obliterating the bars, excepting on the abdomen and flanks.

Rungbong Valley, Thurbo, 4,500′, (*b*) ♂ 25-1-16, wing 212 ; tail 143, not quite as dark as the previous example, bars on the under surface defined and suffused with rufous.

Upper Assam, N. Lakhimpur, Dejoo, ♂ (*c*) 2-12-10, wing 216, tail 150.

Similar to (*b*) lower surface strongly suffused with rufous ; bars distinct. Dibrugarh, Rungagora, ♂ (*d*) 6-4-03, wing 205 ; tail 142 ; an immature example in abraded plumage. ♂ (*e*) 26-1-04, wing 216 ; tail 150 ; an immature example in fresh plumage.

Sikkim, Lachung, 10,000′, ♀ (*f*) 3-3-20, wing 253 ; tail, 183. Left ovary developed, stomach empty. *On migration*, held up with a snow storm. This example is the darkest of six females, and has the head almost black, yet this bird was accompanied by the next specimen which is equally adult ♀ (*g*) but which is correspondingly in a lighter phase of colouration, wing 247 ; tail 162 ; both ovaries showing signs of activity, stomach empty.

Rungbong Valley, Thurbo, 4,500′, ♀ (*h*) 28-11-20, wing 253 ; tail, 169 ; head and nape showing more white than is usually present in adult females, with the under surface and bars dark and well defined. Attracted to the precincts of the bungalow by the Pigeons. ♀ (*j*) 24-12-21, wing 240 ; tail, 156 ; an immature bird in fresh plumage, ♀ (*k*) 20-1-19, wing, 258, tail, 180 ; a fine adult bird with the head dark slaty, contrasting with the back and wings which are a slaty-brown ; an altogether paler phase than (*f*). Gopaldhara, 3,500′. ♀ (*l*) 30-1-19, wing 245 ; tail, 160, evidently an immature bird in slightly abraded plumage. Males Nos. (*b*) & (*c*) in comparison with (*a*) and female (*k*) in comparison with (*f*) might be referred to *A. n. nisosimilis* (Tick.) provided the specimens with which they have been compared are typical and in normal plumage,—not the result of excessive vigour or a phase of melanism.

Blanford refers to a sparrow-hawk as common in the Lachen and Lachung Valleys after the middle of September, evidently migrating southward but none were seen on the Cho La Range at the end of August 1870.

483. The Indian Crested Honey-Buzzard. Pernis cristatus ruficollis Less.

This Buzzard occurs with frequency in the hills at *moderate elevations*. An adult ♀ obtained in the Rungbong Valley in late March 1912. Wing 452 ; underparts more white than cream-coloured with the streaks well defined on the breast. Sungma, 4,500′, ♀ 14-10-19 (C. E. Brown.), this example is a very fine adult bird, showing a rich creamy suffusion over the whole of the lower surface, particularly marked on the breast ; the streaks are well defined. Wing 448. Soft parts : Iris gamboge-yellow ; bill greenish-plumbeous at base of both mandibles, upper mandible plumbeous-black, darkening towards

the tip; lower mandible bluish-plumbeous darkening similarly; tarsus dusky-yellow.

A few observations have been duly noted. Gopaldhara, 9-10-16.* A kestrel seen in company with a honey-buzzard when the former was observed to harrass it, but this act could hardly amount to a serious effort as it was glorious weather at the time and seemed to be more of an ebulition of spirits in sheer delight; even the Butterflies (*Papilio philoxenus*) which usually flitted about the compound at no great height, were this morning disporting some hundreds of feet above their accustomed realm, when they appeared like dimunitive birds in the clear atmosphere. Nagri Spur, 31-3-17*. Mangpu, 3,800′. ♂ 5-5-20; ♂ 13-8-21. (G. E. Shaw). For comparison my specimens from Assam, 3 ♀♀ Wing, 412, 415, 432, ♂ 398. The measurements of my adult birds exceed Kirke Swann's: ♀ 405–418, ♂ 380–390.

484. The Black-crested Baza. Lophastur leuphotes leuphotes (Dumont).

Sparingly distributed and confined to *low elevations*. Reported to me from few localities but evidently breeds on the Nagri Spur at an elevation not higher than 4,250′. Two specimens examined from this locality for which I am indebted to Mr. E. G. Birch. ♂ 26-6-19, wing 232; tail 122; bill from cere, 18; tarsus 36. Iris hazel; bill plumbeous-blue, darker at tip; tarsus plumbeous; claws plumbeous-horny. ♀ 10-7-20, wing 242; tail 128; bill from cere, 18, tarsus, 34. Iris, brown; cere, dark bluish-plumbeous; bill, pale-blue, tip and edges of notches of upper mandible dark; tarsus, pale bluish-plumbeous; claws dark horny. Stomach contained insect remains entirely—grasshoppers and caterpillars.

485. Blyth's Baza. Aviceda jerdoni jerdoni (Blyth).

Recorded from Kurseong, 6,000′, by Mr. E. A. D'Abreu and by Mr. A. M. Primrose from the foot-hills, 1,200′–2,000′, in this Journal, vol. xx, pp. 518 and 1152, respectively. It has since been obtained by Mr. G. E. Shaw at Mangpu, 5,500′, ♂ 13-12-20.

486. The Indian Hobby. Falco severus indicus A. B. Meyer & Wiglesw.

The only specimen obtained in recent years to my knowledge was shot by the late Mr. E. A. Wernicke at Bannockburn Estate below the station of Darjeeling. Observed in lofty forest on the left bank of the Raidak River in January 1922.

487. The Central Asian Hobby. Falco subbuteo centralasiæ (Buturlin).

The typical form appears to be a winter visitor to North-West India, where my specimens have been obtained. Until the following specimens from these hills have been compared, it is impossible to decide whether they refer to this form or *F. s. streichi* Hart. & Neum. Mangpu, 3,850′, ♂ 3 10-18. ♂ 11-10-19. (G. E. Shaw.). Both of us observed a hobby to take up its position in the trees facing the bungalow at Mangpu on 16-10-18* when its identification was fixed. Observed at Gopaldhara on 19-10-18* and again at 3,700′, 7-2-19*, single birds on both occasions.

488. The Eastern Red-footed Falcon. Falco vespertinus amurensis Radde.

A single ♀ obtained at Mangpu at 3,860′, on 18-10-18, (G. E. Shaw.) is the only record that I am aware of for these hills within recent years.

489. The Himalayan Kestrel. Cerchneis tinnunculus saturatus. (Blyth.).

490. The Eastern Kestrel. Cerchneis tinnunculus subsp.?

So far as can be ascertained, no reason has been cited for the acceptance of McClelland's *interstinctus* in place of Blyth's *saturatus*. McClelland's type came from Assam, where two or more races are likely to occur. While some of my skins from the Sikkim Himalaya are without doubt referable to *saturatus*; this appears not to be the case with my Assam skins, as the majority of my specimens are not 'saturatus.' This kestrel is resident in the Rungbong Valley, and breeds sparingly around Gopaldhara from 5,000′ upwards. It seems to lay fewer eggs in the clutch than the typical form. A single youngster, taken from the nest in early 1915, either in March or April, was a female. This bird is now in the Regent's Park Collection.

Six specimens examined: Gopaldhara, 4,720′, ♀ 16-1-12, wing and tail in heavy moult. Thurbo, 4,500′, ♂ 20-8-21, wing 243; tail 146, first two primaries in process of growth. ♀ March 1919, wing 259; tail 150. ♀ 22-11-21, wing, 234; tail, 132; wanting the deep rufous suffusion on the breast, probably not fully adult, otherwise agrees with the rest, in the average run of coloration; noted to be in fat condition.

Turzum, 5,000′, ♀ 17-9-20 (O. Lindgren.), wing 253; tail 144, not fully adult. ♀ 8-11-20, wing 257; tail 149, a fine adult bird; stomach contained Diptera Larvæ and parasitic filariæ.

My Assam specimens and with these are included one ♂ from the Sikkim Himalaya, approach nearer to *japonicus* Temm and Schleg., in coloration, but are far too large for this race, yet at the same time are too small for *dorriesi* Kirke Swann. Another race has been described from Fusan and Corea, 1907:—*perpallida* Clark.

The measurements of my specimens are detailed.

Assam.	♂	Wing	250	tail	149	(November), Immature.
,,	♂	,,	250	,,	141	(April), in change of plumage.
,,	♂	,,	258	,,	143	(December), Adult.
,,	♂	,,	256	,,	158	(November), Adult.
Sikkim.	♂	,,	255	,,	149	(January), Adult.
Assam.	♀	,,	254	,,	156	(November), Immature.
,,	♀	,,	258	,,	147	(April), Adult.

This series I consider to be well removed from '*saturatus*' and sub-specifically underterminable. The elucidation and correct identification of these eastern forms is most desirable. Numbers of kestrels are to be seen during 'the cold weather' at moderate elevations in these hills, and a few pairs were observed in the Lachung Valley up to 9,000′ at a similar period of the year, where Blanford records first seeing it on the 9th of September when it made its appearance a few days sooner than the sparrow-hawk, which evidently refers to the cold-season migrant.

491. The Red-breasted Pigmy Falcon. Microhierax cærulescens cærulescens (L.).

The true home of this interesting, miniature falcon is the deep, hot valleys and at the base of the heavily forested hills. It has come under my observation at limits of from 800-1,700′, and I have not seen it at a higher elevation in the interior of the country; whilst on the outer hills it has been obtained up to 3,860′ at Mangpu, 16-2-18, as well as at 1,100′, 2-3-20 (G. E. Shaw.), and reported from the Nagri Spur at 4,000′ by Mr. E. G. Birch, and from Bloomfield at 6,000′ near the station of Darjeeling by Mr. H. P. P. Barrett. I have seen a number of specimens from the Terai. There is little doubt that it disperses over a wider area after the breeding season, notwithstanding its distribution limits are strictly confined to low elevations. Towards April they congregate in small colonies at their nesting haunts and are then partial to clusters of lofty 'simal' trees in open tracts in preference to the dense forest, when towards evening, they become very active, enlivening the air with their bold, dashing flight, which partakes of the combined actions of *Artamus* and *Cypselus*, and though they eventually settle on the naked branches at a great height from the ground, they often dash overhead within a few feet, uttering all the while a shrill whistle. At midday it is no unusual sight to observe an odd bird enjoying a siesta in the open branches of any diminutive tree by the road-side, and even in a village quite oblivious to the daily routine of its human occupants; unless one is acquainted with this habit it might be mistaken for a shrike. I have found their breeding haunts entirely deserted at other times. In one day, 28-3-17, I had the gratification of observing six birds, at scattered intervals, along one valley. My observations have reference to the years 1917 and 1920 in March between periods covering the 12th-28th.

Four ♂ ♂ examined: Bill from cere, 10-11, av. 10-4; wing 99-104, av. 100·8.

One ♀ examined: Bill from cere 11; wing 100; ovaries developed but not breeding, 28-3-17. Several filariæ taken from behind the eye of one of these specimens. I have come across them in other birds of diverse genera such as *Spilornis*, *Motacilla*, *Siphia*, &c., &c.

Soft parts: Iris brown; tarsus greenish-plumbeous.

I have refrained in this solitary instance from stating the exact locality as

it would be quite within the realms of possibility for an over-zealous or selfish collector to decimate the birds at their breeding colonies to such an extent to disastrously affect their status. As the eggs are very rare, or even not known of this form in collections, no such charge can yet be brought against the brother Oologist, and he well might have a grievance against the skin collector.

492. The Bengal Green Pigeon. Crocopus phœnicoptera phœnicoptera (Lath.).

Entirely a plains-species. I found it plentiful around the village of Kumargram in East Bengal near the Assam boundary.

493. The Thick-billed Green Pigeon. Treron curvirostra nipalensis (Hodgs.).

Evidently confined to the base of the foot-hills and adjacent forested country of the plains.

494. The Pin-tailed Green Pigeon. Sphenocercus apicauda (Hodgs.).

Recorded for the Himalayas below 5,000′ or 6,000′. This pigeon only *appears* in the Rungbong Valley *in the cold weather*, and is then generally found below 4,700′ or thereabouts. Gopaldhara, 3,500′, 30-1-19. I counted twenty-six Pin-tailed Pigeons at rest on the bare branches of a tall 'siris' (*Albizzia stipulata*) tree at the bottom of the valley. Obtained in the Tista Valley at 2,000′. ♂ ♀ 6-3-19. (G. E. Shaw)

495. The Kokla Green Pigeon. Sphenocercus sphenura sphenura (Vig.). 'Halisa' Paharia.

Recorded for the Himalayas between 4,000′ and 7,000′ at which limits it is generally distributed in well-wooded tracts of the Outer Ranges during the summer. It breeds around Gopaldhara at elevations of from 3,440′–6,000′ during 'the rains'; a few birds remaining around 5,000′–6,000′ throughout the 'cold weather' though the majority migrate; in what direction can only be conjectured. It is recorded to the west of Nepal in summer, but stated to remain throughout the year in Nepal and farther east which requires modifying for the Sikkim Himalaya. I have heard the delightful notes of this Green Pigeon in the station of Darjeeling, where the birds are quite at their ease amongst the trees with no likelihood of being molested. Evidently double-brooded, as young birds have been found in the nest as late as 14-9-15 when I saw two nestlings at Okayti. As soon as they arrive or shortly after their arrival at Gopaldhara, they commence calling, when on 24-5-18 between a limit of 3,500′–4,720′ I noted this to be the case. 5,000′, 16-10-14, much in evidence in the forest. 8-10-21, half-a-dozen birds congregated; on 24-10-21, apparently had deserted this same patch of forest and evidently had migrated. In evidence on 27-7-15. Specimens obtained 4,720′, 2-10-19, juvenile male, 5,800′, ♂ 23-11-20, when several pairs were in evidence feeding on a dark purple berry. 6,000′ and below. ♀ 30-1-19; ♀ 21-12-11.

The rufous of the crown, orange wash of pink on the upper breast is wanting in the young male of the year which is in similar coloration to the adult female, inclusive of the under tail-coverts; while there is an entire absence of the maroon on the back, a few feathers of the lesser wing-coverts showing this character, which is faintly indicated on the median wing-coverts. On several occasions I have seen these birds called up to within measurable distance by an almost perfect imitation of their familiar notes.

496. The Green Imperial Pigeon. Muscadivora ænea sylvatica (Tick.)

Recorded for the base of the Himalayas from Sikkim eastwards. Evidently confined to the Terai and Plains. It is entirely absent from the Rungbong Valley even as a straggler.

497. Hodgson Imperial Pigeon. Ducula insignis insignis Hodgs 'Hukas' Paharia.

Recorded for the Himalayas at moderate elevations, 'about 2,000′–6,000′'. Obtained in the Tista Valley at 2,200′, ♂ 29-7-20, 2,500′, ♂ 9-7-18, elevation ? ♂ 6-8-15; 3,500′, ♀ 6-3-21. (G. E. Shaw). I observed it in small parties in the rocky, wooded ground on the precipitous right bank, in the Gorge of the Tista River at Dikchu, at an elevation of 2,800′ in March 1920. I signally failed to locate any Imperial Pigeons in the Eastsrn Dooars, in January 1922. My impression is these birds ascend in 'the cold weather,' as it is only at this period of the year they occur spraingly in the minor valleys on the west.

A pair was obtained in the vicinity of the Gopaldhara Bw. at 4,720′ in January 1914. I had an excellent view of a pigeon at 3,500′ on 14-11-19* which could only have been this species but the fact of its being single and showing a decided chestnut colouration, intensified by a white crown ; were this area within the distribution limits of *Alsocomus puniceus ;* this record would have been nearer the mark by a reference to this last species.

498. The Bronze-winged Dove. Chalcophaps Indica (L.).

Generally distributed at all elevations from the plains-level up to 6,000′. Equally plentiful in the valleys of the interior, where it occurs commonly in winter, as it is on the outer ranges throughout the whole year.

499. The Blue Hill-Pigeon. Columba rupestris turkestanica But.

Recorded under " specimens labelled Kashmir, Sikkim, and Darjeeling in the British Museum Collection probably came from more northern localities". During the Mount Everest Expedition, Mr. A. F. R. Wollaston found this Pigeon above 12,500′ below this elevation occured the next species.

500. The White-bellied Snow-Pigeon. Columba leuconota leuconota Vig.

Recorded for the Himalayas, 10,000′—14,000′ in summer, but descending to lower elevations in winter. The Snow-Pigeon was reported to come down on the maidan at Chungthang, 5,350′, in the interior during severe weather, which is quite feasible. The forest officer who supplied me with this information had a sound local knowledge of the birds. I met with it on the first occasion at about 6,000′ on 26-2-20, when a solitary bird was disturbed out of some growth above a huge projecting boulder along the path to Lachung ; in its flight it crossed the foaming river before a clear view was obtained, once it had taken up its fresh quarters amongst the trees! During my stay in Lachung up to the 10th March ; it was an every-day occurrence for large parties to settle in the rough ground surrounding the village, and on the morning we left, a last impressive view was obtained of a large flock in the valley, at just about the most distant point reached by the Choughs after a fall of snow in the higher reaches. Seen at a distance, long before it is possible to distinguish the form of the birds as they move over the ground, bunched together ; one can aptly describe their rippling motion only by comparing it to that of a forthy sea lapping an open beach. Numerous Fritillaries (*Argynnis lathonia* issæa) chiefly, with a sprinkling of Swallow tails (*Papilio machaon sikhimensis*) were on the wing, and as we reached the wooded glades, a further acquaintance with the rare vivid Blue (*Herda moorei*) was in store.

On leaving Lachung my thoughts were expressive of regret in taking leave of its primitive people—nature's gentle-folk, still isolated from the turmoil of life ; and if smiling countenances heightened by rosy cheeks are any criterion of a happy disposition ; here was ample evidence that, the fewness of their wants more than compensated for any questionable advantages that are likely to accrue from the penetration of Western influences.

Dr. Hartert gives the wing measurement of this form as 233-245.

My three specimens measure : ♂ ♂ Wing 239-243 ; ♀ wing 241.

501. The Tibetan Snow-Pigeon. Columba leuconota Gradaria Hart.

This form is recorded from Gnatong in the Chumbi Valley, and there is a strong likelihood of it occurring within the frontier of Independent Sikkim. The wing measurement is given by Dr. Hartert as 239-262.

502. The Speckled Wood-Pigeon. Dendrotreron hodgsoni (Vig.).

Recorded for the Himalayas at elevations of from 10,000′-13,000′ in summer, and at 6,000′-9,000′ in winter, Obtained at Gopaldhara at 5,000′, ♀ 7-1-12, when feeding on ' Jinghana ' berries in the forest, and also at Mangpu at 5,500′, ♂ 2-4-20. (G. E. Shaw). Elwes obtained it on the Tankra La at 13,000′ in the autumn of 1870. (Blanford).

503. The Eastern Cushat. Palumbus palumbus casiotis Bp.

Reported to have been obtained on Tonglo on several occasions. Up to the present it is unknown to me. Information in respect to its status, if actually occurring in these hills, is desirable. Stuart Baker records it from the better wooded parts above Gyantse and further north. (*Indian Pigeons and Doves*).

504. The Ashy Wood-Pigeon. Alsocomus pulchricollis (Blyth).

Recorded for the Himalayas at elevations of from 7,000′–10,000′ or higher. I have seen specimens obtained on Senchal at 8,000′ during the winter (H. P. P. Barrett). It is said to have formerly frequented the station of Darjeeling in flocks of ten or thirty from November to April, and odd parties probably occur at the present day in the well-wooded portions on occasions. During the cold-season, when on the ridge above Gopaldhara at 6,000′ I saw large flights of this pigeon presumably, descending in a southerly direction, possibly under stress of weather.

Obtained by Messrs. E. O. Shebbeare and W. P. Field from the plains at Gorumara to the east of the Tista River. Recorded Ibid. Vol. XXV, page 300. (C. M. Inglis.).

505. The Indian Turtle-Dove. Streptopelia orientalis meena (Sykes).

This Dove is the *Turtur ferrago* (Eversm.) of Blanford's ' Fauna.' As there is some confusion with the forms of the *orientalis* group, both in the nomenclature and recorded distribution ; the following extracts have been collected for future information, as correctly identified specimens, from any locality and every month, from the hills in particular, are a desiderata. The nomenclature here followed is in accordance with Dr. Hartert's treatment of the group. Recorded as breeding in the Himalayas as far east as Sikkim at elevations of from 4,000′–8,000′ from May to August. Migratory in the winter throughout the whole of India as far east as Behar, from whence my specimens have come. Tirhut. (C. M. Inglis). So far, I have failed to locate this form in the Sikkim Himalaya. All the forms in the *orientalis* group differ from the *turtur* group in having the tips to the feathers of the neck patch grey, *meena* is the palest form of the three here mentioned : the throat is albescent and the belly is almost white, which last character cannot be lost sight of in life. For the purpose of discrimination between the other two forms when available for examination : vent and flanks very pale grey and under tail-coverts white. (Stuart Baker). ♂ ♀ Wing 187–202, maximum 195. (Hartert).

506. The Rufous Turtle-Dove. Streptopelia orientalis orientalis (Lath.).

Recorded from ' East Tibet to Nepal and Sikkim, at all events the northern boundary of the latter State, also from Bhamo in Upper Burma ; probably also in northern Assam as an occasional visitor '. (Hartert.) According to Stuart Baker, Nepal birds are true *orientalis* as are those from Sikkim and Tibet while Darjeeling specimens in the B. M. Coll. are mostly (*meena* = *agricola* Tick.), and recorded as resident in the extreme north. Vent, flanks and under tail-coverts pale grey. (Stuart Baker.). ♂ Wing 190–204 ; in most cases smaller in ♀ 180–198 (Hartert). ♂ 185–200, ♀ 176–195 (Witherby). Specimens obtained around Maling, near Ringim, 4,590′, in the early summer of 1920 are referable to this form, which appears to be found at all events is the interior, though the exact determination of the birds which occur on the outer ranges around Mirik, sparingly in winter at 6,000′ ; when I last observed one on the 6th of November 1921, remains doubtful, until specimens have been actually secured. In the Mai (' Khola') Valley in East Nepal all birds obtained are intermediate *orientalis* × *meena* where at an elevation of about 7,000′, a pair of breeding birds with a clutch of two eggs were taken on 2-5-12, ♂ wing 191 ; ♀, 193. In the female the under tail-coverts and the broad tips to the tail feathers on the underside are white equally ; these characters are less pronounced in the male, which remark applies to another specimen obtained from this locality on 19-4-12, wing 185 ; which agrees more with *orientails* on the upper surface and in showing less rufous and no white tips to the lesser and median wing-coverts, scapulars and tertiaries ; and while the underside approaches nearer to ' orientalis ' there is no plumbeous suffusion as is the case with a bird from Kumargram, ♀ 14-1-22, wing 182. This was certainly the typical form ; as this specimen was neither the pale *meena* nor the rich vinaceous *agricola*. It also showed more plumbeous on the forehead and crown than is the case with *agricola*. In the Eastern Dooars in January, this dove was fairly common in the open country around the villages, but did not occur in the heavily wooded tract at the base of the hills ; unfortunately I failed to make the most of my opportunities.

These doves never seem to be plentiful in the hills, and I have never seen them in the well-wooded portions of the country, which was not the case with the next form in Upper Assam.

507. The Indian Rufous Turtle-Dove. Streptopelia orientalis agricola (Tick.).

Recorded for Assam, Cachar and Sylhet, the Bhotan Dooars and the Terai, south of the last form eastwards to Burma, etc. (Hartert.) It is thus recorded from the Bhotan Dooars and Stuart Baker mentions it as resident in Darjeeling. This is the form with vent, flanks and under tail-coverts dark grey. (Stuart Baker). Wing measurement between 165–191. (Hartert). Blanford did not recognize this form in the 'Fauna' treating it as a synonym of *orientalis*. In my 'Notes on the Birds of Upper Assam' (Ibid. vol. xxiii, No. 4, 1915, page 722), reference is made to the typical form No. 368 which requires alteration to *agricola*. It was common at the foot of the hills in N. Lakhimpur in Upper Assam, where in July 1904, I obtained two pairs of this form. While 'meena' may extend on its descent to the plains somewhat to the east of its breeding range. It appears as if, where the birds are not actually resident, a straight descent from their breeding habitat is all that is accomplished, and the cold-weather distribution area is almost as well defined as the breeding lateral distribution, at all events in the country along the foot of the hills. This group affords an interesting illustration of the overlapping of the several geographical races and we can only expect to find typical birds at the centre of each distribution area.

508. The Spotted Dove. Streptopelia chinensis suratensis (Gm.).

Recorded for the Himalayas up to 7,000′. This little dove arrives at Gopaldhara about the last week in March, when it immediately becomes a familiar object in the bungalow compound at 4,720′. One pair accommodates to the ramblers growing around the porch of the verandah as there is generally one nest in this situation. It breeds commonly up to an elevation of 5,500′ in the open country. The majority leave about the first week in October. First arrivals seen on 17-3-20*, but heard a few days previously. During 1921 the first birds arrived on 25-3-21*, and several departed on 16-10-21*, a pair still about on 29-10-21, whilst a straggler was in evidence 9-11-21 up to the first few days in January 1922. I anticipate the wet and cold which was experienced later on, would compel it to leave; however, I was unable to follow this out. This late stay is most unusual, as crowds are to be seen at the foot of the hills throughout the winter, and are then everywhere obtrusive. Gammie says this Dove leaves in November in reference to its disappearance from Mangpu during 'the cold weather.' Gopaldhara, 4,720′. Whenever unmolested in the quiet hours at midday they congregate at the godown, picking up the remains of the pony food: twelve observed in a cluster on the 8th and eight on 12-6-23.*

509. The Bar-tailed Cuckoo-Dove. Macropygia tusalia tusalia (Hodgs.).

Recorded in its distribution from 3,000′ to about 10,000′. Resident and generally distributed at all elevations from 3,500′–6,000′ in the Rungbong Valley, and in the Tista Valley from 1,500′–6,000′. (G. E. Shaw). A number of birds breed in the bottoms of the valleys and they scatter over a wider area during 'the cold weather,' so that they may be found on the wooded ridges at that period of the year. It commonly occurs in the interior of Sikkim. Obtained above Dikchu at 3,000′, approx. on 22-2-20, ar ommonly observed around Singhik at 4,500′, 13-3-20*, when they we parties on both occasions. Noted as plentiful in forest at Gopaldhar.. around an elevation of 6,000′ on 24-10-21. Obtained at 5,800′, ♂ 23-11-20; 5,900′, ♂ 3-1-15; 5,500′, ♂ 27-12-14; 4,000′–5,000′, ♂ ♂ 2—7-1-12; ♀ 30-1-16; 3,500′, ♂ 15-2-16, wing 189.

The deep sounding note of this dove is characteristic of the bird-life in forest at moderate elevations. The young ♂ (February) has the crown barred, the throat and abdomen barred in patches, whilst the breast and remainder of the plumage is similar to the adult. One ♂ obtained on 23-11-20 had the testes showing signs of activity. Seven adult specimens examined: 5 ♂ ♂ wing 190–219, av. 202·2. ♀ wing 188. The depth of colour on the belly and under tail-coverts is subject to variation. The barring on the tail is more pronounced in some specimens; whilst in others, it is almost obsolete.



H. S. Photo.

SANDAKPHU FROM KALO POKHARI.
Nepal-Sikkim Frontier. May, 1912



H. S. Photo.

KALO POKHARI CAMP, 10,160'.
May, 1912.
Surroundings, the haunts of *Ægithaliscus vonschistos*, *Suthora unicolor*, *Xiphirhynchus superciliaris*, *Myzornis pyrrhoura*, *Æthopyga gouldiæ*, &c., &c.

510. The Tibetan Sand-Grouse. Syrrhaptes tibetanus Gould.

Recorded for the country north of Sikkim, strictly not within our limits, though there is every likelihood of it occurring in the snowy ranges in the extreme north. Blanford only met with it beyond the actual borders of Sikkim.

511. The Common Jungle-fowl. Gallus ferrugineus murghi. Robinson & Kloss. Records of the Indian Museum, 1920, vol. xix, pp. 13–15, 181–183.

Gallus bankiva ferrugineus Stuart Baker.

Recorded up to about 5,000′ in the Himalayas as a breeding bird, keeping much to the valleys. Commonly met with in the Tista Valley and reported as occurring up to an elevation of 5,500′, circ. above Chungthang in the interior of Sikkim. It occurs very sparingly in the Rungbong Valley up to an elevation of 4,500′ or thereabouts, yet formerly, according to local information, it was to be found at somewhat higher limits. The few birds obtained in the Rungbong Valley were shot in 'the cold weather.' I have no record of their breeding at anything approaching an elevation at which they are occasionally reported to breed. Insufficient protection, accounted for by the clearing of the forest and molestation at the nesting season are no doubt the main causes of its disappearance in many parts of the country, where it was formerly comparatively common. The Jungle-fowl delights in the warmth of the deep, hot valleys; and provided there is a sufficiency of suitable cover such localities are ideal breeding haunts. In the foot-hills at and around 2,000′ in 1914, I heard the first bird to commence calling during the second week and again on the 21st of February at evening, when it was to be heard daily afterwards.

The Peacock, *Pavo cristatus L.* is recorded as ascending the Himalayas to about 2,000′ and locally somewhat higher. I have only seen them on the level ground at the base of the hills in the Eastern Dooars.

512. The Black-backed Kalij Pheasant. Gennæus leucomelanos melanotus (Hutton).

The distribution of this Kalij Pheasant is recorded as 1,000′–8,000′, chiefly 2,000′–6,000′, Sikkim Himalayas. Obtained as far west as the Mai 'Khola', East Nepal. Its ideal habitat is the densely overgrown, steep gullies of the hill-slopes on the Outer Ranges, where they manage to maintain a precarious existence, for their numbers are undoubtedly diminish wherever their haunts are brought into cultivation, and when they are not assured protection from molestation during the breeding season. Pine Martens account for much destruction of the eggs and young birds, and this Kalij suffers, in common with other ground game, from the depredations of these animals. They are partial to dense cover in close proximity to running water, moving out in the mornings and evenings, when feeding, to more open cover and apparently do not frequent forested land to any appreciable extent. Gopaldhara, 23-4-17. Observed to be by no means shy and fairly numerous, as I saw a cock bird on my way down, flushed out of 'the tea' by my dog; when it took refuge in an adjacent tree, paying little attention to me as it gave vent at this annoyance to a loud scolding; seen on my return in much the same place. 11-5-15, a single youngster in evidence. 10-6-16 remains of a female found on a secluded path with the eggs mashed in the nest. 15-8-16, a party of two adults and four youngsters seen in 'the tea.' Females are subject to marked differences in the varying depth of the coloration as a whole. Some males show a preponderance of white on the long lanceolate feathers of the breast, which appears like a patch, at the same time the upper tail-coverts have well defined white tips, which is indicated to a less extent over the whole of the back, whereas some examples have the upper tail-coverts devoid of these white markings which are only fairly indicated on the back; but most show the white shaft character on the upper back. The first-mentioned characters seem to be a sign of full maturity. Gopaldhara. Observed on two or three occasions during May and June 1923 in forest at 6,000′ circ.

Six specimens examined: ♂ ♂ wing 234–240, av. 235·5. ♀ wing 216–223.

513. The Monal. Lophophorus impejanus (Lath.).

Blanford records the zonal distribution of this Pheasant in Sikkim in summer at elevations of 10,000′–15,000′, in winter lower. Whilst Dresser states 8,000′–10,000′ in summer and as low as 4,500′ in winter. This latter records may

refer to the N. W. Himalayas but is entirely inaccurate for the Sikkim Himalaya. The lowest limits reached according to my observations and where specimens have been obtained is *9,500' during the winter* at Karponang and below Changu in the mountains of the *Interior*, when birds were often to be flushed out of the dense bamboo-growth on the rockey slopes with the ground under snow, in fact most of the birds were well above the winter snow-line. All efforts to trace it on the Singile La Ridge at elevations of from 10,000'-12,000' during a severe winter in 1911-12 totally failed, and the Nepalis assured me its whereabouts was unknown to them. Reported by a competent observer to have been seen on Senchal, and said to have been obtained on the above-mentioned Outer Ranges ; I prefer to keep an open mind in respect to these latter statements. Around Lachung it was said to occur, but no trace of it was to be had above the snow-line, and there is little doubt that the villagers had reduced its numbers for some miles, beyond the village. It is very probable that it formerly occurred in the afore-mentioned localities even if never numerous, and its disappearance partial or complete, must be put down to persecution Blanford found it above the level of the forest, 14,000'-15,000' (September). Three ♀ ♀ in wing measurement are 260,267 and 282 respectively.

514. The Crimson Horned Pheasant. Tragopan satyra (L.).

This Pheasant—the 'Monal' of the Paharias, occurs on the Outer Ranges and in the Interior of Sikkim at altitudes of from *7,000'-9,000'*, *March and April*, and probably as low as *6,000' in the Interior during the winter* and ascends to *12,000' in the summer*. A large number of specimens collected have enabled me to fix its breeding habitat at much lower limits than *L. impejanus*. It is very restricted in its zonal distribution but widely spread wherever it has the necessary dense cover. Immature males, assuming the adult plumage, present a patchy appearance with the red and ocellated feathers distributed irregularly on the under surface. Its call resembles the syllables 'wak' repeated several times in a loud pitched tone. Blanford never met with it below 8,000' and bears out its lower distribution zone in comparison with L. *impejanus*. I have had specimens from the above-recorded low limits above Mangan, in the interior. Breeding commences on the Outer Ranges in late March or early April. An oviduct egg has been extracted as early as the 5th of April. Available for comparison : Twenty specimens. The wing of four immature ♂ ♂ measures from 249 (18th March)—260 (5th April), av., 257. 11 adult ♂ ♂ 265-277, av. 270·6. 4 ♀ ♀ 216-245, av. 231. My female skins thus show a decided difference in size, which seems to be the case with the females of some of the other pheasants.

515. The Blood Pheasant. Ithagenes cruentus cruentus (Hardw.).

During the winter it occurs only sparingly on the Singile La Ridge at *10,000'-12,000'*. It is plentiful in the Interior of Sikkim at similar elevations throughout the *winter* keeping well within the snow-line, yet under exceptional stress of weather it is sometimes driven down to the clear ground below; this is more likely to take place on the Outer Ranges towards the end of March, and when this event happens, the males generally announce their arrival, and if it is possible then to surround the patch of dense growth ; their stupidity gives every opportunity to secure them as they do not readily take to flight ; a female was secured alive in this way, 23-3-12. It is somewhat surprising, yet at the same time gratifying to know they exist in substantial numbers along the mountain ranges in the interior ; which is accounted for by their occupying the wilder tracts beyond the villages, as to get at their habitat entails some considerable hard toil.

The flesh is the least appetising of our game birds ; but if considered as a change of diet, when only tinned food is available, can never be entirely spurned. A number of specimens have passed through my hands from various localities in Sikkim. Fifteen specimens, 8 ♂ ♂ and 7 ♀ ♀ are available for comparison. The presence or absence of the blood splashes on the breast apparently has nothing to do with age as the smallest ♂ with a wing of 202, though minus the spurs has some crimson spots, whilst a ♂ with the maximum wing measurement 214, is devoid of any of these markings. A not quite mature ♀, with a wing of 183 shows the minimum measurement ; it had a proportion of the crest feathers, banded with fulvous, which appears to be a sign

of immaturity ; after eliminating three birds which are obviously not fully mature. 6 ♂♂ measure in wing 210-214, av. 212·3. 6 ♀♀ 187-205, av. 193. The males are very variable in regard to the crimson spots on the breast which may be entirely absent or more or less indicated or heavily splashed; all show a trace of crimson on the upper black band where it meets the lower band behind the eye ; some examples have an almost complete crimson band with traces of crimson on the forehead and lores, or only on the forehead, but in a single example which is also the densest crimson-splashed on the breast, all the black feathers of the forehead and lores are fringed with crimson and, after comparison with the type, is very near to *tibetanus* of Stuart Baker. This bird was obtained along with others—showing all these variations in colour characters. The females vary slightly in the depth of the tone of the ground colour and in a few examples there is a distinct trace of crimson on the lores, under the eye and on the lower posterior portion of the band above the eye.

516. The Common or Grey Quail. Coturnix coturnix coturnix (L.).

A cold-season visitor to elevations of from 5,000′-6,000′ on their descent to the plains ; they mostly disappear as it becomes colder with the advancement of this period. Its numbers vary each year and sometimes it may be regarded as plentiful. A few birds are generally to be met with in the roughly cut ' makai ' ' baris ' around Gopaldhara. Unfortunately, very few specimens have been examined and none actually compared, so that it is uncertain whether *C. c. japonica* Temm. and Schleg. is to be also found. This Eastern Quail has been recorded on the evidence of a female skin from Bhotan. In this race ' the adult male has the sides of the head, chin, and throat dull vinous-red without black marks, the female and young male have the feathers of the throat and chin elongate and lanceolate, especially those on the sides of the throat.' (Blanford). Dr. Hartert gives the wing measurement of this form, ♂ 98-102 ; ♀ 100-106, and in the typical form, ♂ 104-115, most 108-111 ; ♀ up to 117. Behar birds are the typical form, but these probably descend to the plains by way of the North-West. *Coturnix coromandelica* (Gm.) has been reported to have been obtained in the Rummam Valley where it may possibly be resident to some extent.

517. The Common Hill-Partridge. Arborophila torqueola (Valenc.).

Recorded " commonest between 5,000′ and 8,000′ or 9,000′, occasionally found at 14,000′." This partridge is, in my experience, much *more plentiful on the Outer Ranges* than it is in the Interior, yet occurring at similar altitudes. It may possibly reach this recorded lowest limit of 5,000′ in the interior, which is however erroneous for the outer ranges, as there is no overlapping in the zonal distributions of this species and *A. rufogularis* where they meet. Neither do they move to any extent during the winter. A fine series secured in the Mai ' Khola ' in East Nepal at elevations of from *7,000′-10,000′ during March and April*, and obtained in the Lachung Valley at 8,000′, ♀ 26-2-20, one of a pair. It breeds at the end of April and in early May. Twenty-three specimens examined : 16 ♂♂ wing 144-155, av. 150·5 ; 7 ♀♀ wing 136-145, av. 142.

Soft parts : Iris brown ; bill black ; tarsus ochreous-salmon in the male, with a more decided ochreous tinge (dusky salmon-pink) in the female.

518. Blyth's Hill-Partridge. Arborophila rufogularis rufogularis (Blyth).

Recorded from the base of the hills up to 6,000′, which is substantially correct for these hills. I have no definite information of its lowest limits, but it is fairly plentiful in forest around Gopaldhara at from 5,000′-6,000′, where I have obtained many during December to February.

It appears to have a somewhat higher zonal distribution in the Tista Valley where it apparently does not come into competition with *A. torqueola*, as Mr. G. E. Shaw reports it at elevations of from 3,000′-8,400′ below and above Mangpu. This partridge is often to be heard calling before and after rain when I have known this to happen after a thunder-storm as late as the 20th of July. Towards the breeding season they commence to call in the foot-hills around 2,000′ as early as the 21st of January. The chick soon after hatching, actually gives utterance to the identical call of the adult.

Seven eggs are sometimes laid, one such clutch averages, 42×34 ; all are somewhat conoidal, and in three in the same clutch, this character is much pronounced.

Twelve specimens examined : 9 ♂ ♂ Wing 138–149, av. 143·6 ; 3 ♀ ♀ wing 133–142, av. 135·7.

519. The Red-breasted Hill-Partridge. Arborophila mandellii Hume.

Recorded for the Lower hills of Sikkim at elevations of from 1,000′–6,000′. The Tibetan Partridge PERDIX HODGSONIÆ HODGSONIÆ (Hodgs.) is recorded for the Tibetan Plateau, north of Sikkim, strictly not within our limits, but in all probability occurs at extreme elevations in Sikkim.

520. The Tibetan Snow-Cock. Tetraogallus tibetanus tibetanus Gould.

Recorded for very high tracts in Sikkim and as rarely descending below 15,000′ in summer. Blanford refers to a Captain Chamer having obtained it at Phalung near the Kangra Lama Pasa.

521. The Snow-Partridge. Lerwa lerwa (Hodgs.).

Recorded for the Himalayas from Kashmir to Bhotan and farther east at elevations of 10,000′–14,000′ in summer ; lower in winter. Reported to have been obtained formerly on the Singile La Ridge between Sandakphu and Phalut but these records require confirmation. Blanford met with it at Thangu and Yumthang. (September and early October). Not seen below 17,000′ by the Mount Everest Expedition.

522. The Himalayan Bustard-Quail. Turnix pugnax ocellatus Blyth.

Recorded for the ' Eastern Himalayas, ascends to 7,000′ '. Occurs at moderate elevations in the foot-hills and breeds around Gopaldhara during ' the rains '. Gammie mentions it as equally common from 2,000′–4,000′ breeding in May and June on the eastern side of the Darjeeling district. Gopaldhara, 28-5-23, ♀ taken with clutch of four eggs. Soft parts : Iris white ; bill pale plumbeous, culmen and tip of both mandibles horny, base of upper mandible whitish ; tarsus pale plumbeous, claws yellowish.

523. The Little Button-Quail. Turnix dussumieri (Temm.).

Recorded for the ' Lower Himalayas up to about 6,000′,' though not represented in the National Collection from the Sikkim Himalaya.

524. The Indian Button-Quail. Turnix tanki tanki Blyth.

Recorded for the ' Himalayas up to about 4,000′,' Bhutan Duars, etc.

525. The Ruddy Crake. Porzana fusca bakeri Hart.

Recorded ' Lower Himalayas, probably occurs in Sikkim.' No authentic data of its occurrence in these hills are known to me.

526. Elwes's Crake. Porzana bicolor Walden.

When I was in camp at Kalo Pokhari, 10,160′, on the Nepal-Sikkim Frontier, 22-5-12, two ♂ ♂ and one ♀ were brought in by some Paharias, who said they had been captured at an extreme height between 12,000′ and 13,000′. I did not place full reliance on their word, as the tarn or ' pokhari ' where they were likely to have been obtained was probably not at this extreme height, but might well have been a long distance from my camp in Nepal ; these birds were taken alive. Obtained below Nagri, 4,250′ circ. in the Rungbong Valley, ♀ 27-3-18 (F. S. Boileau) ; an oviduct egg was extracted from this bird. Four specimens examined : ♂ Wing 113–116 ; ♀ wing 110–117.

Soft parts : Iris crimson ; orbits, venetian red ; bill, sap-green, dusky grey at tip with a tinge of venetian-red at the base of both mandibles, inside gape slaty colour ; tarsus dull lobster or venetian-red, dusky at front ; claws, horny.

527. The Eastern Moorhen. Gallinula chloropus parvifrons Blyth.

Certain to occur at plains-levels, which remark also applies to the following.

528. The Purple Moorhen. Poryphyrio poliocephalus poliocepahlus (Lath.).

529. The Red-wattled Lapwing. Sarcogrammus indicus indicus (Bodd.).

Obtained by Mr. G. E. Shaw at an elevation of 500′ at the foot of the hills.

530. The Indian Spur-winged Plover. Hoplopterus ventralis (Wagl.).

This Plover occurs at low elevations along the Tista River.

531. The White-tailed Lapwing. Chetusia leucura. (Licht.).

Recorded for Sikkim. Unknown to me.

532. The Eastern Golden Plover. Pluvialis dominicus fulvus. (Gm.).

I have seen this Plover in open country at the foot of the hills, Sukna, 28-2-15*, observed a party of twelve to twenty settle on the east side of the Railway line. Some of the Ringed-plover (*Charadius*) are certain to occur in the bed of the Tista River and possibly also in the minor rivers.

After making a further examination of my Assam material, which is now available for comparison; there can be little doubt that two forms of this genus breed at all events in the river-beds at the base of the hills on North Lakhimpur, Upper Assam, though probably, only sparingly, and the eggs yet remain to be discovered. I have recorded obtaining *placidus* in July, ♂ 7-7-04 and two ♂ ♂ obtained on 7-1-11 are in breeding plumage with the testes well advanced in development. These specimens were secured in the bed of the Dejoo River where there was ample scope and suitable gravelly stretches of ground for nidification in 'the cold weather'. The other bird is evidently *jerdoni* with a wing measurement far in deficit of the true cold-weather migrant: a ♂ obtained on the Subansiri at Hessamara, 31-12-05, wing 103, is in full breeding plumage; whilst another example obtained on the Runganuddi. ♂ 6-5-04, wing 100, is in similar plumage, but showing signs of moult. Three specimens obtained at Gogaldhubi bhil, ♀ 8-12-05, wing 115; ♀ 11-12-05, wing 116; ♂ 18-12-05, wing 114, are in winter plumage and are evidently the typical form *dubius* to which I refer a ♀ obtained on the Dibru River at Rungagora on 15-4-03, wing 107·5; though this example has assumed the summer plumage with the exception of the black ear-coverts. I am confident that a systematic search from January to March will eventually prove my surmise to be correct in respect to these breeding birds. The fact that Ringed-plover occur at the same period of the year in both summer and winter plumage, if not remarkable, is of interest. The winter migrants appear to frequent the soft, muddy ground around the 'bhils' in company with other numerous non-resident waders and not the sandy beds of the rivers, then occupied by the breeding race.

533. The Green Sandpiper. Tringa ochropus. (L.).

This sandpiper commonly occurs in all hill rivers at low elevations. Others of this genus are certain to be found if sought for.

534. The Ibis-bill. Ibidorhyncha struthersii Vig.

Recorded by Blanford from the interier of Sikkim at 12,000′ at Yematong (Yumthang) in September. It has been obtained during 'the cold weather' in the Tista and Great Rangit River beds. I saw it frequently on the Raidak River in January, in small parties. It evidently *occurs on all the rivers of the Eastern Himalayas at the foot of the hills in the winter.*

535. The Woodcock. Scolopax rusticola rusticola L. 'Simkukra' Paharia.

The Woodcock is widely distributed at moderate elevations in the cold-season, though they apparently do not extend into the plains, as was the case in Upper Assam. In the Rungbong Valley it does not appear to be as plentiful as formerly. It is partial to strips of ground under cardamom cultivation along the 'kholas', when the soft soil at the edge of the running water, wherever these birds have taken up their quarters, is pitted with probings. They arrive at Gopaldhara in late September or early October, 3,500′, 30-10-14*. One noted at evening flying south, evidently intent on settling, and another observed the next day during the evening. A pair were often to be seen at Lachung, 8,800′, in early March 1920, in the bed of a small water course overgrown with scrub vegetation, during the frosty days; at early morning they came out more into the open.

536. The Wood-Snipe. Capella nemoricola (Hodgs.).

The generic name *Gallinago* is discarded for the earlier name *Capella* of Frenzel which takes precedence over the former.

Recorded as breeding at 7,000′–12,000′ in the Himalayas. A few are obtained in the Rungbong Valley nearly every 'cold weather.' Previous to the draining of the 'pokhari' at Mirik, this locality must have been a sanctuary for numerous Warblers, Rails and Snipe. Mr. G. E. Shaw has obtained it at Mangpu 3,500′–400′.

537. The Pintail Snipe. Capella stenura (Bp.).

This Snipe occurs at moderate elevations, though I anticipate the majority of the birds descend to lower limits which is apparently the case also with the Fantail Snipe.

538. The Himalayan Solitary Snipe. Capella solitaria (Hodgs.).

Very few specimens are shot of this rare Snipe. I observed a pair on Tonglo at 10,000′, a short distance below the summit level on the Nepal side of the Frontier in the bed of a mountain stream in January 1912. I am indebted to Mr. A. J. H. Tietkins for a ♀ which he obtained at Tukdah on the 14-11-21. wing, 160. Iris hazel; tarsus pale yellowish-olivaceous. This snipe is recorded at 9,000′–15,000′ or higher at the breeding season. Inglis obtained a ♂ in the Rungbong 'jhora' at Sukna, 9-12-19.

539. The Indian Shag. Pahalacrocorax fuscicollis Steph.

This is evidently the cormorant or Shag which commonly occurs on all the large rivers; it has been frequently observed on the Tista River. On the Raidak River observations pointed to this species. Probably the Large Cormorant occurs, but no specimens have been obtained to settle this point beyond doubt.

540. The Great White-bellied Heron. Ardea insignis Hodgs.

Observed on a few occasions on the Tista River below Birik, when it kept well over to the uninhabited left bank, with little chance of molestation.

541. The Cattle Egret. Bubulcus ibis coromandus (Bodd.).

Commonly occurs at low elevations.

542. The Little Green Heron. Butorides striatus javanicus (Horsf.).

This species frequents the Rungbong River up to at least 3,600′ and possibly right up to the head of the valley. Obtained below Turzum on 15-2-20 (O. Lindgren), and Mr. G. E. Shaw has also secured it in the Tista Valley at an elevation of 1,400′.

543. The Barred-headed Goose. Anser indicus (Lath.).

This goose has occurred in the Rammam River, from whence Mr. H. P. P. Barrett has shown me a specimen obtained out of a small party in 'the cold weather.' The following records refer to unidentified geese on the upward migration: Sandakpu, 11,929′, summit level, Nepal-Sikkim Frontier 2-3-12. Fourteen geese passed overhead going north; on reaching the summit, they paused in their flight after an apparent momentary impulse; as they quickly assumed their accustomed V formation and again headed north. At their oncoming I was located below a spur on the wind-ward side of the mountain; and thus was unable to follow their movements, after they passed my field of vision. 7-3-12. From sixty to seventy geese passed overhead at an immense altitude cackling at the time. On reaching the summit they dispersed into three parties, of which, the two outer gaggles were much the more numerous, probably to unite again once the direction was decided upon, though I could not follow out this conclusion. They were heading north, in the same direction generally as the previous lot, which would take them over the 'Everlasting Snows.' Every appearance of hot weather in the plains yet on 15-4-12, the worst snow-storm during this winter was experienced, which lasted for several days.

Jalpaiguri (Plains of N. Bengal), 27-2-15*. Two huge migrations of geese occurred this morning heading north in a leisurely manner; the second congregation consisted of several V shaped companies which appeared to intersect each other at many points as to cause an apparent break in their formation, but on careful observation this proved not to be the case; the white plumage was enhanced at certain strokes of the wing in the strong light.

Gopaldhara, 4,720′, 11-4-16, 10 a.m. Geese estimated between three and four hundred leisurely wending their flight in a northerly direction ; another lot passed over at evening 7 p.m.

12-4-16, 10 a.m. On this occasion I estimated about one hundred geese to pass overhead, going north.

544. The Ruddy Sheldrake. Casarca ferruginea (Pall.).

Kalo Pokhari, 10,160′, Nepal-Sikkim Frontier, 28-3-12. A pair of Brahminy Duck passed over Sandakpu this morning, heavy north-west and north-east gales accompanied with falls of snow the following two days. 1-4-12. This afternoon during a heavy, dense mist I heard these birds in evident distress at their inability to find their bearings ; they failed to negotiate the ridge, as their cries became fainter as they retreated down the valley. They migrate in pairs and keep in close company at all times. Blanford records a pair on the lake Bidan near the Jelep-la in the Cho La Range when one was shot by Elwes (August).

545. The Gadwall. Anas strepera L.

The Gadwall is to be found on occasions in small parties on the large rivers before the upward migration commences.

546. The Wigeon. Anas penelope L.

Obtained on the upward migration in the Lachung River on 8-3-20, ♀ during a bad spell of weather, when the birds were forced to seek shelter in the river-bed at an elevation of 8,700′.

Soft parts : ♀ Iris brown ; tarsus greenish-plumbeous ; bill slaty-blue, nail, black, terminal portion.

547. The Pintail. Anas acuta acuta L.

Two ♂ ♂ obtained on 8-3-20 in the bed of the Lachung River on the same occasion as the previous records were obtained out of a small party. One bird was ' rolling in fat ', but the stomach only contained small seeds. There had been a heavy snow-storm at this time.

548. The Eastern Goosander. Mergus merganser orientalis Gould.

Recorded, ' summer in pairs at 10,000′ and upwards on the Himalayas.' They commonly occur at the foot of the hills on all fair-sized rivers and may be seen for a long way up the Tista River. When in the Gorges they almost clip the water in flight, while on their return at evening, to the more open water in the plains they fly at a considerable height and with rapidity, generally in a well-separated cluster and it requires accurate shooting to bring a bird down. Unless it can be put to some useful purpose ; there is no object served in such a wanton act, as this handsome Duck is every bit a part of the attractions which go to complete many an entrancing picture of wild-life. On numerous occasions have I watched them busy at work diving in the clear, flowing water or resting contentedly at mid-day, allowing the current to carry them on its course. While it is no unusual sight to see a group sunning themselves in shallow water, when every now and then, they assume an erect position with much beating of the wings.

549 The Indian Little Grebe. Podiceps ruficollies capensis Salvad.

It is generally conceded that the Grebe which Mandelli obtained in Sikkim and described by Blanford as *P. albescens* is an albino ; which record probably refers to this species.

Note.—A number of additional records have been inserted since the compilation of this paper bringing it up to date 31st August, 1923.

H. S.

REVIEWS

THE PROTECTION OF BIRDS. AN INDICTMENT by Lewis R. W. Loyd (Longmans. London 1924).

We have received a little book with the above title from the pen of Mr. L. R. W. Loyd. It appears to be a piece of propagandist literature with reference to the Wild Birds Protection Act of 1923 sponsored by Lord Grey; and to have been written more immediately in response to a book by Miss Linda Gardiner entitled *Rare, Vanishing and lost British Birds*. This latter work has been sponsored by the Royal Society for the Protection of Birds.

We may start by saying that both Mr. Loyd and the Society have the same object at heart; they both desire to protect the Avifauna of the United Kingdom. Where they differ is over the methods of attaining their end.

Mr. Loyd's charge is that the affairs of the Society are managed by people who, with all other qualifications for the work, fail in one essential particular, that they are not experienced ornithologists. As a result of this he believes that they are working on wrong lines; that the protection which they advocate and help to establish is based on sentiment rather than commonsense, and that the result of it is to protect species which need no protection at the expense of scarcer and more interesting forms. In support of this belief he adduces a number of interesting examples and evidences.

We do not wish to enter into the controversy on one side or the other; all we should like to remark is that in this and similar controversies there is seldom any sharply defined path of right or wrong Mr. Loyd has however undoubtedly marshalled a selection of facts which are worthy of consideration and we hope that the Society will at least thoroughly examine the point of view for which Mr. Loyd stands. For behind him directly and indirectly is ranged a large body of collectors and scientific ornithologists who are entitled to be heard in the matter, and whose opinions the Society cannot afford to flout in their entirety without incurring a charge of levity and prejudice in the conduct of its trust.

There is a grave tendency on the part of a large proportion of the supporters of the Society to regard scientific naturalists and collectors with horror and to treat them as the professed enemies of all bird life; and this attitude in many cases has undoubtedly destroyed the fairness and impartiality of judgement which are ever an aid to the true realization of all worthy aims.

The name of Science in the past has frequently been blackened by the acts of unworthy votaries and hangers on. It is too much to hope that it will never again be smirched in the future. But many of the truest friends and preservers of the British avifauna have been found in the ranks of Science and not in the membership of the Royal Society for the Protection of Birds.

Tremendous changes are occurring in the face of the British Isles; the advent of the motor and the great arterial roads and the consequent opening up of vast tracts of country to the builder and the small holder form a danger to our native avifauna greater than it has ever had to meet before. Our plea therefore to both sides in this controversy is to join forces and fight shoulder to shoulder for their common aim: to this end certain prejudices may have to be sacrificed and certain concessions made; but the danger is pressing and let all men look to the end rather than dispute about the best means.

H. W.

'A MONOGRAPH OF THE BIRDS OF PREY'. PART I. By H. KIRKE SWANN, F.Z.S., M.B.O.U. (Wheldon and Wesley, Ltd.) Price 26*s*. net.

We welcome Part 1 of Mr. Kirke Swann's *A Monograph of the Birds of Prey* with its three beautiful coloured plates of Vultures, one of eggs and a photogravure plate depicting a Griffon Vulture's nest and young. The coloured plates are all by H. Gronvold, with whose work most bird lovers are familiar and who needs no introduction in these pages.

The monograph is to see the light of day in twelve parts and if the remaining eleven are up to the standard of this first part ornithologists, the world over, will have nothing to complain of.

In his introduction the author informs us that he has divided the diurnal Birds of Prey of the Order ACCIPITRES, into four families comprising 100 genera, including 322 species which, with their sub-divisions, comprise 692 forms. Part 1 deals only with 28 forms of vultures of which 17 belong to the Old World and 11 to the New and on pp. v and vi of the Introduction will be found a most useful table giving, at a glance, the world distribution of every genus, thus :—

Genera	Forms	Palaearctic	Nearctic	African	Indian	Indo-Malayan	Australian	Polynesian	Neotropical
FAM. CATHARTIDÆ—									
1. Vultur ...	1	...	...	...	...	...	...	...	1
2. Sarcorhamphus..	1	...	...	...	...	...	...	...	1
3. Coragyps ...	2	...	...	...	...	...	...	...	1
etc.	etc.								

The author states that he has altered the boundaries of some of these zoo-geographical regions ' for the sake of convenience in classifying the forms,' but as he defines each region carefully the alterations make but little difference.

The 692 forms dealt with are represented very unevenly throughout the above regions. We find 110 are Palaearctic, 63 Nearctic, 138 African, 52 Indian, 93 Indo-Malayan, 44 Australian, 22 Polynesian and 170 Neotropical. This, of course, does not mean that the forms of one region do not find their way over into those adjoining and we, in India, have to thank the Palaearctic regions for a good many of our winter migrants.

Mr. Kirke Swann gives us four very interesting pages on the ancient sport of kings—' Falconry and Hawking,' and, as he says, ' no monograph of the Accipitres could be considered complete unless it dealt with this fascinating subject.' He traces the art of falconry back to 1700 B.C. in Persia, and tells us that it probably existed in China even before that.

We are told that the ' Boke of St. Albans' (1486) enumerates the falcons and hawks then in use, with the classes of society they were proper to ' and it is interesting to note that the eagle had pride of place as being ' proper to ' an Emperor and the gyrfalcon and its tiercel to the King, and thus down a long list to the priest who had to be content with a sparrow-hawk and the holy-water clerk with the humble, muskayte, or male sparrow-hawk !

What we, however, do not quite follow is the author's assertion that a falcon will not ' bind ' to its quarry after striking it in the air and nor does it sirike it on the ground. We quote the passage referred to :—' The true falcons, it should be noted, kill their quarry with a terrific blow of the half closed " fist " after dropping on it from above in one of those magnificent stoops that always thrill the observer, whether performed by the wild falcon or the reclaimed bird. The flight generally commences by the quarry, well aware of the power of its terrible adversary, endeavouring to escape its fate by wildly soaring up and up, while the falcon, circling always, rises until it obtains a favourable position above its quarry before making the fatal stoop. If the first blow is not effective the falcon will follow its victim down and strike again, *but it does not " bind " to it, nor does it strike it on the ground.*' (The italics are ours.)

Many readers of the B. N. H. Society's Journal will not be inclined to agree with this statement. How often have we seen a saker ' bind ' to a kite in mid-air, after a bout of stooping ; or a peregrine bring down a heron firmly bound to the latter's wing. Again, how often have we seen an houbara, pirouetting beside a friendly bush, with wings drooping to the ground and tail spread, fan-like, over his back, ready to show fight sent staggering by a stooping falcon, showing that falcons both bind to their quarry in the air and also strike it on the ground.

We are entirely in agreement with the author when he says 'I disagree entirely with the present attempt to split up such genera as *Spizaëtus* so that practically every species forms a separate genus. We have such splitters on the one hand, while on the other we have conservative ornithologists like Dr. Hartert, who would unite both *Astur* and *Accipier* in one huge unwieldy genus.'

Considering, as the author points out, that such groups contain about one-fifth of the hawks of the world, to unite them under one genus is asking for 'deplorable confusion' and so long as we have good characters such as the difference in the middle toe, in these two genera, why not keep them apart.

So far as this Part I of the monograph is concerned, we who are chiefly interested in the avifauna of India might consider ourselves somewhat shabbily treated, even though we get a very good share of the world's vultures. Six Indian forms are dealt with which are included in the Family ÆGYPIIDÆ the Old World Vultures. These are :—

1. *Ægypius monachus* better known to us as *Vultur monachus* (Fauna of Br. India.)
2. *Gyps fulvus fulvescens* ,, to ,, *Gyps fulvus.*
3. *Gyps himalayensis.*
4. *Gyps indicus.*
5. *Gyps indicus tenuirostris* ,, ,, ,, *G. tenuirostris.*
6. *Pseudogyps bengalensis*
7. *Sarcogyps calvus* ,, ,, ,, *Otogyps calvus*

The author quotes extensively from previous publications and, in so far as the Indian forms are concerned, Hume and Mr. Stuart-Baker are his chief authorities. It is not possible that in a work of this nature, every reader will see eye to eye with the author or the descriptions he has quoted from other authors, but this is a negligible atom when we consider the excellence and magnitude of the work as a whole. For instance, when dealing with the Indian White-backed Vulture *Pseudogyps bengalensis* the author quotes from Mr. Jesse (*Ibid.*, 1903, p. 66) as saying 'it is common and permanent in the Lucknow District and when too high in the air for its white "waistcoat" to be seen can be distinguished from *Sarcogyps calvus* by the more pointed pinions of the latter.' This is rather misleading, and one would infer from it that the under wing of the Indian White-Backed Vulture was black, as in the Pondicherry Vulture, but this is by no means the case. There can be no possible confusion between the adults of the two species at any height. In *Sarcogyps calvus* the under parts are black, except for the white crop and thigh patches, whereas in *P. bengalensis* one gets the impression of a bird that is *almost* half white and half black. The entire body and tail will appear black and the wings half white and half black.

Moreover we are told that this bird does not range high in the Himalayas as it is not a mountain bird, and yet it is now pretty common in most of our hill stations such as Simla and Murree.

Similarly, the author informs us that the Pondicherry Vulture, (*Sarcogyps calvus*), 'is widely distributed in India but is nowhere very abundant. It occurs in the lower Himalayas, but is rare in the Punjab and Sind.'

We can hardly consider this vulture *rare* in the Punjab as one can seldom see a flock of vultures anywhere without seeing one or two of this species among them, though they are more often seen alone or in pairs.

We have seen them as high up as 9,000 ft. in the Himalayas.

We cordially recommend this part of the monograph, with its beautiful illustrations, to our members and meanwhile will await the appearance of its successors with a pleasurable anticipation of joys to come.

C. H. D.

NATURE AT THE DESERT'S EDGE. (Studies and observations in the Bagdad Oasis). By R. W. G. HINGSTON, M. C., M. B., I.M.S. H. F. & G. Witherby, 326 High Holborn, W. C., 1925, 299 pages, 11 plates. Price, 15/ shillings net.

This exceedingly interesting book is the latest of the series of natural history volumes which have made their author so popular among students of insect life. The book begins with a brief note regarding the physical features of Iraq and life in an oasis in the desert, which was the venue of the activities so

carefully studied and so beautifully pictured. The main theme of this volume is the study of the senses, instincts and behaviour of insects, spiders and other related animals. The first portion deals with the wasps of which the author has selected four examples : *Ampulex assimilis*, Kohl., *Psammochares melas*, Ki., *P. rutilus* and *Cryptocheilus rubellus*, Er. The habits of these 'hunter' wasps as the author designates them, their pursuit of prey, combat, capture and stinging have been described in a most vivid manner. Simple experiments which were introduced to test author's theories of behaviour add still further to the interest of the subject. The most impressive features of the lives of these tiny creatures are :—'A solitary toil, a persistency of effort, a glowing enthusiasm and a deadly skill.'

From the wonders of the armour and skill of the 'hunters' the author goes on to describe the wonders of the defence of the 'hunted.' The life-histories and habits of the caterpillars of *Dicranura vinula*, L., *Taragama siva*, Lep. and *Deilephila nerii*, all members of the Order Lepidoptera, are described and structural details added.

The author has made a special study of concealing coloration, alarming attitude and warning markings, sudden jerky frightening movements, display of hidden structure, and finally the most effective of all weapons the corrosive liquid, as means of concealment and defence.

From the 'hunter' the author passes on to the 'stranglers' who use their nets to capture the prey and wind ropes of silk to strangle it and poison it when he is properly secured. These are the spiders. Here again, the author expounds his theory of perfect concealment of these spiders to catch their prey unawares.

The next two chapters are devoted to the Solifugids and their habits and an exciting description is given of the warfare of a Solifugid with a Scorpion.

The book is brought to a close with an account of a locust swarm.

All through the book the author has endeavoured to prove the perfection of various adaptations met with in the wasps which have to catch their prey and paralyse it, and caterpillars which have to defend themselves against attacks, particularly of birds and parasitic insects and in places his vivid descriptions make his arguments very convincing. While describing the defensive mechanism of the Puss moth caterpillar he says 'up go the tails the long telescopes protrude, the scarlet filaments curl and quiver' and finally the corrosive liquid is squirted. Certainly a very convincing account of the efficacy of the defensive organs. The warning attitude, armour of long setæ and sudden display of hidden structure, etc., are, according to the author, the means of frightening away birds and the insect parasites. Man looks at every thing from his own point of view and it is doubtful how far this anthropomorphic explanation is the correct interpretation of actual facts. It is highly problematic if toads, and frogs, lizards and birds get frightened by such behaviour. And we are not certain if insect parasites search their prey with their sense of vision. It is very likely that the visit of a tiny Chalcid parasite is not even noticed till the deed has been accomplished. Further it remains to be proved whether the worst enemies of insects are not protozoa and bacteria and fungi, rather than other insects and bigger animals.

All arguments of adaptations are based on the fundamental conception of the utility of everything produced by Nature. The author has on every occasion argued to prove the wonderful perfection of structural adaptations and intelligence of insects and spiders, and even the Solifugid has got his share of praise. It is here that one would differ from the author. No praise is sufficient for the skill of the hunter or the war tactics of the spider or the solifugid but does all this show intelligence of a high degree. Just as one could place the gaudiest of animals in surroundings where it will be perfectly concealed, similarly one could read intelligence in the working of the 'meanest' of animals. Yet the author himself while describing the march of the locust says : 'What an excellent example of instinct of direction. How blind in its relentless, its undeviating course. Better self-destruction than instinctive deviation. For nothing must check the all powerful impulse. . . . The living machine must fulfil its purpose though annihilation lies ahead.' Is not this then the true explanation of the behaviour of animals whatever their position in the scale of evolution ? Are not the wasps, the caterpillars, the spiders all living machines though perhaps little more complicated than the locust ?

The wonderful attraction which the beauty of Nature has for the author is depicted in the last page of the book, and the last sentence is truly representative of the spirit dominating all his ideas. 'We perceive at last her infinite domain, her infinite wonder, her infinite beauty, her infinite work, her infinite power.' The description of the working of Nature would have been complete if the author had added 'her infinite horrors, her infinite disharmonies and her infinite absurdities' for Nature has these in quite as great an abundance as the attributes mentioned by the author.

The book is exceedingly entertaining and written in a lucid and captivating style, scientific details have been described in a non-technical language without sacrificing accuracy.

It should be in the hands of every naturalist young or old.

M. A. H.

FAMILIAR FLOWERING TREES IN INDIA by Ida Colthrust (Thacker, Spink & Co., Calcutta. Price Rs. 1-6-0.)

This useful little volume will be warmly welcomed by all lovers of nature. The need of such a useful book was greatly felt by the wayfarer and it is well supplied by the authoress. There are many whose vocations in life do not permit them to indulge, as much as they would like to an intimate knowledge of trees, and it is for these in particular that this book has been written and illustrated.

The object of this volume is to enable us to name our common trees on sight without much labour in hunting for them in learned text-books. A popular subject has been treated in popular language and in a popular style. All the most common flowering trees are lucidly described and the reader is provided with a succinct key which enables him to name the more familiar plants he sees. One very useful feature of the book are the beautiful illustrations which are so very essential and helpful. The illustrations are not only happy but also very accurate and they give a very vivid picture of the trees under description.

The value of the book is further enhanced by the vernacular names of the trees.

The book does not pretend to treat the subject exhaustively, neither are all the flowering trees described, as the authoress confesses in the Preface, but in spite of its size it goes a great way to relieve the embarrassed wayfarer who meets with flowering trees on his way.

We recommend this useful little volume to all lovers of Nature.

D. P. F.

OBITUARIES

Professor H. Maxwell Lefroy

The recent death of Professor Harold Maxwell Lefroy, Professor of Entomology at the Imperial College of Science and Technology, London, marks the passing of a distinguished Economic Entomologist and investigator. The tragic circumstances under which he met his death places him amongst the ranks of those men who have given their lives in the cause of science, for it will be remembered that Professor Lefroy was overcome by gas fumes while experimenting in his laboratory at the Imperial College.

During the years of his service in India as Imperial Entomologist, 1907 to 1912, Lefroy served on the Managing Committee of this Society and was a frequent contributor to the pages of its Journal in which he published several notes on the life histories of Indian Insects, particularly on those of economic importance.

We publish below an extract from an obituary notice which appeared in the *Times* :—

Harold Maxwell Lefroy was born on January 20, 1877, the son of a country squire, at Itchel Manor, Crondall, Hants. He was sent to Marlborough College, and went up to King's College, Cambridge, graduating with first-class honours in the natural science tripos in 1898. He had collected insects as a boy, and at Cambridge specialized in entomology. In 1899 he was appointed Entomologist to the Imperial Department of Agriculture for the West Indies, a post which he held until his appointment as Imperial Entomologist for India. When in 1912 the Imperial College of Science and Technology at South Kensington decided that the training of entomologist, for work in the Empire should form an important part of its functions, Lefroy was called to the new chair from India, as his experience in the tropics, scientific knowledge and enthusiasm, and great success in dealing with the administrative and practical sides of insect-pest problems were pre-eminent. Although his professorial duties had to yield to special war problems, Lefroy showed as much energy and ability in creating a school as in administrative work, and entomologists trained by him at South Kensington soon began to fill important posts in every part of the Empire.

Lefroy's method was to study the life-history of insects of economic importance in the field, as he believed that there could be found some weak link in the chain, some phase in the insect's life, in which it could be most easily attacked if it were noxious, or encouraged if it were useful. He followed this up by translating the methods he devised from a state in which they could be applied only by highly skilled persons to a form suitable for mass application. He showed great ingenuity in adapting elaborate methods for large-scale use and in devising regulations for their employment. The silk and cotton industries owe much to him, and his advice on the destruction of the insect enemies of tropical agriculture generally has been of great service. His results were published in the *West Indian Bulletin*, the *Agricultural Journal of India*, in many official papers, and in three important books—*Indian Insect Pests* (1906) ; *Indian Insect Life* (1910) ; and *Manual of Entomology* (1923).

When the war came Lefroy was one of the first to appreciate the great danger to armies in the field and to people at home from the house-fly. He was honorary curator of the Insect House at the Zoological Gardens in London, and with the concurrence of the Council devoted time and energy to a campaign against these pests of humanity. He conducted experiments into modes of destroying them or preventing them from breeding, arranged an exhibition to impress the public with the dangers arising from them and the modes of dealing with them, and used his great powers as a convincing lecturer in teaching sanitary officials, doctors, and Army officers. In 1916 he was attached, with the temporary rank of Lieutenant-Colonel, to the Field Force in Mesopotamia with the specific duty of conducting sanitary measures against flies. He was recalled to London to deal with an equally important problem, the destruction of vast stores of wheat awaiting shipment to this country in

Australia, the agent being several species of small beetles. A committee of the Royal Society propounded several solutions effective on the laboratory scale, but impracticable on the scale required. Lefroy, on behalf of the Royal Commission on Wheat Supplies, after a rapid survey of the problem in this country hurried to the United States and there inspected the existing methods of cleaning wheat on a large scale. He then went on to Australia and in a few weeks discovered how the mountainous piles of sacks became infected, devised simple methods of preventing this, and also designed an improved and rapid way of removing a very large percentage of the beetles from wheat already infected. When this task had been accomplished he returned to England and resumed his work of teaching and investigation at the Imperial College. The next problem to which he gave attention was the ravages of the Death-Watch beetle in the timbers of old buildings. He studied the question first in connexion with the roof of Westminster Hall and soon devised an effective method. Thereafter he was consulted by the guardians of many famous buildings and old churches in this country.

There were three forms of attack on insect pests in which Lefroy specialized. He believed that it was often possible to encourage the natural insect enemies of insects, and some of his most interesting work was the result of observation in the field of what species of insects preyed on others and how these benefactors could be transferred to areas in which their services were required. He had made many observations on the fashion in which insects were lured by specific scents, sometimes not appreciable by the human nose and he conducted a large series of investigations into appropriate baits by which noxious insects might be lured to their destruction. But his favourite method was the employment of suitable chemical poisons, and his investigation of these led him deep into purely chemical work. His private laboratory at the Imperial College, accordingly, was usually extremely un-pleasant and often dangerous. But Lefroy had no thought of personal discomfort or risk when he was hot in pursuit of an idea and more than once nearly succumbed to the gases with which he was experimenting.

Professor F. Hallberg

On November 2nd last, Mr. F. Hallberg died in the Medical College Hospital, Calcutta. He was a Swede by birth, did a brilliant course in Mathematics and Physics at Upsala University, taught Mathematics in St. Xavier's College from 1915 till 1922, was examiner in Mathematics for the M. A. & M.Sc. during that period, and published original work in Geometry. Mr. Hallberg was a singularly gifted nature. His mind felt at home in the most abstruse speculations, he took delight in philosophical discussion, and read widely. Though Mathematics was his speciality, he was far too many-sided to feel satisfied with one discipline. Before coming out to India he was for two years Observator at the Meteorological and Seismologic Station at Vassijanre, Lappland, and after that, extraordinary Amanuensis at the Meteorological Observatory at Upsala. As soon as he had joined St. Xavier's College, he seized the opportunity of taking up Botany : all his spare time was spent in the Botanical Laboratory, his holidays were given to collecting. A large number of original papers were published, the joint work of Fr. Blatter and Mr. Hallberg. So distinguished did he become, that he was selected to make a Botanical Survey of Kashmir ; that was work which appealed to his venturesome spirit.

To be alone in the heart of wildest nature, to tramp untrodden lands, to discover hidden things, to face difficulties and hardships, to live untrammelled by convention was his delight ; one of his dreams was to join the Mt. Everest expedition. He may almost be called reckless of his life and health. When in the first ecstacy of motor-biking, speed became a passion. He had a serious accident which nearly crippled him for life, but scarcely had he dropped crutches and was able just to hop along, when he got a side-car, nothing undaunted by the awful sufferings he had so lately gone through.

In 1923 he went to Europe to study the Santonin question. On his return in January 1924 he went to Kashmir in search of the anthelmintic plant which yields Santonin. He was working as scientific adviser to the 'Indian Santonin Syndicate.' But his health had been undermined by strain, and an operation undergone in Calcutta could not save him. He died an untimely death. His

breezy, cheerful character, his refinement and accomplishments, his wonderful and varied experiences, his depth and range of knowledge, his sociableness made him a fascinating companion. That so many gifts and talents were not more husbanded, not granted a chance of reaching their full measure, fills all friends of Mr. Hallberg with the keenest regret.

In a letter to Fr. Blatter, Dr. C. C. Calder, Director of the Botanical Survey of India, wrote: 'I am very sad at Hallberg's death. He was an upright man with very much that was loveable.'—

Mr. L. J. Sedgwick, I.C.S.

All who knew Mr. L. J. Sedgwick of the Indian Civil Service must have been grieved to learn that he died on the 27th June in Bombay. The *Times of India* brought the following notice on the 30th of June:

'The sudden death of Mr. L. J. Sedgwick, who was a particularly brilliant member of the I.C.S., will be widely regretted. As far as we are ourselves concerned, this means a great loss to our weekly books page. Mr. Sedgwick made a hobby of reviewing books for us, and his reviews were always of the same high standard. Though he was a Classics man at Cambridge and had afterwards become proficient in Sanskrit, Gujarati, Marathi and Kanarese. Mr. Sedgwick never spoke about these achievements, but preferred to review books dealing with scientific subjects, particularly botany, of which he had an accurate knowledge. In his reviews Mr. Sedgwick took great care to avoid any parade of learning and to write something that would be interesting to everybody, but nobody ever convicted him of a misstatement or even a rash expression of opinion. If he had lived he would, no doubt, have written other books besides the Bombay Census Report of 1921.'

His work was equally appreciated by the Government of Bombay in their resolution of the 8th July in which they say:

'Government have heard with great regret of the death on Saturday, the 27th of June last, of Mr. L. J. Sedgwick of the Indian Civil Service. Mr. Sedgwick displayed throughout his official career of over 18 years a steadfast devotion to duty which gained for him alike the confidence of his superior officers and the affection and respect of the people among whom he worked. He was a scholar of conspicuous ability and his special aptitude for ethnology and languages rendered his services of particular value in the responsible post which he held in 1921 of Superintendent of Census Operations. He was at the time of his death engaged in important investigations as Officiating Director of the Labour Office, Bombay.'

A few days later Dr. B. H. Namvatty of Ahmedabad wrote in the *Times of India*: 'I had the pleasure of being rather intimately acquainted with him. I was impressed by his deep knowledge of several Indian languages as well as of science and arts, for he was a brilliant graduate of Cambridge University. His ways were gentle, unassuming and modest, and a very agreeable and prominent feature of his character was that he was devoid of all false or exaggerated notions of pride of race, power or position. He was readily accessible to all, to the influential and to the poor alike.'

By Mr. Sedgwick's death our Society has lost an enthusiastic worker in Botany. He was a keen observer of nature. All his spare-time was devoted to botanical investigations. As a Civil Servant he was stationed in many places and had, therefore, splendid opportunities for the study of plant-life in many parts of this Presidency, from Upper Sind down to Northern Kanara. Wherever he was he added new material to his extensive Herbarium which, during his life-time, was acquired by the Botanical Department of St. Xavier's College, Bombay.

He published valuable papers in the Journal of our Society, in the *Indian Forester*, and in the *Records of the Botanical Survey of India*. His publications show an independent mind which refuses to be tied down by general statements that are not sufficiently supported by facts.

As to his own statements he was almost scrupulously modest and accurate. He had a vast knowledge of systematic Botany. Though of a strictly scientific turn of mind, it had always been his fond intention to popularize Botany in our Presidency. It is a great pity that death put a stop to all his plans and ambitions.

EDITORIAL

We are pleased to be able to announce that Her Highness Maharani Akhand Saubhagyavati Laxmi Bai Sahib Puar of Dhar, who shares with His Highness the Maharaja a keen interest in Natural History and Sport, has recently consented to become a Vice-Patron of the Society and that Her Highness has signified, by a donation of Rs. 5,000 toward the expenses of the museum her approval of the work that the Society is doing in the Prince of Wales' Museum. The Managing Committee of the Society take this opportunity of expressing their appreciation of Her Highness' interest in the affairs of the Society and thanking her on behalf of the members for her generous gift.

As pointed out in the recently issued 'Annual Report of the Natural History Section, Prince of Wales' Museum' for the year 1925–26, the Annual Grant received from Government for the maintenance of the Natural History Section makes little provision for the supply of show cases and equipment, and the Museum is largely dependent for these on the generosity of private individuals, whose assistance affords us no small encouragement in carrying out the work we are doing. The Curator's Report, to which we refer above, shows that extensive progress has been made in the various galleries of the Section. It is regrettable therefore to read that the absence of suitable show cases for the Reptile and Fish Galleries has largely prevented the development of these two Sections of the museum. The report also indicates that a very urgent need is the building of a suitably equipped laboratory in the museum grounds. At present the work of the Museum Preparation Department is carried on in the Society's Rooms at 6 Apollo Street, which are inconvenient and unsuitable for the purpose. The transport of large exhibits from the laboratory to the museum is one of the minor difficulties with which the department has to contend, particularly when, as was the case with a fully mounted Bison, the windows and masonry have to be removed before the transfer can be effected. A suitable site for the laboratory is available in the museum grounds and it is estimated that a sum of Rs. 15,000 would go far towards meeting the cost of erection but,—there is always a but—it is almost superfluous to add that funds are needed for carrying out the work.

The present issue of the Journal contains a review of Mr. L. R. Loyds' recent book on 'Bird Protection.' The author of the book is at variance with the attitude adopted by the Royal Society for the Protection of Birds. He believes that the methods they advocate are prompted more by sentiment than commonsense. We hope that the Society will carefully consider the case as put forward by Mr. Loyd and the facts which he brings forward in support of his claim. For behind him, as our reviewer points out, is ranged a large body of Scientific Ornithologists and Collectors, amongst whose ranks may be found many of the staunchest supporters of Bird Protection and whose opinions on a subject, on which they are naturally qualified to speak, are worthy of respect and consideration and whose co-operation in a matter of common interest would go far towards the attainment of the end the Society has in view.

The subject of Bird Protection in England brings us to a matter nearer at hand, it concerns the lifting of the present embargo on the export of egret plumes from India. Readers of this Journal will recall the various illustrated articles on the subject of Egret Farming in Sind and other parts of India. These farms are now well established and the trade in their produce could, it is believed, form the basis of a flourishing cottage industry provided the present Plumage Act was amended for their special benefit.

The Government of India are now considering the question of lifting the embargo on the export of *aigrettes* subject to certain conditions. In the main these are as follows :—

Farms would either be licensed or run by Government or recognized Co-operative Societies, subject to such conditions as the local Government might choose to impose. To facilitate despatch through the Customs, the feathers licensed for export would be contained in sealed packets of standard pattern, sizes and weights. Large amounts would be put up in specially sealed bales. These standard containers would be issued by Local Governments

and carry the name of the district or sub-division and have a serial number and the date stamped on them. The farmers would be required to bring their produce once or twice a year to the district *tashil* Head-quarters, where they would be examined and sealed up in the standard containers, the farmer paying the requisite fees. He would then be at liberty to take over the sealed packets and dispose of them as he liked.

In producing the feathers the farmer would be required to show his farm license, the amount of the yield being checked against the anticipated output of the farm. If Local Governments appointed Inspectors, it is presumed that they would be able to tell whether the farmer was supplementing his legitimate stock with feathers of wild birds. In such cases the license would be withdrawn. Certain provisions are to be included to give facilities to middlemen and exporters who would be permitted to examine the contents of the packages either before sealing or under supervision of a Customs Officer.

The lifting of the embargo would of course only concern the produce of licensed farms, the ban on the export of plumage of wild birds, would remain in force as at present.

We welcome the opinions of members of the Society, particularly from those conversant with or interested in the subject, as these proposals are now being considered by the Society's Committee who have been requested to acquaint Government with their views on the matter.

In a letter received by the Editors of the journal, the writer comments on the apparently reckless shooting indulged in by the author of an article recently published in the Society's Journal—the Editors wish it to be known that the publication of an article without editorial comment does not imply approval of the methods adopted by the author.

Col. W. H. Evans' profusely illustrated serial on the identification of Indian Butterflies is now nearing conclusion and we are sure that entomologists and collectors would welcome the proposal which we are now considering to issue the series in book form. Every effort will be made to keep the price of the book at the lowest possible figure so as to bring it well within the reach of all who are interested. The edition will be limited to 200 copies. Those desirous of securing a copy should communicate with the Honorary Secretary. Re-publication will of course depend largely on the number of applications received.

Col. R. Meinertzhagen, who has recently returned from a collecting trip in Kashmir and the countries beyond, writes to solicit the help of members in certain investigations which he is now undertaking.

It appears that something can be learned from a study of the grit which certain groups of birds swallow in order to assist them in digesting their food. An appeal is therefore made to those who shoot the following birds, to extract the stomach (gizzard), an operation which any cook can do, and forward them to Colonel R. Meinertzhagen C/o Bombay Natural History Society. The stomach should be complete and undamaged. Six or seven stomachs of each of the small species and four or five of the larger would suffice. It these stomachs are allowed to dry in the open air, or are even cooked they will travel in a small box without smell. The following data with each batch of stomachs is essential—species, locality, month of year. The groups from which stomachs are required are, all Game Birds, including Pigeons and Doves, Sandgrouse, Peafowl, Crane, Bustard, Geese and Duck and Quail. With regard to Game Birds it will be worth examining these in the neighbourhood of the Ruby mines in Burma. Amongst the societys treasures (Burglars please do not note) are 13 Sapphires found in the gizzard of a jungle Cock shot near Mogok.

MISCELLANEOUS NOTES

No. I.—THE SLOW LORIS (*NYCTICEBUS COUCANG*)

Apropôs of the note on the Slow Loris which appeared in a recent issue of the Journal (vol. xxi, No. 1, p. 215) we publish below an extract of a letter received from Major J. D. Scale:—

This curious little animal, from its nocturnal habits and its shyness, is, in these hills, very seldom seen and rarely captured. In addition, the superstition which attaches to it among the non-Christian Lushais, i.e., that disaster will befall the house and inmates responsible for its capture makes it very difficult to obtain a specimen. In some places even to see it is exceedingly unlucky so that I counted myself fortunate to have the opportunity a few days ago of handling one which had been brought in by a Christian Lushai. The man while climbing a tree had seen it asleep in a hole in the trunk below him and had effected its capture with much difficulty, by dragging it from its retreat with nooses of jungle creeper. When brought in, it was trussed up into a ball, but when loosed was in excellent condition, save for a gall on the hind legs from its bonds. It was a male. Its moments were slow and well considered, it never took a pace unless certain of its foot hold, and its power of hold was prodigious. For three days it lived in the bungalow of its owner, sleeping by day on the top of an almirah and at night climbing about everywhere. It ate bananas, fruit and fowl's eggs broken for it. On the third day, whether with the connivance of non-christian friends or no is doubtful, it returned to the jungle and though searched for high and low has not been since seen. There is no doubt that it could shake off its lethargy and move fast if necessary as on one occasion as I was trying to prevent it climbing out of reach, it struck with lightening-like swiftness, and bit my sleeve. The Lushais firmly believe its bite causes vomiting, and a creditable informant states he saw a half-witted boy, who was incapable of reasoning, knew nothing of the superstition and thought that the Loris he had captured was a monkey, vomiting for some time after being bitten. I did *not* attempt to disprove the belief. Its Lushai name '*Sa-huai*' means the haunted animal and the story goes that 'Once upon a time the great chief Thlangrukpa gave a feast to all living creatures. In order that even the most delicate of them, whom the sun's rays might injure, should be present, the banquet was held at night. So enjoyable was it that at sunrise they were still making merry, so a message was sent to the sun asking him to postpone his coming. Very kindly he agreed but being very curious to see the show he peeped over the horizon at which many of the smaller guests scattered away. The loris, sprightly and nimble in those days, was dancing a passeul and furious at the sudden interruption to his "turn" told the sun what he thought of his behaviour. The sun in anger at the insult, swore the loris should never look him in the face again, or wander abroad in his light and from that minute this little creature was afflicted with the groping gait he has to-day.'

LUSHAI HILLS,
ASSAM.

J. D. SCALE,
Major.

[The bite of the Slow Loris is held to be highly poisonous by certain tribes in Assam and the neighbouring provinces. Frayer in his *Thanatophidia of India* gives a very interesting account of the harmful results which followed a bite from

a Slow Loris. He quotes the instance as indicating how great is the liability to error; even when the evidence is complete. This slow, gentle and harmless creature is convicted on the best evidence of poisoning a man by its bite as a venomous snake would have poisoned him. In commenting on the case Frayer wrote: 'The effects so well described by the author were probably due to mental causes, with some co-incident disorder. This is a good example of the necessity of extreme caution in arriving at conclusions, or generalizing on insufficient data.' *Eds.*]

No. II.—THE OCCURRENCE OF HODGSON'S BAT (*MYOTIS FORMOSUS*) IN THE CENTRAL PROVINCES

While compiling a list of the mammals inhabiting the Central Provinces and on going through and examining the material in the Nagpur Museum, I was a bit doubtful of the identity of a bat, presented by my predecessor, which I had put down as Hodgson's Bat, *Vespertilio formosus*. I have now sent the specimen for verification to the Bombay Natural History Society and they have confirmed my identification. It was taken at Nagpur in a bungalow which it had entered.

NAGPUR MUSEUM, E. A. D'ABREU, F.Z.S.

30th June, 1925

[The distribution of this beautiful bat is given as the 'Himalayas near Mussorie up to 3,500 feet, Nepal, Sikkim Assam, Khasi Hills, Bengal, Calcutta, Purneah, Chabassa and China. Its discovery in Nagpur, C. P., indicates an extension of its known habitat.' *Eds.*]

No. III.—THE SAMBHAR CALL OF TIGER

Your readers will be much interested in Major James' letter and your summary of the various notes on the above subject (Journal, B.N.H.S., vol. xxx, p. 462). You will pardon me however, if I venture to differ in your interpretation of Major James' experience.

Major James does not say that the tiger was meditating any attack on the Sambhar or that it was even stalking it: in fact the whole behaviour of the tiger contradicts this: had it been intending an attack its whole attention would have been focussed towards the sambhar—it would either have been almost invisible, or proceeding towards the sambhar at a belly crawl, or in flashes, like a live wire, and instead of this it was standing up, flanks heaving and head lowered, to make the call. This is not the way a tiger hunts. Major James specially mentions tigers are scarce when he met this one. Is it not more likely that the tiger heard the sambhar moving without knowing what it was, and gave it a call?

In your summary of views on the subject you have been good enough to refer to my brief remarks on the subject contained in *Wild Animals in Central India*. I may be permitted to amplify these. There are many baffling points in connection with this call. To begin with no two people interpret the noise in the same way. Does the call vary to the extent one would suppose, and is there more than one call? I have only heard one: like a soft low sambhar call. The only medium of describing sound is to liken it to some other sound.

Again, tiger are much more addicted to the call in some places than in others. I have only once heard the sound outside *sal* forest and, but for this instance, I would have been almost tempted to say that it is not uttered in the teak forests. It is significant however that all the calls of tiger are far more commonly made in *sal* forest as compared with teak forests. A friend of mine, of vast experience and a most accurate observer, has never heard it in teak forests. It is a fact that the most experienced shikaris exported say from

Chanda to Mandla or Balaghat will not credit the local *Baigas* when they assert that the noise is made by a tiger. Col. Faunthorpe, late Commissioner of Lucknow and a mighty hunter, told me he had never heard it. His experience was of the Terai.

I am convinced the origin of the call has to do with a mate: this includes *finding* a mate; *keeping in touch with* a mate, or a note of *interrogation or enquiry* for purposes of identification towards a noise or a disturbance: a potential mate? These are the only motives which are consistent with my experience. A number of times I have been able to follow the course of a tiger striding across a grass maidan in Mandla by the call being repeated every two or three hundred yards. There is no element of fear or disturbance in this. Two tigers together, one or both being disturbed, keep in touch with each other by this call. There is no essence of hunting in this; and I have never known a case of a *single* tiger make the call when the disturbance has been identified, but they will making it when they do not know what is a foot. It is very difficult to be certain if a tiger has identified a disturbance: also whether it is in touch with a mate or not: the fact that the great mass of tigers on thousands of occasions make no noise on being disturbed makes it necessary to look for some other cause or causes for the call than disturbance alone. It must be borne in mind that in a great number of cases in which the call is heard *disturbance* is taking place: there is a very great danger therefore of associating the call with disturbance, without searching for deeper causes.

Since the publication of '*Wild Animals in Central India*' I have received a number of very interesting letters from all parts of the world from perfect strangers. One of these was from Mr. Robert Cardwell of the Eastern Express Telegraph Co. Ltd., Cocos-Keeling Island, December 3, 1924. He is evidently well acquainted with the Malay Peninsula, an interesting country about which little is published. I make him my apologies for quoting from his letter without having obtained his permission. He writes as follows:—

'I am particularly interested in your description of the tiger's peculiar "fook" or "koi" as I interpret it—for so many books seem to ignore or say very little about it, and often when hearing the cry I have wondered the reason for its utterance. It would appear that this cry is uttered far more frequently in some places than in others. In Cochin China, or at least in those parts that I have shot over, this call may be heard almost nightly and particularly so at certain seasons when the young grass is springing up after having been burnt, with the consequent influx of deer and other game. Sometimes it is uttered so frequently that it is quite possible to tell in which direction the tiger is moving. As you say, it is quite out of the question it being uttered as a decoy cry: for no one who has heard it a few times could possibly mistake it with the belling, or even the note of alarm of sambhar, so that there is no possibility of any deer being taken in by it.

I think that your explanation of it being a mate call must be the correct one, but, so far as my observations go, the call is seldom answered by a second tiger. A peculiar incident happened to me once when crossing a small plain by bullock cart on the way to some tsaine ground. I shot at and wounded, a hog. deer which we could not find at the time in the knee high grass: but on our return after nightfall, a dog, which was following the cart-discovered the wounded animal which started to cry out on being worried by the former. Before we could reach the deer two tigers "fooked" from the nearby jungle, one of which approached at a rapid pace across the plain towards the deer, still "fooking" all the while: when it got within a hundred yards or so off us, (as seen next day)—it evidently discovered our presence for it turned away, still "fooking" till it had entered the jungle once more on the opposite side of the plain.'

In reply I asked Mr. Cardwell if the period when the grass is burned coincided in any way with the approach of the mating season. It is obvious that the concentration of game means also that of tigers and this without other reasons would account for the greater frequency of the call. The story of these two tigers is only consistent with the call being a mate call.

March 24, 1924.

A. A. DUNBAR BRANDER.

TIGER NETTING IN ASSAM



No. 1.
Men pulling on one of the
' Dhenki ' Ropes.



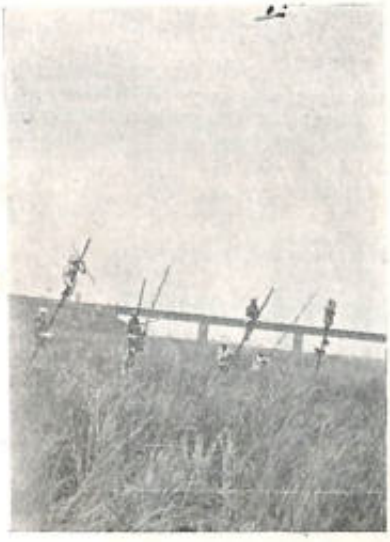
No. 2.
A small portion of the
spectators.



No. 3.
Tiger rushing across the
enclosure.

No. IV.—TIGER-NETTING IN ASSAM

The indigenous plains population of Assam are notoriously a pleasure-loving, simple, and more or less idle folk. At least so reckoned in present times when everyone must be up and doing if he is to survive in the struggle for existence.



Bamboos in position with men on the look out.

In this Province, where the soil is rich, the people's requirements few and easily met, and with a traditionally benevolent Government, the people are extremely improvident, and give up much time to festivity, revelry, and romantic idleness.

The women-folk perform not only all the household duties ; the nursing and tending the children, the collection of fuel, and the cooking of the food, but also bear the brunt of the work in the fields.

From the time of harvesting the mustard crop, till the rains have properly set in and the ground is nice and soft for ploughing, i.e. from about the end of February till about the end of May or beginning of June, we find the fields abandoned, cattle let out to graze untended, all grass lands contiguous to habitations burnt (to secure safety for the cattle, to provide fresh crops of grass for the cattle, to render themselves immune from accidental firing of such grass areas, and largely to provide themselves with a supply of fuel from the unburnt ekra stems) and all the inhabitants holding inter-village carousing.

At this time whether on account of the opportunity afforded by the absence of cattle attendants, or due to the fact that it coincides with the breeding season of tigers, or that the cattle wander further afield, or the combination of all these circumstances, the number of cattle killed even in a single day seems sometimes incredible.

The wholesale destruction of their cattle soon rouses the inhabitants from their supine placidity, to combine and take concerted action against the common enemy, on the shortest notice at a given signal.

In this District the people who go in for tiger-netting are the Lallungs, the Cacharies, the Koches and a few Hera villages.

For this purpose each male adult of the village has to provide two nets, made from $\frac{1}{2}$ inch diameter jute rope ; each net being about 100 feet long by about 15 feet wide, with meshes 6 inches square. A rope about $\frac{3}{4}$ inch diameter passes along both top and bottom of the net and serves for binding the two ends.

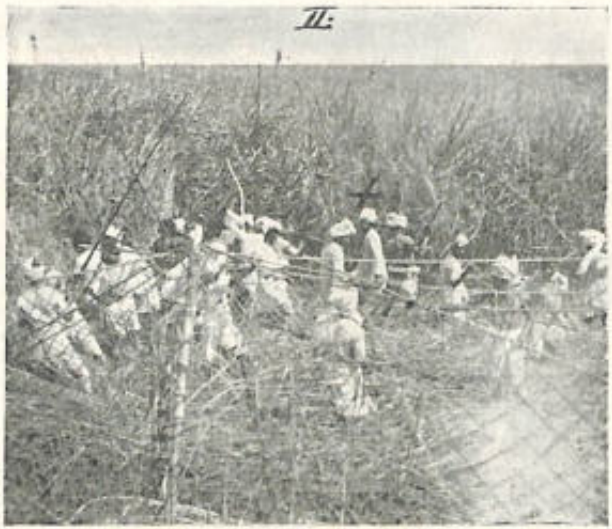
New nets are used each year, or where old nets are used they are doubled.

Having decided to net a tiger, the first kill that occurs is closely examined by a party of about ten to fifteen men who go out armed with spears to investigate. If they are satisfied that the tiger is still not very far from the kill, messengers are sent out in all directions to neighbouring villages (some sometimes 5 miles away) to call all able-bodied men, and to bring all available nets, spears, bamboos, drum, cymbals, and every other contrivance for producing the most diabolical noises conceivable.

The spot most likely to hold the tiger is then partly netted on the outer side, while the rest of the area or adjoining area, if very large, is divided into two or three blocks by breaking down the grass in straight lines. A systematic beat of each block is then carried out, beating towards the netted area ; at the same time men are posted along the cleared lines to intimate when a tiger or tigers break across.

When a tiger is driven into the partly-netted area, the men promptly form a cordon round, whilst others complete the surround with nets as quickly as possible. The top of each net is kept in position by passing the main top rope of the net and one of the meshes over and into the horns formed from bamboo uprights, while the bottom is similarly held down by inversed bamboo forked pegs. The bamboo uprights are about 8 to 10 feet long of which about one foot is driven into the ground.

Long bamboos with the side branches left for about 6 to 8 inches from the culm are then erected all around the enclosure, and serve as look-out posts, to watch the movements of the tiger and to direct the dragging of the log to be described hereafter. (The Photo alone shows these bamboos in position with the men keeping a look-out.)



Men entering the nets.

Having located the tiger at one side of the enclosure, the *Kaviraj* or tiger-doctor performs his *mantras* and enters the net at the opposite side. He is then followed by about 60 to 80 men armed with spears. (Photo 2 shows the men entering the nets.—The *Kaviraj* is shown by a X.)

These men proceed to break down the grass, i.e. the front ranks break down the grass whilst the rear ranks form a semi-circle with their spears, in case the tiger should charge from a side.

Finally having reduced the area to about 50 yards diameter, with the grass broken down all round inside to a width of 10 to 15 feet, a log of wood called a 'dhenki' is fastened at the two ends by two long bamboo ropes (about 3 inches diameter) and dragged backwards and forwards, to break down the grass, as well as to make the tiger rush about the enclosure to the amusement of the spectators. The 'dhenki' is about 10 feet long and about 10 inches diameter. (In the Plate, Fig. 1 the men pulling one of the 'dhenki' ropes are clearly seen.)

At the outset the tiger often rushes the nets and could be easily despatched, but, according to custom, strict orders are given not to do this, to allow spectators for miles around to come and see the 'tamasha'. When the tiger rushes the nets he is beaten back with the buts of the spears. (Fig. 2 of the Plate shows only a very small percentage of the spectators who often number several thousands.)

Watch is kept day and night, and the place takes on the appearance of a circus or theatre. The performance sometimes lasting five days, by which time the tiger is well nigh dead of thirst and exhaustion, while the netters themselves can scarce keep up the strain which earlier excitement had helped them to undergo, and they decide to finish him off. (Fig. 3 shows the tiger in one of his rushes across the enclosure).

At the signal for finishing him off, each man on a bamboo arms himself with a spear.—The 'dhenki' is dragged towards the tiger who, as it approaches, charges it, sometimes biting the rope in two, and then makes for some point in the nets, where he is greeted with a flight of spears, both from the men on bamboos as well as the men surrounding the nets. The end is speedy; for as the tiger is more or less pinned down the men see red and the lust for blood is given full rein to, the crowd surges forward pushing in the nets and were he a leopard he would have as many spear thrusts as he has spots. (Photo 10 shows the last of a notorious cattle-lifter.)

NOWGONG, ASSAM, L. J. DELANOUGEREDE,
June 1925. *D. F. O.*

No. V.—PANTHER WITH ABNORMAL FEET



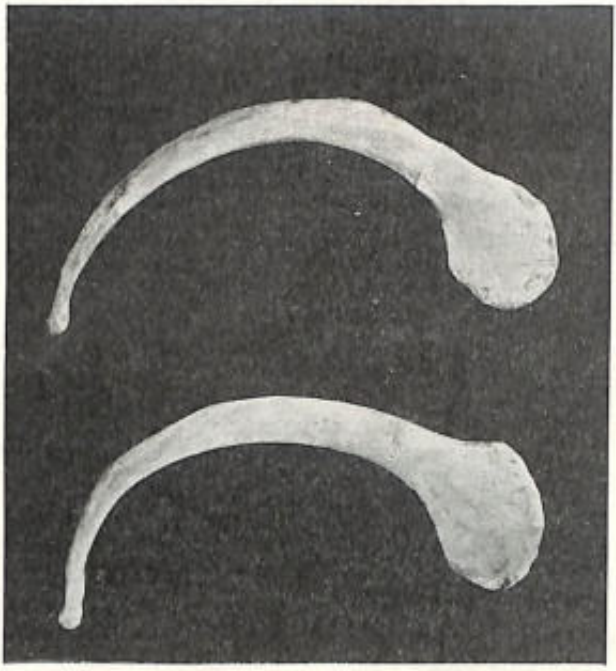
Abnormal Feel of a Panther.

On the 28th January, 1925, I shot a Panther at a place about 2 miles to the north of the village of Jhikadi in the Bhuj District. He was a full-grown male, in excellent condition and measured 6 feet 11½ inches between uprights and 7 feet 1 inch along the curves. He had an extra abnormal toe on each hind foot on the inner side of the leg. These toes were little round balls of fleshy substance with no bones in them and were merely attached by the skin, but there was a claw (non-retractile) on each toe. The toes were placed in a line with the back of the pads, rather high, but the extra claws were quite useless. A freak of this kind has probably been noticed before, however, the present instance may be worth recording and the photographs accompanying this note may interest the readers of the Society's Journal.

BHUJ, KUTCH, MAHARAJ KUMAR SHREE VIJAYARAJJI.
29th April, 1925.

In Volume XI, p. 734 of this Journal Mr. S. Eardley-Wilmot refers to a panther, shot by him in Oudh, with five fully developed claws and toes on each hindfoot. *Eds.*

No. VI.—ABNORMAL CLAVICLE BONES OF A TIGER



Abnormal Clavicle Bones of a Tiger.

I enclose a photograph of two clavicle bones taken from a 9 feet 7 inches tiger which I shot on the 29th April in the Pahalgarh Estate, Gwalior. The tiger, though not very long, was extraordinarily massive and heavy.

I believe the shape of these clavicle bones is unique. The upper one is 4¼ inches long round the curve measured from the red mark on the outside of the flattened head. The lower bone is 3¾ inches in length.

MANPUR *via* MHOW,
14th May, 1925.

W. G. HUTCHINSON,
Lieutenant-Colonel.

[The clavicle or collar-bone is often rudimentary and very frequently entirely absent in mammals ; in the Primates the collar bone is well developed, in the Bats it is very long and curved ; in a few forms of the *Rodentia* it is altogether absent in Cetaceans and in Ungulates it is always absent. In the Carnivores the clavicle is sometimes absent and varies much in its development, thus, none of the Fin-footed Carnivora (*Pinnipeda*) such as the Seals, etc., possess a clavicle bone. When present, it varies much in its development, but is always rudimentary and suspended in the muscles, that is to say, instead of the collar-bone forming a bar to connect the shoulder blade with the breast-bone, as in man, it merely forms a splint of bone embedded in the muscles of the chest between these two points. In the *Felidæ* it is slender and curved—being longer than in any other members of the order—in the *Canidæ* it is very short and rather broad and flat—in most of the Bears it is absent. *Eds.*]

No. VII.—PANTHER AND WILD DOGS

On the evening of 31st May, 1925, I had a clear case of a large male panther driving wild dogs off his kill.

A tethered buffalo calf had been killed by this panther, but a thunderstorm prevented my going to the *machan* until late in the evening. Two men went on

in advance to tidy up the screen. Following a few minutes later I found them returning to say that the nullah was full of wild dogs and they had been afraid to go on. I sent back to camp—not far away—for my shot gun ; and by the time I got to the place, shot gun in hand, the light was very bad. There were no wild dogs, but a large grey shape could be seen tugging at the kill. The nullah being wide and stony no nearer approach could be made. The distance was 50 yards. Twice the panther's head could be made out turned in the direction of myself and the man with me, but he seemed little concerned and renewed his efforts to remove the kill. Exchanging the gun for a ·470 rifle I sat down, raised the enamel foresight disc., and took a careful shot, fully hoping to lay the beast out. The bullet went high, doubtless because the back sight was not sufficiently defined.

Except for the fore part of the kill the dogs had picked the bones of the carcase pretty clean. At daybreak next morning they turned up again ; two large dogs and seven pups of some 7 to 8 months old, as far as I could judge by dentition of one I shot.

It was fully evident that the panther had arrived on the scene, immediately after the two coolies turned back, and driven the dogs away. Had the pack contained more full-grown dogs he would probably have been less successful.

QUETTA,
7th July, 1925.

LT.-COL. R. W. BURTON
Indian Army (Retd.)

No. VIII.—A HYBRID BLACK BUCK (*A. CERVICAPRA*) AND CHINKARA (*G. BENNETTI*)

(*With a Photo*)



Hybrid.

The Hybrid as you will see from the photographs is an extraordinary animal, and was found with a herd of Blackbuck. It used to fight and drive away the other Blackbuck in the herd and was an absolute master of the herd. The colour was almost that of a Chink but some black hair were visible here and there. It was bigger than the ordinary Chink and the shape of the

face was not altogether that of a Chink, but somewhat resembled a young Blackbuck. The tail was black exactly like a Chink. In build it was slightly bigger than a Chink. The horns were a curious mixture of Blackbuck and Chinkara. They started out of the head like the horns of a Blackbuck whilst the tips resembled those of a Chink. Its action and the way it carried its head were more like a Blackbuck than a Chink. As this animal lived in a Blackbuck herd, I presume that the father was a Chink whilst the mother was a Blackbuck doe, for if the mother had been a Chink it would not have been found with a Blackbuck herd.

BIKANER, *13th February, 1925.*

MAHARAJ KUMAR SRI SADUL SINGHJI BAHADUR

No. IX.—DUEL BETWEEN TWO BULL ELEPHANTS

The following incident which resulted in the death of two wild elephants took place in the Feudatory State of Athmallik, which borders on the Mahanadi River in Orissa. The story was related to me by a local official and I visited the scene of the struggle about four months after its occurrence. The State contains some extensive tracts of forest watered by perennial streams which afford a sanctuary to wild elephants throughout the year.

During the month of February 1924 news reached the head-quarters of the State that two bull elephants had been fighting and that one had been killed. This news was received four days after the actual combat took place, and on further investigation the body of one elephant was found while the second was discovered in the jungle close by badly wounded. The survivor was successfully captured by means of trained elephants and was kept tied up in the vicinity for a few days but when an attempt was made to take him out of the forest he succumbed to his injuries.

Unfortunately four months elapsed between the above occurrence and my visit to the scene, so that although I saw what remained, it was impossible to detect any of the injuries from which the elephants died. Both were single tusker bulls, the tusks weighing 45½ and 44½ lbs. respectively.

I relate the above episode as I should imagine that it rarely that one of these combats ends in a double fatality, although many must be severely injured during such encounters.

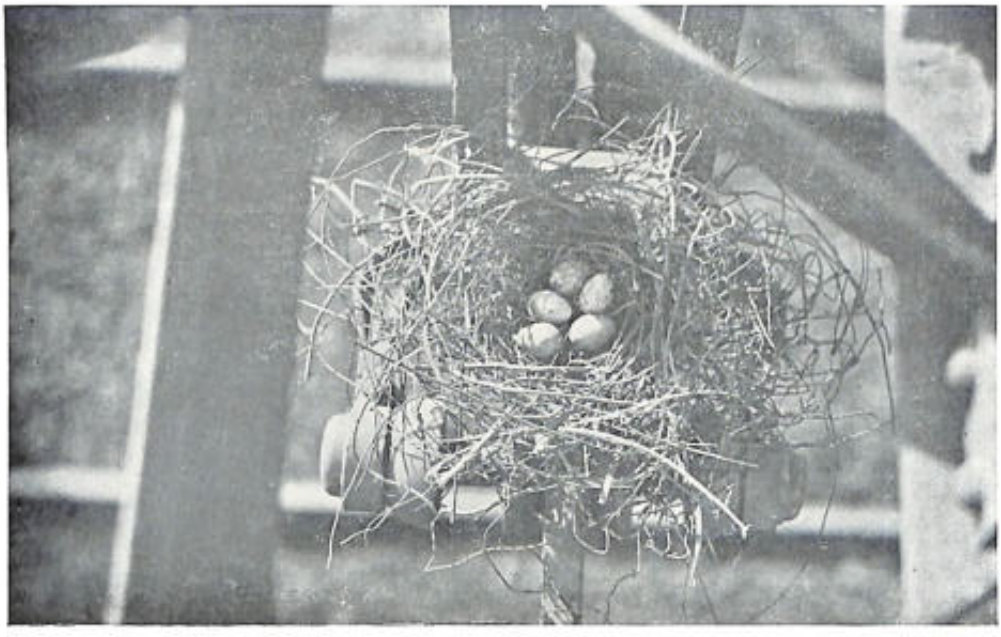
SAMBALPUR, B.N.Ry.

H. F. MOONEY, I.F.S.

No. X.—AN ELEPHANT TRAP

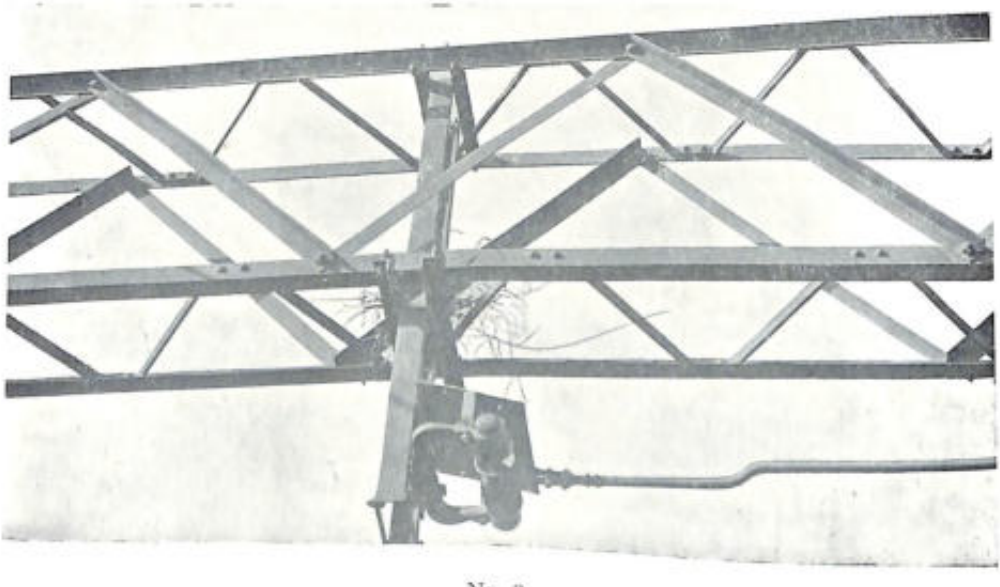
There is a form of trap figured in Sir Aurel Stein's *Serindia*, which is widely used in Africa and I am anxious to discover how far it is still in use in Asia. I append an extract from Bell's book *Wanderings of an Elephant Hunter* which describes the method of using the trap.

'A well frequented elephant path is chosen and somewhere near the spot 'decided upon for a snare a large tree is cut. Judgement in the choosing of 'this must be exercised as if it is too heavy the snare will break, and if too light 'the snared elephant will travel too far. A tree trunk, which ten or twelve men 'can just stagger along with, seems to be the thing. This log is then brought 'to the scene of action and at its smaller end a deep groove is cut all round to 'take the noose at one end of the rope. After this noose has been fitted and 'pulled and hammered tight—no easy matter—the log is laid at right angles to 'the path with the smaller end pointing towards it. A hole, a good bit larger 'than an elephant's foot is then dug in the path itself to a depth of two feet or 'so. Over this hole is fitted a wooden frame work similar in shape to a cart 'wheel with spokes but without a hub. Round its rim the large noose of 'the snare is laid and the whole is covered carefully over with earth to resemble 'the path again. The snare is now laid, and if all goes well some solitary bull 'comes wandering along at night, places his foot on the earth borne by the 'sharp spokes of the hubless wheel, goes through as the spokes open down-'wards, lifts his foot and with it—the wheel bearing the noose well up the ankle, 'strides forward and tightens the noose. The more he pulls the tighter draws 'the noose until the log at the other end of the snare begins to move. Now 'alarmed and presently angry, he soon gets rid of the cart wheel, but its work 'is already done, that does not matter. The dragging log is now securely 'attached to the elephant's leg, and it is seldom that he gets rid of it unless it



No. 1.

Crow's nest (weight 11 lbs.), made almost entirely of wire, built on the side strain insulator Brackets.



No. 2.

Crow's nest of wire in process of construction on the over-head girder.

'should jamb in rocks or trees. Soon he becomes thoroughly alarmed and sets 'off at a great pace, the log ploughing along behind him. Should a strong, 'vigorous young bull become attached to a rather light log, he may go twenty 'or thirty miles.'

COURT LEYS, C. G. SELIGNMAN.
TOOT BALDONE, OXFORD.

No. XI.—CROWS NESTS AND ELECTRIC CABLES

The G. I. P. Railway, since the inauguration of the new electric service in Bombay, was faced with a novel problem intimately connected with the nesting habits of the Bombay crow.

The Bombay crow on looking round for a nesting place decided that the overhead gear which carries the electric cables offered a safe and satisfactory haven in which to bring up its family. The Bombay city crow has advanced ideas in nest architecture and commonly builds itself a nest of wire or hoop iron in preference to the more common-place twigs.

Mr. R. McLean, agent, G. I. P. Railway, has very kindly forwarded us the following particulars :—

During the months of March, April, May and June 62 insulators were damaged by crows, causing a loss of 43 hours on the service ; this loss was spread over 433 trains. From observations taken the trouble was usually caused by the crows either attempting to build their nests on the side strain insulator brackets, as shown in photograph No. 1 or by the crow alighting on the structure near the 'live' line with a length of wire in its beak and the wire coming in contact with live metal. The wire started an arc which, though small at first, spread to the heavier metal of the line and structure and so continued until the insulator was completely burnt down.

In one instance the Catenary Cable, 1 inch in diamater was burnt through. The crow apparently prefers metal such as wire, hoop iron, etc., to twigs for building its nest, for it was noticed that wherever such material was available, the nest was composed entirely of wire with a thin lining of straw or cocoanut fibre. The compositions of the nests varied on different sections of the line. Near Masjid (in the heart of the city), the nests were of small pieces of light hoop iron, probably brought from the metal yards in the neighbourhood. Near the Cotton Green, they were of iron wire such as is used in reinforced concrete construction. Near Kolwada in the suburbs, where no such supplies of metal were available, the nests were of twigs and were not dangerous from our point of view. Near Kurla, they were of twigs and wire.

The crows were most persistent in building on the structure where they had first chosen to build and after the nest had been taken down, returned time after time to rebuild. Early in the season they would rebuild the nest in about three days, but later the new nest would be built in a few hours.

Another interesting point noticed was that the crow did not sit in the nest at night if it was composed of wire, but roosted in a tree close at hand. The wire nests in such cases were found to be quite warm even at 2 a.m.

The statement made in the press that only one crow had fallen a victim to the power is incorrect. Twenty-nine crows were found dead at the site of accidents. They were invariably badly burnt and nearly all their feathers were charred. In two instances a crow flew away leaving its legs behind stuck to the structure as an effect of the arc.

As an emergency measure the railway decided to fix asbestos sheets over the brackets to prevent wires from resting on the 'live' 'pull-off' rod, and so far the fitting of these sheets has been entirely satisfactory.

The crow, however, not to be defeated, has now moved his habitation higher up the structure and photograph No. 2 shows a nest in the overhead girder itself. The chances of wires coming into contact with live parts of the structure are, of course, very much less in the new location, but an examination of the photograph with a magnifying glass will show the great lengths of wire that have been used in making his nest, so that the danger is by no means entirely eliminated.

BOMBAY NATURAL HISTORY SOCIETY, S. H. PRATER,
15th June, 1925. *C.M.Z.S.*

No. XII.—PREDATORY HABITS OF THE MAGPIE

In the Tsangpo valley on 14th July, I came on a Black-rumped Magpie (*Pica pica bottanensis*) having an almost fully-fledged lark in its mouth. The parent lark was attacking it and the young bird struggling to be free. I rode after it to try and make it drop its prey but it refused to do so and flew on a few yards at a time. At last seeing that the young lark was dead, I left the Magpie to its meal.

GANGTOK, SIKKIM
11th May, 1925.

F. M. BAILEY,
Lieutenant-Colonel.

[The food of the European Magpie (*Pica pica*) is stated to consist mainly of insects but also carrion, small mammals (rats, mice, voles), young birds of many species and eggs and vegetable matter. The other forms of the species which occur in N.-W. Africa, parts of Asia and N. America are probably equally carnivorous. *EDS.*]

No. XIII.—FRESH LIGHT ON THE IDENTITY OF THE 'DEVIL BIRD.'

With reference to the note on the above subject which appeared in the last issue of the Journal, our readers will be interested in the following extract from a paper on 'The Devil Bird' read by Dr. Spittel before the Natural History Society of Ceylon and printed in the *Times of Ceylon*, 11th June, 1925. Dr. Spittel gives an exhaustive and interesting account of the many theories which throw light or tend further to obscure the identity of this elusive creature, and, from questioning scores of people met with during his wanderings, sifting carefully the evidence he got and discarding all doubtful data, he has come to the conclusion that:—(1) the Devil Bird was no *owl* but an *eagle* and was crested; (2) it was a large bird and (3) was streaked in its breast plumes rather like a jungle hen.

Dr. Spittel writes:—

'I had come to a dead end; for I knew that with my limited opportunities for visiting the jungle, I could not hope to add the final touch of proof necessary, by securing for myself a specimen of the bird while it cried, or even seeing one that had been shot by a reliable informant.

I now told Mr. E. C. Fernando, the Colombo Museum taxidermist, all I knew about the Devil Bird and suggested to him that the only way to clinch the doubt would be for him to try and shoot the bird while it cried. This, I had no doubt, he would, sooner or later, have the opportunity to do when camping in the jungle collecting specimens; for he is a young and ardent sportsman with a good knowledge of birds.

A couple of months ago I was pleasantly surprised to hear from him on the telephone saying he had shot the Devil Bird and had several specimens to show me.

'What bird is it?' I eagerly asked.

'The *Spizaëtus cirrhatus*,' said he.

Then felt I like some watcher of the skies!

The circumstances under which he had shot the bird were these:—

Towards the end of November 1924 he was camping at Divulana, when often at night he heard the hoots of the Devil Bird, coming from a certain direction. He also observed that a 'harsh cough' often immediately preceded the hoo-oo, and conjectured that the first note might be the male's and the second the female's.

May I be permitted a digression here. The triple 'hu-hoo-hu' cry of the Brown Fish-owl (*Ketupa zeylonensis*) almost running into a single note, very likely comes from two birds; the first 'hee' of the male usually being immediately succeeded by the hoo-hu of the female. Calling my attention to these notes, a forest Tamil once told me that the male owl tells the female, 'when I cry once, if you don't quickly cry twice, I shall choose another mate.' Who knows but that some such understanding may also exist between Devil Birds! But this I rather doubt; and it may be that the same bird tunes up from the harsh guttural to the higher and purer note. On the other hand, there can be little doubt that it only indulges in one or other of these notes at

different times ; for those acquainted with the ' hoo ' have often not heard the ' strangulation cry ' and *vice versa*.

To come back to Mr. Fernando's experiences : One afternoon he shot a large bird that had swooped down on some prey on the *bund* of Divulana Tank. A few days later he shot another on a big tree in a close forest. It did not occur to him to associate these birds with the sounds he had heard at night.

On his return journey, he spent ten or twelve days at a forest ranger's bungalow at Vellavaly—the veritable home of the Devil Bird for here it could be heard invariably every night.

Some 30 yards from the bungalow was an ' aar ' flanked by giant kumbuks. Towards dusk he often noticed that certain large birds came there to roost ; it was from this direction the cries came. At about 6-30 one evening he was loitering under these trees when the harsh throaty chuckle he had so often heard proceeding the 'hoo' cry made him look up ; and there, seated on a branch was the bird from whom the horrible noises came. He shot it. It was not different from the two birds he had secured on the Diyulana *bund*. They manifested the essential particulars I had given him of the Devil Bird—a large crested bird mottled like a jungle hen in its breast feathers, and its back feathers the colour of burnt earth as Veddas had put it.

The next day, when it was even darker, he shot a similar bird, making the same noise, on a neighbouring tree ; but its plumage was much lighter than that of the others—presumably a maturer bird. Two days later he shot a fifth bird under similar circumstances. All the specimens were those of the Ceylon Hawk-Eagle (*Spizaëtus cirrhatus ceylonensis*). He saw no other bird about that might possibly have uttered the cries.

In the stomach of two of these birds he found weaver birds, and in that of another, a green lizard. These birds are said to breed early in the year, and that perhaps accounts for their being so noisy about December.

The bird is evidently diurnal in its habits but like the fishing eagle cries fitfully at night while roosting on large trees by ' aars.' Veddas have told me that they plume their arrows with the feathers of ' Ulamas ' and owls which they pick up along dry stream beds.

The cry of the Devil Bird is generally heard early in the night, at midnight, and towards dawn. The ' hoo ' cry can be heard far, the guttural gurgle only at close quarters.

Two Devil Birds are seldom or never seen in company. While foraging singly during the day, they apparently roost together at night, but often perhaps wander away started by what power who knows, waking the forest with their unearthly cries.

This is the evidence I have that the Devil Bird is none other than the Hawk-Eagle (' *Spizaëtus cirrhatus* '). To me at least it seems convincing. I feel we owe Mr. E. C. Fernando a great debt of gratitude for taking us well towards the solution of a difficult problem.'

[Commenting on the above Mr. A. P. Kinloch writes :—' The shrieks of a pair of Birds are heard at a distance, answering each other they gradually approach and then recede and die away.—Does the Hawk Eagle go in for such lengthy nocturnal promenades ? Why should a bold diurnal bird like the Hawk-Eagle reserve this cry for the still watches of the night ? It is as unlike his ordinary cry as a bulbul's conversation is to a racket-tailed Drongo's carellon of bells.' *EDS.*]

No. XIV.—HAWKS AND SWALLOWS

The following curious information may be of interest, and similar cases may be known to readers of the Journal, in which case I should be glad to have the facts substantiated. I am told that there is a high cliff in this district which is the nesting place of innumerable swallows. My informant visited the place many years ago and gives the following details. Every ledge and crany is covered with nests, globular in shape and made of mud, each nest having in front of the entrance a hanging curtain of mud mixed with fine feathers. This is apparently a precautionary measure, a means of camouflaging their abode from the enemy above, for the cliff overhead is the haunt of a species of small hawk known to the Lushai as *Mu-ral* (swallow — killer). These birds live on their neighbours below, taking continual toll from the swarms always flying about the cliff. There is nothing very strange about this, but what is curious is

that the hawks are gourmets of the most merciless kind in as much as all they deign to eat is the brain of their capture and strew the ground below with bodies uninjured except for the skulls. If this is the case, and I see no reason to doubt the veracity of the narrator, it would be interesting to know how this epicurean taste originated, necessitating, as it must do, so much more effort. The story seems vaguely familiar, though possibly this may be due to its recalling the blood-thirsty habits of the Kea Parrot of New Zealand. Is it not possible that originally the hawk struck at the baby heads peering out of the nest thereby gaining the 'brain' taste, and also causing the hanging of the camouflage curtain. Now that the nests are no longer easy of attack, he has to be content with the older birds ?

The scene of this swallow tragedy is over forty miles distant from my head-quarters, through dense jungle and is therefore difficult to visit but should no verification of the facts from other localities be available, I hope to substantiate the story before leaving the district. A detailed description of the hawk is unluckily not obtainable.

AIJAL, LUSHAI HILLS, MAJOR J. D. SCALES, D.S.O.,
9th March, 1925. O. B. E.

[Major Scale's note regarding the hawks which live on swallows and the formation of the latter's rest is of very great interest, especially the fact that they only eat the brain of the birds they catch. This is very unlike any of the hawk tribe, for, though every hawk loves the brain and eats it first, they are not given to wasting any portion of their victims. Mr. C. H. Donald, to whom we submitted Major Scale's note, suggested that the hawk referred to is possibly a hobby that has taken to eating swallows and given up its usual diet of insects. We look forward to receiving from Major Scale a specimen of the hawk referred to by him and also examples of the swallows with their curious nests. The protective screen described by Major Scale is a feature which we have not seen connected with the nest architecture of any of our Indian swallows. *EDS.*]

No. XV.—AN ALBINO HOOPOE (*EPOPA EPOPS INDICA*)



(*With a Photo*)

I send herewith a photograph of a white hoopoe, taken in our garden at Bikaner. The bird is totally white, including its crest. Other hoopoes display no hostility towards it, but it seems to be tamer than most and seldom leaves the garden.

DURNAM COTTAGE, DALHOUSIE, (MRS.) H. K. RUDKIN.
2nd July, 1925.

No. XVI.—OCCURRENCE OF THE NEPAL KALIJ PHEASANT (*G. LEUCOMELANUS*) AT MUSSOORIE

I am sending you the skin of *Gennæus leucomelanus*, the Nepal Kalij Pheasant, shot here in December last year. It may be of interest to record this, as, as far as I can find out, no one has either observed or recorded this bird from anywhere here. The books too, do not mention Mussoorrie or it neighbourhood. There is only one place here where it is found to my knowledge, i.e., Lyndhust Spur near the Botanical Gardens. I got the birds in this spur—one, the present skin and another young cock. Unfortunately I missed the hen that got up with the bunch.

I have made enquiries from a number of old shikari residents and no one appears to have noticed this bird about here. It does not seem to be generally distributed about these hills as I have never seen it, though may have overlooked it with *G. albocristatus* which is very common about the hills round here. Of course others may have overlooked it also or failed to notice it.

MUSSOORIE, U. P., F. FIELD.
13th April, 1925.

[The skin sent by Mr. Field is undoubtedly an example of the Nepal Kalij Pheasant *G. leucomelanus*, there may be a possibility that some Raja maintains an aviary near Mussoorie, the specimen sent by Mr. Field certainly does not look like a captive Bird. [*EDS.*]

No. XVII.—BREEDING OF THE PAINTED SAND-GROUSE (*PTEROCLES INDICUS*) IN THE PUNJAB SALT RANGE

On 16th March this year, in the Jhelum portion of the Salt Range, I shot a hen Painted Sand-Grouse from a nest containing two eggs. The locality was the stony hills lying south of the village of Dalwal, at an altitude of from 2,000 to 2,500 feet. The nest was on a rocky slope rising gradually from cultivated fields and seamed with small nullahs. The slope was covered everywhere with loose stones and dotted with small bushes, chiefly 'Bahekar' (*Adhatoda vasica*) and a very thick and prickly bush known locally as 'Kander.' There were also a few stunted 'Phulah' (*Acacia modesta*) and Lahura (*Tecoma undulata*) trees.

The nest was a slight depression scratched in the earth between some stones, and the eggs were lying on a small pad of dry grass much resembling chaff. The nearest bush was a 'Bahekar' about five yards distant. On my approach the bird sneaked away from the nest, and after going a few yards squatted flat between two stones, assimilating so with its surroundings as almost to defy detection. Having been watched thus for about a minute it rose and flew into a small nullah close by. I followed and secured it when it rose again, almost from my feet.

The two eggs were slightly incubated and dissection showed no trace of a third.

For the correct identification of the bird I am indebted to Mr. H. Whistler, to whom the skin was sent.

A clutch of three similar eggs, in an advanced stage of incubation, was brought to me last year, having been taken from a nest a few hundred yards from that described above. The parent bird was not secured, hence my visit to the neighbourhood on the present occasion.

Another clutch of 3 eggs, slightly incubated, of this bird have since been brought to me by a *shikari*, who found them on the 25th March, on stoney ground dotted with bushes at the southern base of the Salt Range, within the limits of the village of Kandwal.

JHELUM, H. W. WAITE, F.Z.S., M.B.O.U.,
31st March, 1925. *Indian Police.*

No. XVIII.—THE NESTING OF THE LITTLE GREEN HERON (*BUTORIDES STRIATUS JAVANICA*) IN THE DISTRICT OF 24-PERGANNAS

(With a photograph)



(Green Heron Fledglings)

Instances of the occurrence of the Little Green Heron throughout the district of 24-Pergannas that have come to my notice are so numerous that to call *Butorides javanica* a *rara avis* in this part of the country will be a travesty of fact. But the bird is very sparingly distributed and never abundant even in its favourite haunts. Although extremely sensitive to human intrusion, it is found to frequent tree-overshadowed tanks and jheels within a village. Treeless places and open stretches of cultivation with pools of water are never to its liking. Edges of tanks overgrown with jungle, low bushes and pendant leafy boughs overhanging the water are its hunting ground. Making its abode in the heart of a village, it so adjusts itself to its environment and regulates its activities as to escape detection altogether. Less nocturnal than other herons, it is active in the day time, but its movements are secretive and noiseless. It is unsociable to a remarkable degree, and I have seldom found more than a pair frequenting a particular place. It is in its breeding season that villagers get some remote chance of discovering its existence. Its call, scarcely audible at other times is now heard and gives a clue as to its movement and flight which now centre chiefly round some village tank surrounded by large trees and dense foliage. Nidificatory duties compel the bird's frequent attention to and descent on the edges of the above tank where its prey is available.

Munn in his note on the Birds of the Calcutta District (The Ibis, 1894) records

the occurrence of *B. javanica* in the neighbourhood of Calcutta in the district of 24-Pergannas, and at Mogra on the E. I. Railway which is in the district of Hooghly. But he says nothing as to the time of its nesting in these localities. Oates in the Fauna of British India (vol. iv, p. 396) mentions May to August as its nesting season in most parts of India. I was, however, fortunate enough to have several nests of *B. javanica* under my observation this year. I found the bird began nesting as early as March, and in April, I observed the young ones sufficiently grown up and fully feathered. To quote from my Diary :—

'March 22, 1925.—Locality : Debandipur, two miles roughly N. E. of Sodepur Railway Station : Nests with two eggs of *B. javanica* in a Tamarind tree (which now becomes bare by the shedding of its leaves) overhanging a village tank at a height of 30–35 feet. Inspected this nest again on April 22 and found two grown-up young fully feathered sitting by the nest and at our approach creeping and skulking along the branches. The latter are photographed on April 26.

March 27, 1925.—Loc : Village Nimté, off Belgharia due East. Stick-nest with a newly laid egg of *B. javanica* in a Mango branch (about 15 feet high) within a compound in the heart of the village ; a large tank near by. Inspected this nest again two days later, i.e., on the 29th and saw 3 eggs in it. Shot the hen bird in the legs and bagged her alive.

April 3, 1925.—Loc : Nimté, East of Belgharia Rifle Range. Another nest on a lofty mango tree near the site in which I discovered the nest of March 27 ; contains two newly laid eggs.

April 17, 1925.—Loc : Nátágar, a village of Sodepur : Stick-nest in a short mango tree overhanging a tank ; found the bird sitting on three eggs.'

I find that *B. javanica* raises a second brood not earlier than June, so that all nests of this bird that come to our notice between March and May contain, more often than not, their first brood. A slight structure of sticks, shallow but not without an appreciable depression in the centre, makes up its nursery, which is generally found in these parts of Bengal in branches of mango and tamarind trees overhanging or very near a village tank. Invariably in all the instances of nesting referred to I noticed the behaviour of the nesting couples (notably that of the hen) to undergo a remarkable change soon after the eggs were laid. At the approach of the climber they showed little nervousness, moved slowly up, when he was very near, to the next higher branch and stepped down to the nest again as soon as or even before the climber set his foot on *terra firma*.

CALCUTTA, SATYA CHURN LAW.
17th July, 1925.

No. XIX.—WEIGHTS OF WOODCOCK IN SHILLONG

In reading Mr. Stuart Baker's article on the Woodcock (*Scolopax rusticola*) in his *Game Birds of India, Burmah and Ceylon*, vol. ii, and noting that further information is required on the weights of Indian Woodcock, I send you the record for the 26 birds shot by me round Shillong in the past season, 1924-25.

The first 'Cock seen were on 14th October, 1924 and I shot a couple on 2nd April, 1925, the last I saw. In 1923 I shot one on 10th October.

8	ozs.	...	1	10	ozs.	...	3	11	ozs.	...	3
9	,,	...	1	10¼	,,	...	3	11½	,,	...	2
9¼	,,	...	2	10½	,,	...	1	11½	,,	...	1
9½	,,	...	3	10¾	,,	...	2	12¼	,,	...	1
9¾	,,	...	1	—	,,	...	—	13	,,	...	2

All the birds shot after the middle of March, which includes those over 12 ozs. weighed 11 ozs. and over.

The Woodcock has become a comparatively rare bird in the neighbourhood of Shillong mainly owing to the great increase in potatoe cultivation, which, according to the Khasi system, necessitates the cutting down and burning, for the sake of the ashes, of all undergrowth in the vicinity of potatoe, and to the fact that the fire paths, most of which happen to be near the best Cock nullahs, have been let out to cultivation. A bag of thirty Woodcock in the season would now be considered good and one has to go further afield to get even that number.

SHILLONG, G. R. ROW,
25th May, 1925. *Lieutenant-Colonel (I. A. Retired).*

[In April, 1925, we received a skin of a Woodcock from Lt.-Col. Sir Francis Humphrys, H. M. Minister, Kabul. The weight of the bird is stated by Sir Francis to have been 14½oz.—a very unusual weight for an Eastern specimen. *EDS.*]

No. XX.—RECORDS WITH SNIPE

I should like to invite your attention to the reference given by Mr. Stuart Baker (p. 558 of Vol. XX, Journ., Bombay Natural History Society) regarding the best snipe shooting by Mr. Cornish, then Superintendent of Police, Orissa. I wonder if you or any of the Members of the Society would kindly enlighten me whether this record has been beaten in India or elsewhere, even supposing the sportsman had the advantages of light, wind and ground and that he picked his own shots.

In his Game Birds of India (Volume II, page 67) Mr. Stuart Baker writes that Mr. Cornish's performance was the result of a bet of 25 to one that he could not shoot 100 birds with 100 cartridges, 10 to 1 that he would not get 96 and, 3 to 1 that he would not get 90. 'Mr. Cornish got upto his fiftieth bird without a miss, and eventually failed by exactly 4 birds to get his 100 birds in a 100 shots.'

The following are extracts from letters which I have written on the above subject to the Field which I include with a view to eliciting further information on this topic from readers of this Journal :—

'So far as my limited experience and observation carry me, I venture to think that in India the question of ground, wind and light plays a great part in the chances of success in snipe shooting.'

GROUND—is one of the main factors for consideration in this connection. There are varieties of ground in India that we come across. In some places there are long stretches of paddy fields where a sportsman's foot will hardly go ankle-deep in mud or water—'easy walking' with the kind sun behind and cool breeze, which so much helps the sportsman to feel his day's exertions less tiresome. What better conditions would a sportsman wish than these for his 'ideal day?'

In other parts of the country the picture is quite a different one, where a sportsman who is out for a day's shoot with some desire for a decent bag has often to cover a chain of tanks situated at some distance from one another. He has not only to do hard walking, often over rough ground, but at times just as the bird gets up before he finds his leg, all of a sudden, going into a waist-deep hole. He has sometimes to make his way through long, dry and thorny grass and weeds as high as himself and to make matters more 'sportive,' he has the bright Indian Sun shining clear on the sheet of water in front of him to dazzle his eyes and generally cause him to miss his bird. Those sportsmen who have the experience of an Indian Sun will, I am sure, bear me out that the Indian Sun if he liked, could be unpleasant to a sportsman on any day, even in the cold weather, if the wind got absolutely still.

All these things go to make 'walking' heavy and tiresome, especially where there is no 'Kachha' or fair weather road between the tanks so that they could be negotiated either by a motor car or a country bullock cart; the sportsman has to walk the whole distance.

WIND—is not a small factor. Every sportsman knows how a right 'kind' wind can help to make his chances of the day successful and how, if it chose to be unkind, it can reverse them. I mean high cold wind accompanied by winter rains and bad light.

I have already said enough about the light elsewhere and I do not propose to make special mention of its effects in determining the chances of good sport.

In fact prospects of snipe shooting, whether for 'average' or sport largely depend on the above three chief conditions.

I give below extracts from old pages of my shooting Diary :—

In 1908 I got	24	snipe for	33	cartridges.		
,, 1914	,,	40	,,	,,	61	,,
,, 1922	,,	52	,,	,,	122	,,
,, 1923	,,	59	,,	,,	102	,,
,, 1924	,,	25	,,	,,	65	,,

I can attribute these good days only to the sun, wind and ground being favourable to me and, though last but not the least, also to the snipe being kind to me on those days.

THE PALACE, DHAR, C.I., *27th May, 1925.*

UDAJI RAO PUAR

No. XXI.—THE SNAKE *NATRIX VENNINGI* (VENNING'S KEELBACK)

A Correction

In looking into my note-books I find that I committed an error when describing this snake in this Journal (vol. xx, p. 774), which should have been rectified long ago. I recorded the costal scales as 19 at midbody, whereas they are normally 17 in the whole body length. In four out of ten specimens the rows reduce to 16 before the vent. They hand-list (vol. xxix, p. 601) calls for the same correction.

MAYMYO,
10th August, 1925.

F. WALL,
Colonel.

NO. XXII.—TWO COMMON 'FIRE FISHES' OF MADRAS (*PTEROIS RUSSELLII* VAN. HASS.) AND (*P. VOLITANS* LINN.), A PRELIMINARY NOTE ON THEIR VARIATIONS

During my stay at the Madras Aquarium, with which institution my official connection lasted for over four years (1919-1923) the fire-fishes, sometimes referred to as Scorpion Fishes, had always attracted me not only by their movements but also otherwise. Many of their characters seemed to vary so greatly as to make me think it was just possible that the validity of the two species may not stand rigid tests. The results of an enquiry in the course of which thirty-seven Madras specimens besides two from Tuticorin, one from Cochin and one from Ganjam were examined are set forth in this preliminary paper, along with a few other observations on these fish.

These somewhat conspicuously colored fishes are among the most striking residents of the aquarium. They are brought to the aquarium by line-fishermen who go, for fishing, to some 'pars', hard rocky banks, four or five miles off Madras. Their Tamil and Malayalam name '*thumbi*' refers to the insect-colored markings. As the body in the case of our two species is generally reddish with vertical brown bands alternating with paler ones they are named '*Senthumbi*.' With their elongated finrays, inter-spinous and inter-radial membranes and other leafy outgrowths simulating seaweeds, these flags, etc., are perhaps responsible for the Telugu name *Kodipunjulu*—they look like stones docked with fluttering weeds especially while in their favourite posture of floating listlessly, displaying no perceptible signs of movement. The apparently undue development of the fins misled the ancients to believe the fish was able to fly. Hence the name flying dragon, as also the specific name *volitans*. They are normally very lethargic and when they do swim they do so very slowly, with halts at frequent intervals. Even while sailing, the only movement seen is the gentle quiver of the fins. When disturbed, tred upon or otherwise touched, the lethargy vanishes; the dorsal fin is erected as if in obedience to the order 'Carry swords' and the fish viciously strikes the intruder either upwards or sideways apparently with all the force at its command. It directs its blows with an accuracy which will do credit to a champion game-cock. The wounds show inflammation and cause acute pain. Of the three dangerous residents of the aquarium, the seasnakes, the catfishes and the firefishes, the last is the most dreaded and the aquarium coolies are very chary while cleaning the firefish tank. During my tenure of office at the aquarium, one cooly was unfortunately stung by a *Pterois*. As soon as he was stung he said he felt as if his foot, where he was stung, had suddenly come into contact with flaming fire—hence the name firefish. The wound which was linear in form, all the spines having run their tips along the same furrow, bled profusely for a short while only. With the stoppage of bleeding he did not feel very uncomfortable and managed to walk home. About an hour later his foot became swollen and the slight pain which he compared to that resulting from a scorpion sting—hence the name scorpion-fish—assumed intense proportions. He was taken to the hospital for treatment and was able to resume his duties on the third day.

All the twelve dorsal spines are grooved the terminal portions being deeply so. The groove is lined by a tubular duct which leads from a pear-shaped gland located at the base of the spine, and opens out at the tip. From the glands a milky white fluid may be squeezed out.

One specimen in the aquarium after some days of 'gas eye' lost its left eye-ball. After some months the socket was healed, though empty to such an

extent as to get even the colored band to run across it as of old. This made it well-nigh impossible for observers, casual or otherwise, to detect the absence of the left eye.

Scorpion-fishes occupy in the aquarium a tank with the anglers (*Antennarius* spp.) which are spoonfed by a long-reed with a piece of fish transfixed at the tip being dangled over their heads. The philosophers however take a long time to make up their minds and, more often than not, a firefish pounces on the morsel and snatches it away. Once an angler (*A. hispidus*) 5·6″ in length died in an unsuccessful attempt to swallow a firefish as long as itself. The operation which ended fatally to both the performers stopped when the jaws met the base of the dorsal and pectoral fins which were erect and spreading. The two were found thus interlocked the next morning.

Of the 37 Madras specimens examined 23 were *P. russellii* and the remaining 14 *P. volitans*. The 2 Tuticorin specimens and the one from Ganjam belonged to the species *volitans* while the one from Cochin was *P. russellii*. From the finray formula and the proportionate measurements of head, eye, etc., worked out, the range of variation may be given as follows :—

Pterois russellii.—Branchiostegals 7, Dorsal 12|1/11-12, (12|1/11-12) Pectoral 13 (13), Ventral 1/5, Anal 3/7-8 (3/7-8), Caudal 14 (14), Lateral row 71-75/64-68 (71/66), Lateral transverse 11/30-33 (11/33), Pyloric caeca 3, Length of head : Length of body : 3·7-4·4 (4) Height of body : Length of body : 3·5-4·2 (4) and Diameter of the eye : Length of the head : : (4·4½ ·5) (4½-5).

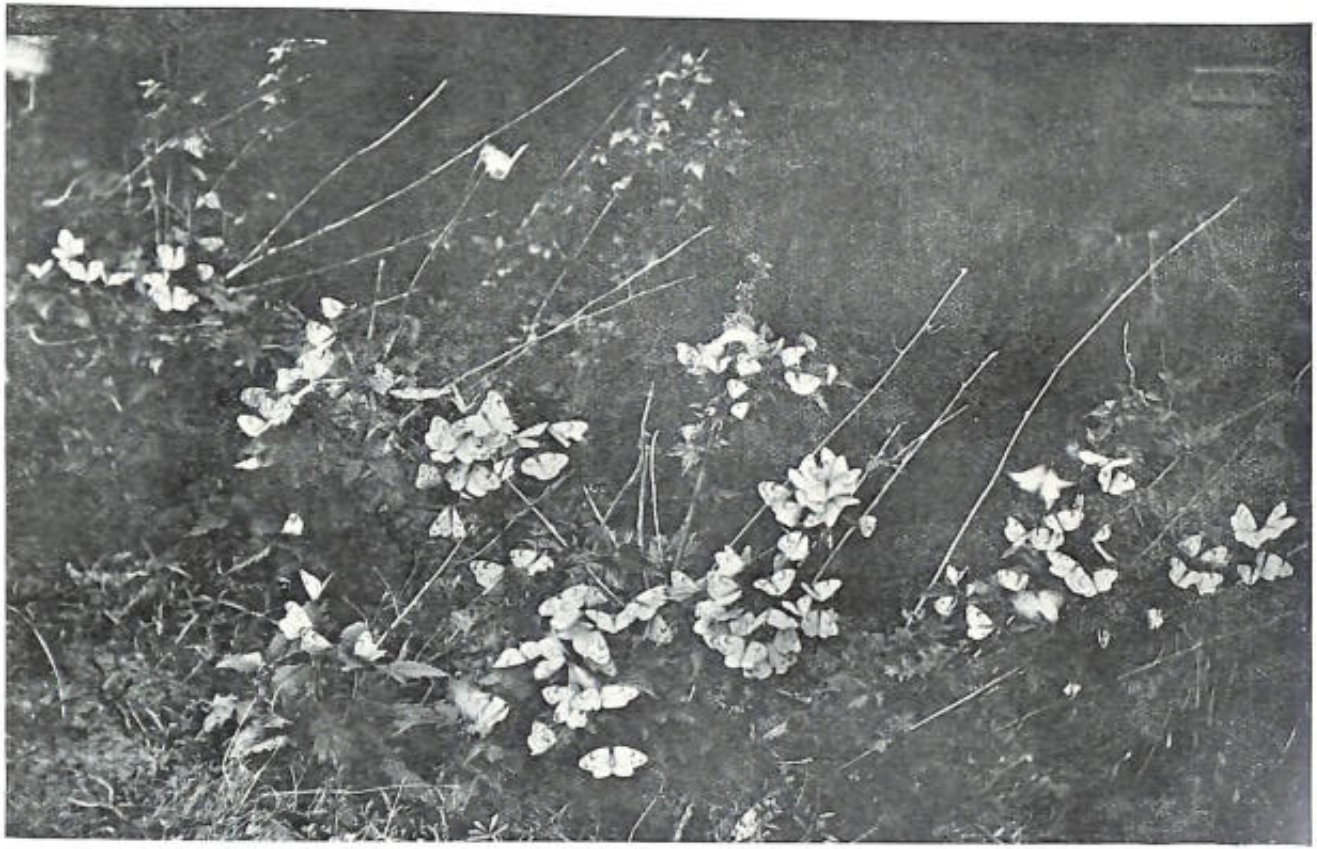
Pterois volitans.—Branchiostegals 7, Dorsal 12|1/10-11, (12|1/10-11), Pectoral 14, Ventral 1/5, Anal 3/6-7 (2-3/7-6), Caudal 14, Lateral row 89-94 (90) Lateral transverse 13/89-174 ? (13/—). Phyloric caeca 3, Length of head : Length of body : : 3·4-4·6 (3·6-4·3) Height of body : Length of body : : 2·8-3·5 (3-3·3) and Diameter of the eye : length of the head : : 4-4·5 (4-4·5).

Dr. Day's figures, taken from his volume II of Fishes of the 'Fauna of British India' series, are given in brackets. It will be seen that the finray formula is a constant factor, but that the proportion of the height of the body to its length is very variable. The shape of the body depends upon the size which is of course a question of age. The spots on the caudal fin form another variable future. The 23 Madras *P. russellii* ranged in size from 4″ to 9½″. Eleven (4-6″) had the caudal fins unspotted but 7 (5-8″) had the caudal fins unspotted except on the edge while 5 (7-9½″) had them spotted. The one partially swallowed by the angler had it unspotted. The Cochin specimen, 5″ long, had the caudal fin unspotted. Of the 14 Madras specimens belonging to the species *volitans* 11 had the caudal fins spotted. Of these one was 13″ and the others ranged from 5-10″; 3 which were 4, 4 and 4·5″ had these fins unspotted. The 2 Tuticorin specimens which measured 4 and 4·2″ and the Ganjam one which taped 5″ had the caudal fins spotted. Thus one characteristic used by Dr. Day to separate the 2 species is seen to be very variable. One impression left on my mind is that young fire-fishes, though without spots at first, developed the spots later as growth progressed. I am however unable to definitely assert it since no fishes were marked and this statement verified. But this is supported by the fact that the unspotted ones are invariably the smaller-sized fishes and the spotted ones the larger. It is indeed curious that color pigments absent early in life should develop later, as in the many examples I have come across at the aquarium, for example *Lutianus flavocaeruleus*, a blue fish with yellow fins and yellow jaws which gradually drops the yellow as it grows, or *Lutianus sebae* whose bright crimson bands fade as the fishes grow older, the reverse holds good. The angler fishes (*A. hispidus*), however, which are dull yellow with brown spots and streaks, assume brighter hues as they increase in size. But this is a case of mere intensification and not the development of new pigments.

MADRAS FISHERIES DEP., CALICUT, S. T. MOSES,
8th April, 1925. *Zoological Assistant.*

No. XXIII.—A RUN OF FISH ON THE STREAMS FALLING INTO THE YAMDROK TSO

When crossing a bridge over a small fall from a smaller lake into the Yamdrok Tso, I noticed numbers of fish jumping up the fall much as salmon do. The fish ran to about ¾ of a lb. weight and were all very much the same size.



A Butterfly Swarm

The next day at Pete Dzong, we noticed a similar thing: a stream 5 or 6 yards wide had overflowed its banks owing to heavy rain, and the overflow fell into the lake by a separate stream. During the night this overflow ceased to run and in the early morning we found the overflow stream dried up except for a few pools. The stream bed was littered with thousands of dead and dying fish, while the few remaining pools were packed with fish so that they could not move. I made the villagers fill baskets and also their coats with the fish, which were not quite dead and, in this way, had hundreds carried back to the stream and ake, The fish were all about to spawn, and it was curious to see that the instinct to go up the stream was so strong that almost dead fish on being put into the stream, instead of resting in the stiller water, immediately joined the rush to go up. We noticed that all streams were crowded with fish going up, and at stiller places near the banks they were so massed that they were almost pushed out; so thick were they that a marauding dog was able to take a fish out of the mass and eat it on the bank. Hundreds of Brown-headed gulls (*Larus brunicephalus*) were taking advantage of this state of affairs, but curiously enough the gulls only eat the heads, leaving the bodies lying about, ravens and village dogs were also feeding on the dead fish.

The Tibetan explanation was that at the head of each stream was a 'snow frog' who fertilized the spawn of the fish.

Specimens have been identified by Dr. Hora of the Indian Museum as *Schizopygopsis younghusbandi* and *Nemachilus tibetanus*.

GANGTOK, SIKKIM, *5th November, 1925.*

F. M. BAILEY, *Lieutenant-Colonel.*

No. XXIV.—EXTRAORDINARY DISPLAY OF '*LEUCODICE SORACTE*' OF THE GENUS '*APORIA*.'

(*With a Plate*)

The accompanying photograph shows masses of this butterfly clustering on a common plant growing by the Himalayan roadside leading from Dalhousie to Chamba, at about nine thousand feet elevation. The sky was also full of them —so much so—that they looked like snow-flakes.

Curiously enough, at the same time as I took this photograph I caught the only two examples I possess of *aporia agathon phryxe* (Bdr.) of the same genus. The *A. leucodice soracte* appeared in May; but by June seemed to have totally disappeared.

The various species of this genus evidently display the same characteristics— For Pallas tells us a similar story with regard to *A. crataegi* (Linn.), as he observed them in Siberia. I might add that I carefully noted at the time there was no single instance of any bird attacking them, though there were some birds about.

In England in 1923 similar scenes, but on a smaller scale perhaps, occurred with *rapæ* (Linn.) of the allied genus *Pieris*. For here too the sky was full of them—equally so on the hill tops, 400 feet high, as over their usual haunts.

Luckily, however, for our gardens, nature seems in the case of *rapæ* to compensate for the unusual numbers of the butterfly by a corresponding scarcity of its larvæ in the following year, for there were very few larvæ in 1924.

I shall be interested to hear whether this is equally true of the species of *Aporia*, and whether the scene in the photograph is of usual occurrence or not.

TIPTON ST. JOHN, DEVON *9th February, 1925.*

R. Y. A. MORSHEAD, *Late 4th Devon Regt.*

Col. Evans has written the following comment on the above note:—

In 1919 when I first went to Murree, the same butterfly was at the same game in early May—just like a fall of snow on the Mall. I have seen trees covered with butterflies, also patches of damp sand, but never in masses in the air like *soracte*; *soracte* only flies for a month, when the horse chesnut is in bloom, and at the end of May dead bodies are found all over the place. It is certainly a protected species—very flimsy and slow flying.

I cannot vouch for the larva theory. The larva of *A. l. soracte* feeds on *Berberis lycium* and is brown with fine soft hairs all over it. Numbers of them can be seen on the foot plant. [*EDS.*]

No. XXV.—*COPTOSOMA OSTENSUM*, DIST. AND ITS ENEMY *SYNIA MELANARIA*, MULS.

In the arboretum established in front of the Agricultural College, Coimbatore, there is one particular *Palas* tree (*Butea frondosa*) out of several planted therein, that has been observed to be specially subject to an infestation by a small Pentatomid bug—*Coptosoma ostensum*, Dist. These insects have been found breeding continuously during the past three years on this particular tree and have sometimes been found crowding on the undersurface of the leaves in big swarms and causing them to dry up. It is rather curious that they should have shown a peculiar attachment to this particular tree all these three years, for there are other specimens of *Butea frondosa* very near on the Estate which have not been attacked up to the present. Young nymphs were introduced on another tree near by and throve on it, but subsequently when they became adults they were found to leave the tree, so that no specimens of the bug were noticed on it later in the year. This curious phenomenon appears to me to be inexplicable and is well worth investigation, perhaps from the chemical or physiological point of view.

The adult bug is small, somewhat rounded narrower anteriorly than posteriorly. Elytra yellow with black reticulations, scutellum with a narrow yellow transverse band and a pair of median black dots. Prothorax yellow with a black line on either side. Head yellow : eyes black and anterior ; the antennæ four-jointed, yellow, rising from under the eyes. Ventral surface black ; openings of the stink glands black, eyelike. The proboscis sharp and yellowish orange. The legs yellow. In the male the genital organs appear as a pair of stylets enclosing a pointed rod, and in the female they assume the form of a depression with a semi-circular ridge. Individuals in copulation pair back to back as usual in most bugs.

The female bug lays a large number of whitish eggs singly on the underside of the leaf on either side of the veins. The eggs are oval in outline with a slight flattening at one end and have the characteristic sculptured lid of a Pentatomid egg.

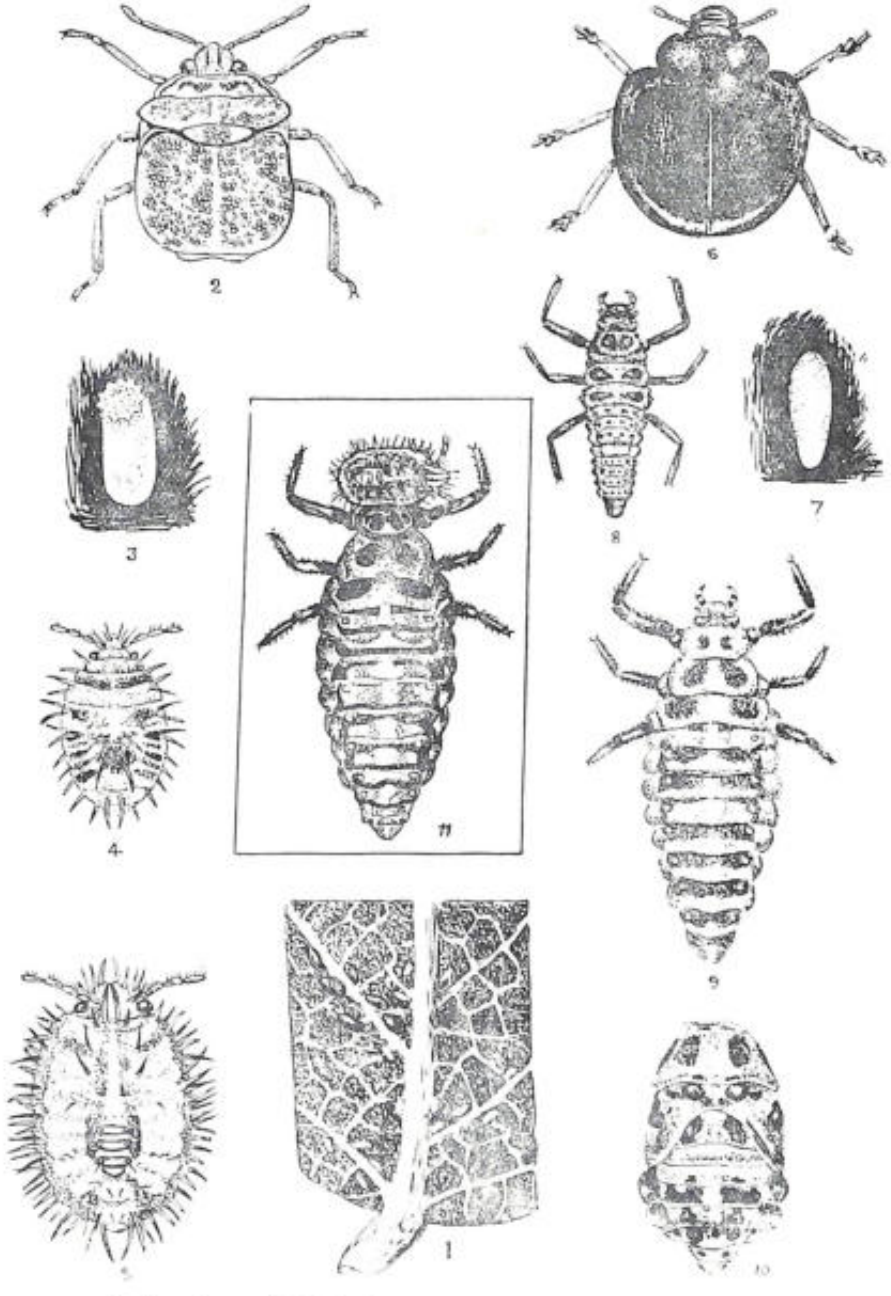
The nymphs emerge by pushing open the lid. They station themselves along the sides of the veins of the leaves for feeding. When just hatched they are small pretty creatures covered with a delicate pubescence all over the body, flattened in shape, and yellowish white in colour with one or two orange patches in the abdomen. The full-grown nymphs are dark brown and are also flattened and covered by brownish hairs all over the body. After the final moult the adult bugs emerge.

I am indebted to M.R.Ry. T. V. Ramakrishna Ayyar for drawing my attention to the presence among the nymphs of the bugs, of the grubs and adults of a certain Lady-bird beetle. I found that the beetle was *Synia melanaria* and that the grubs of this beetle were predaceous on the nymphs of the bug.

Lady-bird beetles are generally known to feed on Aphids, Scale insects, Thrips, etc., but so far as is known to the writer there is no record of a Coccinellid preying upon a Pentatomid Bug.

The adult of this predator beetle is black and almost circular in outline. Elytra, black. Prothorax, orange yellow and its lateral margins are produced forwards so as to encircle the prominent black eyes. Head yellow, mandibles orange, and the clubbed antennæ orange yellow. Ventral surface orange yellow, with the black edges of the elytra forming a ledge on either side. Legs orange yellow. There is no external character by which the sexes can be distinguished excepting the comparatively bigger size of the female.

The beetle lays eggs in groups of 10 to 15, placed on end on the underside of leaves infested with *Coptosoma ostensum*. The eggs are cigar-shaped, yellow and smooth—about 3 mm. in length and 1 mm. thick in the middle ; they turn orange the second day and on the third day hatch into tiny greyish black grubs with a white line across the body posteriorly. They have a flattened body slightly convex dorsally, tapering towards the hind end and covered all over by short black hairs. They are about 2½ mm. in length and have well-developed greyish legs. The ventral side of the body is lighter in colour. As soon as they hatch out they begin to run about and feed on the nymphs of the bug. After two days they undergo their first moult ; during this process they fix



Synia melanaria, Muls., Predator on *Coptsoma ostensum*, Dist.

(*For explanation see reverse.*)

SYNIA MELANARIA, MULS.,

Predator on

COPTOSOMA OSTENSUM, DIST.

Explanation of the Plate.

Fig. 1. Coptosoma ostensum, Dist.—Portion of Butea lea showing eggs and nymphs.

" 2. Do. Grown-up nymph (enlarged).

" 3. Do. Egg (do.).

" 4. Do. Young nymph (do.).

" 5. Do. Grown-up nymph (do.).

" 6. Synia melanaria, Muls. Adult beetle (do.).

" 7. Do. Egg (do.).

" 8. Do. Young grub (do.).

" 9. Do. Grown-up grub (do.).

" 10. Do. Pupa (do.).

" 11. A group of Synia melanaria preying on a nymph of Coptosoma ostensum. (enlarged).

themselves to the surface of the leaves or any other support by the tail end and undergo a moult, the skin splitting open longitudinally along the back. Soon after a moult the legs appear brick-red and are held straight. The head appears likewise to be brick-red. The grubs are 5 mm. long, the prothorax pinkish with a median black patch, the rest of the thorax black with a white longitudinal patch, the abdomen banded with white intersegmentally. The grubs feed voraciously during this and the subsequent stages, burying their jaws into the abdomen of the nymph from underneath, and when the grub finishes feeding the skin of the prey is left intact, so that it looks as if the nymph had been completely sucked dry. The grubs undergo three more moults. After every moult they grow in size and the white markings on their body become more and more pinkish until, when about to pupate, they are nearly 8-10 mm. long and correspondingly stout and all the white markings are completely red.

About 9 days after hatching, the grubs attach themselves to the leaf or some other support by their tail ends and transform themselves into pupæ which are more or less round and about 5 to 4 mm. in size. They are pinkish red in colour. The head has two longitudinal black streaks and the thorax two pairs of black dots along the median line and one on either side along the edges. The abdomen has two longitudinal black median streaks and a cross line on either side anteriorly extending up to the outer margins.

In 6 or 7 days after pupation the adults emerge ; during this process the pupæ undergo a few convulsive movements whereby a break in the pupal skin occurs in the middle just behind the thoracic region and the adults emerge by pushing asunder the two halves of the pupal skin. The freshly transformed adults look entirely red in colour but gradually the colour of the elytra begins to darken and becomes completely black in the course of a day. The adult beetles have not been found to feed on the bugs, but judging from the habits of other predaceous Lady-bird beetles it is likely that they too may be predaceous.

AGRICULTURAL COLLEGE,
COIMBATORE.

T. V. SUBRAMANYAM, B.A.,
Assistant in Entomology.

WANTED : INFORMATION ON INDIAN LEECHES

The undersigned is desirous of bringing together as complete information as possible relating to the natural history of Indian leeches for use in a volume on the Hirudinea for the 'Fauna of British India' and appeals to naturalists, medical men, sportsmen, stock-raisers and others for help.

Any data, whatever whether published or not, relating to any phase in the lives or activities of either land or aquatic leeches, or any specimens of leeches or their egg cases will be of value and any data published will be fully credited, of course.

Among the subjects on which information is particularly desired are the habitats, hosts or prey, breeding times and habits, length of life, enemies, effects of bites on man or other animals, relation to transmission of disease, economic importance, etc.

In connection with the *land leeches* we are particularly ignorant of the ecological relations of the several species, their manner of spending the dry season, breeding, the sense through which they detect the presence of their victims, the exact manner of using the sucker in locomotion, especially on herbage, etc.

Exact information concerning the life-history of the *cattle leech* which enters the nares of buffaloes, yaks, and other mammals is much wanted.

The undersigned will be pleased to correspond with any one able to furnish any such information.

J. PERCY MOORE,
Zoological Laboratory,
University of Pennsylvania,
Philadelphia, Penna.

PROCEEDINGS

Proceedings of the meeting held on July 22, 1925

A meeting of the members of the Bombay Natural History Society and their friends took place on Wednesday, Mr. P. M. D. Sanderson presiding.

The following 56 new members were elected since the last meeting :—Major J. W. Gordon, Jodhpur ; Mr. M. S. Tuggerse, B. F. S. Karwar ; Mr. S. Campbell, Saklipur, Murshidabad ; Mr. J. D. Lewis, Bombay ; Capt. A. J. Hemmons, Bassein, Burma ; Mr. A. J. Jones, Moulmein, Burma ; Mr. F. V. Evans, Europe ; Mr. C. W. G. Morris, Attikan, Mysore ; Mr. Albert Sherriff, Europe: Mr. L.C. Oliver, Attikan, Mysore ; Mr. I. A. Ingram, Khanewal, Punjab; Capt. A. W. Ibbotson, M.C., M.B.E., I.C.S., Ghazipur ; Mr. L. E. Saunders Koraput, Vizagapatam Dist. ; Mr. C. E. Capito, O.B.E., M.I.C.E., Bushire ; Mr. J. K. Swaine, Matang, F.M.S. ; Mr. J. C. Laidlay, Europe ; Mr. A. M. Rogerson, Rangoon ; Mr. E. O. Sampson, I.F.S., Satara ; Mr. J. H. Lindsay, I.C.S., Calcutta ; Mr. John H. Barnsley, Cocanada, S.I. ; Major F. C. Hickie, I.A.S.C., Quetta ; Mons. Jean Delacour, France ; Capt. E. H. P. Jackson, R.H.A., Meerut ; Capt. F. W. Hasweil, Bombay ; Madamoiselle F. M. d'Orle, Udaipur ; Capt. F. O. Cave, Peshawar ; Mr. D. J. Atkinson, I.F.S., Insein, L. Burma ; Mr. A. Forrington, Bombay ; Mr. E. S. Hartnoll, I.F.S., Moulmein, Burma ; Mr. T. H. O. Collings, Delhi ; Mr. P. J. Murphy, Bengal ; Mr. S. W. Walton, Bombay ; Capt. Wm. Bird, R A.M.C., Simla Hills ; Her Highness Maharani Akhand Saubhagyavati Laxmi Bai Saheb, Puar, Dhar ; G. N. Richmond, Bhamo, Burma ; Rao Gopal Sinha Rathor, Ajmer.

Improvements to Galleries

Mr. P. M. D. Sanderson, the Honorary Secretary, drew the attention of the members present to the improvements that had been made in the galleries of the Natural History Section, Prince of Wales' Museum. A recent addition to the mammal gallery is a beautifully mounted example of the Kashmir stag presented by Col. Burton and set up in the Society's laboratory. The Kashmir stag makes perhaps one of the grandest trophies that is possible to obtain in India and the specimen exhibited carries a very fine spread of horns. The Curator has been doing his best to improve the lighting and ventilating arrangements in the galleries. The exhibits suffered very greatly from cross lighting and reflections, but by screening off the lower portions of the windows and cutting off direct light a great improvement has been effected. A notable addition to the Bird Gallery is a nesting group of night herons. Night herons are quite common birds in Bombay, but they are not generally seen as they fly after dark. During July and August they breed in colonies on large trees and there are quite a number of such colonies in Bombay. The group in the museum faithfully reproduces the nesting site of a pair of night herons. The parent birds and young are shown while a young night heron in immature plumage occupies the background. The group is one of a series which the Curator hopes to prepare to illustrate the nesting habits of Indian Birds. Those present inspected a very fine Bison head which was mounted for one of the members of the Society by Mr. McCann in the Society's laboratory.

Animals of the Past

Mr. Prater the Curator, gave an interesting lantern lecture on 'Animals of the Past' illustrated by a series of very fine slides. The lecturer after explaining how fossils came to be formed, proceeded to trace the history of animal life from the earliest known fossil forms to those of more recent origin. He explained that the earliest known fossils were those of highly developed animals and that practically all traces of the lower organisms which preceded them had been lost. He explained how the earth and the seas were ruled by successive races of creatures who held sway for a certain period and then perished and became extinct. Thus in the sea the bony armoured fish gave place to the sharks and these in turn gave way to the great Marine reptiles. These had their day of

several thousand years and then perished. The lecturer illustrated the earliest known type of fossil birds and showed that in their structure, particularly in the earlier types-Birds show evident traces of their reptilian ancestry. He came finally to the last group of animals—the mammals which culminated in man. The lecturer referred to the various animals which were co-existent with man in primitive times. Among these were the horse, the mammoth and the reindeer. The mammoth he explained was probably the great great grandsire of the modern Asiatic elephant and we could trace the ancestry of the elephant back through a series, of stages to the earliest known form, the Meretherium, a small pig like animal with a long, bony face and quite normal teeth.

A Difficult Question

The question as to why animals became extinct was a very difficult one to answer. In some cases a species did not become extinct at all. It was merely replaced by other species more adapted to survive in changing conditions. Then there were creatures like the gigantic extinct reptiles, who were so highly specialized that they were unable to respond to conditions of change however slight and so they perished and yet again we have creatures like the great marine reptiles who were quite as adapted to their condition of life as our whales are to-day and yet these died out. Why? We do not know. It was formerly customary to ascribe the extinction of creatures to great catastrophies such as earthquakes, volcano eruptions, etc., but it is conceded that these must have been purely local in their effect. Man has, however, been a great instrument in the extermination of many species. He destroys animals, takes away their food and cuts down their forests and literally drives them out of existence but at the same time we must remember that the greatest changes took place long before man even came into existence. These are some of the various explanations put forward, but it must be remembered that they are merely conjectures. As Dr. F. Lucas tells us in his 'Animals of the Past'—"Man is an animal that wants to know the why and wherefore of everything and he cannot rest content until he has formulated some theory to explain the many problems before him and hence from his knowledge of apparent fact he formulates a theory to explain the extinction of various creatures which has been taking place ever since living beings came into this world and were pitted against one another and against their surroundings in that ceaseless struggle for existence which has waged since the dawn of time'.

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