THE

JOURNAL

OF THE

BOMBAY NATURAL HISTORY SOCIETY

INDEX AND TITLE PAGE

VOL. XL

BOOK NO.
289

NOS. 1 & 2

Price ... Rs. 2-4-0

MADRAS
PRINTED AT THE DIOCESAN PRESS
1939

505.09547992
PH1

INSTRUCTIONS TO BINDER

The contents of these two parts should be arranged in the following order when they are being bound :—

Title page	To follow frontispiece in this order.
Contents of Nos. 1 and 2 of Vol. XL ...	
List of Contributors	
List of Plates	
Index to Illustrations	
Errata	
Index to Species	To go at the end of two numbers.

THE

JOURNAL

OF THE

BOMBAY NATURAL HISTORY SOCIETY

EDITED BY

P. M. D. SANDERSON, F.Z.S., S. H. PRATER, C.M.Z.S., M.L.A., J.P
& C. McCANN, F.L.S.

1088(0)
967

VOL. XL

Nos. 1 & 2

Containing 3 Coloured Plates, 31 Black and White Plates,
32 Text-figures, and 2 maps.

Dates of Publication

Part 1. (Pages 1 to 136) ... April 1938.
„ 2. („ 137 to 354) ... September 1938.

LONDON AGENTS

DAVID NUTT, Esq., (A. G. BERRY) 212, Shaftesbury Avenue, London, W.C. 2.

PRINTED AT THE DIOCESAN PRESS, MADRAS
1939



505.095979
PHI

ACC.NO- 1546
19/07/07

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ERRATA

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Page 129, para (4), the first sentence should read as follows :—' In the same District (Sadiya) during 1936-37 in August I shot a Pintail on the 13th, I saw a Snipe on the 19th August but failed to secure it. I bagged a Pintail on.....etc.'

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Page 325, line 6 from top, for ' Forty Years among the Wild Beasts of India ' *read* ' Thirteen Years among the Wild Beasts of India.'

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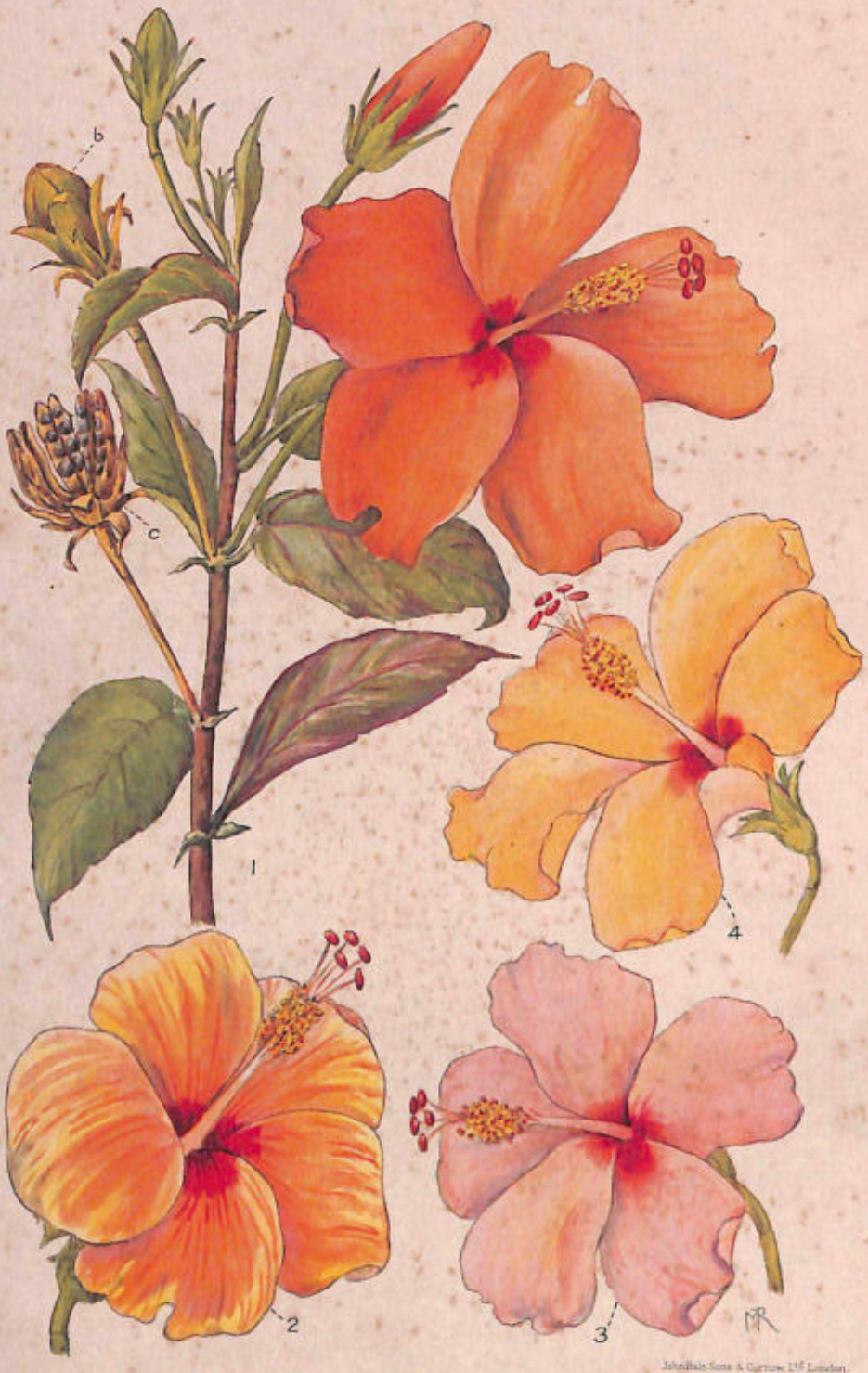
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ZOOLOGICAL GARDEN
1088(0)
CALCUTTA.



John Bale Sons & Curnow Ltd London.

VARIETIES OF HIBISCUS
(For explanation see end of article).

ZOOLOGICAL GARDEN
Kolkata
700027
ALIPORE

JOURNAL
OF THE
Bombay Natural History Society.

1938. VOL. XL. No. 1.

SOME NOTES ON THE RAISING OF HIBISCUS SHRUBS FROM SEED.

BY

M. E. ROBINSON, M.A. (CANTAB).

(With 1 coloured plate and 1 black and white plate).

Among the many beautiful flowering shrubs cultivated in South Indian gardens, the Hibiscus is a popular favourite. There are several species and varieties commonly met with; and their large and handsome flowers appear at all times of the year, and brighten our gardens with the vivid gaiety of their colouring, when the more ephemeral beauty of annuals is over. Some shrubs produce single trumpet-shaped flowers of great size and beauty; others have a double flower resembling a large full-blown rose, but without its scent.

The Hibiscus belongs to the *Malvaceae* Order of plants, and in common with the other members of the Order, the flower has five large separate petals, enclosed in a calyx of five large green sepals, outside which is a second calyx of five or more narrow leaves or bracts. The filaments of the stamens are all joined to form a long tube, bearing a bunch of yellow anthers at the top, and through the centre of the staminal tube passes the long style ending in five round velvety stigmas, ranging in colour from deep orange to crimson, spread out among the yellow stamens. This centre tube is often three to four inches long, and sometimes stands stiffly in the centre of the flower, and sometimes hangs limply from the inverted blossom. The flower is sometimes trumpet-shaped; sometimes the petals open almost flat to a salver shape; and sometimes the petals are recurved.

The shrubby species most commonly planted in gardens are as follows :—

Hibiscus Rosa-sinensis Linn.: This is the Common Scarlet Hibiscus, not indigenous, but introduced from China. Trumpet-shaped flowers, but varieties with recurved petals are also found and double varieties are common.

H. schizopetalus Hook. fil.: Scarlet or scarlet streaked with white petals, very much cut up into narrow segments quite reflexed, with a long pendulous tassel of stamens and stigma. It reminds one of a Japanese lantern, and is sometimes called the '*Japanese lantern flower*'.

H. splendens Fras. and *H. collinus* Roxb.: Both have large trumpet-shaped single flowers of a pale rose-pink. Double pink varieties are often seen.

H. tiliaceus Linn.: is a small tree indigenous in the Konkan and with straw-yellow flowers.

H. elatus Sw.: has sulphur yellow flowers.

H. syriacus Linn.: has large blue-mauve trumpets with pure white staminal column and stigmas. There is also a variety of this with pure white petals.

H. mutabilis Linn.: This species known as the *Persian Rose* has in the morning huge, pure white, double blooms, which change colour during the day. At noon it is a pale pink; by five o'clock in the afternoon, a deep rose, almost red. There is also a single variety.

All these species can be readily propagated by cuttings and as they rarely, if ever, produce seed, that is the usual method of increasing one's stock. Very rare cases of seed production have been observed as for instance the case mentioned by Woodrow in his book *Gardening in the Tropics*, published in 1910, where he refers to, and gives an engraving of some plants of *H. Rosa-sinensis* in Poona that produced seed in 1879, nothing apparently occurring in the intervening period of 31 years. Some recent researches into the structure of the reproductive organs of *H. Rosa-sinensis* undertaken by Prof. Tiwary and his students at the Benares Hindu University seem to show that there is some defect in the cells from the pollen grain that precludes the formation of seed.

There are however some species not included in the above list that do produce seeds quite freely. Of these there are three species, or what appear to be different species, in my possession and from them seeds have been collected and seedlings grown which show very interesting variations in colour and shape of flower, and leaves. These three plants which I shall call species 1, 2 and 3 (as I do not know and am not able to find out the specific names), were obtained as cuttings from plants grown by Mr. G. E. Browning in his garden at Trichur, Cochin State. He had a large collection of Hibiscus plants with flowers of every variety of colour; red, pink, yellow, orange and peach, in every imaginable shade, as well as the blue *H. syriacus*. Many of his plants came originally from Singapore, and also from Calcutta and I have since been told that the peach coloured Hibiscus Species 1 is very commonly grown in Malaya.

Species 1. **Peach** (Coloured plate, fig. 1).

This has very large flowers of a deep peach or apricot colour. The colour is very rich, and uniformly distributed, showing no differentiation into its component pink and yellow. During the day, however, the pink or red component fades out, leaving the

bloom a pale straw colour by the evening. This loss of red colouring matter occurs in all the species except the scarlet ones, and is an interesting variation from the behaviour of *H. mutabilis* which, as mentioned above, *develops* a red colouring matter, changing from white to deep pink. At the base of each petal is a deep crimson splash; the staminal column is peach coloured, the stamens sulphur yellow, and the five scarlet velvet stigmas, borne on pale peach coloured styles, protrude beyond the stamens. The seeds are produced in capsules which split open into five, exposing the grey velvety seeds (Plate, figs. 1b and c). The leaves are simple ovate, with a rather long point (text-fig. 1) and irregularly serrate in the upper half; the lower half tapers somewhat to the stalk. The surface is smooth and glossy, and they are often of a bronze shade, with red veins, clearly seen on the back of the leaf. In quite young seedlings grown from seeds of this plant this bronze colour is quite pronounced, sometimes even appearing in the cotyledons as soon as the first leaves expand.



Fig. 1.

Species 2: **Sunrise** (Col. Plate, fig. 2).

This species has very large, very regular flowers, the petals being more rounded at the outer half, and overlapping almost to the edge; so that the shape is a more regular trumpet or spreading horn. In colour it is a clear sulphur yellow, irregularly flushed with pink, and streaked with pink veins. The base of the petals

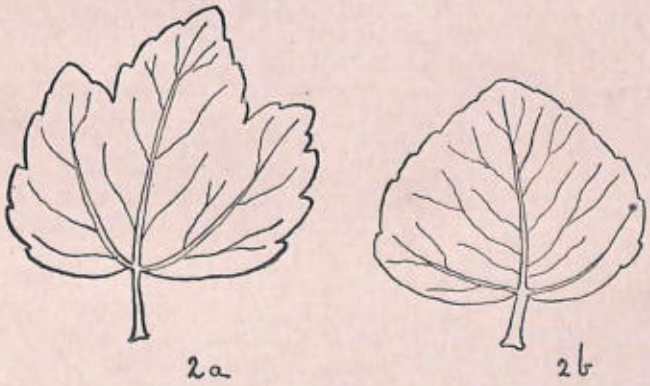


Fig. 2.

are of a very rich crimson, and the staminal column is red at the base shading to the sulphur yellow of the stamens. The orange coloured stigmas are on yellow styles. This is a very beautiful flower reminding one of a sunset or sunrise sky, and as they open in the early morning, and close at night as do all *Hibiscus*.

'Sunrise' seems a most appropriate name. The red fades out of this flower, leaving it a pale clear sulphur yellow at evening.

The capsules and seeds are exactly similar to those of species 1, but very rarely produced. Three seedlings were produced from it in 1934 one only having survived, variety 13. The leaves of this species are simple cordate or cut into three lobes with large uneven serrations at the edges. Many variations of shape occur, fig. 2 (a) and (b) being leaves from the same plant.

For some years the original cutting of this species suffered from a disease which caused the flowers to fall off before they opened, and the leaves to be veined and blotched with pale yellow. It recovered somewhat but has lately suffered again from it. Cuttings taken from it however have grown into strong healthy plants with perfect flowers of a very large size, and leaves with no trace of yellow.

Species 3: **Cherry.**

This species has large flowers of a beautiful shade of cherry or coral red. The lower half of the petal shades to mauve, on which is superimposed the usual crimson patch at the base, so that the colouring of this flower is very subtle, and quite different from the crude scarlet of *H. Rosa-sinensis*. The staminal tube is red, deeper at the base, stamens sulphur yellow, and the scarlet stigmas on pale red styles.



Fig. 3.

Capsules and seeds the same as 1 and 2—less numerous than 1, more numerous than —and several seedlings were produced in 1934.

The leaves (fig. 3) are somewhat intermediate between those of species 1 and 2, being broader and shorter than 1 but not so broad as 2, and show no lobed varieties. The edge is irregularly rather deeply serrated.

Two leaves are shown in figs. 4 and 5 for comparison, taken from two varieties of *H. Rosa-sinensis*, also growing in the compound.

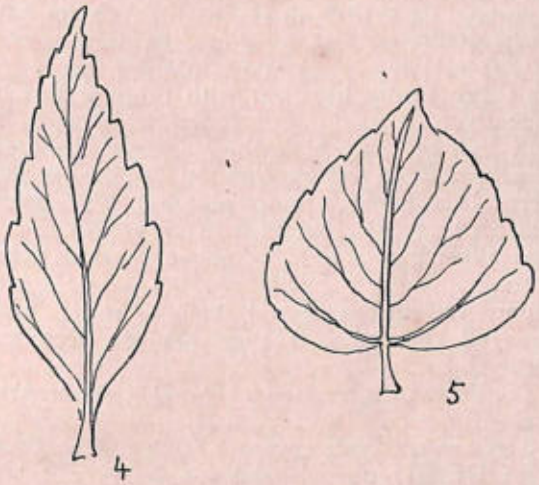
All these plants do well in a good soil and with plenty of rain, but where the soil is poor and rainfall scanty, as at Negapatam, it is better to have them in large tubs. Cuttings root freely and the stock of plants can easily be increased in this way.

It was soon observed however that species 1 produced seeds very freely and some of these were collected and sown and seedling plants were obtained from them in about 1927. There are four quite different varieties of flowers among these seedling plants, which are now as large as the parent bushes, and themselves bear seed.

In October to December 1933 a large number of seed capsules were produced on all the bushes.

The flowers are visited at all hours of the day by small birds, chiefly the 'sun birds' (*Cinnyris asiaticus* and *zeylanicus*) and the 'tailor bird' (*Orthotomus sutorius*), of which there are any number in the compound. I have never seen them at the front of the

flowers however; they seem always to insert their beaks between the petals from the back of the flower, or to peck holes in the petals, to reach honey or insects at the bottom of the trumpet.



Figs. 4 and 5.

Numbers of large butterflies, particularly a black and scarlet species and a white one with black veins and black, orange and blue patches visit these flowers also, and I should imagine that fertilisation takes place through their agency, rather than as a result of the visits of the birds.

At the beginning of 1934 seed production seemed to fall off, and so artificial pollination was tried. Pollen from the stamens of a flower from species 1 being applied to the stigma of species 2 or 3 by lightly brushing the stamens against it. Similarly pollen from species 2 was applied to species 1 or 3 and so on.

The result was a very marked increase in the number of seed capsules formed and the capsules were larger and healthier, and produced more seeds than ever before. This was particularly the case with species 2 and 3 which had hitherto only rarely produced seed.

This would seem to indicate that the lack of seed may be due sometimes to failure of pollination by outside agencies and not to any defect in the structure as in the case of *H. Rosa-sinensis;* but this is a subject that requires further investigation before any definite conclusion can be reached. The seeds obtained in 1933-34 germinated well, and at the end of 1934 there were about seventy healthy seedlings. These were put into six inch pots, and those that survived the hot weather, March to July, of 1935 started to flower in October 1935. A great many of these were given away, as I was not able to deal with so large a number but I have seen some of these young plants at various times, and some of the flowers they have produced. Among those remaining with me there are certainly seven that have flowers quite different from

any of the original three species or first four varieties. Several reproduce the original peach of species 1 exactly, one reproduces species 3. There are two very different reds, and several of different shades of peach, some paler, some more pink, some more yellow, and so on. It is difficult to describe colours but an attempt is made in the following list to show the variety of the flowers produced by the seedling plants now in the garden.

Variety 1: Practically identical with original Peach Species 1. Occurs frequently.

Variety 2: Pale salmony pink, very delicate shade; seeds freely, and seedlings have been raised from it. (Col. Pl., fig. 3.)

Variety 3: Clear straw yellow, no pink, dark maroon centre; produced one seed capsule, but died in 1935 (Col. Pl., fig. 4).

Variety 4: Clear cherry red, no mauve; narrow petals, trumpet-shaped flowers.

These four varieties flowered before 1934. The following varieties flowered for the first time between October 1935 and March 1936.

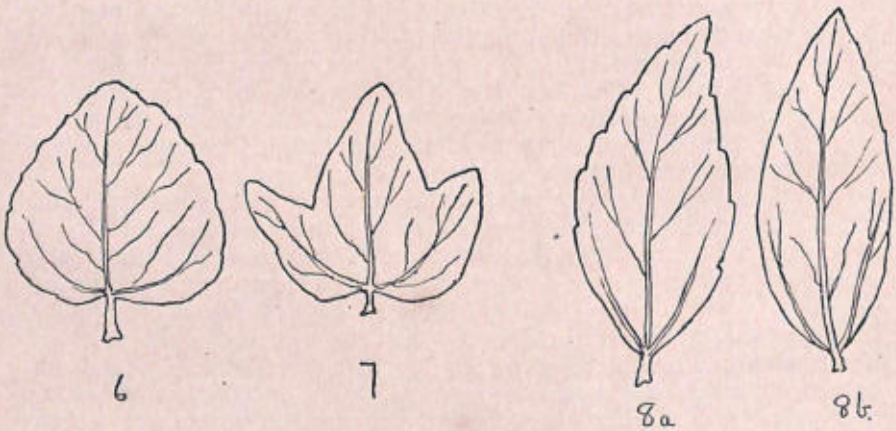
Variety 5: Very dark orange or peach colour; short trumpet, flat flower.

Variety 6: Salmony pink or peach with a pink flush.

Variety 7: Darker salmony pink or peach with a pink flush. (Occurred also in Madras.)

Variety 8: Peach, resembling variety 1, but with a patch of clear yellow on each petal.

Variety 9: Peach with a mauve flush on lower half of petal and purple centre. Occurred in Madras and Podanur.



Figs. 6, 7, 8a and 8b.

Variety 10: Salmony pink, but with a mauve flush, lower half of petals mauve purple centre. This flower is very different in the evening, as all the pink fades out leaving it clear pale yellow with mauve to purple centre.

Variety 11: Very large, rich scarlet flowers with a yellow streak down the overlapping edge of each petal. Very dark red centre.



SEEDLINGS OF HIBISCUS
showing variation in leaves.

Variety 12: Bright tomato red; much smaller and unusual in having the centre almost the same colour as the rest of the petal no dark patch at the base.

Variety 13: Exactly like *Sunrise*, species 2. Leaves mostly as fig. 1 or 8, a few 2a or 7.

The leaves of these young plants show all kinds of variation in size and shape (Figs. 6, 7, 8a and 8b). In the seedlings some have the leaves all of the type of figs. 1, 3 or 4. Others have the lobed leaf of fig. 7. Occasionally both types are found on the same seedling (Plate II, figs. A and B), and on older plants a bunch of the palmate leaves will appear on a small branch of a plant with ovate lanceolate leaves.

The red colouring matter is often found in the first leaves giving them a bronze appearance.

This very slight and incomplete study of hybridisation in these species of Hibiscus seems to give very interesting results, and to indicate that it might very easily be carried further to establish the true Mendelian behaviour of the species, and incidentally to produce some new varieties of this very beautiful plant for our gardens.

Explanation of Coloured Plate.

Fig. 1.—Peach Hibiscus; b. capsule; c. capsule with seed exposed.
Fig. 2.—Sunrise Hibiscus.
Fig. 3.—Pale salmony-pink variety.
Fig. 4.—Clear straw-yellow variety.

MALAYAN GAUR OR SELADANG.

(*Bibos gaurus hubbacki*)

By

THEODORE HUBBACK.

(*With 5 black and white plates*).

The variety of Gaur found in the Malay Peninsula was designated as a subspecies by Lydekker in 1907, who gave the following reasons for doing so in his book *The Game Animals of India, Burma, Malaya, and Tibet* :—

'If the pyoung, or Burmese gaur, is separated from the Indian animal, there can be no reasonable doubt that the seladang, or Malay representative of the species, is likewise entitled to similar rank. This probability is converted to a certainty by the distinctive features presented by three adult bull seladang heads recently sent to London by Mr. T. R. Hubback, author of *Elephant and Seladang Hunting in Malaya*, London, 1904. In that work Mr. Hubback himself states that in adult seladang there is no dewlap, and the colour of the "stockings" is dirty yellow. The heads just referred to show that the seladang has a much smaller development of the ridge between the horns than the Indian gaur, a greater extent of tawny on the forehead, and also a distinct whitish band above the muzzle. In one of the heads there is a fair development of the intercornual ridge, but in the other two the line between the horns is quite straight; in fact, if it were not for the horns, which are of the characteristic gaur type, these two heads might almost be referred to as gayal. They render it practically certain that the latter is not specifically distinct from the gaur; and it is significant in this connection that the one supposed specimen of a wild gayal was killed in Tenasserim.

'The seladang may be named *Bos gaurus hubbacki*; a specimen presented by Mr. Hubback to the British Museum being taken as the type.'

This description, as I shall show later, is not quite accurate, regarding the absence of a dewlap, in fact if such a phenomenon is to be taken as a ground for the making of subspecies it is possible that there may be two subspecies of gaur in Malaya.

Calf seladang are of a bright golden bay colour but it is possible that this colour does not develop in its full brilliancy until the calf is a few weeks old. Regarding this point I am not very certain although I have seen very small calves which were mouse-colour instead of the golden bay colour that I would have expected to see.

When the calves are about a month old they invariably show this golden bay colour and are very conspicuous in the jungle. I shall refer to this phenomenon later on. I think the bay colour persists for about five or six months and then the colour of the body and the legs to the knees and hocks gradually changes into a dark sepia with light stockings and a light forehead. In most



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AN OLD BULL SELADANG. HE IS JUST APPROACHING A SALT LICK.

cases there are lightish patches of hair above the bare part of the nose, round the lips and under the chin. The illustration No. 1 of a young seladang shows a young bull, probably about twelve months old. This animal which was within thirty yards of me for a considerable time was quite dark in colour. In fact one might describe it as being dark sepia, but its legs from the knees and hocks downwards were of a very light khaki colour; the frontlet as is shown in the photograph was a greyish yellow.

These colours persist through life, except that as the animals get older the body colour becomes darker and in very old animals the frontlet becomes grey. Also with mature bulls, it is commoner to see dark khaki stockings than the light ones seen on the calves and the cows.

A mature bull seladang is a magnificent animal measuring up to 6 ft. 3½ in. at the shoulder with a length from nose to rump of between nine and ten feet. It is as the illustrations here show an animal of enormous strength and great bulk, and although I have no figures to support my estimate I do not think that a big bull seladang would weigh less than two thousand pounds. The cows are lighter build but little less in stature than the bulls and an old cow measuring 5 ft. 10 in. at the shoulder is by no means uncommon. There appear to be two distinct phases of development of the dewlap in the seladang. In some cases, mature seladang have a very pronounced dewlap, in other cases, the dewlap is hardly developed at all. I have found that seladang with heavy dewlaps are generally taller than those with little or no dewlap, have longer horns and have more light hair round the muzzle. Those with little or no dewlap are generally stockily built, but less in shoulder measurement, and although the light patch on the chin seems to be common to all seladang, those without a developed dewlap seldom have any light patch over the nose. This applies to cows as well as bulls, but the dewlap is never well developed in the cow.

It is possible that there are two subspecies of seladang in Malaya, but I have no sufficient information to enable me to express a definite opinion on the subject. The soft part of the nose of the seladang is generally dark grey, sometimes almost black, but it is never pink as is sometimes the case in the Indian gaur. The glory of a bull seladang's horns when in his prime and before the tips have become much worn, is one of nature's triumphs. The young seladang has horns yellow at the base with longish black points; as the animal gets older the bases of the horns thicken and become corrugated changing colour to a deep olive green. This happens to the horns of cows as well as bulls although the cows' horns never approach those of the bulls in length or girth. A cow's horns would very seldom reach a basal measurement of fifteen inches; bulls sometimes reach a basal measurement of twenty-two inches or more. The Malayan animal does not, as a rule, have long or wide spreading horns, due possibly to the dense jungle in which it spends most of its time, an outside spread of forty inches and a length of thirty-five inches is seldom attained.

I hesitate to estimate what age a really old seladang reaches but,

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presuming that they reach adolescence during their fifth year, extreme old age would be reached at about their thirtieth year. I have known old bull seladang, which frequented certain tracts of country, well-known to me, which were there for many years, and this leads me to believe that seladang have a long life.

Seladang never wallow in mud baths so beloved by the Indian buffalo (*Bubalus bubalis*). The result is that they always appear, except in the case of very old animals, as if they had just been groomed. Their hides shine with a lustre which is most attractive. This is due to the fact that seladang exude an oily sweat which carries with it a brown pigmentation, especially noticeable if their bodies are wet from rain. When following seladang one is often warned of their proximity by a strong bovine scent, accentuated in the case of old bulls, and very noticeable if they have been put to much exertion, such as a long chase. An oldish animal, under such circumstances, will sweat so freely that a brown stain may be found on trees or saplings against which it has brushed, and the almost continuous scent left behind on the trees should not be allowed to mislead one into believing that one's quarry is near. The fresh scent of close proximity is distinguishable from the scent left on the trees to any one experienced in bush-craft.

I believe domestic cattle never sweat, and as *Bos indicus* (Zebu), the common domestic humped cattle of India is no exception to this rule, it seems unlikely that they were descended from *Bibos gaurus*. The origin of *Bos indicus* is unknown but was regarded by Blyth as probably African. The theory was discredited because it is known that there are no wild cattle in Africa which could have been the progenitors of the Zebu. The only wild species is the Buffalo, an animal quite apart from the Zebu. It was subsequently suggested by Professor Ruttimeyer that the remote ancestor of the Zebu was the wild Banting of Java: better known as the *Tsaine* in Burma, a theory upheld subsequently by Lyddeker. It is now held that the humped cattle of Asia in common with European cattle is descended from the aurochs or Wild Ox of Europe and that the Zebu's hump is a modification developed under domestication. The presence or otherwise of sweat glands in the skin might be a clue to the ancestry of wild or domestic cattle.

The word *seladang* is the Malayan word for the variety of gaur found in the Malay Peninsula and is probably derived from two native words, *satu* meaning one and *ladang* meaning a jungle clearing, indicating that this animal is one which may be seen in a clearing, *satu ladang*, abbreviated to sladang or seladang. Other large Malayan wild animals would not be seen in such places; a rhinoceros, an elephant, or a tapir would not be found feeding in a clearing in the daytime.

The seladang is a forest-edge animal and its habitat is not virgin forest, although it is frequently found in the forest due to circumstances which have been forced upon it. It is unlikely that the seladang is an animal indigenous to the Malay Peninsula. The following reasons seem to indicate a comparatively recent migration from the north. The entire peninsula, except the highest



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A COW SELADANG AND HER CALF IN A SALT LICK. THE CALF APPEARS MORE ALERT THAN THE COW BUT IT IS REALLY ONLY CURIOSITY SO HIGHLY DEVELOPED IN THE YOUNG.

mountains, was originally covered with dense tropical virgin jungle; there were no natural clearings at all, and until Man appeared from the north there would have been nothing approaching grass land except where possibly floods had cleared some river banks of river-edge vegetation. Even now to this day no clearing remains free of jungle growth for more than a few months if left untended and in two or three years returns to a dense secondary forest. This is not the environment which would evolve the large species of *Bovidae* and it is reasonable to suppose that some centuries ago the seladang, or as they were then gaur, came down through Siam and Burma to the Malay Peninsula following the cleared spaces of the early settlers in Malaya. I advisedly write 'settlers' because certain of the aborigines who inhabited the Malay Peninsula and who still inhabit it make no clearings, merely living on roots, fruit, and anything they can catch. Such races would not have helped to provide gaur with the grasses essential to their well-being and without which they would not be attracted to a new country. The origin of the seladang in the Malay Peninsula is I think of the greatest importance when considering their habitat, environment and general reaction to those 'civilizing' influences which are so perilous to their welfare, and for those reasons we must consider carefully the artificiality or otherwise of their present existence.

There is one extremely significant fact which points to a comparatively recent immigration to the Malay Peninsula and that is the light colour of the young seladang calves. I have given this phase of the subject much thought; I have made as careful observations as are possible on wild animals which can seldom be seen except in dense cover; I have seen many scores of young seladang calves; and have drawn the following deductions. That seladang have not yet adapted themselves completely from a physical standard to their environment in which they have to live in the peninsula because a bright bay coloured calf is not able to achieve that concealment in the forest, even when immobile, which Nature generally provides to the young of many species and to the adults of some species, as a protection against enemies. In grass country, which I think is the true habitat of *Bibos gaurus*, a light coloured calf in times of danger would be well concealed when lying or squatting down, and it is this very habit of squatting down when suddenly startled—not of course at very close quarters when panic would lead to flight—that the seladang calves practise even in virgin jungle. I could give many instances but the following will suffice. I had disturbed a herd of five or six seladang on the edge of an old clearing which had grown up into a coarse rank grass called *lalang* (*Imperata arundinacea*). Amongst these seladang was a young calf—a bright golden bay calf. We followed the herd and saw that the tracks of the calf were not there. We returned to the edge of the clearing looking round about for the calf but could see nothing. Presently one of my men spotted the calf on the edge of the jungle looking towards us. It almost at once disappeared from view and I felt certain that it had squatted down for concealment. We walked slowly over to where

the calf had been and almost reached the edge of the jungle when the calf jumped up five or six yards from us and dived into the jungle. It only sought safety in flight when we were very close to it. The cows almost invariably leave the calves to take care of themselves on the assumption I suppose that immobility is a better safeguard for the calf than flight with the herd. I have never known a cow seladang stand by her calf, but the calf will remain more or less in the same place until the mother returns for it, calling in a soft low moo until the calf hears it. I think it may often be hours before the cow returns, especially if much alarmed. These peculiar tactics of the seladang, not at all suitable to its environment in Malaya, no doubt account for a large mortality amongst the calves from tigers, who will certainly know, if I do, that a stampeded herd is liable to leave the calves behind. Here we have one factor against the seladang, owing to an incomplete adaptation to a new environment.

In the Malay Peninsula seladang herds are few and scattered and it is more than likely that the ten or twelve animals in a herd very seldom meet any seladang from another herd. This would make one suspect a great risk of too much inbreeding, but I think Nature has ways and means of getting over such difficulties which we seldom suspect. It has seemed to me from long observation that there is a predominance of males in each herd. I put this forward with some diffidence because it is difficult to tell the young bulls from the young cows and I may have been mistaken in my deductions, but, if I am right, this would, to some extent, help to prevent too close inbreeding. Another phase in the life history of seladang is the frequent absence from the herd of quite young bulls, who will leave the herd for days or weeks, and then return to the fold. I do not hold the view that these young solitary bulls have been driven away from the herd by a more powerful bull, which is what is generally supposed. I believe that seladang are naturally independent and that males are liable at any time to go off by themselves. I have seen quite young bulls three or four years old, miles away from a herd; such youngsters would not have been forced or driven out of a herd. I have known of three young bulls, of which the oldest was not more than five years, away from any others, thoroughly enjoying themselves in a salt lick. They certainly had not been kicked out of a herd *en masse*, but were, I believe, merely following their natural inclination for wandering adventure. This proclivity to wander off by themselves may also help to check too close inbreeding, because young, middle aged and old bulls all do it. Again old bulls are supposed to become entirely solitary, having been driven out from the herd, to live a retired and morose existence. This I do not believe either, although a very old bull will be more frequently by himself than with a herd. Still one finds very old bulls with herds as the photograph opposite clearly shows. So it is more than likely that the mature cows in a herd are not always served by the same bull, because even supposing that the master bull is the strongest one in the herd his habit of going off by himself may at times coincide with a cow's desire for a mate and so some other bull



OLD BULL SELADANG TAKEN WITH A HERD IN A SALT LICK.

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in the herd may be the sire of her next calf. Old bull seladang have a peculiar habit of attaching a young bull to them who is often found in their company. I have come across several cases of this and illustration opposite shows an old bull, with a young bull, in attendance. But this old bull, whose tattered ears make him easily identifiable, is also to be found in a herd as the next illustration shows (vide plate facing p. 14). I have often thought that this 'attendant' is picked up to help an old bull to look after himself, because undoubtedly old bulls frequently become deaf and a companion can make up for their deficiency by acting as a watchman. I once came across a case of a sambhur stag which attached itself to an old bull seladang, but what was the natural attraction I do not know.

I believe very old seladang whose strength has greatly decreased, sometimes fall victims to tigers. I know, at present, of one old bull seladang, obviously very nearly at the end of the trail, who is frequently attended by a very large tiger whose presence is decidedly not to the advantage of the seladang.

Seladang do not appear to have any special breeding season, calves being born at almost any time of the year. During the wettest months in Malaya, October to December, very young calves are seldom seen, although considering it is the cow that comes in season not long after the calf is born and the gestation period is nine months there appears to be no reason why one month should be more favoured than another month. I think seladang cows seldom have more than one calf during the season as I have never seen, except on one occasion, two calves following a cow. On the occasion when I did see two calves attached to a cow, they were each about twelve months old and only one of them may have belonged to the cow, the other may have lost its mother.

Seladang are extraordinarily sensitive to disturbance and will not thrive in country which is continually invaded by Man. In Malaya that has accounted for the almost entire disappearance of seladang from the west coast and from many places on the east coast. It is doubtful if four hundred seladang exist in the Malay Peninsula and of these at least twenty-five per cent., owing to their isolated positions, are sure to disappear in two or three decades. It is all the more necessary therefore to do our utmost to preserve intact those herds which are now in wilderness country. Unless great care is taken seladang will be exterminated in Malaya. Seladang are not mountain animals and although in their many wanderings solitary bulls will go far into the mountain country a herd does not do so, and land consisting of undulating country and river valleys must be preserved intact for their contentment. Therein lies the difficulty in Malaya where irrespective of true economic principles the habitat of wild life is often ruined for some purely ephemeral benefit. National Parks and Reserves are the only hope of salvation for the seladang of Malaya, and I will deal with this aspect of the question later on.

The seladang is by no means voiceless. It has no less than five distinct and characteristic methods of expressing its emotions.

The one most commonly heard is the snort of alarm and surprise which is given by seladang when met at close quarters. This snort is made by a violent and rapid expulsion of air through the nostrils and is one of the terrifying phenomena referred to by Malays when describing the extreme ferocity of the seladang. This snort is supposed to precede an imminent attack and is immediately followed by flight on the part of the Malay who describes with vivid detail on reaching his village how he was charged by a seladang and only by his extreme agility was he able to save his life. What actually happens is that the seladang is terrified as well as the Malay—he probably could not be terrified as much as the Malay—and the snort is immediately followed by a quick turn and precipitate flight.

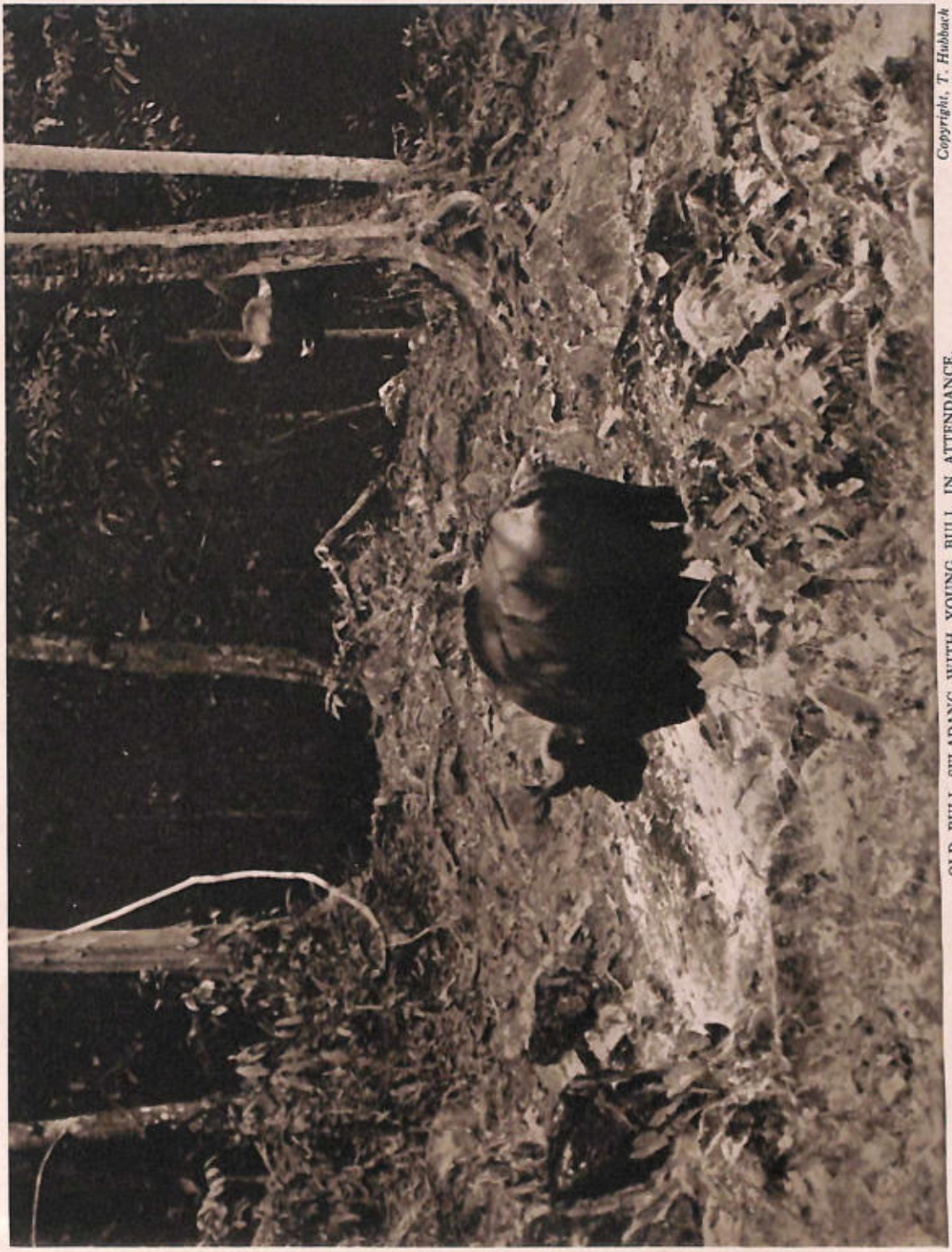
The second sound made by the seladang is of the same class but is made when a bull is explaining to the rest of the herd what a fine fellow he is, or when he is demonstrating to a tiger, which may be in the vicinity, that he is quite ready for a fight if the tiger comes within reach of his horns. These sounds are chiefly whistling snorts made through the nose as in the first instance, but generally accompanied by butting at the undergrowth and by pawing up the ground. During these demonstrations seladang are liable to demolish ant hills with their horns, but this is sometimes due to attempts to remove ticks from their heads. This habit wears down the tips of the horns in some cases, although not invariably. I have obtained old seladang with perfect tips to their horns. It is I think a matter of temperament.

The third sound is that of a cow seladang calling to her calf, which in most cases almost exactly represents the moo of domestic cattle but sometimes may be likened to a mild rendering of a fourth sound which I will presently describe. This noise is only made by the cow calling to a younger animal.

The fourth sound is the most peculiar sound made by seladang. It is a call to other seladang which may be in the vicinity and is a sound beyond my powers to describe. It is a cross between the bugling of a wapiti (elk) and the trumpeting of an elephant. It is a melodious sound which carries a long way in the jungle. I have heard a young seladang calling when waiting in the jungle within a short distance from a salt lick, waiting to go into the lick but probably not wishing to enter alone. It was in more or less the same position for about two hours and during that two hours called four or five times. It had a fairly deep note and I thought that it was a mature bull calling to the rest of the herd, but at the end of two hours when it plucked up courage to enter by itself, lo and behold! this animal which I had taken for a mature bull was a young bull of not more than two or three years of age!

The final sound made by a seladang does I believe only occur once, and that is at the end of its life when it is dying a violent death. It is a dying moan which once heard will never be forgotten, and might be taken as a protest against the deprivation of its life while still strong and vigorous.

The main food of seladang consists of grasses of which the



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OLD BULL SELADANG WITH YOUNG BULL IN ATTENDANCE.

one they like best is known in the vernacular as *rumput chengkenit*. This is a creeping grass common throughout the Malay Peninsula and is cut a great deal for cattle food. *Lalang* and allied coarse grasses are also eaten by seladang when they are young. Clearings which are grown up into *lalang* are often burnt off to attract seladang. In the jungle they do not eat many of the leaves of jungle trees but one tree they are very fond of is *merlimau* (*Atalantia monophylla*). The leaves of trees which grow in secondary jungle, *mengkirai* (*Trema amboinensis*) and *beti-beti* (*Eugenia zeylanica*) are much liked by them. Seladang occasionally raid crops but never crops that are properly looked after or taken care of. They will eat young rice which is of course like any other young succulent grass and will also eat the leaves of young Indian corn, but as a potential danger to cultivation which is properly taken care of the seladang may be ignored. Seladang are very fond of visiting salt licks especially sulphur licks and it is due to the fact that they will visit these licks during the day time that the photographs illustrating this article have been made possible. In the Malay Peninsula there are no open spaces in which one is the least bit likely to find seladang during the brighter hours of the day although one might occasionally see them in the early morning or evening. The sulphur or saline found in these salt licks are taken I think by seladang to clear their stomach of intestinal parasites. In some cases where seladang have visited a mud lick I have seen their droppings almost pure mud, and I think that these licks must be considered as the chemists' shops of these animals. In places where they are undisturbed seladang are liable to visit a salt lick at any time of the day or night, but unfortunately such places in the Malay Peninsula are few and far between and most visits to salt licks are made during the hours of darkness. For many decades when visiting salt licks seladang have been subject to being fired at by Malays safely ensconced in the shelter of high trees with the result that such places are generally avoided during the hours of daylight. Even where there is no disturbance and the seladang have a sense of security the approach to a lick will still be made with the greatest caution and an animal about to enter a lick will generally wait at the edge of the jungle for some minutes before finally entering the lick. Very old bulls are an exception to this rule because they do not seem to care for anybody or anything and walk straight into the lick to have their drink which may take them a long time, perhaps a quarter of an hour, and then walk away without any concern.

With two or three exceptions no expert or intelligent observations have ever been made on the ecology of the seladang. The result of this has been that seladang have been judged by native gossip and have been credited with a ferocity and aggressiveness entirely foreign to their character. A big seladang if met in the jungle *looks* ferocious and has the same psychological effect on a native as the horrible effigies on blatant banners, carried in the van of an army, had on Chinese soldiers in ancient days.

The seladang is in reality an exceptionally quiet and well-behaved wild animal, so far as Man is concerned timid to a degree

and not, so far as I know, intolerant of the presence of other animals. I have a photo of a doe sambhur (*Cervus unicolor*) in close proximity to a cow seladang and apparently unnoticed by a young bull seladang who has with great impoliteness turned his back on the doe, supports, to some extent, my contentions. In this case the doe sambhur came across my front—I was in a hide—and walked quietly up to where these two seladang were drinking in a salt lick. Presently the seladang detected a slight taint in the wind and went off in a hurry, but this did not disturb the doe although she immediately became suspicious and 'froze' into an expectant attitude which she maintained for quite a quarter of an hour. But that is another story.

I have often seen seladang and sambhur deer in this salt lick at the same time within twenty or thirty yards of each other, but only on this one occasion in such close proximity.

Bull seladang do, of course, at times fight. I have shot many seladang with new and old scars on them but although, in my time, I have tracked on foot seladang for thousands of miles I have never come across a single place where a fight had taken place. Signs of demonstrations I have frequently seen, but they appeared to lead to nothing in the way of a 'scrap'.

I only know of one authentic case of a bull seladang being found dead after a fight to the death with another bull, but I did not personally see the site of the affray.

Amongst the big game of Malaya seladang, as a sporting animal, is in a class by itself. Although rhinoceros hunting may be more difficult it is much less easy to obtain, and few Europeans have ever made any attempt to hunt rhinoceroses in the Malayan jungle. The seladang has been fairly widely distributed throughout Malaya and has been hunted a great deal at different times by both Europeans and natives. Unfortunately the seladang is an animal which may occasionally be shot by waiting for it in the evening in a burnt off clearing or in some old estate where there is little disturbance and where these animals occasionally come out to feed. Seladang shot under such conditions are fired at in much the same way that one would shoot at a target and trophies obtained in such a way in no way reflect any credit on the ability of the hunter. On the other hand those who have tracked seladang in the jungle and have finally outwitted an animal which is especially alert when in dense jungle will enjoy hunting and tracking equal to anything to be obtained elsewhere. As I have said already it is by no means certain that because an animal is a solitary one it is therefore a desirable trophy, although it is unlikely that such an animal would be a cow. But any hunter after some experience soon gets to know the difference between the big track of a big young bull and the big track of a big old bull. Very often they are much the same length but they are not the same shape, the older track is wider at the heel, more blunt at the tip and does not show an impression of the outer edge of the hoof seen in the younger track. This perhaps is scarcely the place in which to write a long dissertation on the hunting of seladang, but entirely apart from the great scientific interest attaching to an animal such



OLD BULL SELADANG—KRAU VALLEY, PAHANG, F.M.S. *Copyright. T. Hubback*

as a seladang it must be remembered that the fact of an animal carrying a desirable sporting trophy goes a long way towards insuring that it will not be ruthlessly exterminated. At least that applies in most countries but not very strongly in Malaya where now-a-days few white men take any interest in the hunting of big game. The seladang is extraordinarily difficult to pick up in a dense jungle. It will, like all jungle animals, remain absolutely immobile directly it is suspicious that there is something abnormal in its vicinity and in the dense jungle where it will be found one's vision is confined to a circle of anything from ten to twenty-five yards—it is almost impossible to see a dark animal like the seladang so long as it keeps still. Under such conditions the seladang's first move which may or may not be preceded by a violent snort is to swing round and disappear. I am presuming that the hunter is on the tracks of a solitary animal. A long stern chase of some hours will then take place and will probably be followed by an exactly similar circumstance. If the first approach to the seladang is not successful every subsequent approach will be more difficult. They are extraordinarily alert and until very old have good hearing and good eyesight. Their powers of smell are phenomenal, and the slightest taint in the wind will send them off at once. So to be a successful seladang hunter one has to be a persistent person, but the reward will come because some day either the hunter gets an unexpected piece of luck or the seladang makes a mistake and awaits in a place where he thinks he is concealed but not sufficiently concealed to deceive the hunter. Or possibly the hunter's skill may exceed the seladang's caution, and the animal may be caught unawares.

I remember having a long hunt after a very old bull seladang. In fact I was on his tracks for four days. We came up to him several times but he was always aware that we were there before we were aware where he was. He never ran away—perhaps his running days were past—but he immediately walked off and kept on walking for hours. At last in the middle of the fourth day he made a mistake and I was able to obtain one of the finest trophies that I have ever got. The illustration opposite shows the mounted head. The mistake he made was this. He had gone up a steep hillside and we were tracking him when we heard the heavy breathing of the seladang above us on our right front. We stopped and presently saw that the seladang was coming down the hill towards us, but before we could see him properly he also stopped and although I could see where he was I could not tell which end was which. He was equally mystified. He realized that there was something wrong somewhere down the hill below him but did not know what it was. I dared not fire for fear of hitting the wrong end. He was more or less sideways to me. Presently he put his head down close to the ground to look under the undergrowth to see what it was that was bothering him. The moment he put his head down I of course knew which end was which. Had he not put down his head but moved off I should not have had a chance of killing him. He was about thirty yards above me up a very steep hillside.

I have followed seladang often for several days and they have given me a great deal of wonderful hunting. Despite the fact that a seladang is an enormously bulky animal, and an extremely active animal except when very old, he seldom attacks a hunter even when wounded. I have several times been in such a position when following a wounded seladang that he could have almost certainly made good a charge had he elected to be aggressive. But flight was more to his liking. Only once have I had a near call and on that occasion the animal, badly wounded, came all out to try and get some of his own back. In fact he was so close to me that my shot hit him in the head at about five yards from me and the impetus of his rush carried the body past me.

But seladang hunting in the Malay Peninsula is nearly a thing of the past because although there are still seladang the country is now highly commercialized and seladang will not thrive where they are continually disturbed.

What of the future of the seladang? I wish I could find an answer. Although persistent efforts have been made during the last few years to awaken a lethargic Government to the importance of properly enforcing the Game Laws and of taking proper steps to provide sanctuaries and refuges for the wild life of Malaya, nothing has been placed on a sound foundation, and it is extremely doubtful if it ever will be placed on a sound foundation. Officials who look at the balance sheet of an annual budget hate the idea of allowing a tract of country, which may contain some mineral or some timber or something else that will produce money, being tied up to propagate wild life, and it is difficult to get the realization of the value of wild life into the mentalities of persons who are merely ephemeral office holders. In Malaya nearly the entire population consists of Malays, or Chinese, or Indians. The Malays are the indigenous people, but they do not care a single thing from an ethical point of view about the wonderful natural resources of the country. The others, including most of the Europeans, are here to get what they can out of the country, and without a realization of the necessity for a sound policy regarding the conservation of the natural resources of the country as a matter of ethics wild life conservation in Malaya will fail. It is useless to appeal on the grounds that in a few decades the natural resources of the country will be ruined, because those who are sufficiently intelligent to understand that know perfectly well that they will not be here. The Europeans in Malaya are birds of passage; the indigenous races cannot grasp the value of the wild life to their country. The only hope for the larger fauna of Malaya, seladang in particular, is to make inviolable sanctuaries and unless we can get inviolable sanctuaries, sanctuaries which will not be carved up to allow Mr. A to prospect or mine for gold, Mr. B to prospect or mine for tin, or Mr. C to exploit the timber, the larger wild life is doomed.

There are areas in Malaya which have been set aside and are at the moment ostensibly refuges for wild life, but it is a continual fight to get money or personnel to guard these places, and it is only a matter of time when, if the present apathy continues, it will be considered not worth while. It is a deplorable thing to

realize the fact, as I can from personal experience realize it, that during the last forty years in Malaya the larger forms of wild life have been so depleted that they are in grave danger of extermination, and so long as Malaya worships the cult of Mammon before everything else, it is difficult to see how matters can sufficiently improve to retrieve the situation.

FISH OF DEOLALI.[1]

BY

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PART III.

(With three plates and 6 text-figures).

ON TWO NEW SPECIES AND NOTES ON SOME OTHER FORMS.

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INTRODUCTION AND LIST OF SPECIES.

In the first article of the series[2] a general account of the localities and lists of specimens obtained therefrom were given, and here we propose to give a complete list of the fish-fauna of Deolali, to describe the two new species of *Barbus* and *Parapsilorhynchus*, and to add notes on certain species whose existing descriptions require amplification. In preparing the following list we have adopted the classification proposed by Jordan,[3] and have given the Bhil

[1] Published with permission of the Director, Zoological Survey of India.
[2] Hora and Misra, *Journ. Bom. Nat. Hist. Soc.*, xxxix, pp. 502-519 (1937).
[3] Jordan, *Classification of Fishes* (Stanford University, California: 1923).

names of the various species as supplied to us by Mr. A. G. L. Fraser. Information regarding the distribution of the different species of fishes in Deolali waters is also incuded in the list.

Scientific Name	Bhil Name	Local Distribution[1]
Order : ISOSPONDYLI		
Family : NOTOPTERIDÆ		
1. *Notopterus notopterus* (Pallas)	Chambaree ...	6 and 38.
Order : OPISTHOMI		
Family : MASTACEMBELIDÆ		
2. *Mastacembelus armatus* (Lacép.)	...	38.
Order : APODES		
Family : ANGUILLIDÆ		
3. *Anguilla anguilla* (Ham.)...	Ahhir ...	38.
Order : EVENTOGNATHI		
Family : CYPRINIDÆ		
Sub-Family : ABRAMIDINÆ		
4. *Chela clupeoides* (Bloch) ...	Phal, Phathree, or Pathree ...	3, 4, 6, 8, 12, 16, 20, 21, 22, 23, 26, 30, 31, 41, and 49.
5. *Chela phulo* (Ham.) ...	Gayroonjee or Phal ...	6, 22, 23, 40, and 42.
Sub-Family : RASBORINAE		
6. *Barilius bendelisis* (Ham.)...	Waris, Jhor or Jhoria ...	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 19, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46, 47 and 50.
7. *Danio æquipinnatus* (McClelland)	Gayroonjee ...	3, 6, 9, 10, 13, 18, 23, 27, 29, 31, 33, 34, 35, 38, 39, 42 and 43.
8. *Danio fraseri* (Hora) ...	Gayroonjee ...	5 and 7.
9. *Rasbora daniconius* (Ham.).	Gayroonjee ...	7, 8, 9, 10, 11, 12, 14, 16, 18, 19, 22, 23, 29, 31, 33, 35, 36, 38, 40, 41, 42 and 44.
10. *Rasbora labiosa* Mukerji ...	Gayroonjee ...	1, 2, 4, 6, 10, 13, 15, 24, 25, 26, 34, 35, 39, 45 and 50.

[1] The numerals given in this column refer to the locality numbers corresponding to those given in the first part of this series (*Journ. Bom. Nat. Hist. Soc.*, xxxix, pp. 502-519, 1937).

	Scientific Name	Bhil Name	Local Distribution
	Sub-Family : CYPRININÆ		
11.	*Aspidoparia morar* (Ham.)	Sandokol, Phal, or Ambli ...	6, 8, 33, 41 and 42.
12.	*Barbus amphibius* (C. & V.)	...	16, 18, 22, 30, 31 and 40.
13.	*Barbus chola* (Ham.) ..	Bhokria ...	8 and 12.
14.	*Barbus chrysopoma* (C. & V.)	Bhodeer ...	16.
15.	*Barbus khudree* Sykes ...	Waris ...	5, 6, 8, 9, 19, 20, 21, 23, 26, 27, 28, 33, 36, 40, 41, 42, 46, 47 and 48.
16.	*Barbus kolus* Sykes ...	Bhokria or Kholis ...	6, 8, 9, 12, 16, 19, 20, 21, 23, 28, 36, 38, 40, 41, 46, 47, 48 and 49.
17.	*Barbus melanostigma* Day ...	Gayroonjee ...	19 and 47.
18.	*Barbus parrah* (Day) ...	...	46.
19.	*Barbus pinnauratus* Day ...	...	19, 22 and 31.
20.	*Barbus sarana* (Ham.) ...	Bhodeer ...	20, 21, 22, 26, 30, 38, 41, 42, 47, 48 and 49.
21.	*Barbus ticto* (Ham.) ...	Tiplee or Tiptoo.	3, 4, 5, 6, 7, 8, 9, 10, 12, 16, 19, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 39, 40, 41, 43 and 44.
22.	*Barbus fraseri*, sp. nov. ...	...	6, 8 and 12.
23.	*Cirrhina reba* (Ham.) ..	Arrol ...	38 and 40.
24.	*Crossochilus latius* (Ham.).	Warootee ...	22, 23 and 41.
25.	*Garra mullya* (Sykes) ...	Mallia or Kharandya ...	3, 9, 10, 13, 16, 19, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 35, 36, 39, 40, 41, 42, 44, 45 and 47.
26.	*Labeo boggut* (Sykes) ...	Sandekol ...	3, 6, 19, 23, 38, 40, 41 and 42.
27.	*Labeo calbasu* (Ham.) ...	...	16.
28.	*Labeo porcellus* (Heckel) ...	Khanoos, Kholis or Goghree ...	16, 17, 22, 36, 38, 46, 47, 48 and 49.
29.	*Parapsilorhynchus prateri*, sp. nov.	...	1, 4, 10, 13, 14, 35 and 50.
30.	*Rohtee cotio* (Ham.) ...	Goorda ...	6, 8 and 23.
31.	*Rohtee alfrediana* (C. & V.).	...	22 and 31.
32.	*Rohtee vigorsii* Sykes ...	Kaplee ...	46 and 49.
	Family COBITIDÆ		
33.	*Lepidocephalichthys guntea* (Ham.)	Mhorro, Mohroo Thail or Mohroo Chapra ...	6, 8, 10, 12, 13, 14, 24, 25, 29, 30, 34, 35, 39, 40 and 45.
34.	*Nemachilus botius* (Ham.).	Mhorroo or Mohroo Chickna ...	5, 6, 8, 9, 12, 23, 26, 27, 31, 33, 36, and 40.
35.	*Nemachilus denisonii* Day.	Mhorroo or Mohroo Yaree.	1, 5, 6, 10, 12, 13, 24, 34, and 39.
36.	*Nemachilus evezardi* Day ...	Mhorro ...	13, 14, 23, 24, 34 and 35.

Scientific Name	Bhil Name	Local Distribution
Order : NEMATOGNATHII		
Family : SILURIDÆ		
37. *Callichrous bimaculatus* (Bloch)	Moonee ...	8 and 40.
38. *Wallago attu* (Bloch) ...	Baloo ...	20, 21 and 46.
Family : HETEROPNEUSTIDÆ		
39. *Heteropneustes fossilis* (Bloch)	.....	12.
Family : BAGRIDÆ		
40. *Mystus cavasius* (Ham.) ...	Khirkirya ...	12, 16, 17, 22, 31, 40, 46 and 49.
Family : SISORIDÆ		
41. *Glyptothorax annandalei* Hora	Khordoo ...	23.
42. *Nangra viridescens* (Ham.).	Bibua ...	19.
Family : SCHILBEIDÆ		
43. *Proeutropicthys taakree* (Sykes)	.....	6 and 8.
Order : LABYRINTHICI		
Family : OPHICEPHALIDÆ		
44. *Ophicephalus gachua* (Ham.)	Dakhia or Dhakaray ...	1, 5, 9, 10, 12, 23, 31, 33, 35 and 40.
45. *Ophicephalus leucopunctatus* Sykes	Murral ...	38.
46. *Ophicephalus marulius* Ham.	Murral ...	8, 12 and 40.
Order : PERCOMORPHI		
Family : AMBASSIDÆ		
47. *Ambassis baculis* (Ham.) ...	.....	6 and 40.
48. *Ambassis nama* (Ham.). ...	Goorda or Bing.	4, 6, 22 and 40.
49. *Ambassis ranga* (Ham.) ...	Bing ...	4, 6, 12, 16, 20, 21, 22, 23, 26, 30, 31 and 40.
Order : GOBIOIDEA		
Family : GOBIIDÆ		
50. *Glossogobius giuris* (Ham.).	Kharbia or Kharbya ...	12, 16, 19, 20, 21, 22, 23, 26, 36, 40, 47 and 48.

It is seen from the above that in Mr. Fraser's collection of 4,463 specimens there are representatives of 50 species. Of these

29 belong to the family Cyprinidae, 4 to Cobitidae, 3 to Ophicephalidae, 3 to Ambassidae, 2 to Siluridae, 2 to Sisoridae and 1 each to Notopteridae, Mastacembelidae, Anguillidae, Heteropneustidae, Bagridae, Schilbeidae and Gobiidae. The abundance and variety of Cyprinoid and the comparative rarity of the Siluroid fishes are noteworthy features of the fauna. Even from the point of view of the local distribution of the species, the Cyprinoids are found practically everywhere and no doubt form the major portion of the fish diet of the local inhabitants.

Systematic Account.

Chela clupeoides (Bloch).

1878. *Chela clupeoides*, Day, *Fish. India*, p. 602.

In his account of *Chela clupeoides*, Day referred to the variability of the species with regard to lepidosis and number of rays in the anal fin. Though as a rule the number of rays in the anal fin is stated by him to vary from 13 to 15 $\left(\frac{2}{11\text{-}13}\right)$, in the specimens from Deccan he found them to be $\frac{2}{13\text{-}15}$. A detailed examination of Deolali examples fully bears out Day's results. In a majority of the specimens the number of rays in the anal fin is more than 15 and in some of the examples there are even 18 rays.

Barbus khudree Sykes.

1841. *Barbus khudree*, Sykes, *Trans. Zool. Soc. London*, ii, p. 357.

The precise systematic position of Sykes' *Barbus khudree* has not been properly understood so far, and the reason for this seems to be the great confusion that prevails regarding the species, races and varieties of the large-scaled Barbels of India, popularly known as 'Mahseers'. Unfortunately Sykes did not publish a figure of this species and his description contains no reference to scale counts. He characterised it as:

'A *Barbus*, with 4 *cirri*; blood-stained fins; large hexagonal scales; elongated body; and with 14 rays in the dorsal, 14 in the pectoral, and 7 in the anal fins.'

The above is a generalised definition and is not helpful in distinguishing the species from a large number of similar fishes found in Indian waters. Sykes' detailed description of the species given below is also very vague. He stated:

'Dorsal fin of from 10 to 12 rays; first long ray a thick strong bone, with 3 very short bones before it; the whole four compact; pectoral fin of 12 perfect rays, and 2 incomplete rays, ventral fins of 9 rays; anal fin of 7 rays: tail forked, of 18 rays, besides 4 short rays outside the longest rays:

scales large, hexagonal, and of a silvery bluish-green colour: mouth furnished with 4 short feelers: anal, ventral and pectoral fins tipped with blood-colour. Lateral line concave, below the centre, and corresponding to the arch of the belly: the scales along the lateral line emarginate. Length, 10 inches; height, $2\frac{3}{4}$ inches; greatest length, a foot and a half; weight, from half to three-quarters of a seer. This fish has a considerable resemblance in form, size and habits, to the *Cyprinus Mrigala* of Dr. Hamilton; but its blood-stained fins, 4 feelers, and the discrepancies in the number of its fin-rays, sufficiently distinguish it. It is sweet and agreeable food. The same fish, under varied circumstances of age, has the fins tipped with bluish instead of red.'

'Found in the Mota Mola river, 8 miles east of Poona.'

Bleeker[1] included *B. khudree* in his list of the fishes of India without any comments, but Jerdon[2], who also had no specimen of the species for examination, remarked that 'If Colonel Sykes had not given 14 rays to the dorsal fin I might have considered it the same as *B. Hamiltonii.*' Günther[3] definitely assigned it to the synonymy of *Barbus mosal* (Hamilton). Among the specimens of *B. mosal* in the collection of the British Museum, Günther mentions a 'Young: in bad state. Dekkan. From Col. Sykes' collection'. Day[4] doubtfully referred Sykes' species to his *B. neilli*, but his conclusion is not justified, for in the latter species the last undivided ray of the dorsal fin, though osseous and entire, is very weak.

In 1936, Hora and Mukerji[5] discussed the precise specific limits of Hamilton's[6] large-scaled Barbels—*Barbus tor, B. mosal* and *B. putitora*, and showed that the last two species are synonymous. In the same year, Hora[7] discussed the relationships of the large-scaled Barbels of Assam and recognised among them two species described by McClelland[8]—*B. progeneius* and *B. hexagonolepis*—besides Hamilton's two species referred to above. An examination of a large series of specimens of the large-scaled Barbel collected by Mr. Fraser has convinced us that the South Indian form is distinct from the North Indian species and, so far as it is possible to judge, seems to represent Sykes' *B. khudree*. For convenience of reference in future, we give below a detailed description of the species from fresh specimens.

D. 4/9; A. 2/7; P. 15; V. 9; C. 19; L.l. 25-27.

Like the typical *Mahseer* of Northern India—*Barbus putitora* (Hamilton)—*B. khudree* possesses a graceful, trout-like form in

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[1] Bleeker, P.—Nalezingen op de ichthyologische fauna van Bengalen en Hindostan. *Verh. Bat. Gen.*, xxv, p. 60 (1853).

[2] Jerdon, T. C.—On the Fresh Water Fishes of Southern India. *Madras Journ. Lit. Sci.*, xv, p. 313 (1848).

[3] Günther, A.—*Catalogue of the Fishes in the British Museum*, vii, p. 130 (London: 1868).

[4] Day, F.—*Fishes of India*, p. 569 (London: 1878).

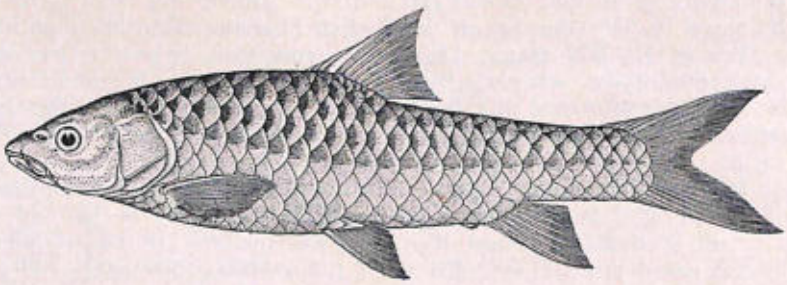
[5] Hora, S. L. and Mukerji, D. D.—Fish of the Eastern Doons, United Provinces. *Rec. Ind. Mus.*, xxxviii, pp. 139-142 (1936).

[6] Hamilton, F.—*Fish Ganges*, pp. 303-307 (Edinburgh: 1822).

[7] Hora, S. L.—On a further collection of Fish from the Naga Hills. *Rec. Ind. Mus.*, xxxviii, pp. 324-331 (1936).

[8] McClelland, J.—Indian Cyprinidae. *As. Res.*, xix, pp. 332-340 (1839).

which the dorsal and the ventral profiles are only slightly arched and the body tapers towards both ends, but more so anteriorly. The length of the caudal fin is almost equal to the length of the head which is contained from 4.1 to 4.8 times in total length and from 3.1 to 3.8 times in the length without the caudal. Both these structures are proportionately longer in the young individuals. The depth of the body is also more or less equal to the length of the head, being contained from 3.4 to 3.9 times in the length without the caudal. The width of the head is contained from 1.5 to 1.8 times and its height from 1.3 to 1.5 times in its length. In young specimens the eye is proportionately very large and is situated almost in the middle of the length of the head. During growth, however, it becomes confined more and more to the anterior half



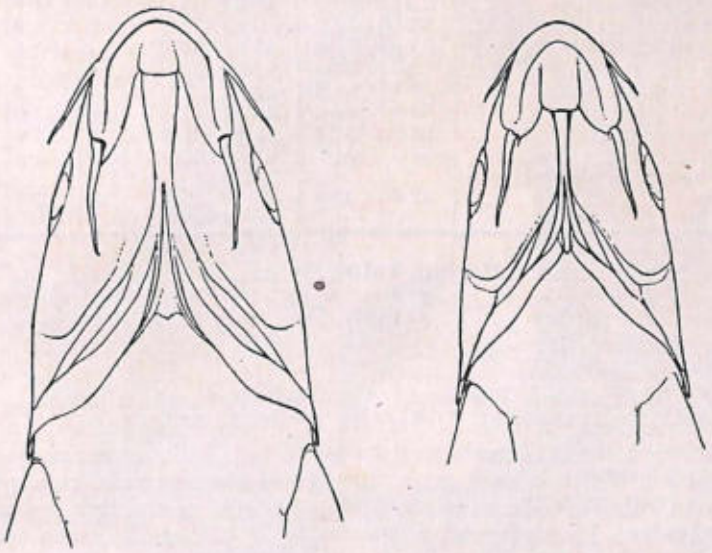
Text-fig. 1.—Lateral view of *Barbus khudree* Sykes. $\times\frac{2}{3}$.

of the head. The diameter of the eye is contained from 2.7 (in the young) to 4.7 (in the adult) times in the length of the head, from 1.0 to 1.4 times in the length of the snout and from 1.0 to 1.7 times in the interorbital distance. The eyes are not visible from below and the interorbital space is almost flat. The lips are fleshy; the lower lip is produced into a median lobe of varying extent. The barbels are, as a rule, shorter than the diameter of the eye, but in half-grown and adult specimens the maxillary barbels may sometimes be as long as the diameter of the eye.

The dorsal fin commences in advance of the ventrals and somewhat nearer to the tip of the snout than to the base of the caudal fin; its last spine is very strong and bony. The length of the dorsal spine is proportionately greater in smaller individuals; it is contained from 1.3 to 1.8 times in the length of the head. The dorsal fin is considerably shorter than the depth of the body below it. The pectoral fin is shorter than the head and is separated from the ventral by a considerable distance. The ventral fin is similar to the pectoral and is provided with a scaly appendage at its base. The anal opening is situated just in front of the anal fin. The caudal peduncle is about one and a half times as long as broad. The caudal fin is deeply forked with both the lobes pointed.

Usually there are 25 scales along the lateral line, but in some young specimens there are 26 or even 27. The number of predorsal scales is 10 and there are $2\frac{1}{2}$ series of large scales between the lateral line and the base of the ventral fin.

The general colour of the spirit specimens is grayish above and silvery below. The scales along the dorsal half of the body are provided with diffuse black markings in their basal portions. In young specimens, up to 45 mm. in total length, there is usually a black spot at the base of the caudal fin.

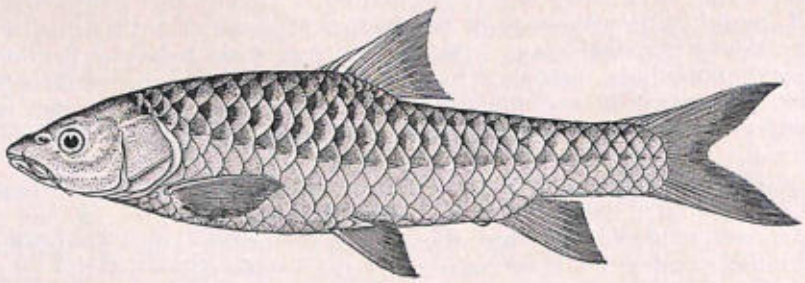


Text-fig. 2.—Ventral surface of head in two specimens of *Barbus khudree* Sykes, showing variation in the extent of the median lobe of the lower lip. $\times 1\frac{1}{2}$.

Remarks:—In general facies, in the form of the head and lips, and in the nature of the dorsal spine, *Barbus khudree* is similar to *B. putitora*; its body is, however, almost as deep as the length of the head whereas in *B. putitora* the head is considerably longer than the depth of the body. *B. khudree* also resembles *B. progeneius*, but the dorsal spine of the former is very strong and the median lobe of the lower lip is fairly distinct, even in young specimens. It may be noted that so far only a few specimens of *B. progeneius* have been collected and it seems probable that when more material becomes available Sykes' species may prove to be a mere local race of the Assamese *progeneius*.

B. khudree favours strong currents in rivers and in such situations it is fairly common in the headwaters of the Godavari River.

which the dorsal and the ventral profiles are only slightly arched and the body tapers towards both ends, but more so anteriorly. The length of the caudal fin is almost equal to the length of the head which is contained from 4.1 to 4.8 times in total length and from 3.1 to 3.8 times in the length without the caudal. Both these structures are proportionately longer in the young individuals. The depth of the body is also more or less equal to the length of the head, being contained from 3.4 to 3.9 times in the length without the caudal. The width of the head is contained from 1.5 to 1.8 times and its height from 1.3 to 1.5 times in its length. In young specimens the eye is proportionately very large and is situated almost in the middle of the length of the head. During growth, however, it becomes confined more and more to the anterior half



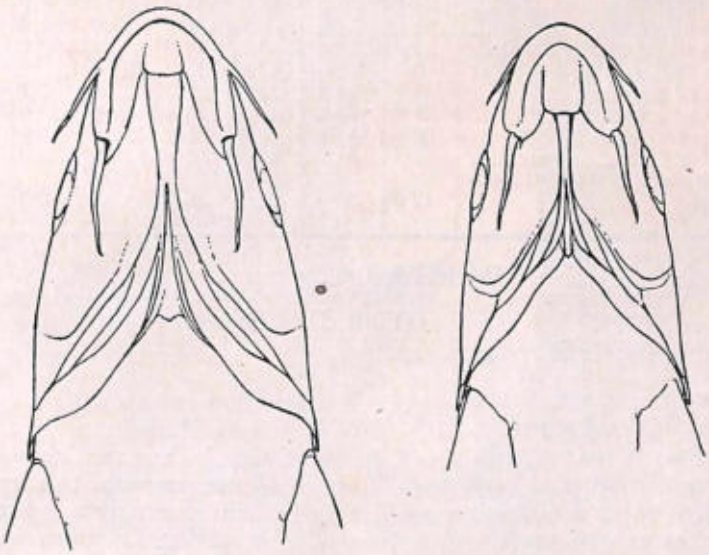
Text-fig. 1.—Lateral view of *Barbus khudree* Sykes. $\times\frac{2}{3}$.

of the head. The diameter of the eye is contained from 2.7 (in the young) to 4.7 (in the adult) times in the length of the head, from 1.0 to 1.4 times in the length of the snout and from 1.0 to 1.7 times in the interorbital distance. The eyes are not visible from below and the interorbital space is almost flat. The lips are fleshy; the lower lip is produced into a median lobe of varying extent. The barbels are, as a rule, shorter than the diameter of the eye, but in half-grown and adult specimens the maxillary barbels may sometimes be as long as the diameter of the eye.

The dorsal fin commences in advance of the ventrals and somewhat nearer to the tip of the snout than to the base of the caudal fin; its last spine is very strong and bony. The length of the dorsal spine is proportionately greater in smaller individuals; it is contained from 1.3 to 1.8 times in the length of the head. The dorsal fin is considerably shorter than the depth of the body below it. The pectoral fin is shorter than the head and is separated from the ventral by a considerable distance. The ventral fin is similar to the pectoral and is provided with a scaly appendage at its base. The anal opening is situated just in front of the anal fin. The caudal peduncle is about one and a half times as long as broad. The caudal fin is deeply forked with both the lobes pointed.

Usually there are 25 scales along the lateral line, but in some young specimens there are 26 or even 27. The number of predorsal scales is 10 and there are $2\frac{1}{2}$ series of large scales between the lateral line and the base of the ventral fin.

The general colour of the spirit specimens is grayish above and silvery below. The scales along the dorsal half of the body are provided with diffuse black markings in their basal portions. In young specimens, up to 45 mm. in total length, there is usually a black spot at the base of the caudal fin.



Text-fig. 2.—Ventral surface of head in two specimens of *Barbus khudree* Sykes, showing variation in the extent of the median lobe of the lower lip. ×1 ½.

Remarks:—In general facies, in the form of the head and lips, and in the nature of the dorsal spine, *Barbus khudree* is similar to *B. putitora*; its body is, however, almost as deep as the length of the head whereas in *B. putitora* the head is considerably longer than the depth of the body. *B. khudree* also resembles *B. progeneius*, but the dorsal spine of the former is very strong and the median lobe of the lower lip is fairly distinct, even in young specimens. It may be noted that so far only a few specimens of *B. progeneius* have been collected and it seems probable that when more material becomes available Sykes' species may prove to be a mere local race of the Assamese *progeneius*.

B. khudree favours strong currents in rivers and in such situations it is fairly common in the headwaters of the Godavari River.

Measurements in millimetres

Total length excluding caudal	362·0	300·0 Damaged	194·0	129·0	85·0	74·0	34·0
Length of caudal ...	93·0		56·0	34·0	23·0	21·0	11·0
Length of head	94·0	81·0	53·0	34·0	23·0	21·0	11·0
Width of head	57·0	46·5	31·0	21·0	13·5	13·0	6·0
Height of head at occiput ...	64·0	52·5	37·0	23·0	16·0	16·0	8·0
Depth of body	97·0	76·5	51·0	36·0	24·0	21·0	10·0
Width of body	60·0	53·0	30 0	20 0	13·5	12·5	5·0
Diameter of eye	20·0	19·0	14·0	9·0	7·0	7·0	4·0
Length of snout	29·0	26·0	18·0	11·0	8·0	7·0	4·0
Interorbital distance ...	34·0	29·0	18·0	11·0	8·0	7·0	4·0
Length of rostral barbel ...	15·0	12·0	9·0	7·0	4·0	4·0	2·0
Length of maxillary barbel.	20·0	17·0	15·0	10 0	5·0	5·0	2·1
Length of dorsal fin ...	73·0	69·0	43·0	31·0	23·0	19·0	9·0
Length of dorsal spine ...	50·0	45·0	37·0	25·0	17·0	15·0	6·0
Length of pectoral ...	71·0	61·0	40·0	25·0	17·0	15·0	6·4
Length of ventral ...	63·0	50·0	34·0	22·0	15·0	13·0	6·0
Length of caudal peduncle ...	61·5	51·0	40·0	25·0	16·0	14·0	6·0
Least height of caudal peduncle	42·0	36·0	23·0	16·0	11·0	9·0	4·0

Barbus kolus Sykes.

(Plate I)

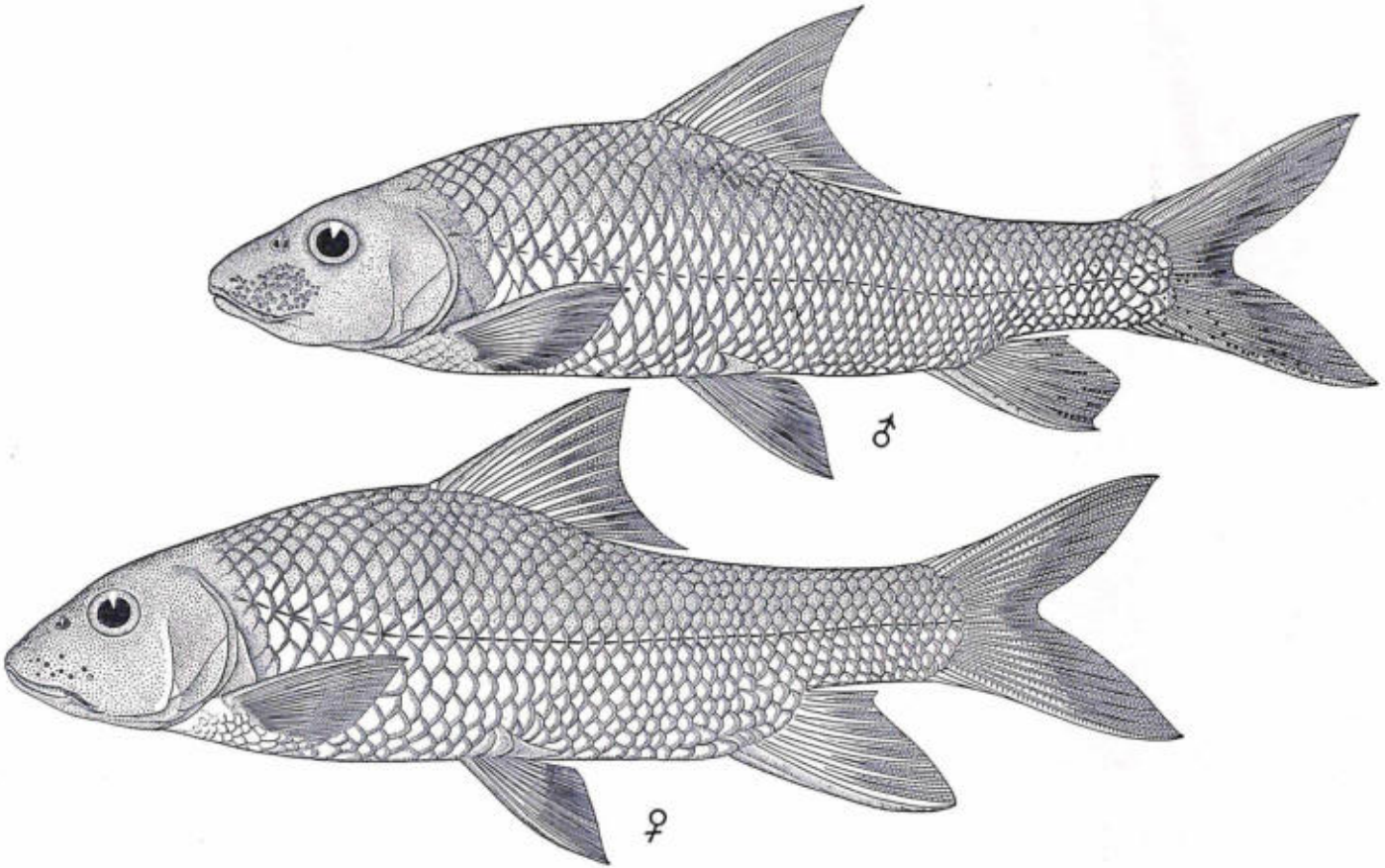
1841. *Barbus kolus*, Sykes, *Trans. Zool. Soc. London*, II, p. 357, pl. lxii, fig. 1.
1868. *Barbus kolus*, Günther, *Cat. Fish Brit. Mus.*, vii, p. 136.
1878. *Barbus kolus*, Day, *Fish. India*, p. 573, pl. cxli, fig. 2.

Barbus kolus is a fairly well known South Indian species. From an examination of a very large number of specimens of this species in Mr. Fraser's collection we found certain characters by which the sexes can be readily distinguished. In the adult males patches of well-developed horny tubercles ('pearl organs') are present on the sides of the snout, on certain rays of the anal fin and in the lower half of the caudal fin. In the case of females only a few small tubercles are sometimes present on the sides of the snout. In the males the body is proportionately less deep and the head longer and more pointed; the dorsal fin is more concave and the outer rays of the anal fin are short so that the median rays form a lobe in the middle of the fin. The secondary sexual differences noted above can be made out clearly from a comparison of the drawings of a male and a female specimens reproduced on plate I.

It may be noted that both Sykes and Günther made a reference to the tubercles on the head, but they were probably absent in Day's specimens, as he makes no mention of them in his descriptions.

Barbus ticto (Hamilton).

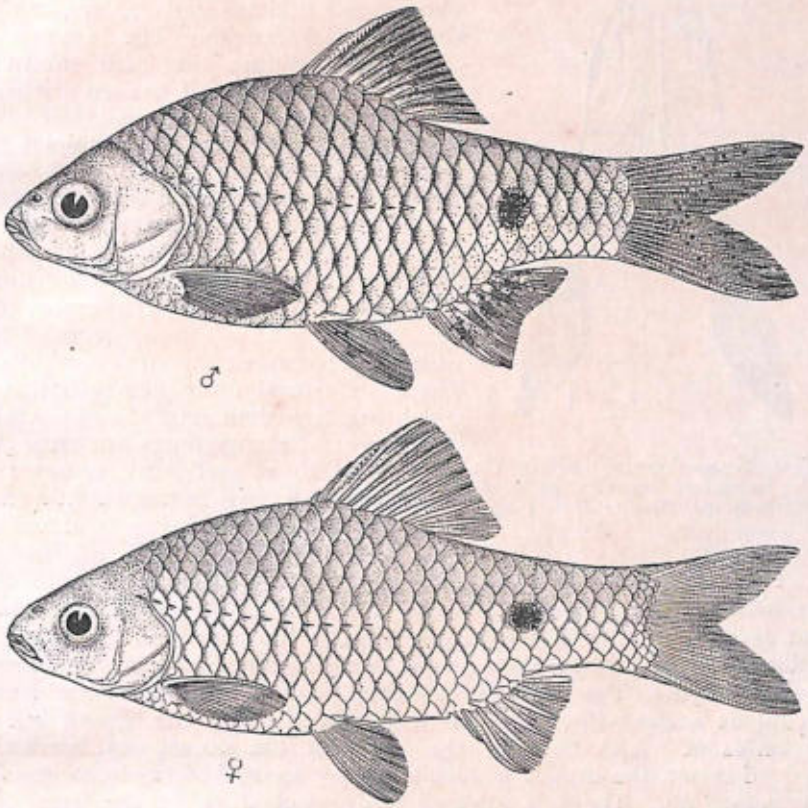
Among the large number of specimens of *Barbus ticto* collected by Mr. Fraser two colour forms could be readily distinguished. In one form the membranes between the rays of the dorsal and the anal fins were intensely black, while in the other these membranes totally lacked this colour. On opening a number of specimens of each



B. Bagchi, *del.*

Barbus holus Sykes.

kind it was observed that the coloured specimens were males and the plain specimens were females. In the males a number of



Text-fig. 3.—Lateral view of a male and a female specimen of *Barbus ticto* (Ham.), showing the nature of the secondary sexual characters. $\times 1\frac{3}{8}$

horny tubercles were present on the caudal fin, while a few of these 'pearl organs' were also present on other fins. Both the colouration and the horny tubercles thus seem to be the secondary sexual characters of the male.

In the Deolali examples the lateral line extends over 10 to 12 scales.

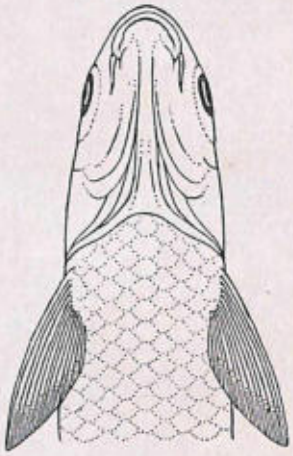
Barbus fraseri sp. nov.

(Plate III, fig. 2).

D. 2/8; A. 3/5; P. 12; V. 8; C. 19; L.l. 42-45.

The new Carp-minnow, which we have great pleasure in associating with the name of Mr. A. G. L. Fraser, is of the *Puntius* type. Its dorsal and ventral profiles are slightly arched and the body is gracefully stream-lined. The head is small and broadly

pointed; its length is contained about 5.4 times in the total length and 4 times in the length without the caudal. The width of the head is contained 1.7 times and its height 1.5 times in its length. The eyes are large and lateral; they are situated much nearer the tip of the snout than the posterior margin of the head; the diameter of the eye is contained 3 times in the length of the head, 0.8 times in the length of the snout and 1.2 times in the interorbital distance. The mouth is small, lunate and subanterior; it is bordered by fleshy lips which are continuous at the angles of the mouth. The labial groove is widely interrupted in the middle. There are two short maxillary barbels which are less than half the diameter of the eye. Sensory pores are arranged in loops above and below the eyes; they meet posteriorly and are continued into the lateral line which extends over 8 to 10 scales.

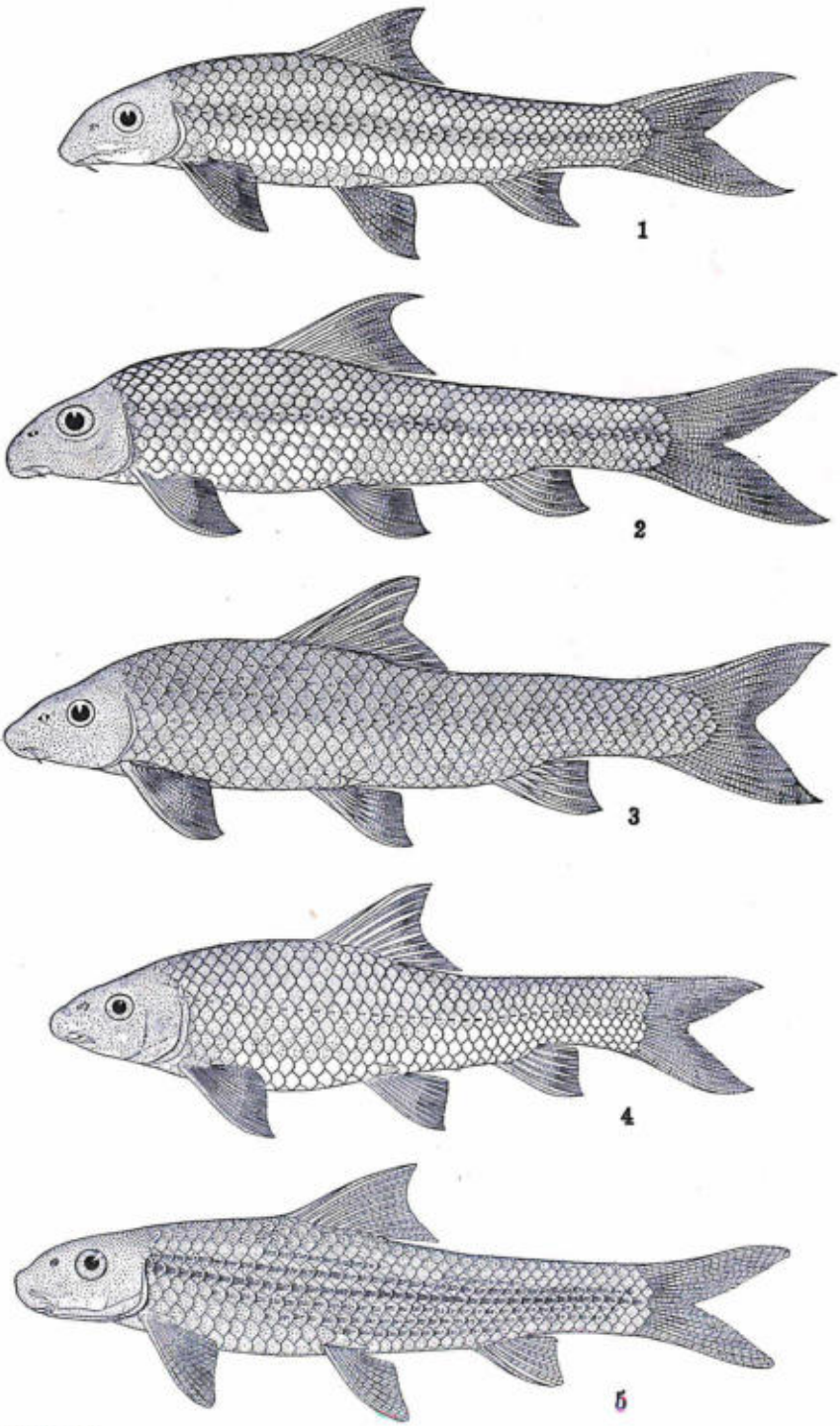


Text-fig. 4.—Ventral surface of head and anterior part of body of *Barbus fraseri* sp. nov. ×4.

The depth of the body is considerably greater than the length of the head; it is contained from 4.3 to 4.4 times in the total length and about 3.2 times in the length without the caudal. The caudal peduncle is narrow; its least height being contained about 1.7 times in its length. The body is covered with small, more or less deciduous scales; there are 42 to 45 scales along the lateral line, 17 series of scales between the bases of the dorsal and ventral fins, 16 round the caudal peduncle and 15 to 16 before the base of the dorsal fin. There is a small scaly appendage at the base of the ventral fin. The anal opening is situated on a prominence close to the commencement of the anal fin.

The dorsal fin commences midway between the tip of the snout and the base of the caudal fin, and almost opposite the commencement of the ventrals; it is almost as long as the head and considerably shorter than the depth of the body below it. The posterior free border of the fin is slightly concave and its last undivided ray is osseous and serrated. The pectoral fin is shorter than the head and is separated from the ventral by a considerable distance; it is about four-fifths of the length of the head. The ventral fin is similar to the pectoral and extends to the commencement of the anal fin. The caudal fin is considerably longer than the head and is deeply forked; both the lobes are sharply pointed.

The colour of the spirit specimens is pale-olivaceous; it is somewhat darker along the dorsal surface. Along the middle of the body there is a silvery streak which becomes wider posteriorly. There is a rounded black spot at the sides of the tail slightly in front of the base of the caudal fin. A somewhat smaller black spot is also present at the base of the anterior rays of the dorsal fin.



B. Bagchi, del.

Crossochilus latius (Hamilton) and the allied forms.

Locality :—Darna river, Deolali. Only seven specimens of *Barbus fraseri* were collected at three different points on the river.

Type-specimen :—F 12497/1, *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks:—*Barbus fraseri* can be distinguished readily by the following combination of characters:—

(i) Presence of only two barbels.
(ii) Presence of an osseous, serrated spine.
(iii) Incomplete lateral line.
(iv) Small scales, about 42-45 along the lateral line.
(v) Colouration.

Judged by the above noted characters, our new species seems closely allied to the members of the Malayan genus *Hampala* Bleeker, but differs from it in the extent of the mouth opening, small scales and incomplete lateral line. We are not aware of any other species of the *Puntius*-type which bears any resemblance to the form described above.

Measurements in millimetres.

Total length excluding caudal	34·0	34·0	33·0
Length of caudal	Damaged	12·0	12·0
Length of head	8·5	8·5	8·4
Width of head	5·0	5·0	5·0
Height of head at occiput	7·0	7·0	7·0
Length of snout	2·2	2·5	2·2
Diameter of eye	2·7	2·8	2·7
Interorbital width	3·3	3·4	3·3
Depth of body	10·5	10·4	10·5
Width of body	5·2	5·1	5·1
Length of caudal peduncle	7·5	7·5	7·6
Least height of caudal peduncle	4·5	4·5	4·5
Longest ray of dorsal	8·5	8·5	8·5
Longest ray of anal	4·5	5·0	5·0
Length of pectoral	6·0	6·1	6·1
Length of ventral	7·5	7·6	7·5

Crossochilus latius (Hamilton).

(Plate III)

1934. *Crossochilus latius* (*forma typica*), Mukerji, *Journ. Bom. Nat. Hist. Soc.*, xxxvii, p. 50.

In his detailed work on *Crossochilus latius*, Mukerji observed three distinct types—the typical form from the Brahmaputra river system, the Assamese and Burmese form and the Punjab form. Later work on these fishes from the Eastern Doons, Naga Hills and Kashmir has fully confirmed Mukerji's conclusions. The Punjab and the Burmese forms are now regarded as distinct species—*C. punjabensis* Mukerji and *C. burmanicus* Hora respectively; while the typical form was observed to be limited to the Ganges and the Brahmaputra systems in Northern India. The specimens collected by Mr. Fraser in the Deolali waters are of a considerably smaller

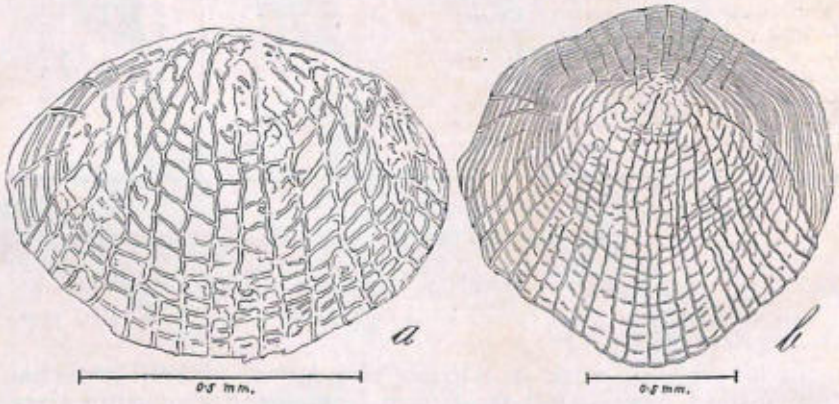
size than those found in North India, but morphologically they seem to represent the typical *C. latius*. In the Deccan specimens, however, the eyes are relatively smaller, and in this respect they agree with the Burmese examples. The different species into which *Crossochilus latius* is now divided are figured on plate III.

Parapsilorhynchus prateri sp. nov.

(Plate II, figs. 1, 1*a*, 1*b*).

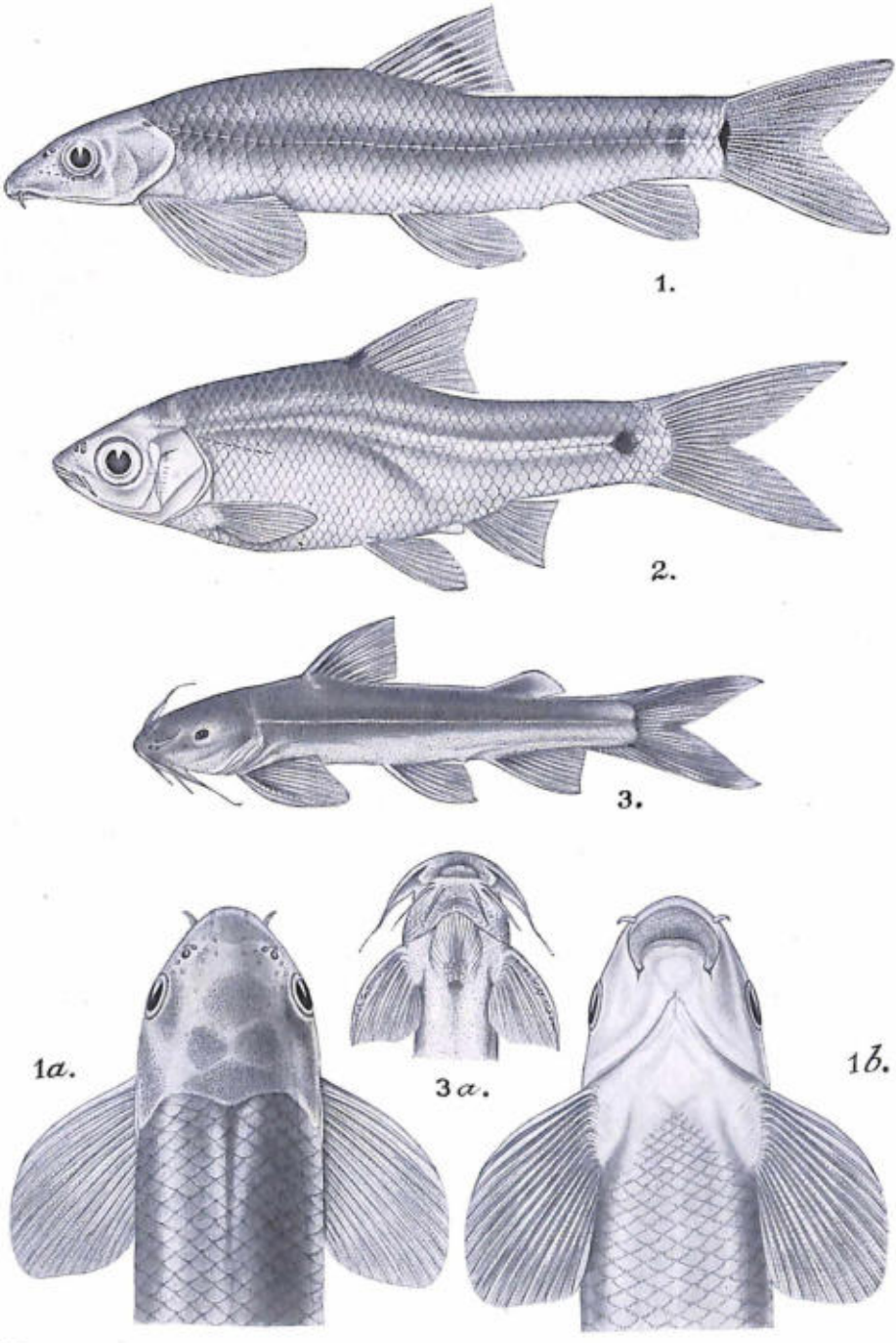
D. 2/8; A. 2/5; P. 15; V. 9; C. 19; L.l. 43-47.

In *Parapsilorhynchus prateri*, a small *Garra*-like fish which we have great pleasure in associating with the name of Mr. S. H. Prater, the head and body are considerably depressed and the ventral surface flattened; the dorsal surface is gently arched while the ventral surface is horizontal. The head is broadly pointed anteriorly; it is proportionately longer in young individuals, its length being contained from 4.4 to 5.3 times in the total length and from 3.5 to 4.2 times in the length without the caudal. The width of the head is contained about 1.3 times and its height at occiput 1.6 times in its length. The eyes are fairly prominent and lateral in position; they are visible both from above and below, and are situated almost in the middle of the length of the head. The diameter of the eye is contained from 3.5 to 5 times in the length of the head, from 1.3 to 1.9 times in the length of the snout and from 1.6 to 2.5 times in the interorbital width; the eye is propor-



Text-fig. 5.—Scales from below base of dorsal fin of *Parapsilorhynchus* Hora.
a. *Parapsilorhynchus prateri* sp. nov.;
b. *Parapsilorhynchus tentaculatus* (Annandale).

tionately larger in young individuals. The mouth is small, inferior and horizontal. The upper lip is covered by a prominent rostral fold which is fringed and covered with minute tubercles. The lower



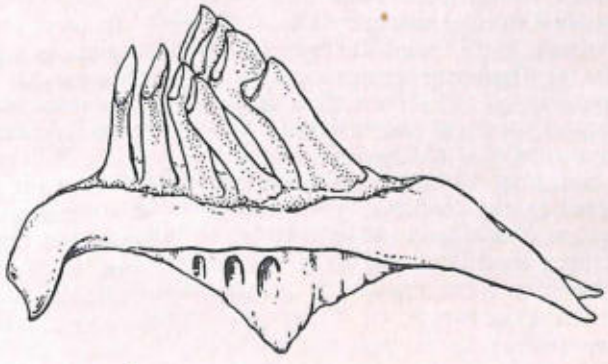
B, Bagchi, *del.*

Fish of Deolali.

lip is also finely papillated. There is a groove round the corners of the mouth which is continued anteriorly round the outer margin of the rostral fold. There are two short and stumpy rostral barbels. The head is provided with a series of sensory pores. Behind the lower lip, which is slightly emarginate, there is a callous area of the skin which presumably helps the fish in adhering to rocks and stones in fast currents and is thus homologous with the post labial disc of *Garra*.

The body is almost as broad as deep; its height is contained from 6.9 to 7.6 times in the total length and from 5.3 to 6.0 times in the length without the caudal. The caudal peduncle is almost as long as or slightly longer than its least height. The scales are small and firmly adherent; there are from 43 to 47 scales along the lateral line, $4\frac{1}{2}$ between the lateral line and the base of the ventral fin, 16 round the caudal peduncle and 21-22 in front of the dorsal fin. The scales are totally absent on the ventral surface between the bases of the pectoral fins and only faintly marked in the area up to the ventral fins.

The scales of *P. prateri* are of a remarkable type; their sculpture consists of a network of radii, all originating from the base and directed distally, and circuli, which enclose small rhomboidal areas. In the allied species *P. tentaculatus* (Annandale) there is a well-defined nucleus from which radii are given both towards the base and to the outer margin. The circuli are not so well developed.



Text-fig. 6.—Pharyngeal bone and teeth of *Parapsilorhynchus prateri*, sp. nov. ×30.

The alimentary canal is greatly convoluted showing that the fish feeds mainly on algal matter which it scrapes off the rocks with the help of its sharp-edged lower jaw. The pharyngeal teeth are sickle-shaped and are distributed in two rows (4.4/4.4). The air-bladder is of the normal Cyprinoid type, but is small and cylindrical. The eggs are of a large size, about 2 mm. in diameter in a fish about 50 mm. in total length.

The dorsal fin commences in advance of the ventrals and is almost midway between the tip of the snout and the base of the

caudal fin; sometimes it is slightly nearer to the latter than to the former; its longest ray is almost equal to the depth of the body below it. The paired fins are horizontally placed and fan-shaped; the pectoral fins are almost as long as the head and are separated from the ventrals by a considerable distance. The outer rays of the pectoral fins are provided with adhesive pads on their ventral surface. The ventrals are similar to the pectorals and just extend to the anal opening, which is situated at a distance of one diameter of the eye from the commencement of the anal fin. The anal fin is similar to the dorsal. The caudal fin is deeply forked.

In spirit specimens the colouration is grayish above and pale-olivaceous on the lower half. Along the lateral line there is a broad longitudinal band of a somewhat deeper colour with a lighter band above it. There is a black mark near the upper angle of the gill opening which is partly covered by the gill membrane. A short, narrow, vertical bar is present at base of the caudal fin and another, somewhat broader and more diffuse, in front of it. There is a series of black markings about the middle of the dorsal fin. In some specimens the body is covered with small black spots.

Locality:—Several specimens of *P. prateri* were collected by Mr. Fraser in the North Nallah and Narsullah Wadi.

Type-specimen:—F 12498/1, *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks:—The genus *Parapsilorhynchus* was proposed[1] to accommodate a species discovered by Annandale[2] from small streams in the Poona District and though I described another species in this genus at the same time, the two were afterwards[3] found to be synonymous. *P. prateri* differs from *P. tentaculatus* in having smaller scales and in proportions. There are differences in the scale-sculpture also (text-fig. 5).

In establishing *Parapsilorhynchus* as a distinct genus attention was directed to the features by which it can be distinguished from *Psilorhynchus* McClelland. The features common to both genera are the structures associated with the mouth, such as the rostral fold, grooves round the corners of the mouth, small mouth, sharp lower jaw, etc. A close study of these genera indicates that *Parapsilorhynchus* is less specialised and perhaps an ancestral form. To these two genera must also be added *Gyrinocheilus* Vaillant of Indo-China, Siam and the Malay Archipelago, in which the mouth structures are of the same type.

The occurrence of *Parapsilorhynchus* at Pachmarhi in the Satpura Hills (Hora, *op. cit.*, 1925) shows that the Satpura Mountains may have served at one time as a highway for the migration of the East

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[1] Hora, S. L.—On a New Genus of Fish closely resembling *Psilorhynchus*, McClelland. *Rec. Ind. Mus.*, xxii, pp. 13-17 (1921).

[2] Annandale, N.—The Fauna of certain small streams in the Bombay Presidency. *Rec. Ind. Mus.*, xvi, p. 128 (1919).

[3] Hora, S. L.—On the Fishes of the genus *Parapsilorhynchus* Hora. *Rec. Ind. Mus.* xxvii, p. 457 (1925).

Himalayan forms to the Western Ghats and thence to the hills of the Peninsula.[1]

Measurements in millimetres.

Total length including caudal ...	59·0	50·0	49·0	49·0
Length of caudal	12·0	11·0	11·0	11·0
Length of head	11·0	10·0	10·0	10·0
Width of head	8·0	7·3	7·2	7·2
Height of head at occiput	6·3	6·0	6·0	6·0
Length of snout	4·0	3·8	3·8	3·8
Diameter of eye	2·5	2·0	2·0	2·0
Interorbital width	5·2	5.0	5·0	5·0
Height of body	8·0	7·0	7·1	7·1
Width of body	7·9	6·9	6·9	6·9
Length of caudal peduncle	6·1	5·0	5·0	5·0
Least height of caudal peduncle ...	5·3	4·8	4·5	5·0
Longest ray of dorsal	9·0	7·5	7·3	7·3
Longest ray of anal	8·5	5·9	6·0	5·9
Length of pectoral	11·0	9·8	9·6	9·9
Length of ventral	9·2	7·5	7·5	7·5

Lepidocephalichthys guntea (Ham.).

1878. *Lepidocephalichthys guntea*, Day, *Fish. India*, p. 609, pl. clv, fig. 4.

In the case of the Deccan specimens of *Lepidocephalichthys guntea*, Day noted that they possessed only about four rows of spots on the caudal fin and often two rows on the anal fin. In the specimens from the Deolali waters the colour is very variable and there are usually several rows of spots on the caudal fin.

Some of the specimens were greatly compressed and attenuated, and superficially seemed to represent a different species. A careful examination of the material showed that with the exception of better marked scales in the thin individual no other differences could be made out. From Mr. Fraser's labels we found that the thin specimens were those that had lived in an aquarium for a long time. Presumably for want of sufficient food under unnatural conditions they had become attenuated. The scales on the body had become prominent owing to the reduction in the surface area of the body.

Nemachilus botius (Ham.).

1878. *Nemachilus botia*, Day, *Fish. India*, p. 614, pl. clvi, fig. 5.

Day's accounts and figures of *Nemachilus botius*, *N. aureus*, and *N. sinuatus* show a very close relationship between these species; they are alike in their general facies but differ in the number of rays in the dorsal fin and the relative extent of the lateral line.

[1] Hora, S. L.—Distribution of Himalayan Fishes and its bearing on certain Palæogeographical problems. *Rec. Ind. Mus.*, xxxix, pp. 255-256 (1937).

Mukerji[1] gave a review of *N. botius* and directed attention to its great variability. We have also noted considerable variation in the number of rays in the dorsal fin and in the extent of the lateral line in the specimens from Deolali, but till good series of specimens become available from different parts of India, Burma and Ceylon it is difficult to discuss its races and varieties.

Nemachilus denisonii Day.

1878. *Nemachilus Denisonii*, Day, *Fish. India*, p. 617, pl. cliii, fig. 5.

The specimens of *Nemachilus denisonii* collected by Mr. Fraser from the Deolali waters are more slender than the examples from the Nilgiris. The colouration of this species is very variable and in the Deolali specimens the caudal fin, instead of being bilobate, is distinctly and deeply forked.

As already noted by Day, we are also of the opinion that *N. notostigma* Bleeker of Ceylon is probably a synonym of *N. denisonii*.

Glyptothorax annandalei Hora.

(Plate III, figs. 3, 3*a*).

1923. *Glyptothorax annandalei*, Hora, *Rec. Ind. Mus.*, xxv, p. 14, pl. i, fig. 3.

In Mr. Fraser's collection there is a single specimen about 65 mm. in total length which we refer to *Glyptothorax annandalei*. It was obtained from the Godavari river and was listed as *G. lonah* in parts I and II of the present series of articles. Recently we obtained some material from the Moola Mutha river near Poona, the type-locality of most of Sykes' species, and doubts arose as to the precise specific limits of *G. lonah*. A more careful examination of the Godavari example and its comparison with the type-series of *G. annandalei* showed that it is presumably a juvenile form of the latter. It possesses an adhesive apparatus on the ventral surface of the pectoral spines, tuberculated body and a series of larger tubercles along the lateral line. The illustrations of the specimen on plate II show some of its salient features.

Glyptothorax annandalei was described from the Bhavani river at the base of the Nilgiris. If our identification of the Godavari example proves to be correct, the species will probably be found to occur all along the Western Ghats.

Ambassis baculis (Hamilton).

1876. *Ambassis baculis*, Day, *Fish. India*, p. 51, pl. xv, fig. 1.

Day gave the distribution of *Ambassis baculis* as: 'Fresh waters of Orissa, Bengal, and as far north as the Punjab: also in Burma.'

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[1] Mukerji, D. D.—Fishes of the Mali Hka River. *Journ. Bom. Nat. Hist. Soc.*, xxxvii, pp. 39-43 (1934).

The record of the species from Deolali is, therefore, of some interest. Though in its deeper body *A. baculis* agrees with *A. nama,* in a great many morphological features it is more closely allied to *A. ranga*. *A. baculis* can be readily distinguished by its smaller scales (about 80 along the lateral line), smaller eyes and the presence of a shoulder spot.

Concluding Remarks.

In the introduction to the first part of this series one of us undertook to discuss the geographical relationships of the fish fauna of Deolali, with special reference to its affinities with that of the Deccan, but such a course will not be possible now as large collections of freshwater fish have since been received from several localities in the Deccan, and until these are worked out it will not be possible to assess fully the geographical distribution of various species. Particular mention may be made of another collection made by Mr. A. G. L. Fraser at Poona which should enable us to clear the taxonomy of some of the little-known species of Sykes, who in 1841 described a large variety of fishes from Poona and the adjoining areas.

Explanation of Plates.

Plate I.

Barbus kolus Sykes.

A mature male and a female specimen of *Barbus kolus* Sykes, showing secondary sexual differences.

Male. × 5/12; Female. × $\frac{1}{2}$

Plate II.

Crossochilus latius (Hamilton) and the allied forms.

Fig. 1.—*Crossochilus burmanicus* Hora from Lower Burma. × $\frac{1}{2}$.
Fig. 2.—*Crossochilus latius* (Ham.) from Manipur, Assam. × $\frac{3}{4}$.
Fig. 3.—*Crossochilus latius* (Ham.) from Dehra Dun, U.P. × $\frac{1}{2}$.
Fig. 4.—*Crossochilus punjabensis* Mukerji from Srinagar, Kashmir. × $\frac{3}{4}$.
Fig. 5.—*Crossochilus latius* (Ham.) from Deolali. × $\frac{3}{4}$.

Plate III.

Fish of Deolali.

Fig. 1.—Lateral view of the type-specimen of *Parapsilorhynchus prateri*, sp. nov. × 2 $\frac{2}{5}$.
Fig. 1*a*.—Dorsal surface of head and anterior part of body of same. × 3 $\frac{1}{5}$.
Fig. 1*b*.—Ventral surface of head and anterior part of body of same. × 3 $\frac{1}{5}$.

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Fig. 1*a*.—Dorsal surface of head and anterior part of body of same. × 3 ⅓.
Fig. 1*b*.—Ventral surface of head and anterior part of body of same. × 3 ⅓.

Fig. 2.—Lateral view of the type-specimen of *Barbus fraseri*, sp. nov. × 2 $\frac{2}{3}$.

Fig. 3.—Lateral view of a young specimens of *Glyptothorax annandalei* Hora. × 1 $\frac{1}{3}$.

Fig. 3*a*.—Ventral surface of head and anterial part of body of same. × 1 $\frac{1}{3}$.

SOME BIRDS OF A COORG DOWN

BY

F. N. BETTS, M.B.O.U.

(*With 3 plates*).

For ornithological purposes South India may be divided into two definite areas, a Wet and a Dry Zone. The former includes the range of the Western Ghats and a strip of varying width on either side, while the latter comprises all the dry Central plateau, the Eastern plains and part of the Western littoral. Each has its typical avifauna, quite distinct but showing a remarkable parallelism and giving an excellent demonstration of the effect of climate on the differentiation of species.

The boundary line, here at any rate sharply defined, runs right through Coorg, making this little province of peculiar interest to the ornithologist.

The full force of the S.W. Monsoon strikes the Ghats, which rise sheer from the Malabar plain to a height of 5,000-6,000 feet. It sheds much of its moisture on their western slopes but has the strength to carry an ample supply of rain to the rolling plateau which stretches for thirty or forty miles on the other side. It is however finally defeated by the parallel range of low, jungle-clad hills bounding the district on the East. Beyond these the Dry Zone begins.

While on the whole the Dry Zone birds are Low-country and the Wet Zone species Hill forms, rainfall seems to have a much greater effect on distribution than altitude. From the foot of the Ghats almost at sea-level, over the hills, and throughout Coorg proper lying at an average elevation of 3,500 feet, the same species are to be seen, but a mere ten miles through the eastern forest belt and a very slight drop in height brings one into quite a different country.

In the North of the province this strip of jungle is at its narrowest and the chain of hills becomes broken. Here and there patches of country of the Dry Zone type encroach through the barrier and in such spots one finds a very interesting intermingling of the two types of avifauna.

The stretch of downland which forms the subject of this study is one of these. It consists of some three or four hundred acres of grassland and scrub, forming not so much a hilltop as the culmination of a gradual rise of land here reaching 3,750 feet. On the East and South it is bounded by the forest, a growth of mixed deciduous trees and giant bamboo, while on the West and North are paddy fields, village gardens, and coffee plantations under thick evergreen shade. The greater portion is open turf kept short by constant grazing save for frequent tussocks of rushes too tough even for the hungry cattle which roam there. A few solitary wild fig-trees and Indian Laburnums (*Cassia fistula*) grow

scattered here and there. All this part is used as a golf course and the high road runs across it, so that, apart from the herd-boys who are always wandering about, it is much frequented. Round the borders and at one end extending over a considerable area there is more cover, clumps of big trees and brakes of lantana, sandal and other scrub growth.

Leaving out of the reckoning most of the birds of prey, swifts and other species, whose daily range is too great to be restricted to such a small tract, an analysis of the representative bird population gives some eighty-five species which occur or have appeared with fair regularity during the last four years. Of these the majority are typical birds of the Coorg countryside and the Wet Zone in general and I do not propose to deal with them here in detail, but sixteen may be classed as Dry Zone forms, eight of them being regular and numerous visitors to the whole of Coorg during the winter, while the remainder, though common enough further east, are seldom seen over the boundary except in a few places such as this.

A comparison of the two divisions shows that the Dry Zone types are dominant. I have remarked on the constant parallelism that occurs and, in almost every case, it will be found that the Dry Zone species or sub-species is that typical throughout the greater part of India, while its opposite number is restricted to the S.W. of the Peninsula. Again, whereas it is rare to find any purely Wet Zone species outside its ecological bounds, one of the conspicuous features of the bird life of the borderland is the annual Westerly invasion of Dry Zone birds in the cold weather and their retreat before the arrival of the rains.

While the long-distance winter migrants from the North all arrive and depart within a few weeks of each other, there is no such uniformity in this local movement, and it is evident that a number of different factors affect the wanderings of the various species. Some leave early to breed in the Dry Zone, others stay up to breed and depart when the young are fledged, and one or two only come up for the breeding season and are gone again within a couple of months.

Although very attractive to these visitors, the extent of the down is too small and the monsoon conditions too severe to encourage permanent colonisation. So far as I have been able to ascertain there is only one strictly Dry Zone species, the White-browed Bulbul (*Pycnonotus luteolus*), that has established itself as a permanent resident remaining throughout the year. It is a great place for bulbuls, for within a square mile can be found six of the seven species inhabiting Coorg. As usual the Red-whiskered Bulbul (*Otocompsa jocosa fuscicaudata*) is much the commonest and abounds in the scrub jungle and cultivation and penetrates a short distance into the forest. It is followed, in numbers, by the Red-vented Bulbul (*Molpastes cafer cafer*). It is interesting to note that although the former is decidedly the dominant species over much of the moister parts of South India, it has not nearly such a wide range as *M. cafer* and is unaccountably absent from Ceylon, though it has reached the Andamans and Nicobars. In this



Yellow-browed Bulbul [*Iole icterica* (Strickl.)] on nest.



Hoopoe at nest.

district at any rate the two species are found side by side all over the country in more or less constant proportions though *O. jocosa* is perhaps less numerous in the Dry Zone, and further East, in Mysore, leaves *M. cafer* in sole possession of the field. The latter bird however is nowhere to be found in such numbers as the Red-whiskered Bulbul in its favourite haunts.

The Yellow-browed Bulbul (*Iole icterica*) is a forest species but frequently wanders into the clumps of trees growing among the scrub especially where these have an undergrowth of evergreen-shrubs. It is also to be seen in the coffee plantations and a coffee bush is a favourite nesting site.

The remaining three are much more restricted in their habitat. The Grey-headed Bulbul (*Microtarsus poiocephalus*), is a lover of moist, dark forest preferably near water and is only found in this rather dry country in the belts of evergreens growing in the damp ravines of the few permanent brooks. The Ruby-throated Bulbul (*Pycnonotus gularis*) likewise demands forest, but of a rather lighter order and haunts the borders of these belts where they mingle with the prevailing bamboo. The White-browed Bulbul, on the other hand, is entirely confined to the scrubland with its dense lantana brakes where it loves to lurk, for it is a secretive bird and, until one learns to recognise its loud rattling call, one does not realise how common it is. At least twenty pairs must be resident in the neighbourhood and their numbers seem to be increasing but there is no other colony within miles. They are cut off from their natural biotope by the forest and, though the more open cultivation in the other direction seems not unsuited to their requirements, they do not occur there. This may perhaps be explained by the fact that in this part of the world every mile further West means an increase of several inches in the annual rainfall. They do not appear to move about much. Each pair has its own patch of thicket which they seldom leave, facing out the heaviest bursts of the monsoon, though at such times they are depressed and silent. They undoubtedly breed here but I have not so far been able to find a nest, their retiring habits and the impenetrable nature of their haunts making the search a difficult one.

Another resident which, though not so particular as the White-browed Bulbul and which is really a Dry Zone species, is the Southern Grey-backed Shrike (*Lanius schach caniceps*). Three true shrikes are on the list of Coorg birds, but of these the Bay-backed Shrike (*Lanius vittatus*) is definitely a Plains bird and only just crosses the eastern border. The Grey-backed Shrike, while much more numerous in the Dry Zone, is locally distributed in small numbers all over Coorg where suitable country obtains, being particularly fond of the borders of paddy fields. Wherever found they are strictly sedentary. Ever since I have known the down, two pairs have occupied the same range of a few acres each. For a month or two after they are fledged the young birds of the year hang about but they are all driven off before the cold weather. Though they have harsh voices when annoyed, the male sings very sweetly in the breeding season. The song is low and by no means powerful,

uttered in a meditative fashion as if half under the breath and not at all what one would expect from such a bold, aggressive bird. The singer is a remarkable mimic introducing all sorts of other bird and animal noises in a most realistic manner.

By contrast the third species, the Brown Shrike (*Lanius cristatus cristatus*) is a great wanderer breeding in Siberia and visiting us during the cold weather. It is one of the earliest of the long-distance migrants to arrive and quite the last to depart. Most of these visitors are young birds. They are common on the down between October and April and, unlike their resident relatives, are by no means confined to open country but are to be seen just as frequently inside the coffee estates and the edges of the forest. They may sing in their breeding quarters but while with us they chiefly make their presence known by their loud, ill-tempered scoldings.

The allied families of the Wood Shrikes, Cuckoo Shrikes, Minivets and Drongos are all represented among the birds of the down but the residents are Wet Zone types. The Malabar Wood Shrike (*Tephrodornis gularis sylvicola*), is common in the coffee plantations and among the big trees round the borders, whereas the Common Wood Shrike (*T. pondicerianus pondicerianus*) which entirely replaces it in the Dry Zone does not occur. The same applies to the Orange Minivet (*Pericrocotus flammeus*) and the Rosy Minivet (*P. roseus roseus*), while the Little Minivet (*P. peregrinus peregrinus*) is equally at home in either biotope, provided it is fairly well-wooded. The little black and white Pied Shrike (*Hemipus picatus picatus*), more a Minivet than a Shrike in habits, is also not uncommon but does not appear to extend further East.

The Black-headed Cuckoo Shrike (*Lalage sykesii*) is a migrant, arriving in October and departing before the breeding season. They are regular frequenters of the down during the cold weather but I have never seen one there after the middle of April though I have found the nest only ten miles away just beyond the forest belt. The Wet Zone representative of this subfamily, the Large Grey Cuckoo Shrike (*Graucalus javensis macei*) is hardly a resident of the down as it is a great wanderer but it turns up at all times of the year even in the middle of the monsoon. It is perhaps hardly fair to class it as a Wet Zone bird as it occurs in the Dry Zone also. It is really a forest species whose range extends for some way on either side.

The Drongos form a most interesting group. Their characteristic habits make them the most conspicuous of birds and though generally so similar in their ways, the difference in the distribution of the various species is most marked. The two resident forms of the Wet Zone are the Bronzed Drongo (*Chaptia aenea malayensis*), and the magnificent Racket-tailed Drongo (*Dissemurus paradiseus malabaricus*). These are both woodland birds and are common in the coffee bounding the down and frequently wander into the big trees in the scrub. The corresponding resident in the Coorg Dry Zone is the White-bellied Drongo (*Dicrurus coerulescens coerulescens*), which has occurred on the down on one or two occasions

in the hot weather as a straggler. It is definitely a bird of rather dry country and low elevations and it is strange that its Ceylon sub-species (*D. coerulescens leucopygialis*) is resident and numerous in the upcountry tea districts at 5,000-6,000 feet where there is an annual rainfall of anything up to 200 inches. The Black Drongo (*D. macrocercus peninsularis*) and the Grey Drongo (*D. longicaudatus*) are probably, with the exception of the Indian Bee-eater, the commonest of our local winter migrants and from October to March are to be seen everywhere. The down with its open spaces and grazing cattle particularly suits their requirements and the telegraph wires running along the main road are a favourite perch. One of the most familiar spectacles of cold weather evenings are King Crows hawking flies from the tree-tops long after all the other diurnal birds have gone to roost. Each has its special perch on the highest point it can find to which it returns again and again after each sally.

There have been sundry notes in the *Journal* on the breeding association of King Crows and Orioles. While the two species do not seem to have much in common in the off season, it is noteworthy that the Indian Oriole (*Oriolus oriolus kundoo*) arrives in Coorg at just about the same time as the Black Drongo. Both species have much the same range in the winter months, leave at the same time and are absent even from the neighbouring portions of the Dry Zone during the monsoon. From the results of the Eastern Ghats survey it seems almost certain that the Orioles migrate to Northern India to breed, but where our King Crows go remains to be discovered. The Drongos appear to be rather given to allying themselves with other birds. In the case of the Racket-tailed Drongo one notices a constant association with the Tree-Pie (*Dendrocitta vagabunda*). This does not however extend to the breeding season, the Drongo wisely disapproving of having that arrant egg-thief as a near neighbour; but at all other times of the year the two are to be found in company and if one is seen the other is sure to be close at hand. What the tie may be is difficult to see unless it is a common hatred of hawks, owls and all birds of prey, for whom they are always on the lookout, and band together to mob and drive away.

Even more numerous in the cold weather than the King Crow is the little Indian Bee-eater (*Merops orientalis orientalis*). They swarm everywhere except in the forest and are particularly numerous on the down. With their bright plumage, pleasant voices, and wonderful mastery of the air, there are few more charming birds. It is a never-failing joy to watch them hunting, darting out from a prominent bough after a passing bee or butterfly, swooping and looping with the utmost grace and agility, almost invariably returning triumphant to their perch to hammer the victim into subjection. They are sociable and affectionate little creatures and vast numbers will roost in company in a favourite clump of trees. As the sun sets the flocks come in from all directions and the last minutes of daylight are spent dust bathing on a sandy road or with much excited twittering performing aerial manœuvres in massed formation above the tree-tops. They are

intolerant of cold and on a chilly December morning one may often see a row of green fluffy little balls huddling as tight as they can pack along a bough, loath to stir until the sun has well warmed the world. While the great majority leave at the end of March, one or two pairs stay to breed in Coorg. They have never done so on the down, but I know of at least two spots where solitary pairs have nested for some years in succession. These are apparently just cases of individual idiosyncrasy but may possibly be the forerunners of a more general colonisation as there seems no reason why they should not breed here in large numbers. Even the few that do stay to raise a family leave before the monsoon, and apparently the old birds migrate to some distance as practically all those that one sees in the neighbouring Dry Zone in June and July are juveniles lacking the lengthened, wire-like central tail feathers.

One other species of bee-eater, the Chestnut-headed (*Merops leschenaulti leschenaulti*), is to be seen on the down fairly frequently but their movements are irregular and puzzling. They breed in small colonies along the banks of the larger rivers all through Coorg and for the rest of the year seem to wander casually in small flocks, lingering in one spot for a few days and then passing on. They may turn up at any time even during the height of a monsoon burst and the weather seems to have little effect on them.

Most of the birds hitherto mentioned occur all over Coorg during the cold weather, but the remainder of the Dry Zone visitors to the down will seldom be seen elsewhere outside their native territory.

Certain birds have become almost parasitic on Mankind, and as the wilderness is opened up and developed extend into regions where they have hitherto been unable to penetrate. The House Crow is a typical example, although it is perhaps out of place to bring it into this paper as it does not occur within the limits under consideration. It is by nature a bird of the plains but has gained a precarious footing in Coorg, a few pairs inhabiting three of the only four towns of any size of which the province can boast. Even here, they are far outnumbered by the Jungle Crows and appear to exist very much upon sufferance never venturing beyond the built-up areas. The status of the Common Mynah (*Acridotheres tristis tristis*) is rather similar, but it has so far only reached the confines of the Wet Zone and I have not come across it anywhere except on the down. Unlike the Crows however, they seem in perfect amity with their near relatives the Jungle Mynahs (*Aethiopsar fuscus mahrattensis*), which are the prevailing species. Nearly always during the winter one can pick out one or two common mynahs among the small parties of jungle mynahs that attend the grazing cattle or spend their evenings chattering on one of the lone trees scattered about the down, and both join with the little Grey-headed Mynahs in the big, cold weather roosting assemblies. Although our birds linger on into the hot weather and pair off when the Jungle Mynahs start breeding, I do not think they nest with us and they are certainly absent in

the monsoon. The Common Mynah is slightly larger and heavier than its cousin and would presumably be the winner if it came to blows, so that one can only presume that their scarcity is a question of climate. It is really rather strange that they should be found at all as they are very much birds of open cultivation and the few that do occur must have followed the carts up the Ghat road running through the wide stretch of uninhabited country cutting them off from their normal habitat. Even in the Dry Zone they leave the jungles to the Jungle Mynah and the Brahminy Mynah (*Temenuchus pagodarum*). One would rather have expected to see the latter bird which swarms just over the border and is very partial to the type of light jungle found on the down but to my knowledge they never penetrate through the forest belt.

Another bird which finds it furthest limit on the down is the Coppersmith (*Xantholaema haemacephala indica*). The Malabar Coppersmith (*X. rubricapilla malabarica*) with its relation the Small Green Barbet (*Thereiceryx viridis*) must be the commonest birds over a great portion of Coorg, their only possible rival being the Red-whiskered Bulbul. They are especially numerous in the coffee estates where wild fig trees grown as shade afford limitless food supplies and nesting sites, and their monotonous calls are the most characteristic bird sounds of the countryside. They abound in the plantations and the trees round the edge of the down but do not extend far into the forest on the East. Here they encounter the true Coppersmith which can be recognised at a distance by the duller green of its plumage and close at hand by the yellow which replaces much of the crimson markings on face and throat. This is the species found in the Dry Zone. It occurs in small numbers through the forest wherever there is a fair stand of trees among the bamboos, while except during the monsoon one or two are usually to be seen on the down. The two species do not intermix and the visitors have a furtive and subdued air as though they realised that they were in unfriendly country. They carefully avoid the strongholds of their rivals and confine themselves to the scattered trees out in the middle of the grassland or to those on its immediate edge. They are usually solitary and I have never heard them calling and do not think that it is likely that they breed here. Probably like so many frugivorous birds they wander a great deal according to the supply of their favourite food

This is certainly the case with the Southern Green Pigeon (*Crocopus phoenicopterus chlorogaster*) which, though common in the Dry Zone, is only a very rare visitor to the down in years when there is a particularly good crop of wild figs. The Pompadour Green Pigeon is much more numerous and almost any fig tree in fruit is sure to be attended by them, but except at these feeding places they are rarely seen and I have yet to discover their breeding haunts. All the Green Pigons of course are adept at concealing themselves. There may be fifty in a tree but until one takes wing, their presence will often be quite unsuspected.

The two remaining, non-breeding Dry Zone visitors which have occurred on the down are the Indian Roller (*Coracias benghalensis*

indica), and the Green-billed Malkoha (*Rhopodytes viridirostris*). Both appear to be mere strays. In some years none are seen but usually one or two turn up at any time between January and April and may linger about for several weeks or be gone in a day or two. There is no missing the presence of the rollers for they keep to the open and choose the most conspicuous perches, their favourites being the telegraph wires or the solitary Indian Laburnum trees which are leafless at that time of the year and, when they swoop down to catch the grasshoppers on which they largely feed, the beautiful blue of their wings is visible at a great distance. The Malkoha, on the other hand, is a skulker and is to be looked for among the scrub. It is decidedly shy and if aware that it is being watched disappears into the heart of the nearest thick tree. It clambers actively among the branches, rarely coming to the ground and is a poor flier seldom going any distance on the wing. At long range it looks not unlike a small male koel but the white tips to the graduated tail feathers are a good distinguishing mark. It is an extremely silent bird and I have never heard one utter a sound.

I have found four species which must definitely be classed as migrants breeding on or round the down. The Hoopoe is with us for the greater part of the year arriving in September and only leaving at the onset of the rains. Its favourite haunt is parkland where large trees grow plentifully but widely spaced on short sward. The latter is essential as they are entirely ground feeders, and dense undergrowth or even long grass is of no use to them. One or two pairs breed regularly in the neighbourhood, finding the down with its expanses of turf and big trees full of nesting holes much to their taste. They start early, usually at the beginning of February, well before the Mynahs are thinking of domestic affairs. Perhaps this is intentional as by the beginning of April, the latter have annexed every suitable hole and would think nothing of evicting their less sturdy neighbours. It always comes as a painful surprise that such a dainty and elegant bird as the Hoopoe should be so insanitary in its domestic arrangements. One has only to put one's nose near one of their nesting holes to identify the owner. Perhaps for this reason, in the case of the one or two pairs with which I have been intimately acquainted, the same site has never been occupied two years running, though they were undisturbed and the holes were vacant. They are devoted parents and, though I have been unable to discover whether the male takes his turn at incubation, he is indefatigable in feeding his mate while she is on the nest, and when the young hatch both are hard at work all day long. They seem to give themselves a lot of unnecessary labour. I watched one for the best part of an hour one morning in which time he made half a dozen trips to the same spot a good quarter of a mile away uphill. Grasshoppers and ants appeared to be his quarry and on examination of the ground they seemed to be no more numerous where he was searching than in an exactly similar locality within a hundred yards of the nest. I have several times had the luck to witness their courtship. The female in each case was the more ardent wooer.



Yellow-wattled Lapwing [*Lobipluvia malabarica* (Bodd.)].



Photos by author.

Indian Stone Curlew [*Burhinus oedicnemus indicus* (Salvadori)].

She flies up to her mate often with an offering of food, cuddles up to him with low croaks and fully expanded crest, then crouches with quivering wings inviting an embrace. Apparently coition goes on much longer than one would expect, for on one occasion I saw the hen fly out from a nest containing eggs at least ten days incubated and successfully solicit her mate who had arrived with food. This particular male used to roost in the crook of a low tree just outside my garden some hundreds of yards from the nest. He would appear every day just after sundown and nestle into the cup formed by the two main branches where his dusty feet soon left a permanent mark.

The Indian Stone Curlew (*Burhinus oedicnemus indicus*) appears every hot weather. During the first few months of the year they may often be heard calling overhead at night but I have only once found them breeding here. This was in the scrubland bordering on the golf course. The two eggs lay in a slight scrape among the dead leaves under a small isolated thorn tree which gave little shade. As might be expected with such a crepuscular species, the bird when sitting found the heat and glare very trying, spending most of the time panting with open beak and half-closed eyes. There were plenty of spots in the neighbourhood apparently just as suitable and well-shaded in the heat of the day and I cannot imagine why one of these was not chosen. The male kept close to his mate while she was on the nest and both birds were extremely wary, slipping off into the jungle on the least alarm. They did not prove difficult photographic subjects however. There was a convenient clump of bushes close at hand in which the hide was concealed and as soon as the helper was gone, the hen returned, announcing her arrival by a short croak, the only sound I ever heard them utter near the nest. I knew the cock was close by, but unfortunately he would never come into the picture.

Last year there was a most unexpected visitation in the shape of a pair of Yellow-wattled Lapwings (*Lobipluvia malabarica*), the only members of this species that I have seen in Coorg or indeed within twenty miles of its boundaries. They arrived in February and by the end of the month had a nest with two eggs right out in the open on the edge of one of the fairways. This for some reason was deserted, possibly because the spot was undermined by white ants, and the birds disappeared for over a fortnight. They returned however and four more eggs were laid on a scanty saucer of small bits of dried cowdung and the brood successfully reared. It was rather surprising that they were able to do this as the spot is much frequented, cover nil, and the birds themselves not small, though the greenish brown of the upper plumage blended so admirably with the burnt-up turf that the hen while sitting was invisible at any distance. I was most anxious to get some photographs but in such a populous situation it was impossible to make any elaborate hide without attracting unwelcome attention. The best I could do was to leave a pile of leafy boughs near the nest late one evening and come back at dawn next day to construct a rough tent of sacking under the heap. I was pleased to see the bird make off at our approach

and with all speed I got into hiding and sent off my helper. Both birds soon came into view. One, which I took to be the cock, ran up to the nest, seized a piece of cowdung lying beside it and went off. Shortly after his mate returned and settled down. Until the sun was well up she was restless but as soon as it got hot she sat closely though she evidently felt the heat as she panted distressfully. To me one of the most puzzling problems of nature is how these ground-nesting birds in the Tropics can survive, sitting all day in the blazing sun-shine often on sand or shingle literally burning to the touch, where the eggs if left uncovered become baked in a few minutes. It was interesting to note her reactions to possible enemies. A human being would send her flying straight off the eggs to a safe distance where, if unnoticed, she would stand until the coast was clear. If however she thought she was watched, both she and her mate would fly right away out of sight as if they had been disturbed from a casual feeding ground. Grazing cattle she cared little for, only moving and that reluctantly if she appeared in danger of being trampled. When a hawk or crow passed overhead she crouched flat, head and neck laid along the ground.

As soon as the young were hatched both parents became highly demonstrative, flapping wildly round any intruder on their domain, calling angrily. The chicks were full-grown by the end of May and the whole family thereupon departed and were seen no more until the following January when a solitary bird turned up in the same place. Within a week its mate had arrived and a nest was made almost on the site of the previous one. I was much surprised to find that the eggs were entirely unlike the previous ones, being an erythristic type with a pinkish ground colour. Presumably the original hen must have met with disaster and the cock had taken a new wife. In view of Stewart Baker's notes on this species in the *Nidification of Birds of the Indian Empire*, it seems likely that she must have come from the laterite belt on the West Coast perhaps seventy miles away as a bird flies, where apparently this coloured egg is the rule. Here they were decidedly conspicuous on the brown grass and were soon robbed. On this occasion no second attempt was made and the down has since been deserted.

The last of our Dry Zone visitors, the Koel makes the shortest stay of any. They seldom stray far over the boundary and the down about marks their limit. Although I have not had conclusive proof that they breed here there is strong presumptive evidence. They arrive towards the end of March when the Crows are starting nesting operations, and for a few weeks make themselves very conspicuous. They are extremely noisy and there appears to be much competition among the males which predominate in numbers for possession of a mate. They always seem in a desperate hurry and dash from tree to tree as though the devil himself was after them. The Crows have no love for them and chase them whenever they encounter them. By the end of April they disappear, their hosts having hatched off their families, and opportunities of cuckolding no longer remaining.



Nesting ground of Stone Curlew.



Photos by author.

The golf course—nesting ground of the Yellow-wattled Lapwing.

SOME NOTES ON BUTTERFLIES AND BIG GAME IN KASHMIR.

BY

COL. W. M. LOGAN HOME.

(*With two plates*).

Although I first started butterfly collecting in Kashmir in 1909, I realised, on the eve of my retirement in 1934, that there were still many fairly common Kashmir species which I had not yet added to my collection.

The principal cause of this had been the lack of available information regarding definite localities for the less common species. With, perhaps, the exception of Bingham's, most works on Lepidoptera give only large districts for the various species; such as: 'Kashmir to Kamaon'; Chitral to Ladakh, etc.

Such information is not definite enough for a collector who has only a month or two of leave; and the following notes are written in the hope that they may be of some benefit to fellow collectors who have been similarly handicapped.

It is not claimed that the lists of butterflies are complete; they simply give those actually seen by the writer.

Having secured 8½ months' leave pending retirement, I set about making preparations for a combined butterfly collecting, and big game shooting expedition, in Kashmir in 1934. I arrived at Rawalpindi in March; and motored up to Srinagar in perfect weather.

En route it was interesting to note, at this early date, *Papilio polyctor* and *machaon* in fresh condition at about 2,800 feet, between Kohala and Domel, and further up, *Pieris daplidice moorei* and *Colias croceus edusina*, flying over the short grass at the road side between Baramulla and Srinagar.

On arrival at Srinagar I spent some days making the usual arrangements for Kashmir travel, and during this time I also investigated the foothills round the Dhall Lake.

There was a great hatch out of *Colias c. edusina* here, and a few *Colias hyale, Pieris d. moorei, Papilio machaon, Lycaena phloeas, Strymon sassanides* were also noticed. The only uncommon species I took was a single *Euchloe ausonia daphalis*, on a low ridge to the east of the Nishat Bagh.

I left Srinagar at the beginning of April, and spent a few days in the Sind Valley trying to bag a Serow, without success. Butterflies I saw there, were *Argynnis lathonia issoea, Vanessa canace himalaya, V. cashmirensis* and a few *Pieris rapae* and *Polyommatus eros*. Before leaving Srinagar I had registered my name at the Game Office for Moji nullah, one of the best districts for Markhor; but at that time two other sportsmen had their names

down for it before mine. About the middle of April I left the Serow ground and moved down to Sopor. Here I learnt that the two sportsmen already referred to had relinquished their claim, and accordingly I marched to the Kajnag and crossed into Moji from the Jhelum Valley.

On the way up the nullah *Papilio polyctor* were plentiful, besides *P. machaon, Pararge schakra* etc., and I found *Everes diporides* alongside the track at 3,000 feet, and secured a nice series.

At the top of the pass into Moji, at about 9,000 ft. a few *Parnassius hardwickei* and *Pieris callidice kallora* were flying about, with the usual *Argynnis lathonia* and *Vanessa cashmirensis.*

The next two months were spent in the strenuous business of trying to bag a good Markhor. In this I was unsuccessful, and I was greatly disappointed at the scarcity of Markhor in this nullah. Poachers were all over the place when I first entered the nullah, shots being fired nearly every day; and the third day I was there I sighted through my glasses 2 men with slung rifles moving across a snowy ridge on the S.W. side of the nullah. The Game Watcher was not to be found, and in fact never put in an appearance till the day I was leaving, when all he did was to ask me the number of my license; truly adding insult to injury!

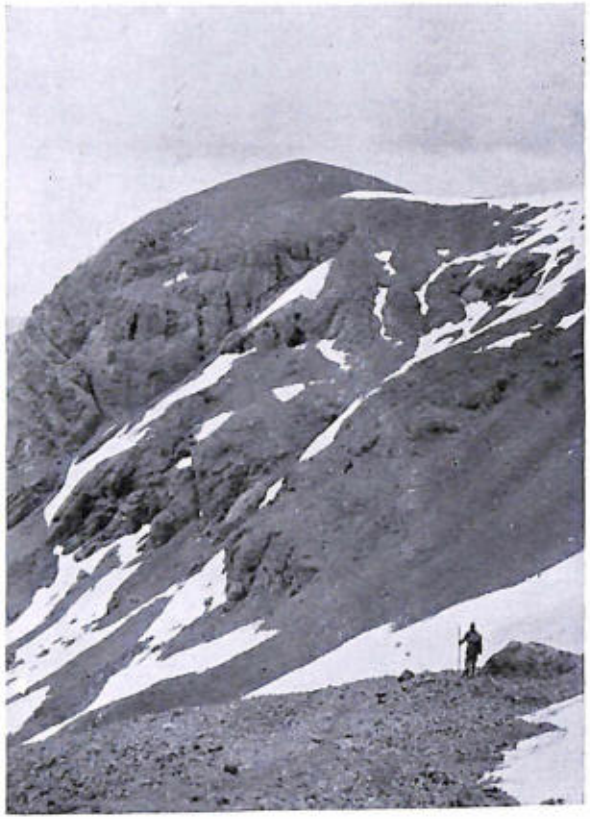
A significant point is that I saw no young kids of the year with any of the few does I saw, and it might not be out of place here to wonder whether any members of the Society have been shooting in the Kajnag since that year (1934), and if so whether they can give any information on the position of Markhor there?

In the butterfly line I was unlucky too, I missed the only *Vanessa urticae rizana* I saw. Other species seen in Moji were:—

Papilio machaon asiatica C. April-June, 8-10,000 ft.
Papilio arcturus arius R. June, 7,000 ft.
Parnassius hardwickei R. a few seen on 15th April at 9,000 ft. afterwards one only in May, 8,000 ft.
Pieris callidice kallora R. a few seen on April 15th at 9,000.
Pieris napi ajaka V.C. May-June, 7,000.
Pieris canidia indica V.C. May-June, 7,000.
Pieris brassicæ C. May-June, 7,000.
Pieris rapæ N.R. May-June, 7,000.
Belenois mesentina R. 2 only seen, 11,000 ft.
Gonepteryx rhamni nepalensis V.C. May-June, 6-7,000 ft.
Gonepteryx aspasia zaneka C. May-June 8-9,000 ft.
Colias croceus edusina V.C. May-June, 8,-9,000 ft.
Pararge schakra N.R. May-June, 6-8,000 ft.
Aulocera padma padma R. 1 only at 8,000 ft., May-June.
Neptis s. sankara R. One only at 8,000 ft., May-June.
Vanessa cardui V.C. 6-9,000 ft., May-June.
Vanessa egea kashmira C. (Spring form) 7-8,000 ft., May-June.
Vanessa urticæ rizana R. 1 only at 9,000, May-June.
Vanessa c. cashmirensis V.C. 6-9,000 ft., May-June.
Vanessa xanthomela fervescens C. 8-9,000 ft., May-June.
Argynnis childreni sakontala C. 8-9,000 ft., May-June.
Argynnis kamala C. 8-9,000 ft., May-June.
Argynnis lathonia issoea V.C. 8-9,000 ft. May-June.
Argynnis jerdoni jerdoni N.R. Very local, large number noticed flying about on small grass slope at about 10,000 ft. on 25th May.
Melitea arcesia balbita R. 1 only at 8,000 in May.
Libythea l. lepita N.R. 6,000, May-June.
Polyommatus eros N.R. 7,000, May-June.



IBEX GROUND, BISAL NULLAH, SEPTEMBER. Steep slopes haunted by:—*Parnassius jacquemontii* R; *P. epaphus nirius* C; *Aulocera swaha gilgitica*; *Arginnis aglaia vitatha* R; *A. pales korla* R; *Polyommatus epiron jermyni* R; *P. eros janetae*; *P. omphisa*.



THE SATPA LA, 14,500 FT., JULY. Rocks on the right haunted by:—*Parnassius charltonius* R; *P. delphius nicevillei*, R; *P. epaphus nirius* C.

Lycæna phloeas indica V.C. 7-8,000 ft., May-June.
Heliophorus bakeri N.R. glades in pinewoods 7-8,000 ft.
Heliophorus androcles coruscans R. 2 only seen, 7-8,000 ft.
Rapala micans selira N.R. May-June at 7,000 ft.
Hesperia alpina C. May-June at 7,000 ft.
Carcharodus altheæ dravira R. 2 only, 8,000, May.
Baoris discreta himalaya R. 1 only, 8,000 ft., May.

The *Argynnis* and *Vanessa* were very fond of both primulas and viburnum. Early in June I gave up all hope of getting a good Markhor; the jungle was very thick and I only kept on seeing the same animals; so I struck camp and marched back to Srinagar.

I already had my name down for an Ovis Ammon block in S.E. Ladakh, and after laying in a stock of fresh supplies, I set out once more to the Sind Valley.

There were very few butterflies to be seen until I had crossed the Zoji La, but on the north side of the Pass *Pieris callidice kallora* were plentiful and near Dras I secured some *Colias hyale* var: *erate* and a good series of *Polyommatus vicrama cashmirensis*. Neither of these had I seen before.

Near Kharbu I noticed a solitary *Polyommatus omphisa* sitting on some wet sand on the path, and I secured some *Pararge menava menava*. The march from Kharbu to Kargil is a hot one in the summer, though the scenery is very fine, the track winding through rugged mountains, with here and there a distant snow peak; while alongside the track are numerous rose bushes in full bloom. I was glad enough however, to reach the comparative coolness of Kargil's green fields and apricot groves.

Near Kargil I met a sportsman who had been in the district of Ladakh for which I was bound, and he told me he had seen only small male ammon and herds of does there. This was disconcerting news, and after discussing matters with my Shikari, I decided to alter my plans and make for the glacier country at the top of the Shigar Valley in Baltistan. This district was well known to my Shikari; he had been with several sportsmen who had secured good Ibex there, and I considered that there was also a chance of my coming across some uncommon butterflies.

Accordingly after a halt in Kargil, I retraced my steps, and finally arrived at the Satpura nullah, south of Skardu, early in July. Near the village of Kirkitchoo I caught a single specimen of the rare *Polyommatus devanica devanica*. The top of this nullah holds a variety of butterflies, and I spent some interesting days there.

No less than 5 species of *Parnassius* occur in the Satpura, 4 of them flying together on the same ground at 13,000 ft. In this connection an interesting point is that *Parnassius hardwickei* is replaced on the same ground at a later date by *Parnassius epaphus nirius*.

My first visit to the Satpa La was on 18th July and *hardwickei* were abundant then, but I only saw 1 *P. e. nirius*.

When I crossed the Pass on 12th September *P. e. nirius* were swarming, but not a *hardwickei* was to be seen.

It would appear that *hardwickei* passes the winter in the pupa stage, and hatches out soon after the snow has left its haunts; whereas *nirius* passes the winter in the egg stage, the larva hatches out in the early summer and pupates, the imago appearing in the autumn. I saw a fair number of *P. delphius nicevillei*, but only 3 *jacquemonti* and 1 *chaltonius*. The latter were flying about among precipitous rocks much higher up than the other 4 *Parnassius*, at about 15,000 ft. and I had no time to go after them.

About the 12th August ♀♀ *charltonius* were observed to be laying their eggs on the large pieces of slaty rock which were strewn about the base of a cliff, round which they were continuously flying.

List of butterflies met with round Skardu.

Parnassius jacquemonti R. 13,000 ft., July-September.
Parnassius epaphus nirius C. 13,000 ft., August-September.
Parnassius delphius nicevillei R. 13,000 ft., July.
Parnassius hardwickei C. July.
Parnassius charltonius R. 13-15,000 ft., July-August.
} Top of Satpur Nullah

Pieris brassicæ C. 7,700 ft., July-September, Skardu.
Pieris rapæ C. 7,700 ft., July-September, Skardu.
Pieris callidice kallora C. 13,000 ft., July, Satpura.
Colias hyale C. 7,7000 ft., July, Skardu.
Colias croceus edusina C. 7,700 ft., July, Skardu.
Aporia leucodice soracta R. 10,000 ft., July, Satpura.
Pararge menava N.R. 7,700 ft., July, Skardu.
Maniola lupinus kashmirensis N.R. 7,000 ft., July, Skardu.
Maniola pulchella N.R. 11,000 ft., September, Satpura.
Karanasa h. hubneri R. 12-13,00 ft., September, Satpura.
Argynnis adippe jainadeva R. 11,000 ft., July, Satpura.
Eumenis parisatis parsis C. 7,700 ft., July, Skardu.
Everes argiades indica N.R. 7,700 ft., July, Skardu.
Polyommatus vicrama cashmirensis N.R. 7,700 ft., July, Skardu.
Polyommatus christophi samudra N.R. 7,700 ft., July, Skardu.
Polyommatus astrarche N.R. 7,700 ft., July, Skardu.
Polyommatus orbitulus R. 14,000 ft., September, Satpura.
Polyommatus eros janetæ N.R. July, 7,700 ft., Skardu.
Hesperia alpina N.R. 11-12,000 ft., July-September, Satpura.

Owing to a sudden rise of the Indus, I was delayed 4 days in my start for the Shigar Valley, as the ferrymen reported the crossing to be unsafe. By the time they considered the water had fallen sufficiently, a large number of would-be passengers had collected, including cows and ponies, all of which were safely ferried over. A hot march of 16 miles brings one to Shigar, and thence another 60 odd miles to Arundu. Between Shigar and Arundu I saw the following:

Colias c. edusina V.C.
Colias hyale V.C.
Eumenis parisatis parsis C.
Pararge menava N.R. in rocky ground.
Aulocera swaha swaha R. near Chetrun.
Vanessa xanthomela fervescens N.R. round Arundu.
Vanessa cardui R.A. few near Arundu.
Strymon sassanides N.R. above Chetrun.
Polyommatus eros C.
Polyommatus christophi samudra N.R.

3 miles below Arundu I caught a few of the rare *Polyommatus astorica* flying among a small aromatic shrub.



In the Chogolungma, August. Meadow in foreground haunted by:—*Colias eogene francesca, Karanasa kubneri, Polyommatus eros janetae, P. omphisa, P. orbitulus, Lycaena kasyapa, Hesperia alpina* and rocks in background by:—*Parnassius delphius chitralica.*



In the Kerolungma, August. Grassy slopes haunted by:—*Colias e. francesca, Erebia mani*, R. *Maniola pulchella, M. d. brevistigma*, R. *Polyommatus omphisa, P. eros janetae, P. epiron jermyni*, R.

On 29th July I pitched my base camp in a pleasant willow grove above Arundu village, with a view to the south and east of range on range of snow-capped mountains.

A couple of hundred yards away was the snout of the Chogolungma Glacier, a black wall of ice, from the base of which gushed out the dirty snow-fed waters of the river; and I spent some time next morning examining this, as our route was to lead over the Glacier near this point.

My Shikari having secured a guide and 8 coolies, we set forth on 31st July with a couple of light tents, and food for 10 days.

A rough track, made by half-bred Yaks, led over the Glacier, and we followed this for 2 miles before reaching the left bank. The villagers drive their Yaks onto the Glacier when the snow has melted sufficiently and the beasts find their way across and up into the flowery meadows beyond.

Camp was pitched about 2 o'clock among some willow bushes, and very soon after a snow storm came on, and blotted out the landscape for the rest of the day.

The next day the Shikari went off very early to look for Ibex, while I spent a profitable morning after butterflies on a grassy hillside near camp. I was very pleased at securing a fine series of the uncommon *Lycaena thetis aditya* which I found flying around a pink flowering Saxifrage, probably the larva's foodplant.

Other species new to me which I got were:—

Argynnis adippe pallida	grass slopes high above glacier, over 13000′
Argynnis aglaia vitatha	,, ,, ,, ,,
Argynnis pales sipora	,, ,, ,, ,,
Aulocera swaha gilgitica	edge of glacier, 10000′-12000′
Colias eogene francesca	grass slopes high above glacier, over 13000′
Lycænopsis ladonides gigas	,, ,, ,, ,,
Polyommatus epiron jermyni	,, ,, ,, ,,
Polyommatus sarta	

Meanwhile the Shikari had located a big herd of Ibex with, he thought, 2 or 3 good heads among them, on the far side of the Glacier. Next day, therefore, we recrossed near camp I, with 3 days' food; this crossing was a much more tedious business than the first day; the Glacier was heavily crevassed, a fact which frequently entailed long detours, and it was not till late afternoon that we had reached a suitable spot for a bivouac among the boulders and seracs.

The right bank proved to be equally productive in butterflies, and in the next week I caught several species new to me, and also shot a 42-inch Ibex, and a brown bear.

We then recrossed to the left bank and moving several miles up, sighted late one evening a small herd of 8 male Ibex, 3 of which appeared to carry better heads than we had yet seen, and after an exhausting stalk of over 16 hours, I got one of these, measuring 46 inches.

During the stalk of this Ibex, I secured a couple of the rare *Parnassius delphius chitralica* at about 15,000 ft.

On 20th August a severe snowstorm set in, lasting for 3 days, and the weather was considerably colder for some time after, but in spite of this one or two new species began to appear.

During the last week of August I explored the Kerolungma Valley and here I came across the scarce *Eumenis heydenreichi shandura* at about 11,000 ft., and secured several in good condition. From the Kero Glacier my small party of myself, Shikari, tiffin cooly and two local coolies, moved *via* the left bank to Bisal, and high up a small ravine off the main nullah, I found *Parnassius charltonius* in considerable numbers, but they were all very worn, and the only good specimen I got was a *P. jacquemonti*; this place would well repay a visit in early August.

At the beginning of September I commenced my return march, crossing to the right bank near Doku by the twig suspension bridge, and reaching Chetrun in the evening; the natural hot springs are a feature of this place, and are well built round with stone huts. Here I made the discovery that the lid of a large tin of mulberry jam, which my cook had made at Skardu, had worked off and its sticky contents were thoroughly mixed up in my only clean change of clothing. The tiffin cooly spent most of the night at the hot spring with the contents of that Yakdan!

I reached Shigar on 8th, crossing the river on a 'Zak', an inflated goat skin raft, this performance necessitated 5 trips to get the servants and baggage across.

Near Nihali village *Eumenis mniszechii droshica* were in considerable numbers round some tall thistles near the river, but these butterflies were rather worn, and had evidently been on the wing for some time.

I found a small hut, which does duty for a post office at Shigar, ankle deep in letters, from which I eventually extracted, with the help of the postmaster, 80 letters and 30 newspapers of mine, nearly all the rest belonging to the International Himalayan Expedition, which had its camp up a valley to the east of the country I had been in.

Other butterflies seen up the Chogo and Kero Glaciers were :—

Papilio machaon asiatica (larva only, on fennel).
Pararge menava mæroides R. edge of glacier.
Maniola pulchella C.
Maniola davendra brevistigma R. edge of glacier.
Karanasa hubneri hubneri N.R. at 14,000 ft.
Erebia mani R. edge of glacier.
Argynnis j. jerdoni R.
Polyommatus orbitulus astorica. R. high up, 14-16,000 ft.
Polyommatus eros janetæ C.
Polyommatus omphisa C.
Polyommatus m. metallica
Lycæna philoeas flavens N.R.
Lycæna philoeas indicus C.
Lycæna kasyapai C.
Hesperia a. alpina C.

On the 11th September I crossed the Satpa La, collecting several *Polyommatus orbitulus* in good condition on the south side of the Pass; *Parnassius e. nirius* were abundant here and I saw one *P. jacquemonti* but failed to secure it.

The next two days were spent marching across the Deosai Plateau and it may be of interest to mention that there were very few butterflies to be seen on the Plateau itself, although grass

and wild flowers are to be seen everywhere; all I saw in the 35 odd miles between Ali Malik Sar and the Sar Sangri La above Borzil were a few *Pieris callidice kallora*, 1 *Maniola pulchella* and 2 *P. orbitulus*.

Between Borzil and Gurais I saw the following :—

Colias stoliczkana, in good condition.
Colias c. edusina, in good condition.
Colias p. pyale, in good condition.
Gonepteryx rhamni nepalensis, worn.
Maniola cœnonympha, worn.
Karanasa hubneri, worn.
Aulocera swaha garuna, worn.
Argynnis adippe jainadeva, in good condition.
Vanessa c. canace, in good condition.
Polyommatus eros, in good condition.
Polyommatus astrarche, in good condition.

While I was after Barasingh in the Pulwar above Bandipur, I noticed

Aulocera swaha garuna
Vanessa egea kashmira
Vanessa c. cashmirensis
Colias c. edusina

in good condition as late as 15th October at a height of 9-11,000.

It will be seen from the foregoing that a useful line for a 2-months trip in July and August would be, starting from Bandipur; Gurais-Borzil-Deosai (*via* the Satpa La) -Skardu-Arundu-Chogolungma and back.

I secured 34 species new to me from 18th July to the 10th September between Borzil and the Chogolungma.

ON THE BIONOMICS OF A BAGWORM (*KOPHENE CUPREA* M.) ON BANANA

BY

K. BRAHMACHARI, M.A., *Madras Agricultural Department.*

(*With a plate and 6 text-figures*).

INTRODUCTION.

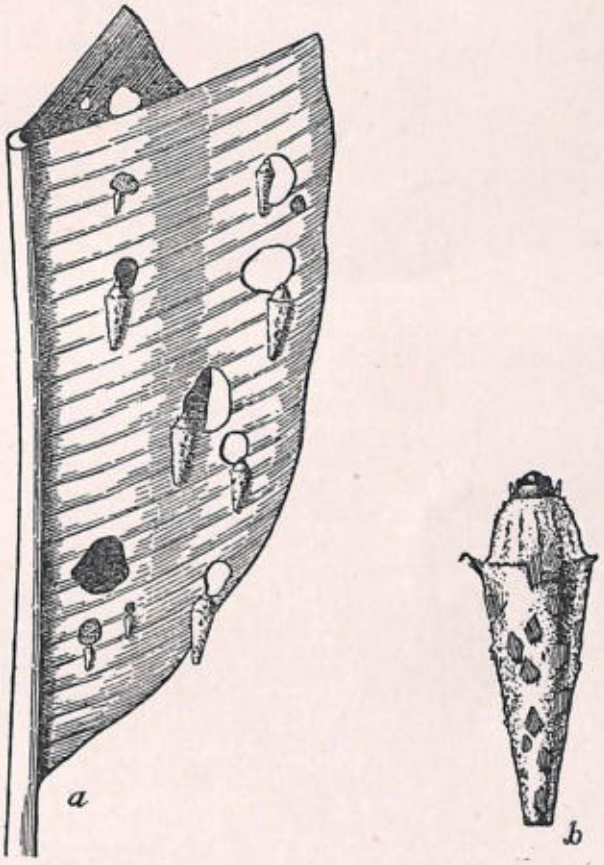
The name Bagworm is generally applied to the caterpillars of the family of moths called PSYCHIDÆ, because of the characteristic habit of carrying bags or cases with them. There is a pronounced sexual dimorphism among them in that the males are normal and winged, while the females are vermiform, legless, wingless and devoid of mouth parts and antennae. The female after laying its eggs inside its chrysalis creeps out of its bag, drops down and dies. Since very early times, the Psychids were the subject of most interesting observations by entomologists and a good deal of literature has accumulated round this group. The insects were known in Europe about the first half of the 17th century. In India, on the contrary, little attention has been paid to them; not because of their scarcity, but because they have not been found to occur frequently as serious pests of any cultivated crops; nor do they cause any appreciable injury when they occasionally appear in numbers. Apart from the scanty references to the Psychids which occur as pests occasionally sporadic on the tea plant in Assam and Ceylon, no detailed life-history of any Psychid has ever been worked out. Dr. T. V. Ramakrishna Ayyar bred two Psychids *Chaliodes vitrea* H., and *Pteroma plagiophleps* H. which recently occurred in the form of pests on tamarind at Coimbatore. This paper deals with the bionomics of *Kophene cuprea* M.

LOCALITY AND HABITAT.

The writer remembers having seen this insect on banana in the South Canara district a few years ago; but it was definitely noted at Saidapet in the vicinity of Madras in March last (1937) causing appreciable damage to banana (*Musa paradisiaca*).

NATURE AND EXTENT OF DAMAGE ON BANANA.

The caterpillars remain on the lower surface of the plantain leaf and feed from it. The very young larvae simply scrape the epidermis. As they get older, they eat the leaf in small bits, thus causing a number of small or big irregular perforations all over the surface of the leaf, a caterpillar hanging close to each of the perforations. The number of perforations on a single leaf depends upon the number of caterpillars, which may vary from 10 to 150.



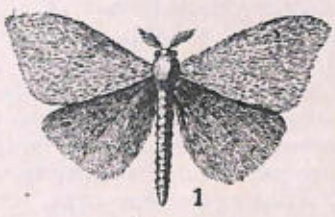
Bagworm (*Kophene cuprea*, M.) on banana leaf.
a. Caterpillars on banana leaf.
b. Caterpillar.

In a badly attacked leaf there is very little of the green tissue; consequently the plant suffers from want of nourishment. The leaves, one by one, droop down and dry up. The caterpillars which are at first confined to the lower leaves migrate to the fresher ones at the top; these in turn droop and dry, and the plant finally dies. As the leaves of the adjoining plants are long and touch each other, the migration of the caterpillars from one plant to another is easy. In a very short time, therefore, a number of plants become affected. In a garden of about 50 plants more than half were severely attacked by the pest and consequently died.

Life History and Habits.

The female moth lays from two hundred to three hundred eggs which hatch out in a week. The caterpillars immediately begin to spin their own cases, move about snail-like, feeding and growing, moulting nine times before they are completely mature. The mature larvae pupate within their own cases and the adults emerge after 7 or 8 days. The period of larval activity is the longest, lasting nearly 2½ months. The duration of the whole life cycle from oviposition to the emergence of adults is about 3 months. The length of life of the adults, male and female, after emergence varies from 2 to 4 days.

The male (*Fig.* 1) is a small moth with a small head and fairly large eyes. The antennae are bipectinated to the tips, the branches diminishing in length from the middle. The thorax is covered with brown and the abdomen with black hairs. The forewing has the same colouration as the thorax while the hind wing is fuscous like the abdomen. The fore tibia is provided with a long spine. The length of the adult from head to the tip of the abdomen is 0.8 cm. and the wing expanse from tip to tip measures 1.8 cm.



1

Fig. 1.

The female (*Fig.* 2) is a bag-like degenerate creature with a minute head and a large abdomen full of eggs. In the head, the eyes and the mouth parts are rudimentary while the antennae are entirely absent. The anterior and posterior pairs of wings are represented on the dorsal side of the thorax by two pairs of brownish scale-like spots. The three pairs of ambulatory legs are almost absent. On each of the abdominal segments from the 1st to the 7th, rows of very fine hairs are found. The tufts of hairs on the 8th and 9th are more strongly developed than those of the other segments. Chapman (1) found the same feature in the female of *Acanthopsyche opacella* H. Sch. The general colouration of the adult female is dirty-white and the external cuticle is so thin that the eggs contained within the abdomen can be easily seen through.



2

Fig. 2.

The female measure 0·8 cm. × ·3 cm. The female genitalia are prominently developed.

Sexual Union.

As soon as the males emerge they unite with the females which are enclosed in their bags. Though copulation has not actually been observed in this particular species, it is believed the process must be same as in other Psychids. This has been described by Heylaerts (2) in his monograph on the Psychidæ. When a male finds a case in which a mature female is enclosed, it fixes itself near the narrow region of the bag, then it elongates its rather protrusible abdomen, introduces it by the side of the head of the female, and finally bending the tip of the abdomen thrusts its penis into the vaginal cavity. The copulation is completed within a few minutes. As the males are fewer than the females, a single male has to fertilise several females.

Oviposition.

A few words may be added with regard to oviposition. Between the pupal sac and the maggot-like female there exists a space in which eggs are laid after fertilisation. Before the female makes its final exit it sheds its hairy covering found on the abdominal segments 1 to 7 to which reference has already been made. If one were to examine a female pupal case after the adult has left it, one would find at the bottom, lumps of soft powdery matter easily mistaken for some fungus. On removing this however, one sees beneath a number of eggs undergoing development. In all probability, this powdery substance is a protective covering for the developing embryos. A part of their post-embryonic life appears to be spent embedded in this substance. Evidently, the female moves up and down and rubs against the inner walls of her pupal case in order to shed the hairy covering.

The egg.—The eggs are fairly large for the size of the female, slightly ovoid in shape, shining white in colour. Each egg is 0.5 mm. long and 0.3 mm. broad. Usually the eggs are laid inside the female chrysalis as mentioned before and the hatchlings creep out of it and migrate to various parts of the host plant. But sometimes the vermiform female pushes itself out of its own case and then through the narrow region of its bag and hangs with only its terminal abdominal region outside. In such cases the eggs fall into the soil below or are not laid at all. This is the behaviour exhibited by a female which has not been fertilised by a male. After the eggs have been normally laid the female escapes through the narrow region of the case as previously mentioned, falls to the ground and dies. The eggs hatch in about 7 days.



3 3A

Eggs (Figs. 3, 3A).

Larva.—The larva when just hatched is about 1.5 mm., pale brownish in colour with a large head and the post-cephalic region

gradually tapering towards the anus. In the thorax, the prothoracic segment is the largest, while the meso- and metathorax are of equal



4 4A

The Larva (Figs. 4, 4A).

size. There are ten distinct abdominal segments which, as well as the throax, bear six rows of fine hairs rising from warts. Of the five pairs of pro-legs borne on segments 3 to 6 and 10, the last pair alone is strongly developed and the first four pairs are short. The three pairs of thoracic legs are pretty long and well developed so that, once the young larva comes in contact with the host plant, it walks only on its thoracic legs with the tapering tip of the abdomen slightly raised, thus foreshadowing the condition of the adult caterpillar within its bag. Within 2 to 6 hours after hatching the larva begins to construct the bag wherein it is to pass a large part of its life. As the larva grows, the case grows correspondingly in depth and width. After the 9th moult, the larva is fully grown. The full-grown larva (Fig. 4A) does not differ from the newly hatched one except in size. When stretched it measures 1.5 cm. in length; it has a fairly big head and a gradually tapering abdomen. The head and the thorax, which are often protruded for purposes of locomotion, are grey in colour with patches of brown; while the abdomen is of a darker hue. The larval period extends over 2½ months.

Method of Bag Making.

The most characteristic habit is that of bag making. Different genera of Psychids utilise different materials for the construction of their bags. Some like (*Clania crameri*) popularly called Faggot worms, utilise thorns of *Acacia arabica*, dried twigs of *Casuarina* or leaves of grasses (*Mahasena graminivora*); others like (*Amatissa consorta*) use the leaves on which they feed, a few again use feathers, thoracic plates of Chrysidids or beetles. Again, the size, shape and the mode of attachment to the host plant differ as well. In the Psychid under consideration, the case is fairly smooth and conical, ashy grey in colour and made up of cut pieces of plantain leaves stuck up on its outer surface. It was already mentioned that the young larva begins to form its own bag 2 to 6 hours after emergence from the egg. The larva cuts small bits of leaves with its mandibles which automatically adhere to the frothy mass exuding from its silk glands. When the exudation hardens, the bag is formed with leafy bits glued on to it. Then another flow of exudation runs round the rim of the bag already formed and a few more bits are added. Thus the bag grows day by day. At first, the bits of leaves appear greenish but later on, when dry, they turn ashy grey in colour. In the beginning, the case is pyramidal in

shape and remains so for over a month. After this period, the growth is rapid and the bag assumes the shape of a truncated cone. The bag (*vide* plate) carried by a fully mature larva measures 1.8 cm. in depth and 0.8 cm. at its base. From the inner rim of the base of the cone there extends a diaphragm with a circular hole in the centre through which the inmate pops in and out. When the larva moves about or when it has retreated inside the bag, the diaphragm cannot be made out. In the resting position, however, it is drawn out so that the bag appears biconical.

If the bag is cut open on one side from the top to the bottom and the larva removed, it gets into the case again and in a short time begins to repair it as before. Though the line of restitching is visible externally, the internal silken lining is as perfect as before. When more than one bag is offered, the larva is not able to recognise its own case but gets into whichever is nearer.

A few words may also be added on the mode of attachment of the larva within its own bag. The last pair of abdominal legs of the larva has well developed crotchets arranged almost circularly. This and the other four pairs which are similarly supplied with circular crotchets grip the inner sides of the case and help carrying the bag from one place to another.

If the larva is removed out of its bag it curls round bringing the tapering tip of the abdomen near its head, thus hindering its progression in a straight line. Difficulty of locomotion is further accentuated by the fact that the thoracic legs are longer than the false legs whose crotchets are helpless in the gripping of the smooth surface.

The fully grown caterpillar pupates within its own bag, the moulted skin of the final instar being attached to the cremaster hooks of the pupa. When the caterpillar is about to pupate, the head which was at the broad end of the conical case is withdrawn, the tail end which was near the narrow region is bent and pushed forward so as to lie near the broad end. By the muscular contractions of the abdomen, the head is pushed more and more towards the narrow end while the tail is brought towards the broad end. The pupation of the larva takes place in this altered position and the moth comes out through the narrow end. When the pupa wriggles out it draws along with it the last moulted skin already referred to so that in each empty case, there will be attached to the narrow region of the bag the last moulted skin and the pupal case through which the adult has emerged. The male pupa is 1 cm. long and normal like any other lepidopterous pupa, with wing pads, antennae, legs, etc. In general form it is supposed to resemble a Bombycid chrysalis from which it can, however, be distinguished by the position of two recurved hooks (Fig. 5A) found at the tip of the abdomen. The colour of the pupa is yellowish brown. The adult moth emerges in about 8 days.



Male Pupa
(Figs. 5, 5A).

The change in the position of the mature larva before pupation already described above in the case of the male pupa also holds good in this case. But the female pupa differs remarkably from the male. Wing pads, antennae and legs are entirely absent while the eye spots are rudimentary. The head and the following three segments are slightly curved at the base and pressed together while the abdominal segments beginning from the first are large and bear impressions and excrescences. Some excrescences at the base of the three thoracic segments may indicate the presence of the feet of the larva. The stigmata are visible as also the genital opening on the 8th segment which is probably the combined vaginal and oviductal openings in the adult, a very primitive condition in the Lepidoptera. The terminal abdominal segment near the anus bears a number of protuberances. (Fig. 6A.) The general shape of the female pupa differs very much from that of the male and in fact from that of any other Lepidoptera. From the head downwards the segments get progressively bigger as far as the 7th segment and thereafter gradually taper to a blunt point. The colour of the pupa is as in the male yellowish brown and the adult female emerges from its pupal case on the 7th day.



Female Pupa (Figs. 6, 6A).

Parasites.

No egg parasite was noted. But the larva, though much guarded by the outer bag, is subject to the attack of a small Tachinid of which two or three may be found in a single bag. The percentage of parasitism was very small varying between two to five. The Ichneumonids generally have a partiality for the Psychids. From *Clania crameri*, the author has bred the Cryptid *Goryphus nursei* Cam. An unidentified Bombylid fly has been noted as parasite on another Psychid.

Acknowledgment.

In conclusion the writer acknowledges his indebtedness to Dr. T. V. Ramakrishna Ayyar for his many suggestions and helpful criticisms during the course of this study and the preparation of the paper and for getting the insect identified.

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NOTES ON THE BIOLOGY OF THE FRESHWATER GREY-MULLET, *MUGIL CORSULA* HAMILTON, WITH OBSERVATIONS ON THE PROBABLE MODE OF ORIGIN OF AERIAL VISION IN FISHES.

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B., F.N.I.,

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(With a coloured plate and 3 text-figures).

(Read at the Silver Jubilee Session of the Indian Science Congress Association at Calcutta, and published with permission of the Director, Zoological Survey of India).

Grey-Mullets of the genus *Mugil* Artedi are mostly shore fishes, of which about two dozen species are known from the seas of India. Several of them enter the mouths of large rivers for breeding purposes, but a few, such as *Mugil corsula* Hamilton, *M. cascasia* Hamilton and *M. hamiltoni* Day, mostly or entirely reside in fresh waters. Of these, *M. corsula* has the remarkable habit of swimming with its eyes above the surface of the water; it attains a foot-and-a-half or more in length and usually moves in small shoals. As aerial vision is unusual among fishes, the biology of the species was studied with a view to elucidate the probable mode of evolution of this habit. Observations detailed below were made at the Calcutta Corporation Water Works at Pulta where in the settling tanks this fish is found in great abundance at all times of the year. Normally, however, it is a fluviatile species.

Hamilton,[1] who described this species in 1822, remarked:

'The *Corsula* (*Khorsula*) is found in most rivers of the Gangetic provinces,[2] and, in the southern parts of Bengal, has been introduced into some ponds. It grows to a foot in length, and swims with the nose and eyes above water, probably in search of insects. Although, no doubt, of a very different genus, it would seem to have much of the appearance and manners of *Cobitis anableps* (Bonnaterre, *Tabl. Encycl.*, p. 148, Pl. lxi, Fig. 240). It is very well tasted, and, by the Europeans, is much sought after for their tables.'

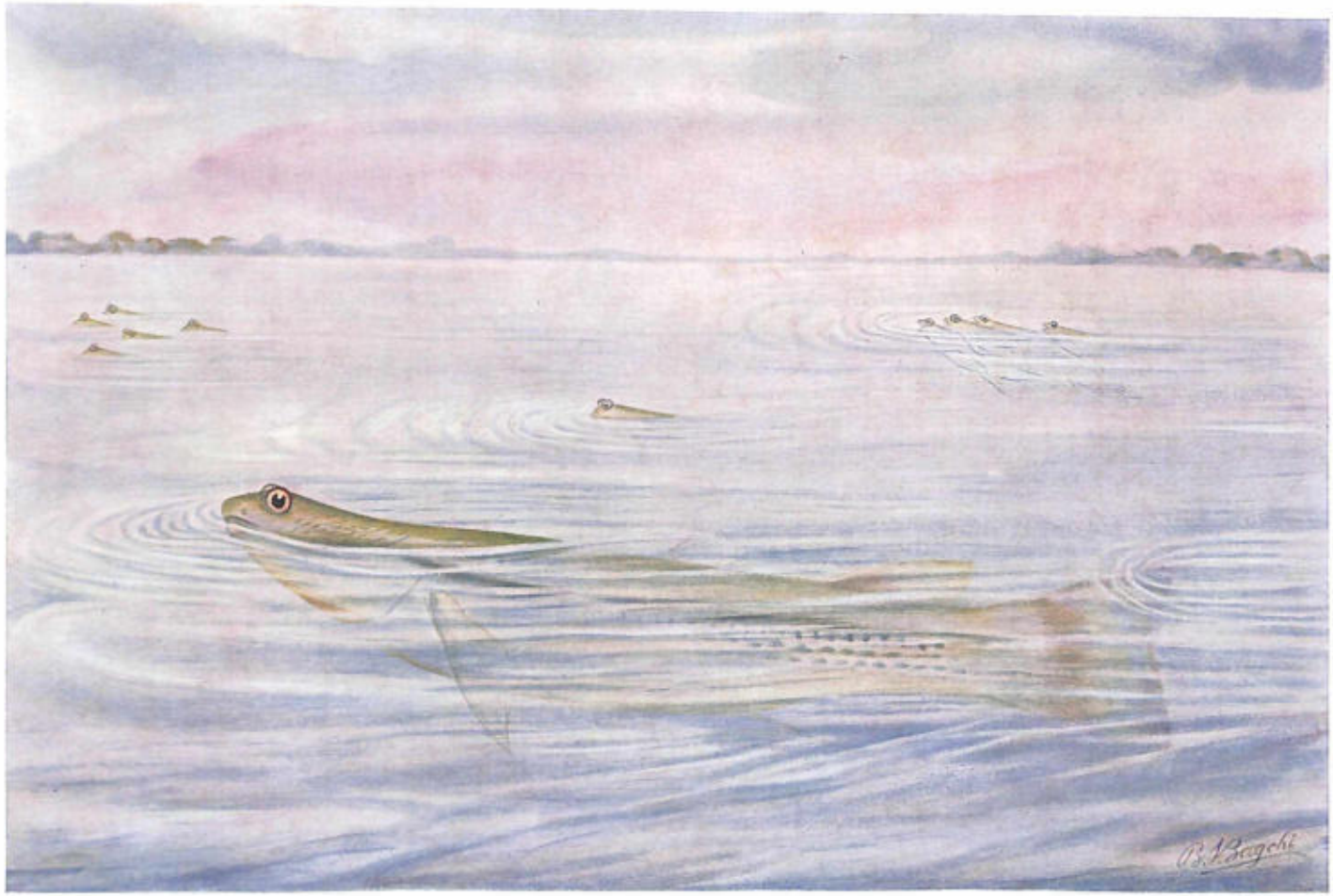
Day (*Fish. India*, p. 354, 1876) extended the range of the species to Burma and gave the following vernacular names:—*Kakunda*, Ooriah; *Hurd-wahre*, Punj.; *Corsula* and *In-ge-lee*, Beng., *Undala*, Hind.; *Nga-zen*, Burma.

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[1] Hamilton, F.—*An Account of the Fishes found in the river and its branches*. Pp. 221, 338, pl. ix, fig. 97 (Edinburgh, 1822).

[2] Day in his account of 'The Fish and Fisheries of Bengal' (Hunter's *Statistical Account of Bengal*, xx, London: 1877) published Hamilton's notes on the fish and fisheries of the various districts of Bengal. From these notes it is clear that Hamilton obtained specimens of *M. corsula* from the districts of Dinajpur, Rangpur, Purniah, Bhagalpur, Patna and Gorakhpur. He noted the following vernacular names for the species:

Dinajpur—*Ghobol*; Rangpur (Goalpara)—*Muji* and *Ingli*; Dacca—*Kholá*; Calcutta—*Khorsalá*; Purniah (Náthpur)—*Hundará*; Purniah (Bholáhat)—*Mürál*; Bhagalpur—*Andewári*; Patna—*Angruyari*; Gorakhpur—*Bhágá*.



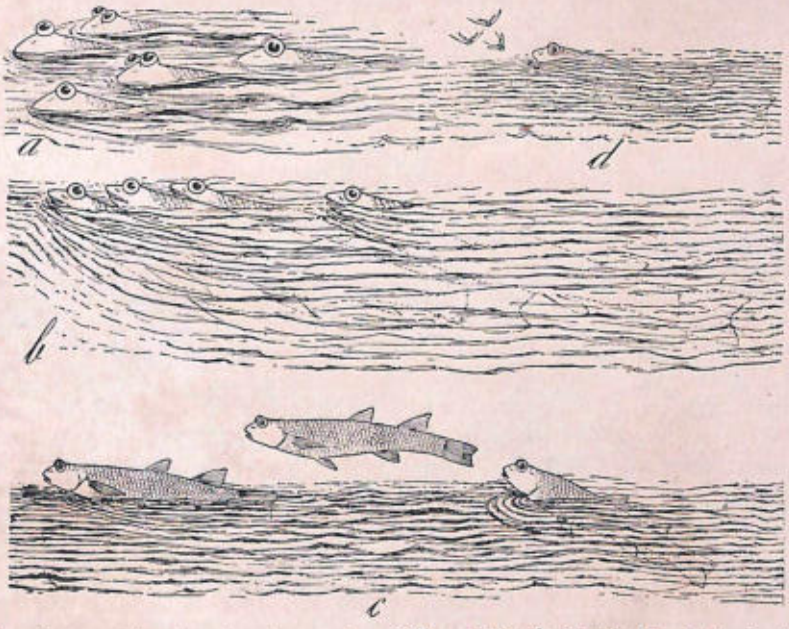
THE FRESHWATER GREY MULLET.

Mugil corsula (Hamilton).

In the Settling Tanks of the Calcutta Corporation Water-Works at Pulta.

I made observations on the locomotion, aerial vision, respiration, feeding and breeding of the species. Notes on these subjects are given below separately.

Locomotion: When the fish is swimming at the surface, the eyes, a portion of the head and the anterior part of the body are entirely out of water; the rest of the body is obliquely inclined to the surface of the water. As the fish progresses, ripples of the displaced water are formed at the sides of the head. During locomotion the pectoral fins are constantly in action, and the pelvics are held out fully stretched. The tail fin moves gently from



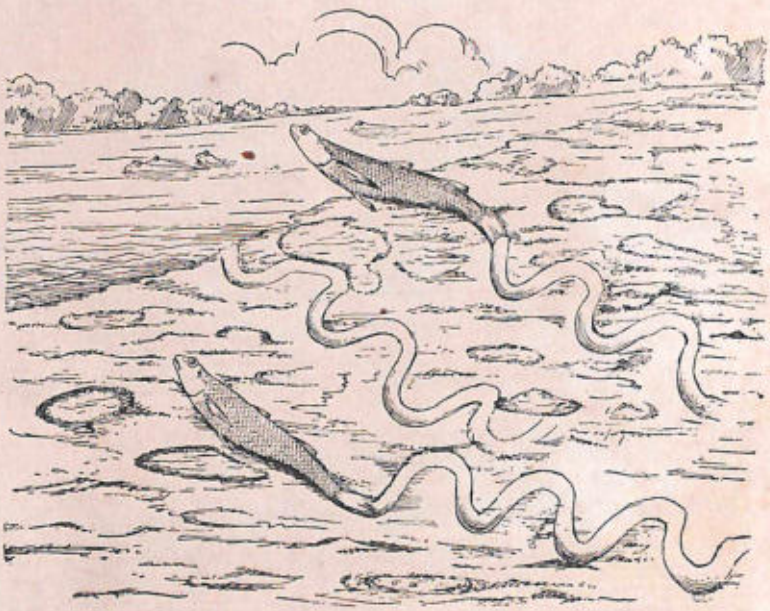
Text-fig. 1.—Sketches showing mode of life of *Mugil corsula* Hamilton in the settling tanks of the Calcutta Corporation Water-works at Pulta. *Diagrammatic.*

a. A group of fishes in their natural posture at time of swimming; *b*. A group of fishes swimming away in a hurry on approach of a person; *c*. Skipping and jumping posture; *d*. A fish keeping in sight the Caddis-flies hovering over water.

side to side. Thus the fish moves through the water very gracefully (text-fig. 1*a*) and occasionally ducks its head below the surface, presumably to keep the eyes moist. On the approach of an individual the fish dives under water with great agility but does not stay there long and comes up to the surface at a short distance from its original position. On certain occasions the fish was observed to swim away rapidly and in this action the whole of the anterior part of the head was projected out of the water (text-fig. 1*b*), presumably to decrease resistance. Sometimes, when suddenly alarmed, it skips along the surface by using its

muscular tail and tail fin for giving a push to the water (text-fig. 1c). The skipping is done only over a very short distance after which the fish dives and clears away under cover of water.

When the water is drained away from the pucca settling tanks for cleaning them, it was observed that the fish jumps out of the receding water (the narrow channels at the bottom by which the water is finally drained off) and wanders over the muddy bottom, presumably in search of larger pieces of water. The fish could thus wander over the mud for 15 to 20 feet, but it usually halted



Text-fig. 2.—Sketch of *Mugil corsula* Hamilton wandering over mud flats in search of larger pieces of water. *Diagrammatic.* Sketches of tracks were made from a photograph.

for a few seconds in the course of a long journey. During progression through mud the posterior part of the body is whipped about vigorously and a fairly deep zig-zag track is left behind (text-fig. 2).

It was further observed that in a current the fish has the habit of swimming against it.

Vision: Hamilton in describing *Mugil corsula* correctly remarked that his species had much of the appearance and manners of *Anableps* (Gronow) Scopoli, the so-called 'Four-eyed Fish' of Tropical America. 'The four-eyed fish has only two eyes but each has become divided into an upper and lower section by ingrowth of the iris. The lower pupil is shaded from the glare of the surface film by a double screen which, like horse 'blinkers', prevents the water-eyes from looking anywhere but in one direction,

namely downward, where the fish's enemies prowl about'.[1] *Mugil corsula*, however, has no such bi-focal arrangement for a double vision. Its eyes are wholly out of water and are no doubt adapted mostly for an aerial vision. From a distance they shine like two white silvery balls, probably on account of the reflected light. When looked at from close quarters in an aquarium the pupil is black and the iris has a shade of orange yellow. The eye-balls can be moved in all directions, especially antero-posteriorly. Even when the fish is under water the eye-balls are moved in various directions, showing thereby that the fish is probably capable of seeing to a limited extent under water also.

In its protruding eyes, mobility of the eye-balls and perfect aerial vision, *M. corsula* agrees with the goggle-eyed fishes of the genera *Periophthalmus* Bloch & Schneider and *Periophthalmodon* Bleeker.

Respiration: Respiration is mostly aquatic, as the fish keeps its mouth under water even when a considerable part of the head and eyes are out of it. Thus for respiratory purposes the fish normally makes use of the better oxygenated water at the surface. When, however, the water of an aquarium becomes foul, the fish takes gulps of air at irregular intervals, passes them over the gills and out at the gill-openings. As with most of the tropical fishes, the gills of *M. corsula* probably subserve both for aquatic and aerial respiration.

It has been remarked above that the fish, when the water is drained away from its habitat, jumps out of the water and wriggles about on mud in search of a more congenial habitat. In such wanderings, which do not last more than a minute or two, the fish probably resorts to aerial respiration. To test the capacity of *M. corsula* for aerial respiration, a specimen was left in a dish and its surface was kept moist by occasionally sprinkling a little water over it. The experiment was started about 7 p.m. After 10 minutes, the fish was breathing air at the rate of 80 respiratory movements per minute and after about every 15 movements it took a sort of a deep breath. After about 20 minutes, the rate of respiration was the same, but a couple of minutes afterwards the animal became restless and when placed in water revived fully within a very short period. The experiment was repeated with other specimens with more or less similar results. It would thus appear that the fish, though not fully adapted for aerial respiration, is capable of living out of water for a short time.

The popular belief that *M. corsula* burrows in soft mud, when the waters dry up altogether in its habitat, is not borne out by my observations. It was found that if fishes moving on soft mud failed to reach a piece of water they lay at the surface and were usually found dead after a short time. They made no attempt to burrow, in spite of the fact that kites swooped over them from time to time and carried some of them away.

Feeding: The mouth (text-fig. 3) is angular with the upper

[1] Noble, G. K.—The Four-Eyed Fish. *Journ. Amer. Mus. Nat. Hist.*, xxxvi, pp. 34, 36 (1935).

muscular tail and tail fin for giving a push to the water (text-fig. 1c). The skipping is done only over a very short distance after which the fish dives and clears away under cover of water.

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In its protruding eyes, mobility of the eye-balls and perfect aerial vision, *M. corsula* agrees with the goggle-eyed fishes of the genera *Periophthalmus* Bloch & Schneider and *Periophthalmodon* Bleeker.

Respiration: Respiration is mostly aquatic, as the fish keeps its mouth under water even when a considerable part of the head and eyes are out of it. Thus for respiratory purposes the fish normally makes use of the better oxygenated water at the surface. When, however, the water of an aquarium becomes foul, the fish takes gulps of air at irregular intervals, passes them over the gills and out at the gill-openings. As with most of the tropical fishes, the gills of *M. corsula* probably subserve both for aquatic and aerial respiration.

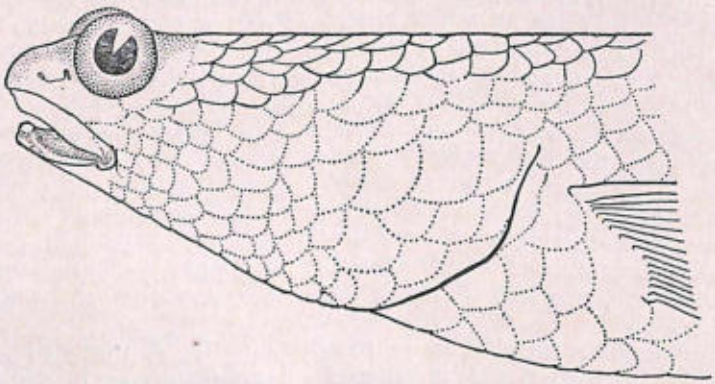
It has been remarked above that the fish, when the water is drained away from its habitat, jumps out of the water and wriggles about on mud in search of a more congenial habitat. In such wanderings, which do not last more than a minute or two, the fish probably resorts to aerial respiration. To test the capacity of *M. corsula* for aerial respiration, a specimen was left in a dish and its surface was kept moist by occasionally sprinkling a little water over it. The experiment was started about 7 p.m. After 10 minutes, the fish was breathing air at the rate of 80 respiratory movements per minute and after about every 15 movements it took a sort of a deep breath. After about 20 minutes, the rate of respiration was the same, but a couple of minutes afterwards the animal became restless and when placed in water revived fully within a very short period. The experiment was repeated with other specimens with more or less similar results. It would thus appear that the fish, though not fully adapted for aerial respiration, is capable of living out of water for a short time.

The popular belief that *M. corsula* burrows in soft mud, when the waters dry up altogether in its habitat, is not borne out by my observations. It was found that if fishes moving on soft mud failed to reach a piece of water they lay at the surface and were usually found dead after a short time. They made no attempt to burrow, in spite of the fact that kites swooped over them from time to time and carried some of them away.

Feeding: The mouth (text-fig. 3) is angular with the upper

[1] Noble, G. K.—The Four-Eyed Fish. *Journ. Amer. Mus. Nat. Hist.*, xxxvi, pp. 34, 36 (1935).

jaw longer; it is overhung by the snout. There is a single row of fine teeth in either jaw. The lower jaw is provided with a



Text-fig. 3.—Head and anterior part of body of *Mugil corsula* Hamilton. ×1½.

prominent symphysial knob in the middle and corresponding to it in the upper jaw there is a deep pit to receive it. These structures are similar to those found among Carps of the subfamily Abramidinae. The alimentary canal is considerably convoluted.

As a rule the adults living in the settling tanks of the Calcutta Corporation Water Works at Pulta feed on copious quantities of filamentous algae and one can notice them browsing near the shores in the evenings and mornings. In this process the incisor-like structure on the lower jaw probably helps in uprooting algae from the shores. When feeding, it appears from a distance as if the fish is resting near the edge of the water with a part of its head out of the water. The stomach contents of several adult specimens contained nothing but algae and a few insects and young molluscs entangled among the plants.

During May-June, when swarms of Caddis-flies (Trichoptera) are out in the evenings and hover about near the surface of the water, the fish keeps the insects in sight and usually moves about with them (text-fig. 1*d*). It was, however, never observed to jump out of the water to catch them, but as soon as an insect touched the water *M. corsula* was observed to raise its head and devour it with a jerk of the head. If, however, it missed to catch the insect at the first attempt, the insect usually started moving with great speed on the surface of the water and was chased by the fish. The fish was usually successful in its attempt. On such occasions, when there are swarms of insects, *M. corsula* feeds voraciously on insects, as within a period of 10 minutes a specimen, 6 to 8 inches in length, was noticed to devour about a dozen Caddis-flies.

The stomach contents of small specimens from 6 to 8 cms. in length were found to consist mostly of large numbers of Copepods, and sometimes small insects.

The almost toothless jaws, the presence of a symphysial knob, and convoluted alimentary canal indicate that the observed feeding habits of *M. corsula* correspond with those of the 'Carp-Minnows'

(Rasborinae) and 'Chilwas' (Abramidinae). Though the mouth of *M. corsula* is situated on the ventral surface of the head, when the eyes and a part of the head are out of water, its position becomes almost anterior and the gape becomes obliquely directed upwards and forwards, as is usually the case with the fishes that feed near the surface. Thus the anterior position of the mouth for feeding actually results from the fact that the fish keeps a greater part of its snout out of the water.

Breeding: No direct observations were made on the breeding habits of the species, but a large number of young ones appeared in the settling tanks and filter beds of the Water Works at Pulta during March and April. Presumably these months represent the peak-period of breeding for the species. *M. corsula* presumably breeds in the river and connected waters, and also in confined waters such as those of the Pulta Water Works. The presence of the fish in an isolated settling tank (Pucca Settling Tank No. 4) after cleaning shows that the fish must have come in a very early stage of development. This also indicates that *M. corsula* is in reality a fluviatile form and that its occurrence in confined waters at Pulta is only accidental.

Though *M. corsula* is at present mostly confined to fresh waters, its habits, as detailed above, seem to have been acquired under estuarine conditions during the transition period from marine to freshwater life. In the estuaries during ebb-tides certain small animals are left high and dry on muddy banks and even a few fish become stranded in small pools and puddles. The partial aerial respiration and the habit of wriggling back to water-channels, no doubt developed under these conditions, must have been of immense value to *M. corsula* in tidal creeks. Further, its habit of swimming against the current probably helped it to invade fresh waters and prevented its being carried away to the sea. Its habit of swimming near the surface was probably induced by feeding on the floating matter. Those, who have observed the incoming tides, know what an immense amount of dead and living organic stuff is collected from the mud-flats and floats on the surface layer of the water. As indicated above, the position of the mouth in *M. corsula* is ventral, but for feeding on the floating matter effort had to be made to bring the mouth to the level of the surface. The ventral profile of the head, which is sharply directed upwards (text-fig. 3), is very suggestive of such efforts having been made by the fish. In this effort the upper part of the head and the snout were continually being thrust out of the water. The eyes thus pushed out of water became gradually modified for aerial vision by an adjustment of the form of the lens. In the evolution of aerial vision the globular lens of the aquatic fishes, which is myopic both in water and on land, becomes flattened for hypermetropic vision on land. In *M. corsula* the ratio of the diameter of the lens to its thickness is as 7 : 6.

As a rule, Mullets feed on algae and other minute water plants contained in mud near the sea shore or in lagoons, but the habit of feeding on the floating matter was, in my opinion, acquired

under estuarine conditions and led to the initial stages in the development of the aerial vision of *M. corsula* and also of such Gobies as *Periophthalmus* and *Periophthalmodon,* both of which possess a ventral mouth. The observed habit of *M. corsula* of browsing on algae is no doubt a secondary feature for life in confined waters. In the actual estuarine channels there is usually no growth of filamentous algae, though the connected pools may sometimes be full of them. The favourable position of the mouth must have been of great help in feeding on algae near the edges of ponds. At the present day, the fish seems to be equally well adapted for feeding both at the open surface and on the sides of a piece of water.

The terrestrial habit of the Gobies was probably acquired at a later period when during low tides they stayed on the mud-flats, instead of wriggling back to water channels as *M. corsula* does, and began to wander about in search of food. The cup-shaped ventral fins of the normal Gobies would, in the earlier stages, act as a support to enable the fish to prevent its head from sinking into the soft mud. Later the pectoral fins became modified to support the weight of the fish and a terrestrial mode of locomotion was acquired by it.

Noble (*op. cit.*) remarks that *Anableps* 'has specialised in feeding on the floating material which it encounters in its wanderings in the dual realm of air and water.' Here again it would seem probable that the richness of floating food and the comparative lack of competition in acquiring it must have induced the initial stages in the development of the remarkable modifications of the eyes in *Anableps. Anableps* belongs to the freshwater group of 'Top-minnows' (Cyprinodonts) which are mostly confined to fresh waters. With the exception of *Anableps,* all are small fishes, rarely exceeding 3 to 4 inches in length. As a group, they are in every way adapted for feeding near the surface and have for the same reason been used all over the world for the control of insects, especially mosquitoes. *Anableps* seems to have acquired the habit of using the upper part of its eyes for aerial vision in its search for floating organisms. Thus the primary inducement for aerial vision—feeding at the surface on floating matter—was probably the same in both the cases, but modification of the eye proceeded along different lines owing to differences in the position of the mouth in the two types of fishes. In *M. corsula* the eyes had to be wholly out of the water for the mouth to come to the level of the surface, whereas the already anterior mouth of *Anableps* had only to be slightly raised to come to the level of the surface, and hence only a part of the eyes was exposed to aerial conditions.

Noble has characterised the bi-focal vision of *Anableps* as 'The first stage in the evolution of vision in the air'; but to me it seems that such a fine arrangement, probably perfected under the circumstances detailed above, cannot be regarded as a generalised structure. At any rate, it seems probable that an aerial vision was acquired by estuarine animals of the type of *Periophthalmus, Periophthalmodon, Boleophthalmus* and *M. corsula* without undergoing the *Anableps*-stage of bi-focal vision.

MEDICINAL AND POISONOUS PLANTS OF INDIA: *MAGNOLIADS, DILLENIADS, ANONADS, MENISPERMADS, BERBERIDS.*

BY

J. F. CAIUS, S.J., F.L.S.

I

The MAGNOLIACEÆ are trees or shrubs, sometimes climbing, often aromatic. They are chiefly natives of the tropical and temperate Asiatic mountains and United States, a few are Australian.

There are about 70 species belonging to 10 genera, 9 of which are used medicinally in various parts of the world:—DRIMYS (South America; New Zealand to Borneo); EUPTELEA (Japan to Bengal); ILLICIUM (Atlantic North America; Asia); KADSURA (tropical Asia, China, Japan); LIRIODENDRON (North America); MAGNOLIA (Asia, North America); MICHELIA (tropical Asia, China); SCHIZANDRA (tropical and warm temperate Asia, North America); TALAUMA (eastern Asia, South America, West Indies).

Many members yield essential oils.

Among the products isolated the following may be mentioned:—(1) *cyanogenetic glucosides* and *saponins*; (2) *crystalline compounds of alkaloidal* (?) *nature*—tulipiferine—; (3) *bitter principles*—liriodendrin, magnolin, shikimin—; (4) *toxic principles*—sikimitoxin—; (5) *tannins* and *resins—;* (6) *mucilage.*

The medicinal Magnoliads of India belong to the three genera ILLICIUM, KADSURA, and MICHELIA.

A.	Erect trees or shrubs.	
	Stipules absent. Carpels in one whorl ...	... ILLICIUM.
	Stipules conspicuous. Gynophore stalked ...	... MICHELIA.
B.	Climbing shrubs.	
	Carpels of fruit capitate	... KADSURA.

ILLICIUM.

The genus consists of 20 species distributed over India, China, Japan, and Atlantic North America.

The fruits are aromatic, stimulant, and carminative.

The following species are used medicinally in China—*I. anisatum* Linn.—; in Indo-China—*I. anisatum* Linn., *I. Griffithii* Hook.f. & Th., *I. verum* Hook.f.—; in Malaya—*I. verum* Hook. f.—; in the Philippine Islands—*I. anisatum* Linn.—; in North America—*I. floridanum* Ell., *I. parviflorum* Michx.—.

Sikimitoxin, a highly toxic substance, has been isolated from *I. anisatum.*

The fruit of *I. verum* Hook. f. or the essential oil from it is official in Austria, Brazil, France, Germany, Great Britain, Hungary, Italy, Portugal, Russia, Spain, Sweden, Switzerland, and the United States.

The essential oil from *I. anisatum* Linn. is official in Mexico.

Illicium Griffithii Hook. fil. & Th. occurs in Bhutan and the Khasia Hills between 4,000 and 5,000 feet.

The fruit is aromatic, stimulant, and carminative.

French: Faux badianier—; *Indo-China*: Dai hoi nui—.

Kadsura.

This genus includes 8 species, which inhabit tropical Asia, China, and Japan.

K. japonica Juss. is used medicinally in Japan.

Kadsura scandens Bl. is common in the forests of the Malay Peninsula and the Malay Islands at low elevations.

A decoction of the root is used by the Malays for rheumatism.

Malay: Akar dama daura, Akar kapala patong—.

Michelia.

The genus consists of 15 species inhabiting tropical Asia, and China.

The barks are bitter and aromatic, stimulant and antiperiodic.

The following are used medicinally in Indo-China—*M. Champaca* Linn.; in Malaya and Java—*M. Champaca* Linn., *M. montana* Blum.

1. Leaves 15-25 cm. long. Flowers yellow. Sepals and petals 15 or more ... ... *M. Champaca.*
2. Leaves 5-10 cm. long. Flowers white or with a tinge of yellow. Sepals and petals 9-12 ... *M. nilagirica.*
3. Leaves up to 19 cm. long. Flowers white. Sepals and petals 8 ... ... *M. montana.*

1. **Michelia Champaca** Linn. occurs wild in the Eastern sub-Himalayan tract and lower hills up to 3,000 feet, Assam, Burma, Western Ghats and South India; it is much cultivated in various parts of India and Burma. It is distributed to Yunnan, Indo-China, Siam, and Malaya—not in the Malay Peninsula where, however, it is common in gardens.

The root is bitter and demulcent; it is also considered purgative.

The dried root and root-bark, mixed with curdled milk is useful as an application to abscesses, clearing away or maturing the inflammation. In the form of an infusion it is a valuable emmenagogue.

The bark has febrifugal properties; it is a stimulant, expectorant, and astringent. It is described in Ayurveda as bitter with a sharp acrid taste, causing warmth in the abdomen, destroying poisons, removing worms, facilitating micturition and sweating, useful in bile and blood affections.

A decoction of the bark was tried in sixteen mild cases of chronic gastritis. After using it for several days the patients obtained considerable relief from the pain and discomfort in the epigastrium with which they were troubled, but none of the cases was completely cured (Koman).

Ayurveda practitioners use the leaves in combination with other drugs to remove the foetid odour of vaginal discharges. In Dacca the juice of the leaves is given with honey in cases of colic.

According to Ayurveda the flowers are bitter, stomachic, diuretic; they remove bilious conditions; they are good in leprosy, skin diseases, and ulcers. Yunani doctors consider their smell a good stimulant; they use the flower as an expectorant and look upon it as useful in cough and rheumatism.

The flowers and fruits are considered bitter and cool remedies, and are used in dyspepsia, nausea, and fever. The flowers mixed with sesamum oil form an external application, which is often prescribed in vertigo; they are also applied to foetid discharges from the nostrils. They are useful as a diuretic in renal diseases and in gonorrhoea. They are considered stimulant, antispasmodic, tonic, stomachic, and carminative.

The perfumed oil prepared from the flowers is a useful application in cephalalgia, ophthalmia, and gout.

The seeds and fruit are said to be useful for healing cracks in the feet.

The flowers and the fruit in combination with other drugs are recommended as an antidote to snake and scorpion venoms, but Caius and Mhaskar have shown experimentally that both the flower and the fruit are useless in the antidotal and symptomatic treatment of snake bite and scorpion sting.

Annam: Dam bac, Su Nam—; *Assam*: Phulchopa, Phulsopa, Titasoppa—; *Bengal*: Champa, Champaka, Chumpa, Kotu—; *Bombay*: Champa, Chapha—; *Burma*: Changal, Paranyam, Saga—; *Canarese*: Champaka, Kendasampige, Kolasampige, Sampage, Sampaghy, Sampige—; *Deccan*: Champa—; *English*: Golden Champa, Yellow Champa—; *French*: Champac—; *Gujerati*: Champo, Pitochampo, Raechampo, Sonchampa—; *Hindi*: Champ, Champa, Champac, Champaca—; *Indo-China*: Kim cuong moc—; *Kathiawar*: Pilochampo, Rayachampo, Sachochampo—; *Konkani*: Champa, Champo, Pudchampo—; *Lao*: Chum pi—; *La Reunion*: Champac—; *Malay*: Bongasjampacca, Mangliet—; *Malayalam*: Champakam— *Marathi*: Kudchampa, Pivalachampa, Sonachampa—; *Matheran*: Champaka, Pilachampa, Souchampa—; *Mundari*: Champabadaru—; *Nepal*: Aulechamp, Ouliachamp—; *North Western Provinces*: Champa—; *Philippines*: Champaca, Champaga—; *Portuguese*: Champo—; *Punjab*: Chamba, Chamoti, Champa, Chamuti—; *Sadani*: Campa—; *Sanskrit*: Anjana, Atigandhaka, Bramaratithi, Bhringmohi, Chambunala, Champaka, Champeya, Deepapushpa, Gandhaphali, Hemanga, Hemapushpa, Hemapushpaka, Hemavha, Kamabana, Kanchana, Katu, Kumara, Kusuma, Kusumadhipa, Kusumadhirata, Nagapshpa, Patichampaka, Peetapushpa, Punyagandha, Rajachampaka, Shatapadatithi, Shitala, Shitalachchada, Sthiragandha, Sthirpushpa, Subhaga, Sukumara, Surabhi, Svarnachampakapaka, Svarnapushpa, Ugragandha, Vanadapika, Vanadeepa, Vanamalika, Varalbdha—; *Sinhalese*: Champak, Hapu, Sapu—; *Tagalog*: Champaga, Sampac, Sampaka, Tsampaka—; *Tamil*: Amariyam, Sambagam, Sembagam, Shampangi, Vandumarmalar—; *Telugu*: Champakmu, Champeyamu, Gandhaphali, Gangaravi, Hemangamu, Hemapushpamu, Kanjanamu, Sampangi, Sampega—; *Tulu*: Champaka, Sampay—; *Uriya*: Chompa, Chompoko—.

2. **Michelia nilagirica** Zenk. is found in the shola forests of the Nilgiris, Anamalais and Pulneys above 5,000 feet.

The bark is used as a febrifuge.

Canarese: Bilisampage, Doddasampage, Sampana, Sapage—; *Hindi*: Pilachampa—; *Marathi*: Pilachampa—; *Sinhalese*: Walsapu—; *Tamil*: Kattuchambagam, Nilagirishambagam, Shambagam—.

3. **Michelia montana** Bl. is found in the Himalaya, the mountains of Perak and Redah, and in Java.

The bark is a bitter tonic useful in fevers.

II

The DILLENIACEÆ are trees or shrubs, chiefly natives of the southern hemisphere. Tropical America and Asia possess about an equal number of species; they are rare in Africa, and hitherto none have been found in South Africa or temperate South America.

4 of the 16 genera are reputed medicinal :— CUROTELLA (tropical America, West Indies); DAVILLA (tropical America, West Indies); DILLENIA (Indo-Malaya); TETRACERA (tropics; chiefly America). Two of these—DILLENIA and TETRACERA—are represented in India.

I. Woody climbers; filaments dilated upwards. Carpels 2 to 5 ... ... TETRACERA.
II. Trees; filaments not dilated.
Follicles not expanding nor dehiscing enclosed in the thickened pulpy sepals; seeds not arillate ... DILLENIA.

DILLENIA.

This genus includes 20 Indo-Malayan species.

In Indo-China the calyces of *D. Baillonii* Pierre, *D. indica* Linn., and *D. ovata* Wall. are made into jellies and cooling drinks; the bark of *D. ovata* is used medicinally in Cambodia.

1. Flowering with the leaves; flowers large, 6 to 9 in. across, white; fruit very large ... ... *D. indica.*
2. Flowering before leaves; flowers 2 to 5 in. wide, yellow; leaves 4 in. long, oblong, blunt, velvety beneath ... ... *D. ovata.*

1. **Dillenia indica** Linn. occurs from Nepal to Assam, extending to the Malay Peninsula and Indo-China; southwards it spreads over to Ceylon.

A syrup of the juice of the unripe fruit allays coughs, assists expectoration, and cures angina and aphthae.

The juice of the fruit, mixed with sugar and water, is used as a cooling beverage in fevers, and as a cough mixture. The fruit is slightly laxative, and is apt to induce diarrhoea if too freely indulged in.

The bark and the leaves are astringent. The bruised bark is applied as a cataplasm in arthritis.

The Malays use the pulp of the fruit as a hair-wash.

Assam : Chalita, Otengah—; *Bengal* : Chalita, Chalta, Hargesa, Ruvya—; *Bombay* : Karambel, Mothakarmel, Mothekaramala—; *Burma* : Thabyu, Thibuta, Zinbrun, Zinpyunngan—; *Canarese* : Bettadakanagal, Bettakanigala, Ganagalu, Kadkanagula, Kanagala, Kanigala, Neyitaku—; *Deccan* : Mutakurmul—; *Garo* : Panpui—; *Gujerati* : Karmbal, Otaphal—; *Hindi* : Chalta, Chaltr, Girnar—; *Indo-China* : Dok shan, So ba—; *Kachin* : Masang—; *Kolami* : Korkotta—; *Konkani* : Corombol—; *Lepcha* : Kyangmozhu, Phamsikol, Phan-se kung—; *Magahi* : Chauralesi, Thapru—; *Malay* : Chimpuh, Simpoh—; *Malayalam* : Chalita, Punna, Syalita, Valapunna—; *Marathi* : Karmbel, Motakarmal, Motakarmbal—; *Monghyr* : Chilta—; *Mundari* : Korkotadaru, Kurkutadaru—; *Nepal* : Panchkule, Panchphal, Ramphal—; *Sanskrit* : Bhavya, Ruvya—; *Santal* : Korkot, Korkotta—; *Sinhalese* : Hondapara, Wampara—; *Taleing* : Carllow—; *Tamil* : Akku, Ugakkay, Uva, Uvav, Uvatteku—; *Telugu* : Kalinga, Peddakalinga, Uvva—; *Uriya* : Chalota, Oao, Ou, Rai, Uau—.

2. **Dillenia ovata** Wall. is found in the Eastern Peninsula, Malaya, Cambodia, Indo-China.

In Cambodia the astringent bark is given for diarrhoea in the form of a strong infusion.

Cambodia: Knang krepeu, Plou—; *Cochinchina*: Thu dau mot—.

TETRACERA.

The genus consists of 25 tropical species.

The following are used medicinally in the Philippine Islands—*T. indica* Merrill, *T. macrophylla* Wall.—; in Nigeria and Guinea—*T. alnifolia* Willd., *T. potatoria* Azfl.—; in Guiana—*T. alnifolia* Willd., *T. aspera* Willd., *T. ovalifolia* DC.—; in Brazil—*T. oblongata* D.C.—.

1. Follicles 3-5-seeded.
   Leaves 2-5 in. long up to 2 in. wide, toothed, glabrous except the nerves beneath ... *T. indica.*
2. Follicles 1-2-seeded.
   Leaves 3-5 in. long, oblong or lanceolate. Sepals silky inside, glabrous outside, broadly oval ... *T. laevis.*
3. Follicles 1-seeded.
   Leaves 5-7 in. long, 3-6 in. wide. Sepals silky inside, puberulous outside, obovate obtuse, edges ciliate ... ... *T. macrophylla.*

1. **Tetracera indica** Merrill (=*T. assa* DC.) is found in Eastern Bengal and the Eastern Peninsula from Chittagong to Singapore. It extends to Siam, Cochin-China, Java, and the Philippine Islands.

In the Philippines an infusion of the plant is used internally for pulmonary haemorrhage, and externally as a gargle for the treatment of aphthae.

Malay: Ampelas, Mempelas minyak, P'las payah—; *Tagalog*: Malacatmon—.

2. **Tetracera laevis** Vahl is found in the Western Peninsula, the forests of Malabar, Ceylon, Java and Borneo.

In Malabar a decoction of the leaves is mixed with rice gruel and given for the treatment of aphthae.

Malayalam: Piripu—; *Tamil*: Anaittichal—.

3. **Tetracera macrophylla** Wall. occurs in the Eastern Peninsula from Penang to Singapore, extending to Sumatra.

An infusion of the plant is used in the Philippine Islands as a drink for haemoptysis, and as a gargle for aphthae.

Malay: Ampelas gajah, Ampelas lidah kuching, Ampelas rimau, Ampelas rimbah, Mempelas gajah, Mempelas lidah kuching, Mempelas rimau, Mempelas rimbah—; *Tagalog*: Malacatmon—.

III

The ANONACEÆ are trees or shrubs, often climbing and frequently aromatic. There are 80 genera comprising 820 species, nearly all tropical, especially of the Old World.

The medicinal and poisonous Anonads of the world belong to 22 genera: ALPHONSEA (tropical Asia): ANAXAGOREA (tropical

Asia, America); ANONA (Tropics; chiefly America); ARTABOTRYS (palaeotropics); ASIMINA (Cuba, Mexico, Eastern United States); BOCAGEA (tropical America and Asia); CANANGIUM (tropical eastern Asia to Australia); DESMOS (tropical Asia); ENANTIA (West Africa); GONIOTHALAMUS (tropical Asia); HABZELIA (tropical Asia); HEXALOBUS (tropical Africa, Madagascar); MELODORUM (Tropics); MONODORA (tropical Africa, Madagascar); OROPHEA (Indo-Malaya); OXYMITRA (palaeotropics); POLYALTHIA (palaeotropics); ROLLINIA (tropical America); SAGERAEA (Indo-Malaya); UNONA (tropical Asia, Africa); UVARIA (warm regions); XYLOPIA (Tropics).

The medicinal and poisonous Anonads of India belong to 12 genera:—ALPHONSEA, ANAXAGOREA, ANONA, ARTABOTRYS, CANANGIUM, DESMOS, GONIOTHALAMUS, MELODORUM, OROPHEA, POLYALTHIA, SAGERAEA, UVARIA.

A. Petals 2 in 2 rows, one or both rows imbricate in bud. Stamens many. Anther-cells concealed by a flat appendage
   1. Sepals imbricate. Trees or shrubs. Ovules 6-8. Torus flat ... ... SAGERAEA.
   2. Sepals valvate. Climbers. Ovules many ... UVARIA.

B. Petals valvate in bud, flat, or base only concave. Inner petals similar to outer. Stamens many, with overlapping appendages. Ovaries indefinite, rarely few
   1. Petals connivent at concave base, covering stamens and ovaries. Climbers with hooked peduncles. Flowers rather large ... ... ARTABOTRYS.
   2. Petals flat. Carpels indehiscent
      a. Trees. Ovules many in 2 rows. Stamen-appendages acute ... ... CANANGIUM.
      b. Trees. Ovules 1-2 ... ... POLYALTHIA.
      c. Shrubs, half climbing. Ovules 6 in 1 row. Petals sometimes connate and reduced to 2 ... DESMOS.
      d. Shrubs. Fruit follicular dehiscent ... ... ANAXAGOREA.

C. Petals valvate, outer spreading; inner concave connivent different, arching over stamens. Stamens and pistils numerous and anther appendages overlapping except *Orophea*. Trees. Inner petals clawed.
   1. Inner petals connivent, not vaulted. Flowers rather large ... ... GONIOTHALAMUS.
   2. Inner petals vaulted, longer than outer. Stamens 6. OROPHEA.

D. Petals valvate, thick, connivent; outer long narrow or broad, inner small but similar.
   1. Trees or shrubs. Ovules solitary. Fruit fleshy of many connate carpels ... ... ANONA.
   2. Climbers. Ovules 2 or more. Outer petals broad. Torus convex ... ... MELODORUM.

E. Petals valvate, outer often very small. Stamens definite loosely imbricate. Ovules 1 or many. Flowers usually solitary. Trees or shrubs.
   Ovaries indefinite. Petals all larger than sepals saccate at base ... ... ALPHONSEA.

ALPHONSEA.

The genus consists of 9 to 10 Indo-Malayan species.

Alphonsea ventricosa Hook. fil. & Th. occurs in Assam and Chittagong and extends to the Andamans and Penang.

The plant contains a poisonous alkaloid.

ANAXAGOREA.

The genus numbers about 8 species, natives of tropical Asia and America.

Anaxagorea Scortechinii King is found in the woods of the Malay Peninsula.

The Malays put the seeds among clothes.

Malay: Bunga lerak, Pali monyet—.

ANONA.

The genus includes 70 tropical species, especially American.

The following species are used medicinally in Senegal—*A. senegalensis* Pers.—; in Nigeria—*A. cherimolia* Mill., *A. senegalensis* Pers.—; in Guinea, Oubanghi-Chari and the Gold Coast—*A. muricata* Linn., *A. senegalensis* Pers.—; in Indo-China—*A. muricata* Linn., *A. squamosa* Linn.—; in the Philippine Islands—*A. muricata* Linn., *A. reticulata* Linn., *A. squamosa* Linn.—; in North America—*A. muricata* Linn., *A. palustris* Linn., *A. spinescens* Mart., *A. squamosa* Linn.—; in California—*A. cherimolia* Mill., *A. muricata* Linn.—; in Porto Rico and Jamaica—*A. muricata* Linn.—; in Guiana—*A. Ambotay* Aubl.—; in Brazil—*A. cherimolia* Mill., *A. Marcgravii* Mart., *A. muricata* Linn., *A. palustris* Linn., *A. Pisonis* Mart., *A. reticulata* Linn., *A. spinescens* Mart., *A. squamosa* Linn.—.

A. muricata Linn., *A. reticulata* Linn., and *A. squamosa* Linn. are used medicinally in India.

Fruit tubercled	... 1. *A. squamosa.*
Fruit smooth, slightly areolate ...	... 2. *A. reticulata.*
Fruit bearing numerous fleshy spines ...	... 3. *A. muricata.*

1. **Anona squamosa** Linn. is a native of the West Indies, now cultivated throughout India.

The root is considered a drastic purgative, and is administered in acute dysentery. It is also employed internally in depression of spirits and in spinal diseases.

The astringent bark is used as an antidiarrhoeal cure in Cambodia.

An infusion of the leaves is considered efficacious in prolapsus ani of children; and the bruised leaves with salt make a cataplasm to induce suppuration.

In Brazil they are applied as a poultice over boils and ulcers. In Gambia, the West Indies, Central and South America they are used to kill lice and to prevent bed bugs, etc.

The ripe fruit is medicinally considered a maturant; and when bruised and mixed with salt, is applied to malignant tumours to hasten suppuration. The seeds contain an acrid principle fatal to insects, and the dried unripe fruit, powdered and mixed with gram flour, is used to destroy vermin.

In Chota Nagpur the seeds are crushed and used for destroying worms in the wounds of cattle.

The seeds are a powerful irritant of the conjunctiva.

Annam: Mak khieb, Mang cau ta, Qua na, Tiep—; *Antilles*: Cachimant, Hattier, Pomme-canelle—; *Arabic*: Ambeberesch, Beresch, Chermisch, Saripha—; *Assam*: Ata, Katal—; *Bengal*: Ata, Luna, Meba, Sitaphal—; *Brazil*: Ata, Pinha, Frutta de Condessa—; *Burma*: Auza—; *Cambodia*: Tiep srok—; *Canarese*: Amritaphala, Duranji, Sitaphala—; *Ceylon*: Anoda—; *Cuba*: Anon—; *Deccan*: At, Sitaphul—; *English*: Custard Apple, Sugar apple, Sweet Sop—; *Ewe*: Eevunyikleng—; *Fanti*: Apre—; *French*: Anone écailleuse, Ate, Attier, Cachiman, Guanabane, Hattier, Marie baise, Pomme canelle—; *Ga*: Ngawyei, Nangwi, Ngaasie—; *Guam*: Atis—; *Gujerati*: Anan, Anuram, Seetaphul, Sitaphal—; *Hasada*: Sarupa—; *Hindi*: At, Ata, Atasitaphal, Saripha, Shariphal, Sitaphal—; *Ibo*: Mbubo-ago—; *Indo-China*: Phan le chi—; *Kolami*: Mandal, Nenwa—; *Konkani*: At, Ath—; *Krobo*: Hangbue—; *Lambadi*: Sitaphal—; *La Reunion*: Attier—; *Malay*: Mannapapuwa, Srikaya—; *Malayalam*: Antacheecha, Attachchakka, Sirpa, Sitapalam, Sutakanni—; *Marathi*: At, Sitaphal—; *Mexico*: Anona, Anona blanca—; *Mundari*: Borordaru, Neoa, Sampa, Sarupa—; *Nagpuri*: Neoa—; *Nepal*: Sharifal—; *North-Western Provinces*: Behli, Sharifa—; *Persian*: Kaj, Sharifah—; *Portuguese*: Ateira, Fructo de Conde—; *Puerto Rico*: Anon, Anona con escamas, Atis—; *Punjabi*: Sharifa—; *Sanskrit*: Agrimakhya, Atripya, Bahubijaka, Gandagatra, Krishnabija, Sitaphala, Subha, Suda, Vaidehivallabha—; *Sakalave*: Konkony—; *Santal*: Mandargom—; *Sind*: Sharifa—; *Sinhalese*: Anoda, Atta—; *Sumatra*: Sirikayu—; *Tagalog*: Ates—; *Tamil*: Atta, Sitapalam—; *Telugu*: Gandagatramu, Sitapandu, Sitaphalamu—; *Timne*: Momina—; *Tulu*: Amritakay—; *Twi*: Apre, Bororfo nyankonga—; *Uriya*: Ato, Sitapholo—.

2. **Anona reticulata** Linn. is a native of the West Indies, now cultivated in India.

The bark is a powerful astringent, and is used as a tonic by the Malays. In China it is used in the treatment of inflammation of the eye.

In Brazil the leaves are used as a maturant.

In the West Indies and in Central and South America the green fruit is much used as an antidysenteric and an anthelmintic.

A. de Santos has isolated from the bark of the trunk an alkaloid which he has named *anonaine*.

Antilles: Cachimen, Coeur de boeuf, Corossol réticulé, Mamilier—; *Bengal*: Luvuni, Nona—; *Bombay*: Ramphal—; *Burma*: Awza—; *Canarese*: Ramaphala, Ramphal—; *Ceylon*: Anona—; *Chinese*: Meng Pa—; *Cuba*: Anona, Mamon—; *Deccan*: Ramphal—; *English*: Bullock's Heart, Custard Apple, Netted Custard Apple—; *French*: Anone en réseau, Cherimolier, Mamilier—; *Goa*: Anona—; *Guam*: Anonas—; *Gujerati*: Ramphal—; *Haiti*: Guanabano—; *Hindi*: Anta, Luvuni, Nagnewa, Nona, Ramphal—; *Hova*: Voankobohobo—; *Konkani*: Anon—; *La Reunion*: Anone, Coeur de boeuf—; *Malay*: Manua, Nona, Nona Kapri—; *Malayalam*: Manilanilam, Parankichchakka, Ramachchita—; *Marathi*: Ramphal—; *Mexico*: Anona, Ilama—; *Mundari*: Nagneva—; *Philippines*: Anonas—; *Portuguese*: Anona—; *Puerto Rico*: Anona de redecilla, Corazon—; *Sakalave*: Hobohobo—; *Sanskrit*: Krishnabija, Lavali, Lavani, Mriduphala, Raktatvatch, Ramawhaya, Ramphala, Vasanta—; *Santal*: Gom—; *Seychelles*: Coeur de boeuf—; *Sinhalese*: Anoda—; *Tamil*: Aninuna, Ramachita, Manilayatta—; *Telugu*: Ramaphalamu, Ramasitaphalamu—; *Uriya*: Barhial, Neua, Ramopholo, Ramositapholo—; *Venezuela*: Rinon—.

3. **Anona muricata** Linn. is a native of tropical America, now common in the tropics of the Old World.

In La Reunion the root is considered antispasmodic and parasiticidal; the leaves are given in fevers, and also used in the form of a poultice to produce suppuration; the flower buds and the flowers are considered an excellent remedy for cough; the unripe fruits when dried and powdered are given in chronic dysentery,

and they are used for aphthae in the form of a decoction; the seeds are valued for their astringent and emetic properties.

In Jamaica a decoction of the root is said to be an antidote against fish-poison.

In Southern California and Tropical America the bark is used as a drastic purgative.

In Brazil the leaves are steeped in hot water or ground with oil, and used as a maturant. An infusion of the leaves is used as a remedy for dysentery in Porto Rico. In general the leaves are regarded as a useful remedy for fever and dysentery. In Guinea they are pounded and applied fresh to cicatrice wounds. In Gambia they are used to get rid of bed bugs.

The seeds are emetic and astringent. In Southern California and Tropical America they are said to be poisonous and they are used as a parasiticide and an insecticide; they are used to poison fish.

Akim: Abrorfontunkum—; *Antillas*: Anona de puntitas—; *Antilles*: Anone en bouclier, Cachiman épineuse, Corossol montagne, Grand corossol, Sapadille—; *California*: Guanabana, Sour-sop—; *Canarese*: Mulluramphala—; *Cartagena*: Anona de broquel, Catuche, Guanabana—; *English*: Sour sop—; *Ewe*: Vo, Voti, Votsi—; *Fanti*: Apre—; *French*: Corrossolier—; *Fula*: Dukumeporto—; *Ga*: Aluguntungung, Nkrangmrobe—; *Guam*: Laguaná—; *Indo-China*: Mak khieb thet, Mang cau xiem, Tiep parang—; *Krepi*: Yevunyaklè—; *Krobo*: Alukutum—; *La Reunion*: Corossol—; *Malayalam*: Mullanjakka, Vilattinuna—; *Mexico*: Anona, Anona amarilla, Cabeza de negro, Catuche, Guanabano—; *Peru*: Guanabano—; *Philippines*: Goyabrano, Guanabano—; *Sakalave*: Kaoraosaly—; *Sinhalese*: Katuanoda—; *Tamil*: Mulluchitta, Pulippala—; *Tschaudjo*: Alola—; *Twi*: Aduatungnkungm, Apre, Deboo, Nkrangmrobe—.

ARTABOTRYS.

This genus consists of 30 species distributed over the tropics of the Old World.

A. odoratissimus R. Br. is used medicinally in Indo-China, the Philippine Islands, the Malay Archipelago; *A. suaveolens* Bl. in Java.

1. Limb of petals broad, lanceolate or elliptic-oblong ... 1. *A. odoratissimus.*
2. Limb of outer or all the petals linear, narrow-oblong, or subclavate ... ... 2. *A. suaveolens.*

1. **Artabotrys odoratissimus** R. Br. is largely cultivated in India, Ceylon, Java and China.

A decoction of the leaves is given for cholera in some of the islands of the Malay Archipelago.

Bombay: Vilayatichampa—; *Canarese*: Kandalisampage, Manoranjanballi—; *Deccan*: Madanmast, Madmanti—; *Hindi*: Champa—; *Indo-China*: Day cong chua—; *Malayalam*: Madanakameswari, Manoranjitam—; *Philippines*: Ilang-ilang de China—; *Sanskrit*: Harachampaka, Nilachampaka, Phalasampenga—; *Southern California*: Climbing Vine, Climbing Ylang-ylang—; *Tagalog*: Alagalag sonson, Alangilang sonson—; *Tamil*: Manoranjidam—; *Telugu*: Manoranjidamu, Muddasampenga, Phalasampanga, Sakalaphalasampanga—; *Uriya*: Kalomuro, Monasocompa—.

2. **Artabotrys suaveolens** Bl. is found in Sylhet, Chittagong, Mergui, the Malay Peninsula and the Malay Islands.

The Malays use the leaves to prepare an aromatic infusion whose good effects have been extolled in the treatment of cholera.

Malay: Akar chenana, Durie carban—.

Canangium.

This genus consists of 3 species inhabiting tropical Eastern Asia and extending through Burma to New Guinea and the Philippine Islands.

1. Leaves glabrous. Flowers over 2 in. long ... *C. odoratum.*
2. Leaves ovate to orbicular, woolly beneath, deciduous. Flowers large ... ... *C. latifolium.*

1. **Canangium odoratum** Baill. is cultivated throughout India. From Ava and Tenasserim it extends to Java.

The flowers yield the 'ilang-ilang' of perfumes. 'Cananga Oil' consists of the early portions of the distillate.

The oil is used as an application in cephalalgia, ophthalmia, and gout.

Burma: Kadapnyan, Kadatnyan—; *Canarese*: Apurvachampaka—; *English*: Ylang-ylang—; *French*: Bois de Bananen, Bois de lance bâtard, Caneng aromatique—; *Guam*: Alangilang—; *Ilocano*: Alangilang, Ilangilang—; *Jolo*: Angilang—; *Malay*: Cananga, Ilangilang, Kenanga—; *Rarotonga*: Moto-oi—; *Samoa*: Moso'oi—; *Sinhalese*: Wanasapu—; *Tagalog*: Alangilang, Ilangilang—; *Tamil*: Karumugai, Maladi, Maramanoranjidam, Sadi, Sirusambagam—; *Telugu*: Apurvachampakamu—; *Visayan*: Alangilang, Ilangilang—.

2. **Canangium latifolium** Pierre is distributed over Burma, the Malay Peninsula, and Cambodia.

In Indo-China the wood is considered a febrifuge.

Indo-China: Su tay, Tai nghe, Tom xui—.

Desmos.

This genus numbers 20 species inhabiting tropical Asia.

Flower opposite leaf. Leaves glabrous.
1. Pedicel 4 to 6 in. long; leaves hardly glaucous beneath ... ... *D. cochinchinensis.*
2. Pedicel 1 to 2 in. long; leaves quite glaucous beneath *D. chinensis.*

1. **Desmos cochinchinensis** Lour. is found in Assam, the Malay Peninsula, and Cochin-China.

The Malays use a decoction of the roots for fever.

Malay: Akar sugi-sugi, Larak salai—.

2. **Desmos chinensis** Lour. occurs in East Himalaya, Burma, the Malay Peninsula and Islands, and Cochin-China.

The Malays use a decoction of the plant for dysentery.

Malay: Akar darah, Akar mariam, Akar singa, Kenanga hutan, Poko sikenchong—,

Goniothalamus.

The genus includes about 50 species distributed over tropical Asia.

Goniothalamus macrophyllus Hook. fil. is common in woods all over the Malay Peninsula whence it extends to Sumatra and Java.

The wood is aromatic. The plant is used medicinally by the Malays.

Malay: Bongsoi, Penawar hitam—.

MELODORUM.

The genus consists of about 40 species found in tropical Asia, Africa, and Australia.

Melodorum Kingii Boerl. is found in the forests of Malacca and Perak.

A decoction of the flowers is used by the Malays for dyspepsia.

Malay: Poko achar—.

OROPHEA.

This genus consists of 30 Indo-Malayan species.

Inner petals vaulted.
Stamens 12; stem hairy; carpels globose ... ... 1. *O. setosa.*
Stamens 6; stem hairy; carpels globose ... ... 2. *O. hirsuta.*

1. **Orophea setosa** King is found in the woods of Perak and Negri Sembilan from 500 or 1,200 ft. altitude.

A decoction of the roots is used by the Malays in malaria.

Malay: Pialu—.

2. **Orophea hirsuta** King inhabits Perak, where it is however rare.

The Malays chew the plant with betel-nut in cases of cough.

Malay: Supucha pelandok—.

POLYALTHIA.

The genus includes 70 palaeotropical species; mostly in tropical Asia, a few in Africa and Australasia.

P. Oliveri Engl. is used medicinally in Sierra Leone, Liberia, and parts of Cameroon.

1. Leaves narrow, lanceolate, undulate ... ... 1. *P. longifolia.*
2. Leaves oblong ... ... 2. *P. simiarum.*

1. **Polyalthia longifolia** Benth. and Hook. fil. is cultivated throughout the hotter parts of India.

The bark is used as a febrifuge in the Balasore District of Orissa.

Bengal: Debdaru, Devadar, Devadaru—; *Bombay*: Asok, Asoka, Asopalav, Asupal, Asupala, Devadaru—; *Canarese*: Putrajivi—; *Ceylon*: Maraillupai—; *English*: Indian Fir, Mast Tree—; *Gujerati*: Ashopalo—; *Hindi*: Asok, Debdari, Deodar, Devadar, Devadaru, Devidari—; *Konkani*: Assok, Devandaru—; *Madras*: Nettilingam—; *Malayalam*: Aranei, Aruna, Ashokam, Ashvattam, Chorani, Hemapushpam, Vanjolam—; *Sanskrit*: Devadaru, Putrajiva—; *Tamil*: Asogam, Asuvattai, Kalgoli, Kasubam, Kolikkudi, Nettilingu, Pundi, Ravadam, Saribam, Selai, Sendu, Tevadaram, Vansulam—; *Telugu*: Asokamu, Asvattamu, Devadaru—; *Tulu*: Asoka—; *Uriya*: Debodaru, Asoka, Oswottho, Putikashto—.

2. **Polyalthia simiarum** Benth. and Hook. fil. is found in Orissa, Pegu Yoma, Martaban and Tenasserim.

The bark is used in Orissa as a cure for scorpion sting.

Bhuia: Champa—; *Modesia*: Khari—; *Nepal*: Khutti, Labshi—; *Orissa*: Mongai, Ojarh, Mojarh—; *Santali*: Dighibentia—.

Sageraea.

The genus consists of 6 Indo-Malayan species.

Sageraea laurifolia Blatter occurs in South Konkan.

The leaves have a pungent, astringent, and bitter taste. In the Konkan they are used for fomentation.

Bombay: Andi—; *Canarese*: Sagare—; *Konkani*: Sagerce—; *Marathi*: Harkinjal, Sageri, Undie—.

Uvaria.

The genus numbers 100 species distributed over the Tropics of the Old World.

V. Chamae P. Beauv. is used medicinally in Gold Coast, Sierra Leone, Togo, Lagos, and Senegal; *V. Afzelii* Scott Elliot in Liberia; *V. calamistrata* Hance in Indo-China.

1. Stamens all cuneate ... ... 1. *U. Narum.*
2. Outer stamens flat ... ... 2. *U. dulcis.*

1. **Uvaria Narum** Bl. occurs in the Bombay Presidency—Konkan and North Kanara—, and the Madras Presidency—forests of the Western Ghats from South Kanara to Travancore, and hills of Salem up to 4,000 feet.

The oil obtained from the roots by distillation, as well as the root, are used medicinally in various diseases. The root is fragrant and aromatic, and the bruised leaves smell like cinnamon.

Canarese: Kariballi, Unamini—; *Malayalam*: Narampanal—; *Matheran*: Narampanal—; *Tamil*: Pulichan—; *Tulu*: Pandel—.

2. **Uvaria dulcis** Dunal occurs in Burma, the Malay Peninsula, Java and the Philippines.

The bark of the root has astringent, stimulant, and alterative properties.

Malay: Pisang-pisang hitam—; *Visayan*: Dalaganum, Dalagao—.

IV

The Menispermaceae are scandent or twining shrubs, found chiefly in the tropics of the Old and New World. They number 65 genera and 360 species. Many of them figure among the poisonous plants used in making arrow and dart poisons.

The medicinal and poisonous Menispermads of the world belong to 21 genera:—Abuta (tropical South America); Anamirta (Indo-Malaya); Anomospermum (Brazil, Guiana); Burasaia (Madagascar); Cissampelos (tropical and subtropical regions); Cocculus (tropical and subtropical regions); Coscinium (Indo-Malaya); Cyclea

(tropical Asia); FIBRAUREA (tropical and subtropical Asia); JATRORRHIZA (tropical Africa); MENISPERMUM (eastern Asia, Atlantic North America); PACHYGONE (eastern Indo-Malaya); PENIANTHUS (western tropical Africa); PERICAMPYLUS (eastern Indo-Malaya); SPHENOCENTRUM (western tropical Africa); SPIROSPERMUM (Madagascar); STEPHANIA (palaeotropics); STRYCHNOPSIS (Madagascar); TILIACORA (Indo-Malaya); TINOMISCIUM (tropical Asia); TINOSPORA (Palaeotropics).

The following are among the products isolated:—(1) *alkaloids*—bebeerine, isobebeerine, beta-bebeerine, berberine, buxine, chondrodine, curarine, menispermine, para-menispermine, pelosine, sangoline, tiliacorine—; (2) *quaternary bases* (none of which has been obtained in a free state)—columbamin, jatrorrhizin, palmatin—; (3) *crystalline bitter principles*—anamyrtin, columbin, picrotoxin, picrotoxinin, trilobin—; (4) *acids*—columbic, picrotoxic—.

The medicinal and poisonous Menispermads of India belong to 12 genera:—ANAMIRTA, CISSAMPELOS, COCCULUS, COSCINIUM, FIBRAUREA, JATRORRHIZA, PACHYGONE, PERICAMPYLUS, STEPHANIA, TILIACORA, TINOMISCIUM, TINOSPORA.

A. Flowers trimerous. Ovaries usually 3. Drupes with a subterminal, rarely ventral or basal style-scar. Seeds oblong or subglobose
1. Sepals 6. Stamens 6 or 3, often connate ... JATRORRHIZA.
2. Sepals 6. Petals 6. Filaments free ... TINOSPORA.
3. Sepals 9. Petals 6. Filaments free ... TINOMISCIUM.
4. Sepals 6. Petals 0. Filaments free ... FIBRAUREA.
5. Sepals 6. Filaments all connate ... ANAMIRTA.
6. Sepals 9. Outer filaments free ... COSCINIUM.

B. Flowers trimerous. Ovaries usually 3. Drupe with a subbasal, rarely subterminal style-scar. Seed horseshoe-shaped. Albumen copious. Embryo slender, cotyledons linear or slightly dilated
1. Petals 6, minute. Ovaries 3-12. Style subulate ... TILIACORA.
2. Petals 6. Ovaries 3-6. Styles subulate ... COCCULUS.
3. Petals 6. Ovaries 3. Styles forked ... PERICAMPYLUS.

C. Flowers 3-5-merous. Ovaries usually solitary. Drupe with a subbasal style-scar; endocarp dorsally muricate or echinate. Seeds horseshoe-shaped. Embryo linear; cotyledons appressed
1. Sepals 6-10, free. Petals of male flower and female 3-5, free ... ... STEPHANIA.
2. Sepals 4, free. Petals of male 4, connate, of female 1 CISSAMPELOS.

D. Flowers usually trimerous. Ovaries usually 3. Drupes with a subbasal or ventral style-scar. Seed curved, hooked or inflexed.
Sepals, petals and stamens 6 each ... ... PACHYGONE.

ANAMIRTA.

The only Indian species of this genus, **A. paniculata** Colebr. is found in the Khasia Hills, Assam, Eastern Bengal, from Orissa and the Bombay Konkan to Ceylon; it extends through the Malay Archipelago to New Guinea.

According to Yunani authors the berry is slightly bitter, expectorant, demulcent, and carminative; useful in the treatment of rheumatism; poisonous to fish.

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The bark is used in Orissa as a cure for scorpion sting.

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3. Petals 6. Ovaries 3. Styles forked ... PERICAMPYLUS.

C. Flowers 3-5-merous. Ovaries usually solitary. Drupe with a subbasal style-scar; endocarp dorsally muricate or echinate. Seeds horseshoe-shaped. Embryo linear; cotyledons appressed
1. Sepals 6-10, free. Petals of male flower and female 3-5, free ... STEPHANIA.
2. Sepals 4, free. Petals of male 4, connate, of female 1 CISSAMPELOS.

D. Flowers usually trimerous. Ovaries usually 3. Drupes with a subbasal or ventral style-scar. Seed curved, hooked or inflexed.
Sepals, petals and stamens 6 each ... PACHYGONE.

ANAMIRTA.

The only Indian species of this genus, **A. paniculata** Colebr. is found in the Khasia Hills, Assam, Eastern Bengal, from Orissa and the Bombay Konkan to Ceylon; it extends through the Malay Archipelago to New Guinea.

According to Yunani authors the berry is slightly bitter, expectorant, demulcent, and carminative; useful in the treatment of rheumatism; poisonous to fish.

The bitter berries are sometimes used in the form of an ointment. This ointment is employed as an insecticide to destroy pediculi, and in some obstinate forms of chronic skin diseases. Koman prepared an ointment containing 80 grains of finely powdered seeds to one ounce of vaseline, and used it as an external application in ringworm; cases of one to two months' duration were cured by a few days application, but chronic cases did not derive benefit.

The fresh leaves are used in Bengal as a snuff in the treatment of quotidian ague.

In Ceylon the bruised fresh bark is applied to the bitten part in cases of snake-bite. But Mhaskar and Caius have found that the bark, leaves, and berries are equally useless as an external application in the treatment of snake-bite.

The seeds are used in the nightsweats of phthisis.

The jungle tribes of the Malay Peninsula use the plant to poison their arrows and their kriss.

Both its poisonous properties and any therapeutic virtues the plant may contain depend upon picrotoxin of which the fruit is the source. The plant also contains two minor alkaloids of unknown constitution, menispermine and paramenispermine, both physiologically inactive.

Arabic: Mahijehreh—; *Bengal*: Kakamari—; *Bombay*: Kakaphala, Kakphal, Vatoli—; *Burma*: Hong—; *Calcutta*: Bacaenkaphal—; *Canarese*: Kakamari, Kakkiseppugade—; *Deccan*: Kakmari—; *Dutch*: Indiaansche rezies, Koklus—; *English*: Crow Killer, Fish Berry, Fish Killer, Indian Berry, Indian Cockles, Louse Berry, Oriental Berries, Poison Berry—; *French*: Arbre à enivrer, Bois à enivrer, Bois enivrant, Bois ivrant, Coque du Levant, Coque Levant, Herbe à tous maux, Pareire à feuilles rondes—; *German*: Fischkoerner baum, Kokkelskoernerbaum, Tollkoernerbaum—; *Gujerati*: Jermae, Kakaphula, Kakmari—; *Hindi*: Jermae, Kakmari—; *Indo-China*: Ben nau, Day tao, Seg Dom—; *Italian*: Coccole d'India—; *Konkan*: Garudphul, Kadul—; *Malay*: Dawonnboelann, Tubabidji—; *Malayalam*: Anakrytu, Garalaphala, Garaphala, Kantakakonnuveli, Kantakakunavam, Karantakam, Miunannu, Machattinkaya, Nanninkuru, Pola, Pullukunavam—; *Oceania*: Lacton, Lagton, Libtang, Soma, Suma, Tubaflava—; *Pampangan*: Balasin, Bayati, Lactang, Lanta, Lictang, Lingtangbaguin, Suma, Tuba—; *Persian*: Mahijehreh—; *Philippines*: Abutra, Pangmavan—; *Portuguese*: Coca de Levante, Fruta matapeixe—; *Sanskrit*: Garalaphala, Kakahva, Kakamari, Kakanashika—; *Sinhalese*: Pangan, Tittawel—; *Spanish*: Coca de Levante, Coca levantina—; *Tagalog*: Balasin, Bayati, Lactang, Lanta, Lictang, Lingtangbaguin, Suma, Tuba—; *Telugu*: Kakamari, Kakichempoo, Koditige, Tippatige—; *Tulu*: Chipulu—; *Urdu*: Mahijehreh—; *Uriya*: Kalabiti Nai, Kaumari—; *Visayan*: Balasin, Bayati, Lactang, Lagtal, Lanta, Lictang, Lintangbaguin, Suma, Tuba—.

Cissampelos.

This genus includes 21 species inhabiting the warm regions of the world.

The following are used medicinally in the Philippine Islands and Indo-China—*C. Pareira* Linn.—; in the Antilles and Guiana—*C. Pareira* Linn.—; in South America—*C. caapeba* Linn., *C. Pareira* Linn.—; in Brazil—*C. glaberrima* St. Hil., *C. ovalifolia* DC.—; in the Gold Coast and in Nigeria—*C. mucronata* A. Rich., *C. owariensis* P. Beauv.—; in Southern Africa—*C. angustifolia* Bucch., *C. capensis* Thunb., *C. mucronata* A. Rich., *C. Pareira* Linn., *C. torulosa* E. Mey.—; in Mauritius—*C. mauritiana* Pet. Th.—.

Cissampelos Pareira Linn. occurs throughout tropical and sub-tropical India; and throughout the warm parts of Asia, East Africa, and America.

The root is the part most esteemed; it has an agreeable, bitterish taste, and is considered a valuable stomachic. It is frequently prescribed in the later stages of bowel complaints, in conjunction with aromatics. It is given for pains in the stomach and for dyspepsia, diarrhoea, dropsy and cough; also for prolapsus uteri. It is applied externally in snake-bite and scorpion-sting.

Among the Mundas of Chota Nagpur the root, ground and mixed with water, is used against stomach-ache and diarrhoea, especially against infantile diorrhoea.

In Hausaland the bitter root is sold as a medicine for many purposes.

The Chuanas, Subias, and Kobas of South Africa drink an infusion of the powdered root for stomach-ache. The Filabusi natives and the Xosas drink a similar preparation for snake-bite. The Pedis use a decoction of the root as a wash for children who have pimples over their body.

In Madagascar the root is considered diuretic, emmenagogue, and antipyretic; it is given for urinary gravel.

In La Reunion the bitter root is considered tonic, stomachic, and diuretic; and it is used in the treatment of bladder troubles.

In French Guiana the roots are used as a diuretic in cases of dysuria and calcular nephritis. An infusion is expectorant and is considered a potent alexiteric.

The root acts as an antiseptic of the bladder and is used in chronic inflammation of the urinary passages. In Yoruba it is used as an anti-emmenagogue.

The leaves are said to have a peculiarly cooling quality, and they are used locally in cases of unhealthy sores and sinuses. In the Gold Coast they are applied to abscesses. The Xosas apply a paste of the leaf to wounds.

The root in combination with other drugs is an Ayurveda cure for snake-bite and scorpion-sting. Mhaskar and Caius have, however, demonstrated that the root is not an antidote to snake venom and that it is useless as an external application in the treatment of scorpion-sting.

The root contains the alkaloid bebeerine. It is official in Portugal.

Annam: Moi tron, Tiet re—; *Antsianaka*: Voaravinaviavy—; *Ashanti*: Akuraso—; *Batangas*: Calancalamayan—; *Bengal*: Akanadi, Nemuka, Nimuka, Tejomalla—; *Betsileo*: Vahemboatavo—; *Betsimisaraka*: Vahifotsy—; *Bombay*: Pahadmul, Pahadvel, Venivel—; *Canarese*: Padavali—; *Cebu*: Batangbatang—; *Chuana*: Mokaekae—; *Dehra Dun*: Parhe, Purhe—; *East Africa*: Kinukadjio —; *English*: False Pareira brava, Ice Vine, Velvet-leaf—; *Filabusi*: M'cessie —; *French*: Faux pareira brava, Liane à glacer l'eau, Liane à serpents—; *French Guiana*: Pareira brava, Paria brava—; *Garhwal*: Pahari, Parhe—; *Goa*: Parayel—; *Gujerati*: Venivel—; *Hausa*: Fiyaka, Jibdakassa, Judarkas, Piyaka—; *Hindi*: Akanadi, Dakhnirbissi, Harjeuri, Harjori, Pari—; *Hova*: Vahivory, Voriravina—; *Ilocano*: Cuscusipa—; *Java*: Areujtjantjuan—; *Koba*: Mokaekae—; *Kolami*: Pitu-singh, Ranu-sed—; *La Reunion*: Liane blanche, Pareira brava—; *Lepcha*: Tamshaprip—; *Madagascar*: Ravinbury, Vahenosy—; *Malaya*: Akar mumpanang, Gasinggasing, Gegasing—; *Malayalam*: Kattuvalli, Patuvalli—; *Marathi*: Padavali, Padavel, Pahadvel, Paharmul, Paharvel—;

Mexico: Oreja de raton—; *Mundari*: Cutulutur, Dirikakaru, Haruarajaite, Huringpitusing—; *Nepal*: Batulpoti—; *North Western Provinces*: Dakhnirbisi, Duknirbissi—; *Oudh*: Harjewri—; *Pedi*: Lepeta—; *Philippines*: Calaad, Chanchae, Sansao—; *Porebunder*: Kardhiyunbang—; *Porto Rico*: Bejuca de mono—; *Portuguese*: Abutua, Pareira brava—; *Punjab*: Bat, Batindupath, Bel, Katori, Parbik, Pataki, Tikri, Zakhmihaiyat, Zucumyeat—; *Sakalave*: Hamafana—; *Sanskrit*: Ambashtha, Ambashthika, Avidhakarni, Brihattikta, Chchinnaveshika, Devi, Ekashthila, Kuchela, Kucheli, Laghupatha, Mahanjasi, Malati, Malavi, Papacheli, Papehelika, Patha, Patika, Prachina, Prachinambastika, Pratanini, Rasa, Ruchishya, Shishira, Shreyasi, Sthapini, Sushhira, Tiktapushpa, Trishira, Trivrita, Uthika, Vallika, Vara, Varatikta, Vatsadini, Venivalli, Vidhakarni, Vridhakarnika, Vriki, Vrittaparni—; *Santal*: Tejomalla—; *Saora*: Paterutivu—; *Sind*: Belpath, Katori—; *Sinhalese*: Deyamitta, Diyamitta, Weniwela—; *Spanish*: Butua, Pareira brava—; *Subia*: Mokaekae—; *Tagalog*: Chinchaochinchauan, Gulangulamanan, Sansaosansansaosan, Yemoumohan—; *Tamil*: Appatta, Puimushti, Punaittitta, Punmushti, Puttutiruppi, Sina, Titta, Tuvan, Tuvigaba, Vattattiruppi—; *Telugu*: Adivibankatige, Pata, Visaboddi—; *Tharu*: Batulpati—; *Twi*: Aportororkungma—; *Uriya*: Okanobindhi—; *Uruguay*: Butua, Pareira brava—; *Visayan*: Hampapari, Himpapara, Pari, Sampapari—; *Yoruba*: Je-in-joko, Jo-ko-je—.

Cocculus.

This genus consists of 11 species found in all warm countries. *C. laurifolius* DC. and *C. trilobus* DC. are used medicinally in Indo-China and Malaya, *C. Thunbergii* DC. in Japan, and *C. pendulus* Diels in the Sudan and in Senegal.

I. Scandent shrubs.
1. Leaves suborbicular, glabrous; panicles large ... 4. *C. macrocarpus.*
2. Leaves deltoid or hastate, villous; panicles short ... 1. *C. hirsutus.*
3. Leaves oblong or trapezoidal, at length glabrous. Male flowers fascicled, female solitary ... 2. *C. pendulus.*

II. A shrub or small tree ... ... 3. *C. laurifolius.*

1. **Cocculus hirsutus** Diels occurs in tropical and subtropical India from the foot of the Himalayas to South India and Ceylon and Pegu; it extends to Southern China, Arabia, and tropical Africa.

The root is generally used as a refrigerant, and also as a gentle laxative. It has been extensively used as an alterative in chronic rheumatic and venereal diseases.

A decoction of the fresh roots, with a few heads of pepper, in goat's milk, is administered for rheumatic and old venereal pains; half a pint every morning is the dose. It is reckoned heating, laxative, and sudorific.

In the Konkan, the roots, rubbed with Bonduc nuts, are administered as a cure for belly-ache in children. In bilious dyspepsia, they are given in 6 *massa* doses, with ginger and sugar.

In Sind, the root and leaves are used in headache and neuralgic pains.

The juice of the leaves, mixed with water, has the property of coagulating into a green jelly-like substance, which is taken internally, sweetened with sugar, as cure for gonorrhoea.

In Baluchistan the mucilage is used to cure spermatorrhoea, taken in milk; it is used for coughs and to put on to sore eyelids and to soften breasts

Arabic: Haddal, Herrije, Luah, Schirwai—; *Baluchistan*: Afaband, Zamur—; *Bengal*: Huyer—; *Bombay*: Parvel, Vasanvel—; *Canarese*: Dagadiballi, Dusariballi, Sugadiballi, Yadaniballi—; *English*: Broom Creeper, Ink Berry—;

Gujerati: Vevati, Vevdi—; *Hansot*: Vachhana—; *Hindi*: Chireta, Dier, Faridburti, Hier, Jalayamani, Jamtikibel—; *Jaisalmer*: Bajarbel—; *Konkan*: Vanatiktika—; *Marathi*: Hunder, Parvel, Tana, Vasanavela, Vasanel, Vasanvel —; *Matheran*: Tan, Vasanyel—; *Nimar*: Bochan—; *North-Western Provinces*: Patha—; *Oudh*: Karsane—; *Persian*: Faridbutti—; *Porebunder*: Vadhinovelo—; *Sanskrit*: Patalagarudi, Chchilihinda, Dirghakanda, Dirghavalli, Dridhakanda, Dridhalata, Garudi, Mahahala, Mahamula, Mochakabhida, Sauparni, Somavalli, Tiktanga, Vanatiktika, Vasandi, Vasantitikta, Vatsadani—; *Sind*: Kursan, Zamir—; *Tamil*: Kattukodi—; *Telugu*: Chipurutige, Dusaritige, Katlatige—; *Urdu*: Faridbutti—; *Uriya*: Musakani—.

2. **Cocculus pendulus** Diels occurs in Sind, Baluchistan, Waziristan, the Punjab Plains to the Northern Circars, Kathiawar, Deccan, Carnatic to Tinnevelly. It extends through Afghanistan and Arabia to tropical and subtropical Africa.

The root is used in Sind and Afghanistan in the treatment of intermittent fevers and as a substitute for *Anamirta paniculata*. It is used by the natives in Senegal and in the French Sudan for the cure of periodic fevers.

The flowers are added to food, and an infusion of the plant is used in Senegal to assist in removing thorns from the feet.

The Arabs make an intoxicating drink from the fruits.

Heckel and Schlagdenhauffen have found in the root about 2 per cent. of pelosine, and about 3 per cent of a new crystalline alkaloid 'sangoline'. The root also contains columbin.

Arabic: Ssag-el-ghorab, Turrach—; *Baluchi*: Zamor—; *Brahui*: Zamor—; *Egypt*: Lebakh-el-gebel—; *Falor*: Tiati—; *Gujerat*: Parwatti—; *Jaisalmer*: Pilwan—; *Jodhpur*: Pilwan—; *Punjab*: Illarbillar, Parwatti, Vallur, Vehri—; *Sind*: Ullarbillar—; *Senegal*: Sangol—; *Songhai*: Liligui—; *Telugu*: Dusaratige—; *Tukulor*: Safatou—; *Waziri*: Jadhai, Parwatiae—; *Wolog*: Mboum sehet, Mboum tiéré—.

3. **Cocculus laurifolius** DC. occurs in subtropical Himalaya from Nepal to Jammu up to 5,000 feet, in the Western Ghats of the Madras Presidency, Eastern Bengal, and Burma. It is distributed to South Cochin-China, South China, Java, Formosa, and Japan.

The jungle tribes of the Malay Peninsula use the plant to poison their arrows and darts.

China: Wu Yao—; *Dehra Dun*: Tildhara, Tilphara—; *Garhwal*: Tildhara—; *Japan*: Kansirowujak, Vjaku, Wujak—; *North-Western Provinces*: Tilphara—.

4. **Cocculus macrocarpus** W. and A. is found in the Konkan, North Kanara, the South Mahratta Country, and China.

The powdered leaves are taken in milk as a cure for biliousness, gonorrhoea, and syphilis.

Matheran: Vatoli, Wat-yel, Watan-yel—; *Tamil*: Kottaiyachachi—.

COSCINIUM.

The genus consists of 6 Indo-Malayan species.

Coscinium fenestratum Colebr. occurs in South India and Ceylon, extending to Sumatra.

The root is extensively used in Ceylon as an efficient bitter tonic, and is viewed as a very good substitute for Columba. It

has also antiseptic properties to a great extent, and can be used for dressing wounds and ulcers.

The wood is valued as a bitter tonic by the Sinhalese. It is also much used as a cure for tetanus.

A decoction of the stem is given internally in cases of bites from monkeys, snakes, brahmin-lizards and geckos. Mhaskar and Caius have found experimentally that the stem is not an antidote to snake venom, whether colubrine or viperine.

The decoction of the bark was administered in doses of one to two ounces three times a day to several patients suffering from malarial fever, but no beneficial effects were noticed (Koman).

The plant is used by the Sakais in the preparation of their dart poisons.

Tummin Katti and Shintre (1930) have analysed the alcoholic extract of the stems and they have reported *inter alia* a considerable amount of a mixture of alkaloids.

Bengal: Haldigach—; *Canarese*: Doddamaradarasina, Maradarashina, Maramanjali—; *Deccan*: Jhadihaladi, Jharkihaldi—; *English*: Calumba Wood, Ceylon Calumba Root, Columbo Wood, False Columbo, Tree Turmeric—; *Malay*: Akar kunyit, Kunyit babi—; *Malayalam*: Haridram, Maramannal—; *Marathi*: Venivel—; *Sakai*: Tol—; *Sanskrit*: Daruharidra, Darvi, Pitadru—; *Sinhalese*: Bangwellgetta, Venivel, Woniwol—; *Tamil*: Atturam, Imalam, Kadari, Manjalkodi, Maramanjal, Pasamantram, Sanniyam, Seyebasam, Tiyaram, Udaravi, Ududadi—; *Telugu*: Manupasupu—; *Tulu*: Maramanjali—.

Fibraurea.

The genus consists of 4 species found in tropical and subtropical Asia.

Fibraurea chloroleuca Miers is very common in hedges and woods from Singapore to Penang. It extends to Tavoy and to the Malay Islands and Celebes.

The plant is used medicinally in Cochin-China and in the Malay Peninsula.

The root is used as a diuretic. The bitter stem is considered a valuable tonic, and is given in intermittent fevers and hepatic troubles.

Indo-China: Day vang giang—; *Malay*: Akar kinching kerbau, Akar kuning—.

Jatrorrhiza.

The genus consists of 2 species, natives of tropical Africa.

J. strigosa Miers is used medicinally by the Bakwiri and others in Cameroon.

Jatrorrhiza palmata Miers is cultivated in some parts of India.

The root is much used in Zambezi, Mozambique, Madagascar, and Indo-China as a bitter tonic and stomachic. By the natives of Mozambique it is used in dysentery and various other diseases.

It is a mild bitter free from astringency. It is useful in functional atonic conditions of the digestive organs, especially with other tonics, aromatics, or cathartics.

The root contains three physiologically active bases: columbamin, jateorhizin, and palmatin.

J. palmata Miers. is official in all pharmacopoeias. The difference in botanical origin is merely one of synonymy; and there is considerable confusion in the spelling of both the generic and specific names.

Austria: Kalumba—; *Belgium*: Colombo—; *Bombay*: Colombo—; *Brazil*: Calumba—; *Denmark*: Kolumbo—; *England*: Calumba, Colombo—; *Finland*: Kolumbo—; *France*: Colombo—; *Germany*: Kolombo—; *Holland*: Calumba—; *Hungary*: Calumba—; *Indo-China*: Phong Ky—; *Italy*: Colombo—; *Japan*: Calumba—; *Mexico*: Columbo—; *Norway*: Kolumbo—; *Portugal*: Calumba—; *Russia*: Kolombo—; *Spain*: Colombo—; *Sweden*: Kalumba—; *Switzerland*: Colombo—; *Tamil*: Kolumbu—; *Telugu*: Kalamba—; *Turkey*: Guvercin, Kalumba—; *United States*: Calumb, Calumba, Columbo—; *Uriya*: Kolombo—.

Pachygone.

This genus consists of 11 Indo-Malayan species.

Pachygone ovata Miers inhabits South India and Ceylon. The dried fruit is used to destroy vermin and to stupefy fish.

Burma: Ngupyu—; *Ceylon*: Kadukkodi—; *Tamil*: Kadukkodi—.

Pericampylus.

This genus consists of 6 Indo-Malayan species.

Pericampylus glaucus Blatter occurs in Sikkim, Khasia, Assam, Pegu, Martaban, Tenasserim, Mergui, Chittagong, the Nicobars, and the Malay Peninsula. It extends to the Malay Archipelago, eastwards to the Moluccas, Cochin-China, Laos, Tongking, South China and Formosa.

The roots have long been held in great repute among snake-charmers in India as an antidote to the bites of poisonous snakes; but Mhaskar and Caius have shown that they are not an antidote to snake venom.

Bengal: Barakkanta—; *Cochin-China*: Day loi tien—; *Java*: Aroygeureung—; *Nepal*: Lahara, Pipalpati—; *Sumatra*: Currung—.

Stephania.

The genus numbers 32 species, found in the Old World, chiefly in tropical Africa, China, and the Malayan Islands.

S. abyssinica Walp. and *S. Dinklagei* Diels are used medicinally in Yorula, Liberia and Sierra Leone.

1. Leaves ovate or subdeltoid, peltate ... ... *S. hernandifolia.*
2. Leaves broadly ovate or suborbicular, at the base rotund ... ... *S. glabra.*

1. **Stephania hernandifolia** Walp. is found on the western and eastern coasts of the Indian Peninsula, in Cachar, Sikkim, Eastern Bengal, Assam, and Penang; it is distributed over Siam and the Malay Archipelago to Australia.

The bitter root enters into the composition of a good many Ayurveda preparations as a substitute for that of *Cissampelos Pareira* Linn.

It is regarded as bitter, astringent, easily digestible and useful in fever, diarrhoea, urinary diseases, dyspepsia, etc.

The extract acts as a strong poison on frogs (Bancroft).

Bengal: Agnadnemuka, Akanadi—; *Burma*: Sha ma say nway—; *China*: Chien Chin T'eng—; *Hindi*: Akanadi—; *Java*: Areujgeureung, Ojotminjak—; *Malayalam*: Patakilannu, Patavalli—; *Mundari*: Marangpitusing—; *Nepal*: Tambarki—; *Sadani*: Gaipari—; *Sanskrit*: Ambashtha, Patha, Vanatiktika—; *Saora*: Duvgyatige—; *Sinhalese*: Lunuketigawel, Lupuketigawel—; *Uriya*: Musakani, Nimukha, Okanobhindi, Sondhimali—; *Zulu*: umTambane—.

2. **Stephania glabra** Roxb. occurs in the Himalaya from Simla to Sikkim, in the Khasia Hills, Assam, and Tenasserim.

Roxburgh states that the acrid root is used medicinally in Sylhet.

In Cochin-China it is used in pulmonary tuberculosis, asthma, dysentery, and fever.

Annam: Cu binh voi, Cu mot, Tu nhien—; *Dehra Dun*: Parah, Purha—; *Garhwal*: Gindaru—; *Nepal*: Brakulilahara, Nimilahara, Tambarki—; *Tongking*: Day moi tron—.

Tiliacora.

The genus includes 15 species, which inhabit India and tropical Africa.

Tiliacora acuminata Miers occurs from Bengal to Orissa and Konkan, Ceylon, Singapore, Java, and Cochin-China.

The root rubbed between stones and mixed with water, is given as a drink for the cure of venomous snake-bites; but, according to Mhaskar and Caius, the root is not an antidote to snake venom.

Bengal: Tiliakora, Tiliakoru—; *Canarese*: Kuri—; *Hindi*: Bagamushada, Karraath, Karwanth, Rangoe—; *Malayalam*: Vallikkanniram—; *Oudh*: Karwanth, Rangoe—; *Telugu*: Kappatige, Nagamushini, Nallatige, Pataveru, Tigemushidi, Vettichitramulamu—; *Uriya*: Ralajati noi, Kolichiti—.

Tinomiscium.

This genus consists of 8 Malayan species.

Tinomiscium petiolare Miers is very common in forests and secondary jungle, along roadsides, etc., from Singapore to Kedah. It is distributed to Tongking, Sumatra, and Borneo.

The Malays use the plant as a drug in rheumatism.

Malay: Akar langkap, Akar lempoyang, Akar lumpang, Akar mumbulu, Akar nasi—.

Tinospora.

The genus numbers 40 species distributed over most of the palaeotropical regions, but chiefly in Indo-Malaya.

The following species are used medicinally in Senegal—*T. bakis* Miers.—; in Indo-China—*T. cordifolia* Miers., *T. crispa* Miers., *T. malabarica* Miers.—; in the Philippine Islands—*T. crispa* Miers.—; in Java—*T. Rumphii* Boerl.—.

I. Endocarp distinctly tuberculate
   1. Leaves pilose on both sides or at least beneath ... 1. *T. malabarica*.
   2. Leaves glabrous ... ... 2. *T. crispa*.

II. Endocarp rotund-ovoid, ribbed on the back, otherwise almost smooth ... ... 3. *T. cordifolia*.

1. **Tinospora malabarica** Miers is found in Bengal, Khasia, Assam, Orissa, Konkan, Kanara, nearly all the districts of the Madras Presidency, and Ceylon.

The plant has tonic properties.

In China and Tongking the fresh leaves and the stem are used in the treatment of chronic rheumatism.

The whole plant is used medicinally in Cambodia. Fumigations are recommended for piles and ulcerated wounds. Medicated baths are prepared in cases of liver complaint.

Almora: Gureh—; *Annam*: Khoan can dang—; *Bengal*: Bara padmagulancha, Padmagaluncha—; *Cambodia*: Kambaur—; *Ceylon*: Bukinda, Walkinda—; *Garhwal*: Gileh—; *Hindi*: Giloe, Gulancha, Gureh—; *Malaya*: Bara sarasati lat—; *Marathi*: Gulvel—; *Rannagar*: Gurja—; *Sinhalese*: Bukinda—; *Tamil*: Potchindil—; *Tongking*: Day dan xuong—; *Uriya*: Guduchi, Gulochi, Podmogulochi—.

2. **Tinospora crispa** Miers occurs in Sylhet, Assam, and Burma. It is cultivated in the Malay Peninsula and Ceylon. It is found throughout the Malay Archipelago.

The whole plant is exceedingly bitter, and is employed by the Malays in the cure of intermittent fevers.

In Indo-China the stem is considered a febrifuge of great importance. As a tonic it is said to give as good results as quinine. There is a widespread opinion that it is an excellent tonic during convalescence from exhausting diseases.

In the Philippine Islands it is considered to be a panacea to be applied to all bodily afflictions. It is given in general debility, in chronic rheumatism, in malarial fevers.

The jungle tribes of the Malay Peninsula use the plant in the preparation of their arrow and dart poisons.

Annam: Day Ki nin, Day than thong—; *Cambodia*: Bandaul pech, Bora phet—; *French*: Liane-quinine—; *Malay*: Toba, Tuba, Tubabidyi—; *Sinhalese*: Tithakinda, Tittakinda—; *Sunda Islands*: Andawali—; *Tagalog*: Macabuhai—; *Tongking*: Thuoc sot ret—; *Visayan*: Paliavan, Panavan, Pangiavan—. The Indian names are the same as for *T. cordifolia*.

3. **Tinospora cordifolia** Miers is found throughout tropical India, Burma, the Andamans, and Ceylon.

The stem is one of the most popular drugs in India, being held in high repute by Ayurveda and Yunani doctors alike.

The stem is a bitter stomachic; stimulates bile secretion; causes constipation; tonic; allays thirst, fever, burning sensation, vomiting; diuretic; enriches the blood; cures jaundice; useful in skin diseases; the juice is useful in diabetes, vaginal and urethral discharges, low fevers, and enlarged spleen (Ayurveda).

Stem bitter; appetiser, stomachic, tonic, antipyretic, expectorant; good in cough, jaundice, giddiness, vomiting, piles, anaemia, chronic fever; renews the blood; mixed with sesame oil it is useful for massaging the body (Yunani).

An infusion of the powdered stem is used as an alterative and tonic, and has enjoyed the reputation among ancient Hindu writers of being an aphrodisiac.

In Ceylon the stem is used in fevers, skin diseases, jaundice, and syphilis. A decoction of the stem is given internally, and the

bruised fresh leaves are applied externally for the bites of flies and the sting of bees.

The starch obtained from the roots and stems of the plant is similar to Arrow-root in appearance and effect. It answers not only as a remedial medicinal agent in chronic diarrhoea and some forms of obstinate chronic dysentery, but it is also a valuable nutrient, when there is intestinal irritability and inability to digest any kind of food. I have myself had experience of the usefulness of this starch. I think that this drug is useful where there is an acid diarrhoea, due to an acidity of the intestinal canal or acid dyspepsia. It is useful in relieving the symptoms of rheumatism. There is another preparation of this plant, the *succus* (juice), freshly prepared from the fresh plant. It acts as a powerful diuretic. It is prescribed by ancient Hindu physicians in gonorrhoea with advantage (Kirtikar).

The Mundas of Chota Nagpur apply the ground plant on fractures.

In certain parts of India the plant is regarded as a specific for the bites of poisonous insects and venomous snakes. The juice and decoction of the root are applied to the part bitten, poured frequently into the eyes and administered internally by mouth at intervals of half an hour.

The majority of Sanskrit authors prescribe the root and stem in combination with other drugs as an antidote to snake-bite and scorpion-sting. Mhaskar and Caius have, however, shown experimentally that the root and stem are useless in the antidotal treatment of snake-bite; the root is also useless as a collyrium or as an external application to the bitten part; the root is equally useless in the treatment of scorpion-sting.

A tincture was tried in mild cases of malaria and was found to be useless in such cases. The aqueous extract was tried in the low chronic fever of kala-azar and also in diabetes, but it was not found to possess the virtues attributed to it. . . . The drug was given, another fair trial in the form of a liquid extract in several cases of malarial fever, both in children and adults. Its action was found to be very slow. The drug had to be administered for several days before even mild cases were cured. In chronic cases it did not do any good, although it is a reputed medicine in the Hindu Pharmacopoeia for all fevers (Koman).

Arabic: Gilo—; *Bengal*: Gadancha, Giloe, Gulancha, Guluncha, Gunchi, Nimgilo—; *Bombay*: Ambarvel, Gharol, Giroli, Guloe, Gulwel—; *Burma*: Singomone, Sinzamanne—; *Canarese*: Amrytaballi, Madhuparne, Uganiballi—; *Cantonese*: Fun khu hang—; *Central Provinces*: Gulwel—; *Ceylon*: Chintil—; *Chinese*: K'uan Chu Hsing—; *Deccan*: Gulbel, Gulo, Gulvel—; *French*: Culancha—; *Goa*: Amritvel, Amrityel—; *Gujerati*, Gado, Galo, Gulo, Gulwel—; *Hansot*: Galavel—; *Hindi*: Giloe, Gulancha, Gulbel, Gulel, Guloh, Gurach, Gurcha—; *Indo-China*: Day than thong—; *Kathiawar*: Galo, Galonowelo—; *Khond*: Gursilai—; *Konkani*: Amontevel, Ekoiss givanem—; *Kumaon*: Gulancha, Gurcha—; *Lepcha*: Kantherrik—; *Malaya*: Foon kan thang, Sarasati lat—; *Malayalam*: Amrytu, Peyamrytam, Sittamrytu—; *Marathi*: Ambarvel, Gharol, Giroli, Gulavela, Gulaveli, Guloe, Gulvel—; *Mundari*: Harajora, Harajuri, Harjora—; *Nepal*: Garjo—; *Persian*: Gulbel—; *Punjab*: Batindu, Garham, Garum, Gilo, Gilogularich, Zakhmihaiyat—; *Reddi*: Korapattatige—; *Sadani*: Harjora—; *Sanskrit*: Amrita, Amritalata, Amritavallari, Amritavalli, Bhishakapriya, Chakralakshana, Chakrangi, Chandrahasa, Chandrapasa, Chchinna,

Chchinnaruha, Chchinnodbava, Chchinnodhana, Dhira, Goraksha, Guduchi, Guluchi, Jivanthika, Jivantiha, Jwaranashini, Jwarari, Kundalini, Kundalli, Madhuparni, Madhuparnika, Nagakumarika, Nirjara, Pamrodhara, Pittaghni, Rasayani, Shyama, Somalatika, Somavalli, Surakrita, Tantri, Tantrika, Uddhara, Vara, Vataraktari, Vatsadani, Vayastha, Vishalya—; *Sikkim*: Gurjo—; *Sinhalese*: Galuchi, Rasakinda, Rassakinda—; *Tamil*: Amridavalli, Amudam, Asasi, Kaippuchindil, Kunali, Narsindil, Niraidarudian, Paganrai, Padalamulam, Parivai, Pattigai, Sadi, Sagadundam, Sagamuli, Silam, Sindil, Sivandi, Sivedai, Ubavam, Vallikkandam, Vayamadu—; *Telugu*: Duyutige, Guduchi, Iruluchi, Jivantika, Madhuka, Manapala, Somida, Tellatippatige, Tippatige—; *Tharu*: Gulach—; *Tulu*: Amrytaburu—; *Uriya*: Gulancha, Gulochi—.

V.

The BERBERIDACEÆ are glabrous herbs or shrubs, sometimes climbing. They number 200 species included in 12 genera. They grow in the temperate regions of the northern hemispheres, in tropical mountains, in the Andes and extra-tropical South America. They are absent from tropical and South Africa, Australia and New Zealand.

The medicinal and poisonous Berberids of the world belong to 10 genera:—ACHLYS (Japan; Pacific North America); BERBERIS (Northern hemisphere; South America); BONGARDIA (Eastern Mediterranean); CAULOPHYLLUM (North-eastern Asia; North-America); DIPHYLLEIA (Atlantic North America; Japan); EPIMEDIUM (northern temperate regions); LEONTICE (northern temperate regions); MAHONIA (southern hemisphere; cultivated); NANDINA (China, Japan); PODOPHYLLUM (northern temperate regions).

In general the root and bark are purgative; the bitter bark is tonic and antiperiodic or depurative and cooling; the sour fruit is astringent and antiscorbutic.

The following are among the products isolated:— (1) *alkaloids*—berbamine, berberine, oxyacanthine—; (2) *resins*—podophylloresin, podophyllotoxin—; (3) *colouring matter*—podophylloquercetin—; (4) *acids*—malic, citric—.

The medicinal and poisonous Berberids of India belong to 4 genera—BERBERIS, BONGARDIA, MAHONIA, PODOPHYLLUM.

A. Stem 0 or erect. Flowers hermaphrodite. Carpel 1. Seeds usually small
  I. Leaves unequally pinnate. Leaflets opposite ... MAHONIA.
  II. Leaves simple, fascicled in the axils of 3-5-partite, rarely simple spines ... ... BERBERIS.
  III. Leaves simple, palmate. Ovules many ... ... PODOPHYLLUM.
B. Glabrous herb with tuberous root. All the leaves radical ... ... BONGARDIA.

BERBERIS.

This genus includes 190 species inhabiting the northern hemisphere, and South America.

About forty species of *Berberis* are used medicinally, and they all seem to have similar therapeutical properties. Their stems and barks are bitter tonics and mild laxatives.

There are three well-defined medicinal groups:—(1) The Rocky Mountain group, including *B. aquifolium* Pursh.; (2) the Asiatic group, which includes *B. aristata* DC.; (3) the European group, which includes *B. vulgaris* Linn.

The following deserve special mention in Europe—*B. aetnensis* Presl., *B. vulgaris* Linn.—; in China—*B. Sieboldii* Miq., *B. vulgaris* Linn.—; in Indo-China—*B. asiatica* Roxb., *B. Lycium* Royle, *B. japonica* R. Br., *B. vulgaris* Linn.—; in North America—*B. aquifolium* Pursh., *B. nervosa* Pursh., *B. pinnata* Lag., *B. vulgaris* Linn.—; in Central America—*B. trifoliatus* Moric.—; in Colombia—*B. glauca* DC.—.

Berberine has been isolated from *B. aetnensis, B. aquifolium, B. buxifolia, B. glauca, B. nervosa, B. vulgaris.* Berbamine and oxyacanthine are contained in the root barks of *B. aquifolium* and *B. vulgaris.*

A. Ripe fruit red. Inflorescence a simple raceme. Leaves usually toothed, lower pedicels 8-25 mm. long ... 1. *B. vulgaris.*

B. Ripe fruit blue black. Inflorescence a simple raceme
1. Leaves glossy green not glaucous beneath ... 2. *B. aristata.*
2. Leaves pale glaucous beneath
a. Leaves 1.3-3.8 cm. broad, secondary nerves prominent above ... ... 4. *B. asiatica.*
b. Leaves 7.5-18 mm. broad, secondary nerves not prominent above ... ... 3. *B. lycium.*

1. **Berberis vulgaris** Linn. is found in the Western Himalaya from Kashmir to Nepal up to 12,000 feet. It also occurs in Western Tibet, and is generally distributed over temperate Asia and the greater part of Europe and Northern Africa.

The root-bark and the stem-bark have the same composition and possess the same medicinal properties.

Barberry bark is tonic, purgative, and antiseptic. As a bitter stomachic tonic, it proves an excellent remedy for dyspepsia and functional derangement of the liver, regulating the digestive powers, and if given in larger doses, acting as a mild purgative and removing constipation.

The bark is used for all cases of jaundice, general debility and biliousness, and for diarrhoea. It possesses febrifuge powers and is used as a remedy for intermittent fevers. It also forms an excellent gargle for a sore mouth. A good lotion for application to cutaneous eruptions has also been made from it.

In the Punjab, the root bark is used as diuretic, and for the relief of heat, thirst and nausea. It is considered astringent, refrigerant and antibilious. In small doses it is tonic, in larger cathartic. In the form of decoction, it is useful in scarlet fever and brain affections.

In Baluchistan the roots are boiled in water and the decoction given both to men and cattle for internal injuries. It is said to be good for fever, especially high fever.

On the Pacific Coast of North America the root-bark is considered tonic and aperient; the leaves are used as an antiscorbutic.

The berries are official in France. They contain citric and malic acids, and possess astringent and antiscorbutic properties. They are useful in inflammatory fevers, especially typhus, also in bilious disorders and scurvy; and in the form of a jelly they are very refreshing in irritable sore throat, for which also a Syrup of Barberries made with water, proves an excellent astringent gargle.

In England the fruits are macerated in about twelve times their quantity of water, to which a little fennel seed has been added, and the liquid is used as a cooling draught in cases of fever.

The Egyptians are said still to employ a diluted juice of the berries in pestilential fevers. In Ceylon the ripe fruits are used in the preparation of cooling, astringent, and antiscorbutic drinks which are given in febrile diseases and diarrhoea.

In Persia the consumption of the berries is said to remove itch and other skin complaints.

Arabic: Ambarbaris, Ambar-us-shahab—; *Baluchi*: Karoskae, Korae, Zrolg—; *Bombay*: Zarishk—; *Brahui*: Zarch—; *Catalan*: Coralets—; *Dutch*: Barbarine, Berberis, Kweekdorn, Zuurdoorn—; *English*: Barbaryn, Barberry, Barboranne, Berber, Berberry, Guild, Jaundice Berry, Maiden Barberry, Pepperridge, Piperidge, Piperidge Bush, Piperidge Rilts, Pipperidge-bush, Piprage, Woodsore, Woodsour, Woodsower Tree—; *French*: Berbéris, Chivafou, Epine-aigrette, Epine-vinette, Verre-vinette, Vinette, Vinettier—; *German* Basselbeere Berberitze, Berberstrauch, Bramelbeere, Bromelbeere, Dreidorn, Erbselbeere, Erbsele, Essigdorn, Farsbeere, Gallhageldorn, Gelbbeere, Passelbeere, Peiselbeere, Reifbeere, Reisbeere, Reissbeere, Reisselbeere, Rhabarberbeere, Sauch, Sauerdorn, Sauerrach, Saurach, Spitzbeere, Versuchsbeere, Weinaengleinstrauch, Weinling, Weinnaegelein, Weinshade, Weinschaerl, Weinzaepfel, Wuetscherling, Zwackholzbaum—; *Greek*: Axokanda—; *Hamadan*: Zirishk—; *Hattu*: Chamchur, Chochar—; *Hindi*: Zarishk—; *Italian*: Berberi, Berbero, Crespigno, Crespino, Spina santa, Trespino—; *Jaunsar*: Chatrod—; *Pacific Coast*: Barberry, Common Barberry, European Barberry, Garden Barberry, Guild-tree, Jaundice-berry, Sowberry, Wood-sour—; *Persian*: Bedana, Cutch, Karoskai, Zarishk—; *Portuguese*: Berberis—; *Punjab*: Chachar, Chochar, Kashmal, Zirishk—; *Pushtu*: Karoskai—; *Roumanian*: Dracila, Lemn galben, Macris de riuri—; *Russian*: Barbaris—; *Sibi*: Karoskae, Zrolg—; *Spanish*: Acetin, Agracejo, Agracillo, Agraz, Agrecillo, Alarguez, Alguese, Azlacristo, Berberos—; *Toba Hills*: Karoskae, Zrolg—; *Urdu*: Ambar—; *Zarghun*: Karoskae, Zrolg—; *Zhob*: Korae, Zrolg—.

2. **Berberis aristata** DC. occurs in the Himalaya from Chota Banghal to Nepal, between 6,000 and 10,500 feet.

The wood, root-bark and extract of Indian Barberry have been used in Hindoo Medicine from a very remote period. Its properties are said to be analogous to those of turmeric. Indian Barberry and its extract, *rasot*, are regarded as alterative and deobstruent, and are used in skin diseases, menorrhagia, diarrhoea, jaundice, and above all in affections of the eyes. Sarangdhara recommends a simple decoction of Indian barberry to be given, with the addition of honey in jaundice. In painful micturition from bilious or acrid urine, a decoction of Indian barberry and emblic myrobalan is given with honey. A decoction of the root-bark is used as a wash for unhealthy ulcers, and is said to improve their appearance and promote cicatrization. *Rasot*, mixed with honey, is said to be a useful application to aphthous sores.

A decoction of the root bark in doses of one to two ounces was given to several patients for malarial fever and was found to be beneficial, the effect being very slow (Koman).

Arabic: Aargis, Ambarbaris, Hhodhub, Itrarahh, Messuk—; *Bagi*: Chochar, Kambra, Tharmala—; *Bhutia*: Tsema—; *Canarese*: Bagisutra—; *English*: Indian Barberry, Tree Turmeric—; *Garhwal*: Kingora—; *Greek*: Lykion indikon—; *Hindi*: Chitra, Chotra, Darhald, Hooshish, Kashmal, Kashmar, Rasvat, Rusot—; *Jaunsar*: Kashmoi—; *Malayalam*: Maradarisina, Maramanjal—; *Narkand*: Chochar, Kambra, Tharmala—; *Nepal*: Chitra, Chutro—; *North-Western Provinces*: Chitra—; *Persian*: Chitra, Zirishk—; *Punjab*: Chitra,

Kasmal, Kemloo, Simlu, Sumlu, Tutrum—; *Sanskrit*: Daruharidra, Darvi, Kata, Katankati, Kateri, Pitadaru, Suvarnavarna—; *Simla*: Kammul, Kashmal, Kaumul—; *Tamil*: Mullukala, Usikkala—.

3. **Berberis lycium** Royle is found in the Punjab Himalaya between 3,000 and 9,000 feet, and in Kumaon at 2,500-8,500 feet.

The root is highly esteemed as a febrifuge and as a local application in eye diseases.

An extract prepared by digesting in water sliced pieces of the root, stem, and branches, is called *rusot*, and is used advantageously in cases of ophthalmia.

The leaves are administered in Baluchistan as a cure for jaundice.

In Indo-China the fruit is given as a tonic in troubles of the kidney.

The tincture was found to be useless as a remedial agent in fevers of malarial origin (Central Indigenous Drugs Committee).

Arabic: Ambarbarin, Hooziz, Hoozizindi—; *Baluchistan*: Koroski, Zarch—; *Cutch*: Kasmal—; *Hindi*: Chitra, Kushmul—; *Indo-China*: Cau tu, Ky tu—; *Jaunsar*: Chahoi, Daruhaldli, Kashmal—; *North-Western Provinces*: Kushmul—; *Persian*: Unjebar—; *Simla*: Chochar, Chotra, Kashmal, Kasmal—; *Sind*: Kushmul—; *Waziri*: Khadavanai, Sakazie, Sarghazie—.

4. **Berberis asiatica** Roxb. is found in the dry valleys of the Himalaya, from Garhwal to Bhutan, between 2,000 and 8,000 feet. It also occurs in Bihar, Mount Abu, and Afghanistan.

The plant is used for the same purpose and in the same ways as *B. aristata*. It is reputed useful in the treatment of snake-bite and scorpion-sting; but Mhaskar and Caius have shown the root, stem, and gum are all equally useless for the purpose.

Almora: Kilmoru—; *Bengal*: Daruharitra—; *Canarese*: Maradarisina—; *Dehra Dun*: Kingora—; *Garhwal*: Kingora—; *Gujerat*: Daruhaldar—; *Hindi*: Daruhaldi, Sumlu—; *Jaunsar*: Kishornoi—; *Kumaon*: Kilmora, Kilmoru—; *Marathi*: Daruhaldi—; *Nepal*: Chitra, Kissie, Matekissie—; *Persian*: Darhuld, Daruhuld—; *Ranikhet*: Kilmoru—; *Sanskrit*: Daruharidra, Darupita, Darunisha, Darvi, Dvitiyabha, Haimavati, Haridra, Hemakanti, Hemkranta, Kaliyaka, Kamini, Kapitaka, Karkatini, Karnavati, Kashtha, Kashtharajani, Katankateri, Marnmari, Nirdishta, Pachampacha, Parjani, Parjaniya, Pita, Pitachandana, Pitadaru, Pitadru, Pitatvaka, Pitika, Sthirraga—; *Simla*: Kammula, Kashmala, Kaumula—.

Bongardia.

B. Rauwolfii C. A. Mey. The only species of this genus occurs in Baluchistan, whence it spreads to Afghanistan, Persia, Transcaucasus, Syria, Palestine, Bithynia, and the Greek Islands.

In Baluchistan the leaves are used as a cure for sore eyes in horses.

Ghandoba: Puccatutuka—; *Kotra*: Shrin—.

Mahonia.

This genus includes 50 species, which inhabit the southern hemisphere. Many are cultivated as ornamental shrubs.

In North America the berries of *M. fascicularis* DC. are considered a cooling laxative medicine.

Mahonia napaulensis DC. is found in the temperate Himalaya at 4,000-8,000 feet, from Garhwal to Bhutan; in the Khasia Hills

between 4,000 and 5,000 feet; in Mergui; and in the Nilgiri mountains between 5,000 and 8,000 feet.

The berries are considered diuretic, and demulcent in dysentery.

Chamba: Kandlu, Sharor—; *Garhwal*: Gurm, Haldia—; *Jaunsar*: Khoru —; *Nepal*: Chatri, Jamnemunola, Milkissie—; *Punjab*: Amudanda, Chiror—; *Ramnagar*: Bankhilmana—; *Travancore*: Maranthu—.

PODOPHYLLUM.

The genus consists of 5 species distributed over the northern temperate regions.

The rhizome of and resin from *P. emodi* Wall. are official in Great Britain; the dried rhizome and roots of *P. peltatum* Linn. are officially recognized in Belgium, Brazil, Denmark, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, United States; the resin from *P. peltatum* Linn. in Austria, Finland, Hungary and Yugoslavia.

Podophyllum emodi Wall. is found in the interior ranges of the Himalaya from Hazara and Kashmir to Sikkim.

The constituents of the Indian podophyllum and of the American podophyllum (*P. peltatum* Linn.) are identical. The chief constituent is podophyllotoxin. An uncrystallizable resin, podophylloresin, has also been isolated.

The drug was administered in the form of a tincture to six cases and was found to possess all the properties that the podophyllin of the British Pharmacopoeia possessed. It acts as a hepatic stimulant and cholagogue purgative (Koman).

Gujerat: Venivel—; *Hindi*: Bakrachimyaka, Bhavanbakra, Papra, Papri, Nibishi, Pilijati—; *Kashmir*: Banwangan—; *Marathi*: Podwel, Patvel—; *Punjab*: Banbakri, Bankakra, Bankakri, Chimyaka, Chyakri, Gulkakri, Gulkakru, Kakra, Papri, Wanwangan—.

OBSERVATIONS ON THE BIONOMICS OF *PANCHAX LINEATUS* CUVIER AND VALENCIENNES, WITH SPECIAL REFERENCE TO ITS LARVICIDAL PROPENSITIES.

BY

A. G. FRASER, I.M.D.

The opportunity of making the following observations was provided by Mr. Adams who showed the writer a pool near Poona containing a large number of specimens of the 'Top-Minnow' *Panchax lineatus* Cuv. & Val. The local Hindi name of the fish is *Konkani garah*. It can be readily distinguished from the other local fishes by the possession of a silver star mark on the head. The pool referred to above is situated on the south bank of the Mutha-Mulla river and, at the time of our visit, contained specimens of *P. lineatus* only, though from the end of the channel connecting the pool with the river a young *Ophicephalus* was also obtained. The paucity of the fish-fauna of the pool was probably due to the fact that it was at the time stagnant and very foul with evidence of sulphuretted hydrogen emanations. There was a heavy scum on the greater portion of its surface with fragments of floating algae. The pool was about 15 feet in diameter with an average depth of 18 inches. The bed was practically rocky throughout and grown with algae; some portions of the bank and the bed at the edges were overgrown with long grasses and weeds.

Field observations show that *Panchax lineatus* has the habit of lying for hours on end nearly flat with the surface film. When disturbed it dives below, and after 4 to 5 minutes reappears again to resume its position at the surface. Dorsally in a line with and behind the eyes there is a bright silver shield—shaped somewhat like the letter I in very thick type—the lustre of which when viewed from the bank and also in the aquarium is very striking. Owing to the sheen on this silver patch one is able to spot these fishes in the clearer portions of the pool almost at once, especially if the sun is shining when the scintillation produced by it is very noticeable. In the aquarium, when the fish were placed in a very dark corner of the room, the silver shield faded away and was replaced by a black or greatly dulled blotch; and at times, when there was a dim light streaming into the room, the lustre of the shield waxed and waned. When exposed to the glare of sunlight, or in the light of a dull day when clouds hide the sun, the lustre of the shield is always bright. The more light, the brighter does the sheen and scintillation become and the fishes themselves tend to turn towards the source from which the light is falling. Fishermen tell me that this species lies at the

surface and waits for insects to fly over, when it leaps out for them. I was unable to confirm their statement as during my visits to the pool there was no ocular evidence of this habit. Owing to my observations having been made during the rainy season when the skies are overcast with clouds, and also because of an absence of small insects—large red and blue dragon flies were numerous and disturbed the fishes by darting down on the surface of the water—the fish, in the matter of insect food, were perhaps at a seasonal disadvantage.

The habitat of *Konkani garah* and the evidence of fishermen indicate that it is probably an insectivorous fish. Mr. Adams informs me that he has never at any time of the year been able to find larvae of mosquitoes in the pool from which the fishes were recovered. I can certainly say there were no larvae present in this pool at the time of my four visits within a period of a fortnight during June-July, 1937.

In the aquarium, as in the pool, the fishes lie flat on the surface film, particularly if the water is foul. The same foul water from the pool was used to keep a batch of 6 fishes, and 6 others were kept in a receptacle containing clear tap water.[1] One fish in the clear water receptacle died after 24 hours, but five others lived on without showing any ill effects. They only occasionally rose to the surface, but remained most of the time below in mid-water; and even in this situation the silver shield on the head remained bright as long as the fishes were directly exposed to light. When kept in a dark corner of the room the lustre of the shield gradually faded to black. On the other hand, those kept in foul water with green algae in it, remained the whole time —night and day—at the surface film, practically motionless except for a slight wriggle of the caudal and pectoral fins and with them also the shield shone brightly when in the light. The position of the fish at the surface film is such that they lie almost flat with it. The head with the silver shield is under water, but the dorsal ridge from this point backwards is flush with the surface right up to the caudal fin which is below the water line. The dorsal fin near to the caudal fin is partly above the water level. The fish will remain thus for hours unless disturbed. It should be noted that the mouth is only imperceptibly opened in the act of breathing and that the gill covers are seen to move very slightly as the respiratory rate is very slow. Some fishes leaped out of the receptacle and it was then noticed that the silver shield became black and remained so as long as the fishes were out of the water. As a matter of interest, I kept three of these fishes in a wet handkerchief and observed them from time to time and at the end of 6 hours all were alive and during the whole period they remained in a form of suspended animation with the shield showing up dulled and dark. There was no evidence of any respiratory movement or gasping for air as in the case of other

[1] Tap water should usually be allowed to mature for at least 48 hours before it is used for aquarium purposes.—*S. L. H.*

surface fishes when out of water. They only wriggled or jumped if touched. One was restored to water and it recovered in ten minutes. The other two died after 6¾ hours and, only in the final stages of death, showed respiratory embarrassment by opening their mouths and muscularly exerting the gill covers. After death the colour tones became much darker. Another physical presentation is that the body is semi-transparent; the vertebral column is visibly defined as a dark shadow, so also are the stomach and the lungs, but the swim bladder is not seen as is the case with the glass-perch *Ambassis ranga*. A curious fact is that the fish, which died after a stay of 24 hours in clear water, showed the silver head shield still fairly bright; this has not yet faded in preservative up to now—a period of about one month—it is quite white but without the sheen observed in the living fish. The two fishes which were kept in a wet handkerchief and died after 6¾ hours also show a subdued discoloured patch. In all the others which had to be killed in preservative the shields have become black.

The significance of the phenomenon observed in connection with the silver shield is at this stage very difficult to explain. The behaviour of the fish and the photosensitivity of the shield on the head appear to indicate that it may be a means of attracting those insects which are usually drawn towards light. It was observed in an aquarium that at night when there is no luminosity the shield is quite dark. It reacts to artificial electric light in the same way as to daylight. This would indicate that during moonlit nights, when myriads of small insects hover over pieces of water for breeding purposes, the silvery head spot is capable of shining and presumably of attracting insects. These facts therefore, appear to support the conjecture that the silvery spot is a specialization which enables the fish to attract the particular kinds of insects required as food. Further investigation is required to confirm this purely tentative theory.

Colouration: When alive the fishes are pretty. Dorsally there is a dark colour tone on a background of buff with a slightly yellowish green tinge. The caudal and anal fins are piped in scarlet. The dorsal fin is yellow and faintly pink at the tips with a basal black dot, and the junction with the body is stippled with silver. The pectoral fins are also yellow and the area behind them is stippled with crimson dots. The body is semi-transparent. The anterior portion of the anal fin is prolonged into two red stained rays. There are 7-8 transverse black bands on the posterior half of the body.

[The mosquito-larvae eating propensities of the genus *Panchax* are well-known, and several workers have already reported the absence of mosquito larvae from pieces of water in which these 'Top-Minnows' live. Mr. Fraser's observations show that *P. lineatus* can live in very foul waters and that it can subsist on aerial respiration alone for considerable periods. Moreover, the tentative hypothesis concerning the function of the silver spot on the head, advanced for the first time, seems to be well worth further investigation. If it proves to be a fact that the silver

spot is used for attracting insects, then in *Panchax* we shall not only have an agent for destroying mosquito larvae but also a trap for luring adult mosquitoes that visit suitable pieces of water for breeding purposes. It may be noted that adult mosquitoes have often been found among the stomach contents of *P. panchax* (Hamilton). Reference may also be made to certain fishes, which live in deep seas, and emit light from special organs to attract their prey. It would thus seem that Mr. Fraser's view concerning the utility of the silver spot is not in any way extravagant.

The habits and habitat of *P. panchax*, the well-known *Ti-Choki* fish (the three-eyed fish, in the third eye reference is made to the shining, silvery spot on the head) of Bengal are similar to the Péninsular species—*P. lineatus*. While determining the utility of *P. panchax* in keeping pieces of water free of mosquito larvae, Nair and I kept one valve chamber opposite the Engine Room of the Pulta Pumping Station as a control and introduced no fish in it. In three other chambers specimens of *P. panchax* were introduced early in July. Occasional inspection of the chambers showed that no mosquito larvae were present in the chambers containing the fish, while in the control chamber the water became very foul and in about half a pint of water taken from the surface there were over 200 mosquito larvae on the 7th of August, 1937. Ten specimens of *P. panchax* were introduced in the evening, but two died during the night. More specimens were introduced the following day and by the evening the number of mosquito larvae in the chamber was reduced to 4 or 5 in half a pint of surface water. These observations show that *P. panchax*, like its congener *P. lineatus*, can live in very foul waters and is an effective larvicide.

Two specimens of *P. panchax* were left in a small glass bowl on wet cotton wool and the bowl was covered with a wet piece of cloth at about 8 p.m. At 8 a.m. next morning both the specimens were alive, but one died an hour after, while the second was revived by keeping it in water. This experiment bears out the hardy nature of these fishes, and shows the ease with which it should be possible to transport them over long distances.

In connection with the subject of the larvicidal fishes of India, it seems desirable to refer to an earlier observation made by Mr. Fraser while stationed at Deolali in the Nasik District. He found that a stagnant pool in a disused quarry was kept free of mosquito larvae by a small Carp-Minnow, *Rasbora labiosa* Mukerji, a remarkable fish which has developed a special contrivance, by the hypertrophy of the lower lip, for catching insects by jumping out of the water. The fishes of the genus *Rasbora* are usually regarded of moderate utility in destroying mosquito larvae, but it seems probable that they may prove very useful for local needs in certain areas.—*S. L. Hora.*]

PRINCIPLES OF WILD LIFE CONSERVATION.

By

THEODORE HUBBACK.

(With 4 black and white plates).

INTRODUCTION.

Are the principles of Wild Life Conservation to continue as elusive conceptions without material form, or are they to become a living presence increasing in virility year by year?

There appears to be a danger that these principles will be sacrificed for private profit. The present tendency to exploit all natural resources regardless of the future will eventually result in the disappearance of many species of the larger fauna unless such tendency is drastically checked.

Until it is recognized that Wild Life is a valuable natural resource and that the benefits derived from an unguarded resource are wasting benefits, waste will continue till the resource has gone and the benefits have vanished.

* * * * *

No natural resource is more sensitive to conservation than wild life, and no natural resource has suffered more from lack of conservation. During the last fifty years species have been exterminated due to this deficiency.

Wild life is only just being recognized as one of our valuable assets, but this recognition is so tardy, especially in some of our Colonies and Dependencies, that there is a very real danger of the recognition coming too late. The days when efficient conservation may be possible are rapidly passing away.

Unfortunately it is a fact that those principles of conservation which it is imperative should be applied to wild life preservation are seldom understood by those who have the power to further or retard the measures desired. The lack of proper financial provision is, I believe, the real reason why in some of our Colonies and parts of India and Burma we are losing our wild life. Those who hold the keys of the money bags never appear to be conservationists!

I shall endeavour to show in this article how senseless it is to expect to save wild life unless the true principles of conservation are recognized and adopted. The 'hit or miss method' of a budget allowance for what is erroneously called 'game protection' will never achieve the saving of our wild life.

To conserve wild life resources you must have a fairly accurate idea of what you have to conserve and what you wish to conserve. In other words, you should know what your stock consists of; you should know where it is to be found; you should have a knowledge of its ecology, numbers and status.

These alone are questions which cannot be answered except after careful research and skilled inquiry.



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TWO OF A KIND. SAMBHUR STAGS IN A SALT LICK. OBSERVE THE SORE ON THE STAGS NECK. AN ENDEMIC AFFECTION OF SAMBHUR IN MALAYA.

Let us take the larger forms of wild life and consider certain species. Wild elephants, for instance, may have, as they have in India and elsewhere, an economic value, apart from the value of their ivory, because they are used for domestic and transport purposes. Therefore, there is probably in such countries a desire to conserve elephants for economic reasons and it is not desired to see the wild stock, the natural resource, exterminated. A wild elephant is certainly out of place in a highly cultivated or industrial area, but not out of place in his jungle habitat, and so long as it is desired to conserve wild elephants for economic reasons, so long should we retain sufficient of their habitat to make that conservation a possibility. But principles of conservation cannot be based solely on such premises. I merely give the above illustration as an instance of one reason for consideration of the problem from an economic outlook.

There is much wild life which we cannot claim as having to our knowledge any direct commercial value to the community, although its æsthetic value may be very great.

One will readily divide the classes of commercially valuable and æsthetically valuable wild-life resources by thinking of fur-bearing wild animals, and the many attractive song-birds which delight our hearts and soothe our nerves. People desire that both classes should be conserved, but for dissimilar reasons. Then again wild life is conserved for recreation all over the world, another reason different from those quoted above.

It is legitimate to presume that there being many reasons for the continuance of wild life in most parts of the world, proper steps for its conservation should be taken, and therefore one would expect to receive the support and approval of the Public for any sound policy of conservation.

It is useless to imagine that you can conserve wild life without spending money on an organization to do so. You get very little in this world for nothing and wild life conservation is no exception to the general rule of having to pay for a good article.

An International Conference for the Protection of the Fauna and Flora of Africa was held in London in November, 1933, and a convention was ultimately signed by the representatives of nine Governments.

Besides the representatives of the Governments immediately concerned the Governments of the United States of America, India and the Netherlands sent observers to the Conference.

This Convention embraced many phases of conservation and should prove of inestimable value to African Fauna and Flora.

Although the recommendations are far-reaching and are vital to a proper system of conservation the question of how the expenditure on such proposals should be met was not referred to in any of the documents published.

Possibly it was not within the province of this Conference to deal with or even refer to the question of financial arrangements: such matters are left to the Governments concerned. Nevertheless the whole constructive policy of conservation may break down,

whatever resolutions are passed, unless financial provision is assured for that policy.

It is clear, I think, that as a Nation we are anxious to preserve and keep from extermination the fauna in our charge. To an International Conference for the Protection of Nature held in Paris in July, 1931, the Prime Minister, Mr. Ramsay MacDonald, sent a message of which the following is an extract:

'In the Territories for which they are responsible His Majesty's Government in the United Kingdom regard themselves as trustees for the Protection of Nature not only in the interests of their present inhabitants, but in those of the world at large and of future generations.

'The wonderful fauna and flora with which Nature has endowed the world have already suffered grave losses. Animals and plants of great scientific interest and often of great beauty have been exterminated, objects of great geological interest have been destroyed and the beauties of Nature defaced. Lovers of Nature may do much to stem this process, but if their object is to be secured the active co-operation of Government is essential.'

The obligation of a Nation towards the wild life in its territories is well stated in a speech made by the present King of Belgium, when he was still Prince Leopold, at a dinner of the African Society held in London on November 18, 1933. He said:

'The protection of nature raises problems of universal importance, the evolution of which cannot be left to the initiative of isolated groups, whose action is necessarily limited, and who are unable to enforce in their entirety the effective measures of preservation which are necessary.

'The State alone can and must take the responsibility for a protective organization which will command the interest of all mankind in its moral, social, economical, and cultural development; and thus the political aspect of the question becomes apparent.'

Are we, as a Nation, to allow the conservation of wild life to be undertaken by local Governments as a purely domestic policy? The pronouncement of the Prime Minister is against this.

Yet during the last few years, serious steps have been taken by local Governments to prejudice considerably the work of conservation by withholding funds and reducing personnel, making constructive methods impossible. Financial stringency has been the excuse.

In my opinion these unfortunate *contretemps*, which most seriously affect the status of the fauna, can be and should be avoided by a recognition of the fact that there is an intimate connection between the revenue derived from Wild Life Resources and the amount of money that can be spent on its conservation.

This is the base on which a sound financial policy for efficient conservation can be built.

Whatever laws are passed, without adequate means to enforce them, the work of conservation must fail; and to inaugurate successfully a real service for the conservation of wild life there must be



A COW SELADANG AND HER CALF ENTERING A SALT LICK. OBSERVE HOW THE COW IS TESTING THE WIND.

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a definite financial policy to deal with it. So long as funds can be cut off, which reduce, or even abrogate, the service for conservation, while the methods of destruction are left unchecked by any practical application of the law, so long will our work fail. We must appreciate the fact that failure means the ultimate disappearance of the wild fauna.

We are not concerned at the moment with the laws: their general principles are, broadly speaking, agreed to, and although not consistent throughout our Territories and Colonies could easily be brought more or less into a condition of co-ordination. The great importance of inviolate reserves is now widely recognized, but steps to implement the laws for such sanctuaries are awaited.

What we are concerned with are ways and means to enable the laws we have to be properly enforced.

A method has been adopted in many parts of the United States whereby a 'Game Fund' is established by law—embodied in fact in the Game and Fish laws—by which all revenue, direct and indirect, derived from Wild Life Resources is credited to the Fund. That money is kept apart from the general revenue and earmarked for the conservation of wild life. The most striking example of the success of this method can be seen in the results obtained in Pennsylvania, U.S.A. This State was 'shot out' in 1890, but in that year a few of the people realized that drastic steps would have to be taken if their wild life was to be saved. Finally a Board of Game Commissioners was appointed, and when the Board began its work in 1896 its funds consisted of the sum of G. $800 only. In 1913 a sum of G. $97,000 was available; in 1930, G. $1,413,251 was the amount budgeted for the fiscal year, June 1, 1929, to May 31, 1930.

Not only was a large revenue obtained, but a 'shot out' State was turned into one of the best sporting States on the eastern side of North America.

Can we afford to ignore such methods which have proved so strikingly successful? I think not.

Another method is by the 'yard-stick,' whereby the amount to be spent on conservation of wild life is budgeted according to the estimated revenue for the year from Wild Life Resources.

But whichever system is used it must be laid down by law that in the case of a fund—call it 'Wild Life Fund' if you like—that fund cannot be raided or interfered with by the Legislature. The Budget Commissioner, or whoever is the officer handling finance, cannot be allowed to interfere with the proposed expenditure provided it is within the estimated revenue of the fund, or the limits of the measurement by 'yard-stick.'

Whichever system is adopted it must be recognized that the service for the protection of wild life will be expected to protect certain types and forms of the fauna which do not produce any direct or indirect revenue, but still require expenditure on their preservation for other reasons.

It may therefore be necessary before a substantial fund has been built up, to obtain from the general revenue funds for the conservation of insectivorous birds, and other forms of wild life

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The direct and indirect revenue which should be credited to th
department for the conservation of wild life should consist of:

Game Licences.
Licences and Permits for Sporting Arms.
Import and Export Licences for Sporting Arms.
Duties on Sporting Arms.
Duties on Sporting Cartridges.
Licences for Purchase of Sporting Arms and Sporting Car
ridges.
Licences to Sell or Store Sporting Arms and Sporting Car
ridges.
Fishing Licences.
Fines and Costs.
Sales of Confiscated Articles and Picked-up Trophies.

The expenditure should include:

Salaries, Allowances and Transport of Officials.
Construction work on and maintenance of National Park
Sanctuaries and Reserves.
Building and Maintenance of Offices.
Predatory Animal Control.
Fencing.
Rewards.
Court Expenses.
Sinking Fund for Leave, Gratuities and Pensions.

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The whole matter turns on proper measures being taken
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The officer in charge of the conservation department, with the opportunities that a stable financial policy would give him, could surely organize a service which would not only benefit the wild life of his country but would be of inestimable value to the country itself.

What we are now doing for conservation of wild life in many places is just so much waste of time, because we have never got past the stage of treating the work as a casual matter which can be undertaken by anyone.

It is useless trying to build up a staff knowing that just as the work of conservation is beginning to make its mark it is liable to be dispensed with at the behest of some ephemeral office holder.

The whole matter turns on proper measures being taken to finance the work required. If the system of the 'Wild Life Fund' is adopted, and the organization necessary and possible with the funds obtainable placed in the hands of experienced conservationists, success is assured.

Adequate funds at the disposal of an efficient organization—you cannot have such an organization without adequate funds—would enable the proper guarding of wild life resources, the proper policing of sanctuaries and reserves, the building up of a loyal service for these objects, all of which are quite impossible so long as the position of the staff and the execution of the work has no foundation for lack of a financial policy.

In actual practice the work of successfully conserving wild life



ANOTHER SAMBHUR STAG. OBSERVE ALSO THE SORE NECK.

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is one of considerable difficulty and is highly specialized work. Few have the aptitude to become practical conservationists, and still fewer have the knowledge or experience to enable them to exercise that aptitude if they possess it.

But the real menace to any sound policy of wild life conservation lies in that ugly word 'indifference.' This is generally synonymous with 'ignorance'. The latter is easier to overcome. There is often a feeling, in a new country especially, that exploitation can be better carried on by not paying too much notice to the claims and rights of the indigenous fauna. In the United States of America there has frequently been an outcry against the creation or extension of a National Park by certain of the get-rich-quick fraternity. These people are sometimes described by the elusive expression 'vested interests.' This class of opposition to the conservation of natural resources will be found in many places, generally coming from local inhabitants who are looking for immediate profit and immediate 'development.' Sometimes this indifference to conservation is shown by Governments—no doubt for the same reason.

The opposition to a National Park project may come from the fact that the conservation would then be real and effective. That, I think, is the truth.

By leaving the financial arrangements for the service of conservation to local Legislatures we are taking a great risk of losing our fauna altogether. Some Legislatures might not object to a *dénouement*!

India, Burma and Malaya have adopted a policy by which many firearms are now in the possession of those whose observance of the laws for the preservation of wild life is only governed by the chances of detection if such laws are disregarded; and although during the last few years the issue of weapons for the destruction of wild life has been great, funds or personnel to ensure the observance of the laws for preservation have not been increased, in some cases they have even been curtailed.

Usually the argument used to justify the supply of arms to the ryot is to enable him to defend his crops; in most cases his crops can be much more efficiently protected by a stout stake and rail fence. In the case of large wild animals, such as elephant, the frequent wounding by firing at them with any sort of missile, even bird shot, merely aggravates the trouble. Guns issued for crop protection are used for poaching, and such poaching can only be kept in check by the enforcement of an energetic policy through an adequate organization.

In the Dominions, especially Canada, the value of the conservation of wild life is well recognized and the work well organized. It is in countries such as India, Burma, Ceylon, Malaya, British Borneo and parts of Africa that so much yet requires to be done.

The principles of conservation have not been fully and generally applied in these countries.

In India there are no appointments of Game Wardens as such, conservation work being entrusted, as a side-show, to the Forest Department. Burma had a Forest Officer appointed as a whole-time Game Warden, but directly there was financial stringency, the

billet was discontinued, and is still discontinued. A Forest Officer with a full-time job was appointed as an Honorary Game Warden; he subsequently resigned. Another Forest Officer has now been appointed Game Warden.

At the recent Conference on Indian Fauna it was resolved that the Provincial Governments should be asked to appoint Game Wardens. Also that licence fees, etc., accruing from wild life resources should be spent on conservation.

Even these principles had not been recognized, or at least not publicly advocated, in India as vital to the conservation of wild life.

Dr. R. L. Spittel, President of the Ceylon Game and Fauna Protection Society, speaking in London at a meeting of the Society for the Preservation of the Fauna of the Empire on October 8, 1934, did not hesitate to emphasize the parlous condition of the wild life in that Island. Here are some extracts from his address:

'Those who know our jungles have long realized that unless protective measures are instituted, the wild life of so small an island as ours would soon be doomed.

The story of the Ceylon Game Protection Society, since its birth some thirty-eight years ago, is that of a long-sustained struggle to interest Government in the protection of the larger fauna, which, but for its efforts, would hardly be worth speaking of, to-day.

Owing to the interest taken by Sir Henry McCallum, the then Governor, the Dried Meat Ordinance was passed in 1908 and the Game Protection Ordinance in 1909, when the Yala and Wilpattu Sanctuaries were established; the first real step in protection was then taken.

But since that time things were allowed to drift, and the situation was becoming very alarming.

Game is now scarce even in our remotest jungles, largely because thirsty animals are killed in months of drought (June-August) at water-holes, and their dried flesh bartered. Up to some years ago shooting had to be done by moonlight. The slaughter then was not anything like as terrible as it became with the introduction of the electric torch, by the aid of which animals could be killed nightly throughout the year.

But worse than that, parties began to ply the jungle roads at night in cars equipped with powerful spot-lights, carrying a battery of guns and hand-torches. They blazed away at the gleaming eyes of "timid hunted hares", deer, leopard, or anything they met. One such car to my knowledge was responsible for six deer and a dozen hare in a single night and another for twenty-eight hare in a few hours. One man, accustomed to driving out occasionally for an hour or two at night, accounted in about six years for no less than thirty-five leopards.

When animals thus worried became shy of the roads, the "spot-light sportsman" carried his torch along jungle paths, giving the creatures no quarter in their seclusion.

Then breech-loaders became cheap and began to replace the muzzle-loaders of villagers, who also acquired torches, and the



YOUNG BULL SELADANG OF ABOUT TWELVE MONTHS OLD TAKEN IN A SALT LICK.

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animals were harassed out of existence. Their carcasses always commanded a ready sale to passing buses.

You will inquire, "Were there no games laws to put a stop to this?" There were, but they were not enforced. A policy of *laissez-faire* made even people who should have known better forget the existence of these laws. There was no prohibition against the shooting of any but game animals by night, even with spot-lights from cars. And men going out on the pretence of shooting leopard and pig did not scruple to kill any sambhur and deer they met. Sport had degenerated into night-shooting with lights or driving jungles with gangs, legitimate stalking being practised by few.

We, like other countries, realize to the full that this is the age of the destruction of the world fauna, and that many species will be exterminated unless provision is made for their protection.

The spectacle of wild animals in their natural surroundings is one of the greatest joys of man. The true sportsman gradually becomes the champion of wild creatures, and it is chiefly owing to his initiative and understanding that sanctuaries have been established. Nowhere, perhaps, has this been better exemplified than in Ceylon. The religion of the land is mainly Buddhism—perhaps the only religion in the world that extends its benevolence to animals—yet the outcry for protection has come not from the Buddhist, but from the men who shoot.'

A sorry picture of the failure of a Colonial administration to enforce its own laws.

Malaya has been, due to unstable and vacillating administrative methods, in a state of disturbance and uncertainty regarding what should be done for wild life, and is still in that state, despite the fact that a full constructive programme in the Report of a Commission appointed to inquire into the whole matter was submitted to the Malayan Governments so long ago as 1932.

In Africa recent reports made at the instance of the Fauna Society showed that in West Africa at least no satisfactory methods of wild life conservation exist.

The destruction of elephants in Uganda goes along merrily, and the following figures taken from the Game Warden's Reports are instructive:

1930 . . .	892	
1931 . . .	1,211	These elephants were officially destroyed.
1932 . . .	1,210	
1933 . . .	1,380	
1934 . . .	1,603	

In the Annual Report of the Uganda Game Department for 1934, the following words appear (para. 34):

'This gives an aggregate wastage of 13,096 elephants, which is the minimum for the period (ten years), and with the addition of tuskless juveniles which are not shown on the returns, and a percentage of elephants which perish in swamps and are never

found, the grand total can be taken to be approximately 14,000, truly a stupendous figure.'

Stupendous indeed!

The stock of elephants must be enormous to stand this destruction, because in addition to the above figures, many hundreds of elephants must have been killed or died in other ways. But perhaps this is merely the backdoor to 'birth control', because such disturbance as must result from the harassing, inseparable from so much killing, must react to hinder normal breeding. There is some fatal period reached in the life-history of wild animals when the continuing abnormality of a disturbed existence appears to break their spirit and they are then liable to cease to produce their species. This psychological phenomenon is not properly understood, but is recognized as existing by persons who have studied wild life at close quarters.

These are only meagre outlines, space forbids an extensive review, but they indicate that we have a long way to go before the principles of conservation are applied as they should be applied in some of our Possessions.

In America it is now fully recognized that organizations for wild life conservation are necessary and that proper financial support should be forthcoming based on the revenue which accrues from wild life resources.

Wide latitude in dealing with the funds at their disposal is given to the officers who carry out the conservation programme.

To illustrate this policy I wish to quote from a statement made by Mr. Slautterback, the Executive Secretary of the Pennsylvania Game Commission, at the annual meeting of the American Game Association, held in New York, in December, 1929. Mr. Slautterback having addressed the meeting on the subject 'Budgeting Game Funds,' was asked certain questions and gave certain answers. Here they are:

MR. ADAMS: As I understand it, you have a separate game fund in Pennsylvania to which all the revenues from licences go automatically, but in making any expenditure against that fund must you receive legislative sanction?

MR. SLAUTTERBACK: No.

MR. ADAMS: Must you get sanction from any budget commission or any one outside of the game department?

MR. SLAUTTERBACK: We prepare our budget, holding it within our expected revenue. This is presented to the officer and he naturally approves the budget if our several items are within the estimated revenue. I am referring to the state budget officer.

MR. ADAMS: In the last analysis have they the authority if they wish to use it of making any changes in your set-up, or simply inspect it to be sure that it stays inside of your anticipated revenue?

MR. SLAUTTERBACK: Your explanation is correct—to inspect it to see that it remains within our revenue but to be used for no other purpose except for game protection and propagation purposes.

CHAIRMAN QUINN: Your budget commissioner has no authority to disapprove the budget if it is within your income?

MR. SLAUTTERBACK: He has not.

JUDGE MILES: I would like to ask if it is necessary that the funds accumulated to this department have to be appropriated by the Legislature before it is available?

MR. SLAUTTERBACK: They are not appropriated by the Legislature.

The Game Commissioner is made responsible and is held responsible for the work and is given the power and means with which to do it.

As the exact opposite of this, I should like to mention a case in Malaya where a Game Warden's monthly bills were held up and sent back to him, although they were certified by the guarantee of the Game Warden's signature, because one bill, a recovery for a small petty-cash payment to an illiterate native, was witnessed by one person only and not by two as required by a general order!

Such red-tape entanglements can scarcely come within the category of the 'principles of conservation.'

After all, what are the principles of conservation which we can apply to wild life?

I think we may claim that the chief object of conservation of wild life must be to prevent the disappearance of species. We cannot say we don't want such-and-such a species because it eats our fowls or disturbs our garden; its benefits to the universe in other ways may be more important than our pet fowls or our local garden.

We can say we don't want such species in our backyard and we can take steps to protect our property, but we are wrong if we say such-and-such species should be exterminated. Our knowledge is much too incomplete to allow us to say anything of the sort.

Most people would have answered in the affirmative a question regarding the desirability of the extermination of the shark, and yet the first discovery of insulin, a drug which has brought relief to thousands of diabetics, was made in the liver (pancreas ?) of a shark (see *Journal of Mammalogy*, No. 2, vol. 6, p. 87, 1925).

Therefore, I think the practical application of steps to prevent extermination of species must be the foundation on which to build our framework of conservation.

This can be done in many ways, but the most certain, most equitable and most spectacular method of achieving this is by setting aside certain areas of suitable land as permanent sanctuaries for the fauna.

Conservation must be recognized as a specialized subject and the execution of the duties necessary to conserve any natural resource should be entrusted to, and undertaken by, persons whose training and practical experience enable them to know what is required to make such conservation a success. This sounds like a platitudinous argument which is redundant in its obviousness; and

so it is, but unfortunately the intelligent minds in this world are in the minority, and it often happens that conservation work is looked upon by the unenlightened mind belonging to someone who is in a position to place conservation on a low plane of activity, as work which can be looked after by anyone as a spare-time job. No greater mistake could be made. Until it is recognized as essential to make full-time appointments for those in charge of the work of preservation and protection, so long will the work fail; as it has failed everywhere in countries where preservation of the fauna is professed but the application of the principles of conservation refused. Certainly we must recognize as one of the practical applications the entrusting of the work to persons with full responsibility to carry out the duties necessary.

We must guard against a present tendency to treat a Game Warden as a conservationist only as a last resort. He may be expected to devote too much of his time looking after the interests of agriculturists leaving him insufficient time to attend to matters relating to conservation. Funds may be voted for control schemes, which generally mean destruction of some sort or other, rather than for guarding sanctuaries or for enforcing the game laws. A Game Warden is expected to take action to relieve cultivators when they allege damage to crops by wild life, irrespective of the condition of the cultivation; the indolence or industry of the cultivator; the feasibility of prevention of damage by fencing or other non-lethal methods. Advice which does not include the killing of something is unwelcomed, sometimes because a killing means a feast, and sometimes to satisfy a desire for revenge. Revenge on a wild animal! What a high ideal for a human being.

But, if a Game Warden is to achieve the objects of conservation he must only take extreme measures when really necessary. It is unfortunately the truth that much unnecessary killing, wounding and suffering is inflicted under the guise of crop protection. Have a proper financial policy with a Wild Life Fund; allow the Game Warden full powers to spend it; then these matters would be dealt with by those who would know what to do and relief could be, and no doubt would be, given to cultivators by fencing and other methods. The dangerous policy of 'control' if not properly controlled is a real menace to the future of many species.

An important principle of conservation is the utilization of natural resources for the benefit of mankind. We cannot improve on Theodore Roosevelt's definition of conservation as 'preservation through wise use.' Only such use may be made of wild life species which we desire to conserve as will ensure that the stock is not dangerously depleted.

A wise policy of wild life conservation will provide for:

(1) Adequate laws for protection.

(2) Adequate areas as permanent sanctuaries or refuges for species in their known habitat.

(3) Adequate organizations to enforce the former and administer the latter.

If these three principles are insisted on, then we may have some

hope for the future of the fauna of our Empire, but unless steps are taken, and taken soon, to recognize the critical state of the wild life in many of our Colonies and Dependencies, and to check the present rate of destruction, the future can be contemplated only with apprehension. To those who know how inefficient and inadequate in many places our methods of wild life conservation are, the wild life in such places appears doomed to extinction.

You can replace trees; you can sustain domestic animals by private breeding; but wild life must have an environment of its own in which to thrive and increase in a natural and normal fashion.

The price to pay for the neglect of the observation of conservation principles as applied to wild life is a terrible one—no less than the disappearance for ever of species after species.

'Qui nunc it per iter tenebricosum illuc unde negant redire quemquam.'

MISCELLANEOUS NOTES

I.—WILD BEASTS—REAL AND APOCRYPHAL.

The description of the skin of a Blue bear (*Ursus arctos pruinosus*) from Eastern Tibet, by Captain R. K. M. Battye and Mr. S. H. Prater in Volume xxxviii, No. 3, page 610 of the *Journal* is of special interest, not only as relating to an animal first described by Edward Blyth in 1853, but in view of recent correspondence in *The Times* regarding footprints of so-called 'Mountain Men', seen by Mr. Ronald Kaulback at an elevation of 16,000 feet in the Tibetan interior during a journey in December 1935. Mr. Kaulback could not identify the footprints as those of any particular animal, but he wrote that they were 'very extraordinary tracks. There were five sets of them leading down the side of the valley through the snow, at an almost impossible angle, and on to the comparatively level floor. Unfortunately there had been a very slight fall of snow, and the tracks were not completely clear, but they looked exactly as though they had been made by bare-footed men. There are no bears in that part of the country'. He thought they 'might have been the pug-marks of snow-leopards going slowly with the hind-paws overlapping the fore, but had never heard of these animals travelling in a party'. There is, however, no reason why snow-leopards, like other felines, should not so travel; tigresses have been known with four well-grown cubs; a pack of six panthers were seen walking across a jungle glade in Berar, just like a pack of hounds; and lions are frequently observed in large parties. Four or five bears may be met with together.

Two of Mr. Kaulback's coolies favoured the snow-leopard theory, while two said the footprints were those of 'Mountain Men', a wild race which they all agreed lived in the snow, described as being 'like men, white-skinned, naked, with long hair on the head, shoulders, and arms'. That is what a bear may look like. Its tracks, at least of the hind-feet, are just like those of a bare-footed man; the bear, like the man, has long hair that may fall over the head at times, when, for instance, it descends a mountain side 'at an almost impossible angle', as a sportsman who shoots at a bear above him will find; an isabelline bear may be as white as a polar bear; in India *bhalu* or *reench*, the bear, with his skin stripped off, is very like a grotesquely-shaped human being; he is known as *adamzad*, 'man-kind', and the Hill-man, when in the depth of the forest, always refers to him as *Rishi*, that is 'Master', says Mr. F. W. Woods. One of my beaters in Berar had a strong growth of black hair on his shoulders and back; the other men nicknamed him 'bhalu'.

Certainly indications point to the tracks being those of bears, notwithstanding Mr. Kaulback says there are none in the district, where, however, he spent only five months. Even if they are not always found in that part of the country, these and other animals often travel and stray far from their usual haunts. The habitat

of the Blue Bear, described by Captain Battye as being 'in the bare mountains where there is no jungle and where there is snow lying for seven months in the year', corresponds with the description of this Tibetan region. There is no reason to look for marvels and suggest that the tracks 'may have been made by some unknown relative of the Giant Panda or Snow Bear', as does one correspondent writing from what *The Times* terms 'the British Museum (Natural History) stable', adding that 'dramatists have so often used unknown relatives to explain away improbable occurrences that there seems no reason to make apocryphal additions to the Panda's family circle in order to evade the issue'. Moreover, if improbable unknown Pandas, (the Panda feeds only on bamboo shoots), may exist in that region where there are no bamboos, why not far more probable bears? It may also be remarked that Pandas are bears to natives but not to science, while *Ursus isabellinus* has priority of claim to the name of 'Snow Bear'.

From the same source as the apocryphal Panda comes the suggestion that the tracks might be those of langur monkeys. This was ruled out by Mr. Kaulback, for the footmarks were found 3,000 feet above the tree-line, while the creatures that made the tracks had both come down and returned to a considerably higher point on the mountain. The only interest of this suggestion is that a similar one was made regarding the *Mamh* or black bear in Baluchistan, which excited considerable controversy in India some sixty years ago, 'some writers maintaining that it was a mythological animal, and others that it was a monkey' (see Valentine Ball's *Jungle Life in India*, 1880, page 447). Bears had hitherto been unknown in Baluchistan, when the production of a skin led Blanford to suppose that the animal was a new species which he called *Ursus gedrosianus*. It was afterwards identified as the Himalayan Black Bear, *Ursus tibetanus* or *torquatus*. The earlier specific name of that animal is itself of interest, for the species is unknown in Tibet. Lydekker, however, refers (*Game Animals of India*, p. 388) to a local race of Malayan Bear, *Ursus malayanus*, occurring in Eastern Tibet.

As for mythical monsters, conjured up not only into the native imagination, it is surely time to put them in their proper place in the realms of mythology, whether they be Mountain Men in the Himalayas, Mahoni in Alaska, or Grey Seals in Scottish lochs, transformed by local imagination into 'monsters of the prime'. Meanwhile reports of new species or varieties of fauna must be received with caution; even black tigers have proved to be leopards; obliterative colouration has strange effects, and a leopard in shadow may look like a lion in the way!

BAFFORD GRANGE, R. G. BURTON.
CHARLOTN KINGS,
GLOUCESTERSHIRE.
October 4, 1937.

[The discovery of mysterious footprints in the snows of the higher Himalayas have drawn various conjectures as to the identity

of the owners. Most appealing to the popular imagination is the theory that the footprints were made by a mysterious race of 'Mountain Men' to whom local legend ascribes the name 'Abominable Snowmen'; the term 'abominable', it has been explained by a correspondent in the *London Times*, is used by the Himalayan folk, not in disparagement, but in the fear and reverence due to that which is 'awful'. The belief in the existence of a race of demigods or their reincarnations has its origin in Hindu Mythology. Hindu Epic Literature abounds in stories of warriors and sages who, relinquishing the world and its vanities, retired into the Himalayan fastnesses, where by fasting and meditation, they overcame the forces of Evil and acquired such spiritual power as made Gods and Men tremble. Stripping the meat of fiction from the dry bones of fact, the most likely conclusion that we can arrive at is that the footprints were those of bears. The species concerned being either the Kashmir Brown Bear (*Ursus arctos isabellinus*), which ranges from Thian Shan to the Western Himalayas or the Tibetan Blue Bear (*Ursus arctos pruinosus*), which ranges from Western China into Tibet. These bears keep to the higher elevations in summer living chiefly on the grass slopes above the tree line close to the snow and the human-like impress of their broad feet in the snow, with some imagination, might be taken for the tracks of the so-called Abominable Snowmen—Eds.]

II.—MEASUREMENTS OF TIGER.

With reference to Mr. Marshall's note on measurements of tiger in the Naga Hills, Assam, I give below measurements of a few tigers shot in the North Coimbatore jungles. One of these, a male, (length : 9 ft.) weighed 366 lbs.

I also give measurements of panthers shot in the same area including, some weights, and also the weights of four bisons shot.

Tiger	*Panther*	*Bison*
Male : 8′8″	Male : 7′	Bull : weight 1530 lbs.—height 6′—spread : 37″ .
Female : 8′6″		
Female : 7′	Do. : 7′	Bull : weight 1900 lbs.—height 6½′—spread : 34″.
Male : 9′10″	Do. : 7′2″	
Female : 8′7″		Bull : weight 1720 lbs.—spread : 33½″ (7½″ × 21″) very old bull.
Do. : 7′5″	Do. : 7′	
Do. : 7′10″	Do. : 7′½″	Bull : weight 1700 lbs.—spread : 36″.
Male : 8′	Do. : 7′6″	
Do.[1] : 6′6″		
Do. : 6′6″	Do. : 6′9″	
Do. : 9′2″	Do. : 6′9″	
Do. : 9′		
Do. : 8′6″	Do. : 6′9″	
Do. : 8′6″	Female : 6′6″	

[1] Tailless Tiger.

Tiger	*Panther*	*Bison*
Female : 8′2″	Male : 8′2″	(shot and measured by Capt. J. Todhunter, R. A.).
Male : 9′3″		
Do. : 9′5″	Female : 6′	
Do. : 9′	Male : 6′10″	
Female : 8′10″	Do. : 7′4″	
Do. : 8′2″	Do. : 6′11″	
	Do. : 7′3″	Weight 131 lbs.
	Do. : 6′8″	,, 91 lbs.
	Do. : 7′2½″	,, 132 lbs.
	Do. : 7′3″	,, 143 lbs.
	Do. : 7′4″	,, 131 lbs.
	Do. : 6′6½″	,, 145 lbs. (abnormaliy short tail).
	Do. : 6′10″	,, 132 lbs.
	Do. : 7′	,, 125 lbs.
	Female : 5′9½″	,, 60¾ lbs.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O.,
SOUTH INDIA.

R. C. MORRIS.

III.—CURIOUS BEHAVIOUR OF WILD DOGS AND A PANTHER AT A KILL.

I am writing you a curious incident which I have personally come across while bringing to book a 'notorious cattle lifting panther'. The panther measured 7 ft. 5 in. round the curves. It was a very cunning beast and it was causing a lot of damage to the calves. It was decided to tie a kill on a raised platform about 5 feet high and then to shoot the panther with a spot light. A kill was duly reported and as a major portion of the kill was already devoured, it was thought best to remove the old kill and tie up a fresh goat. I sat up and about 7 p.m. it was seen that two jungle dogs came near the raised platform where the kill was tied up. Shortly afterwards the panther also came, and sat at some distance from the tied-up goat. It did not at all mind the presence of the two wild dogs. The panther was killed with a neck shot while sitting, and the dogs were moving about when the shot was fired only at a distance of 20 yards from the panther. This is rather a curious incident and I thought it better to put this in writing as it may be interesting to the readers of your *Journal*. Could any reader kindly throw more light on the subject?

RAMANUJ SAREN SINGH DEO, C.B.E.,
Maharaja of Surguja.

RAGHUNATH PALACE,
AMBIKAPUR (SURGUJA),
EASTERN STATES AGENCY.
November 13, 1937.

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EASTERN STATES AGENCY.
November 13, 1937.

IV.—UNUSUAL MAULING BY A LEOPARD.

During May last year a party of Survey labourers were working on the re-survey and clearing of the old 'cut' boundary of the Yala Wild Life Sanctuary, which soon will be Ceylon's Strict Natural Reserve.

The place where the sad accident happened is very thick forest with hardly any small glades.

K. Charlie, the deceased, was in charge of a party of five Survey labourers.

Having returned at noon for their meals, the party left their camp again at 1 p.m., each man taking a katty, but no other tools or arms.

K. Charlie went a little ahead of the men (it must be noted that this was just after 1 p.m.), to try and locate an old picket and a blazed tree marking the old and overgrown boundary.

Suddenly the men heard him screaming, and suspecting he had been attacked by some wild animals, they ran after him, shouting to scare away any animals, and found Charlie some 12 chains further on bleeding profusively from severe injuries all over his body, and crying out that a leopard had suddenly pounced on him and wounded him. They tried to take the wretched man to the nearest hospital, at Tissamaharama, some 20 miles away, but he died *en route* and was given a last resting place near the scene of his labour in a wild and inhospitable part of the country where he lost his life when serving his Department.

According to the enquiry the deceased had stated that the leopard had suddenly charged him, this at about mid-day, a most unusual time for a leopard to feed at a kill. It was stated that there was a carcass, but it is not stated where that carcass actually was when the animal so suddenly mauled the labourer.

Perhaps the man disturbed the animal in its sleep near its kill, and in surprise and anger and by way of self-defence it at once went for and attacked the intruder.

Nevertheless the sad accident is so unusual that I think it is worth recording.

The hearsay report that 'leopards sometimes attack pilgrims to Kataragama,' (some twenty or twenty-five miles away,) and 'there is every possibility of animals which have tasted human flesh roaming about in the neighbourhood' seems to me most unlikely. It is also very unlikely that the man disturbed the leopard actually while it was feeding on the kill at that hour of the afternoon. It seems hardly possible to me that the man could have made his way through that very thick undergrowth so quietly that the leopard would not have heard his approach.

The sad accident happened at a spot on the old boundary, miles from anywhere, and where no one had been for very many years until this Survey party arrived to re-survey the boundary. If the leopard was not wounded, the case is a very unusual one for Ceylon.

The true facts of course can never be known, but in many years out here I have never yet heard of a leopard, which had not been

fired at, suddenly attacking a man in Ceylon, except for the well-known man-eater of Punanai, one of the rarest cases of man-eaters ever recorded for Ceylon.

Not very far from there, walking quietly along a narrow game track and unarmed, a leopard, a very fine male, suddenly slipped out of the jungle some ten yards from where I stood, a magnificent sight, I actually saw him 'grin' and with one bound he had disappeared.

A. C. TUTEIN-NOLTHENIUS, F.Z.S.

WEST HAPUTALE ESTATE,
OHIYA, CEYLON.

V.—DISAPPEARANCE OF JACKALS.

I should like to know whether cases of disappearances of jackals from an area or district have been recorded previously.

Jackals were very numerous up to three or four years ago in this part of the Coimbatore District lying on the Mysore Plateau, but appear to have almost vanished from these jungles. This is probably due to an outbreak of some disease, wild dogs for instance have been attacked by mange badly in the last year or two, but it is curious that their disappearance appears to coincide with the last stages of a very serious outbreak of rinderpest among village cattle which lasted for three years. Jackals naturally fed their full on the carcasses of cattle that died from this disease, and one wonders whether the jackals did not fall victims to a complaint brought on by a surfeit of stricken beef!

HONNAMETTI ESTATE, R. C. MORRIS.
ATTTIKAN—MYSORE P.O.,
SOUTH INDIA.
September 12, 1937.

VI.—ON WHISTLING OF BISON.

In regard to the whisting sound made by bison (*Bibos gaurus*) mentioned by Mr. Biddulph in the last *Journal* this 'whistling' noise, or high-pitched wail, is always made by a *bull* during the breeding season months, October-November to February-March.

HONNAMETTI ESTATE, R. C. MORRIS.
ATTIKAN—MYSORE P.O.,
SOUTH INDIA.
October 12, 1937.

VII.—CAUSE OF SORE NECK IN SAMBAR.

A circular bare and hairless patch on the throat of sambar has been the subject of controversy going on from 1921 under the caption 'Sore Neck in Sambar' in the *Journal* of the Bombay Natural History Society and readers of this valuable *Journal* owe the editors a debt of gratitude for allowing many sportsmen and writers to express their own views.

In this connection a note appeared in the *Journal* of the Natural History Society of Siam under the signature of Mr. P. R. Kemp. It was referred to in Volume xxxvii, No. 4, Misc. Note No. viii of the Bombay Natural History Society's *Journal* for the first time in 1921.

Although this subject is discussed in *Shikar Books* and in subsequent issues of the *Journal* of the Bombay Natural History Society in recent times, yet this phenomenon seems to have been observed for the first time, as early as 1890 by Mr. W. S. Thom (vide his interesting article in the *Journal* of the Bombay Natural History Society, Vol. xxxix, No. 2).

Before coming to the real cause for 'Sore Neck', it would not be out of place to summarise the opinion of various writers and tribes who live in forests where sambar abound. Mr. Kemp was told by the Siamese that this 'Sore Neck' is the leprosy of the Sambar and it is caused by the animal eating the fruit of the Ma-Kawk tree known as the wild olive or plum. The matter was referred to Mr. Dunbar Brander, I.F.S., who writes that he always observed this mark or sore during the period when hair and horn are undergoing a change. He naturally connected the two and came to the conclusion that the sore was the result of the changes taking place. He qualifies his remarks and states that this is merely his suggestion.

On reading the above notes, Lieut. R. A. H. McConnel states that while shooting in the Southern Province of Ceylon, he encountered a sambar hind which was incapable of movement. On examination he found that the under part of the neck was covered with festering sores. The hind was otherwise in fair condition and, as the sore was superficial, Lieut. McConnel supports the theory of disease. Here it may be mentioned that the sore neck due to a change in horn does not explain the phenomenon. (Vol. xxviii, No. 4, Misc. Note No. v, *Journal* of the Bombay Natural History Society.)

Then in Vol. xxviii, No. 2, Note No. ii appears the note from Mr. J. H. Hutton (now Dr. Hutton) with reference to 'Sore Neck'. He was told by Nagas that it is due to the animals perpetually rubbing themselves to get rid of ticks. Dr. Hutton adds that ticks certainly attack the necks of sambar but suggests that it may possibly be the result rather than the cause.

A further reference was made to the Honorary Secretary, Bombay Natural History Society through Mr. Blackburn and he very kindly supplied me with a reference to 'Sore Neck' in Mr.

Dunbar Brander's book *Wild Animals in Central India*. The author says that—

'In parts of India, especially towards Assam, Sambar have often been observed to have a curious sore bare patch or spot on the base of the neck. The cause is not known: it has been suggested that it is the manifestation of some disease. The phenomenon is not common in the Central Provinces, and I have only noticed it late in the hot weather or at the commencement of the rains. At this season of course Sambar are subject to little intelligent observation so it is possible that these spots exist more frequently than we are aware of. Occurring as they do in the region of a hair whorl or centre, and at a time when rapid moult is taking place, I have associated the phenomenon as being in some way connected with the new growth of hair. When Sambar change their coats they often do so in large tufts, the old hair coming away in sections before the new hair has developed. During this stage they have a very ragged appearance.'

In the publication of 15th April, 1937 of the Bombay Natural History Society's *Journal* (Vol. xxxix, No. 2) a very interesting article on this subject appears. This is 'The Malayan or Burmese Sambar' by Mr. W. S. Thom. In this article Mr. Thom not only explains his own theory and observation but adds the experience of other sportsmen and observers. At the instance of Mr. Thom, tubes were supplied by Mr. Mitchell to Mr. Mustill, the Game Warden, Burma to collect some of the exudation from the sore of the sambar, so that Mr. Mitchell may be in a position to make an attempt to diagnose the disease, if disease it is. Mr. Thom thinks that if the sore or circular patch on the sambar's neck is not the result of a parasite or a secretory gland such as is found in elephants, camels, black buck etc., then it may be the result of bites by ticks and the intense irritation set up by the animals pushing their way through elephant grass and under growth. Mr. Thom suggests that plants like *Mucuna pruriens* whose pods are clothed with intensely irritating bristles, stinging nettles and the fine hairs of the bamboo set up irritation, and he adds that when sambar push their way through grass and tick-infested jungle, the animals hold their heads well up and these insects then find the throat and neck the most convenient spot on which to gather. Mr. Thom writes that he has been told that 'Sore Neck' has been seen on the necks of brow-antlered deer and in one instance, on the neck of a barking deer.

Captain S. R. Rippon informs Mr. Thom that skin on the bare patch on the tame sambar's neck appeared to be quite normal, i.e., there was no sign of any parasitic disease to the naked eye nor did it appear as if the hair had been lost by rubbing. Captain Rippon thinks that the bare patch is probably a normal characteristic of the species and he doubts whether the sores are due to rubbing. He states also that it certainly would seem to be too much of a coincidence to find only this area on the neck affected in the way in every case, ticks must be found on other parts of the body.

Mr. Thom gives further very interesting facts from Major C. P.

Evans' book *Big Game Shooting in Upper Burma.* This is quoted below :—

'Major C. P. Evans in his book *Big Game Shooting in Upper Burma* has a lot to say on the subject of the sambar sore, *vide* pp. 144-48 of his book, but I will only quote a few extracts. He says that the Burman and Indian Shikaris state that the sambar is attacked by a parasite (I doubt whether they could explain what a parasite was) and that the sore is caused by the animal rubbing itself to get relief from the irritation. This he says no doubt is true so far as it goes; but they are quite unable to explain why sambar should invariably be attacked in exactly the same place or why the sore should be as circular as if it were made by a pair of compasses, and why sambar alone of all deer should be so afflicted. But are sambar the only deer so afflicted. Haven't black buck in India got it? Evans goes on to say that he does not himself believe in the rubbing theory. If the beast rubbed itself against a tree or branch to get rid of the irritation it would do so with an up and down motion and the result would be irregular scratches along the throat. But strange to say in spite of the forbidding appearance of the sore sambar do not appear to be at all inconvenienced by it. Evans says that he has watched sambar, when out in the open both in India and Burma for half an hour or more at a time, on purpose to see whether the animals rubbed the sore; but he never saw any sambar whether young or old pay the slightest attention to it. That the disfigurement is caused by a peculiar parasite which only attacks the sambar is according to Evans quite certain; but why it should invariably confine its attentions to the throat, or why it should cause a complete circular sore and, having done so, desist from further attack he is unable to explain. Judging by the bleeding spot in the centre of the circle it looks, according to Evans, as if the parasite having reached its limits, returned to the original spot and fed there, since it is, in full-grown animals, always quite raw, the remainder of the circle being merely bare and pink-looking. Seen in the early dawn this raw spot has quite a gruesome appearance.'

The writer of this article has seen several sambar at close quarters during the course of 20 years of his roamings in the jungle, but has never seen a single specimen of sambar with a 'Sore Neck' and never attempted to wait and watch for sambar as Major Evans did.

Though there are several sportsmen and scientists in the field, seeking to *unravel* the mystery of this phenomenon, for the last 20 years, the writer had an uncommon bit of good luck to read a passage in a small book which explains the cause of 'Sore Neck' in such a manner that it leaves no room for any doubt.

The fact of the matter is, our jungle friend the sambar although sometimes described as 'Monarch of the Dale' does not carry 'blue blood' in its veins. He has much humbler origin than people think. This 'Sore Neck' is nothing but a badge of inferiority complex which sambar and other higher forms of animals carry round their necks to remind them for all time, that they were

once marine animals. When the Himalayas were under water, these animals including sambar perhaps were swimming in the shallow sea.

In the biological language, 'Sore Neck' in sambar is an insistence of 'Atavistic Degeneracy', i.e., a return to an ancestral type. What we see as a bare patch and a sore on the neck of the animals used to be a place where gills were attached when these animals were leading a marine life. The disease is called 'Cervical Fistula'. I recommend the readers to study Mr. B. Lindsay's book *The Story of Animal Life*. I now quote the relevant passage from this book.

'Nor do we need to go into the nursery to find links with our inferiors. Much, indeed far too much, has been written of late years about "atavistic degeneracy"; that is to say degeneracy which imitates the characteristics of our forefathers. Many things which are classed as diseases, whether of the body, mind, or moral nature, may be explained in this way. Take the gills, which, as we have stated, exist in all vertebrates, but not in the adult of the highest groups. In a sickly individual, even among the highest vertebrates, traces of these are sometimes seen existing in the adult, as a gap or open space in the neck called by the medical man "cervical fistula": this is an instance of degeneracy in the body. Take, for another instance, the kleptomaniac, who snatches up everything he takes—a degeneracy of the mind, a relic of savage nature out of place in civilised man. Yet the gill-space is an ancestral feature which has its right time to appear though it is out of place in the adult; and the "want-to-snatch" stage, as we have already seen, is quite natural in the young child.'

To understand clearly the development, position, and modification of 'gills' in the modern animal, I quote another passage from Mr. Lindsay's book.

'The classes of the Vertebrata are Fishes, Amphibia, Reptiles, Birds and Mammals. We used to learn that of these, fishes had gills, and Amphibia gills for a time; but, to be strictly accurate, we must say that fishes have gills, and all the rest of Vertebrata have gills for a time. There is no exception to this rule, not even among the highest vertebrates. But in those vertebrates which stand higher in the scale of life than Amphibia, viz., Reptiles, Birds and Mammals, these gills are never brought into use. They only exist in the early embryo, and afterwards disappear, giving rise by their modification to other structures.

'Strange to say, one of these structures is the ear. This takes its origin from one of the gill-"clefts" or spaces. The Eustachian tube, which communicates between ear and nose, is part of this cleft; and the little bones which are inside the ear represent the bones of the gill-cleft. For, in fishes, bones support each gill, and are connected together to form a complex arrangement. In the higher vertebrates, which possess gills only in the embryo, this gill-skeleton is much modified, and persists as a bone, the hyoid bone, supporting the tongue.

'The gills of vertebrates, arranged in successive pairs along the throat, are "perforating gills"; that is to say, they consist

essentially of holes or spaces which pass right through the wall of the throat.'

JAGDALPUR, S. R. DAVER.
BASTAR STATE.
October 7, 1937.

VIII.—SOME BIRDS OBSERVED IN KUTCH AND KATHIAWAR.

From the ornithological point of view Kutch appears to be one of the least known of our Indian provinces, and Lester's *Birds of Kutch* is the only reference work to it that I can trace. A few notes jotted down during two short week-end visits (mid-June, 1936 and mid-August 1937) may be of interest.

At Bedi Bunder in Kathiawar, a curlew was seen on 12th June. Lester cites a local sailor to the effect that curlew breed on the islands in the Gulf. At Rozi Bunder (also on the Kathiawar side), curlew and whimbrel were both common on the 16th June. Again in mid-August this year, both species were plentiful in the mangrove swamps around Kundla. Judging from the arrival and departure of these birds round Bombay, however, my notes alone would not justify a belief in the breeding of these birds in India. Further information on this point would be interesting.

At the Hemisa Tank in the heart of Bhuj, I saw a solitary drake cotton teal (*Nettapus coromandelicus*) in full plumage.

This is apparently the first record of this bird in the State. Subsequent to this I learnt from Prince Fatehsinghji of Kutch (who is taking a keen interest in birds) that two more had been obtained at a recent shoot and their identity confirmed in Bombay.

I was also fortunate enough to meet during my short visit, a pair of those rare and elusive birds, the white-winged black tits (*Parus nuchalis*) on a scrub-covered hill-side. Unfortunately I had no occasion to add anything to our knowledge of this little-known bird.

Other birds seen, apparently rare in Kutch (vide Lester) were the two Jacanas (*Metopidius* and *Hydrophasianus*) both of which were common at the Hemisa Tank in June. The Crow-pheasant (*Centropus sinensis*), which Lester particularly notes as absent in Kutch, was seen at Jamnagar, just across the Creek.

ANDHERI, SALSETTE, HUMAYUN ALI.
BOMBAY.
December 15, 1937.

IX.—DRUMMING OF WOODPECKERS.

Anyone who lives in or near the jungles of this continent is familiar with the peculiar rat-a-tat or drumming on dead trees, a performance so often heard but not so often seen. I have the good fortune to have a vocation which permits of a study of bird

life and situated where woodpeckers abound After a number of years witnessing these performances I am still at a loss to account for the reason therefor.

A woodpecker will fly to a dead tree which is often used time and again for this purpose and after sitting still for a short while will peck rapidly with ever quickening strokes of its bill at the bole or branch of the tree selected. It will keep up for some time with regular intervals between each bout of drumming the while looking round as if expecting something to turn up in response, but I have never seen any other of the species attracted in this manner so it would not appear to be a mating call. In any case why should a bird with usually loud vocal call go to the trouble of wasting its energy, tapping against trees to attract the female? It seems to be a practice common to all types of woodpecker and even those allied species which cannot be called true woodpeckers such as the Piculets. The other day I was attracted to a dead Grevillea tree by a persistent br-r-r-r, br-r-r-r sound at regular intervals and saw up at the top a Nilgiri Speckled Piculet performing.

I give a list of the various woodpeckers I have observed drumming.

Southern Golden Backed Woodpecker, Malabar Golden Backed Three-toed, Malherbe's Golden Backed, Malabar Heart-spotted, Malabar Great Black Woodpeckers and the Nilgiri Speckled Piculet.

It would be interesting to hear through the medium of the *Journal* others' observations on this subject. I note that Whistler mentions that it apparently is an outlet for sexual emotion though he does not support it with any reasons why it should be.

NADUAR ESTATE, R. N. CHAMPION-JONES.
VALPARAI P.O.,
SOUTH INDIA.
December 12, 1937.

[The vocal or instrumental music of birds though it has its origin in sex, cannot be interpreted as nothing more than an elaborate form of sex signalling. It may pass outside the immediate circle of sex relationship and become an outlet for such emotions as joy, fear, jealousy or even the expression of mere content. In an interesting article on the drumming of the Heart-Spotted Woodpecker (*Field*, November 20, 1937), Major A. Buxton, writing about the performance of the birds at the nest, says that little drumming took place while the birds were sitting, but when he first entered his hide to film the birds in the act of drumming, the hen, disturbed by the noise he made, hit the trunk of the tree a resounding bang and ran up it drumming for all she was worth. The writer says that for two or three days he could always make her drum by making noises in the hide or by getting some one to hang about near the nest, for it was simply 'a case of making her rather but not too annoyed'. But once the woodpecker became accustomed

to these disturbances, she ignored them and ceased to demonstrate. What part if any the drumming of the woodpecker plays in the inter-relationship of the sexes is not known. Both sexes apparently indulge in the habit—but Major Buxton's note indicates that drumming may be a reaction to emotion not directly connected with the sexual impulse. It is interesting also here to include a comment by Mr. Eric Parker on Major Buxton's note published in the same issue of the *Field*. The series of cine camera photographs which illustrate Buxton's article record probably for the first time the movements of the woodpecker's head when drumming—movements too quick to be caught by the eye, the head of the bird during the process becoming as blurred as a fast spinning top. The photos reveal a rotatory movement—the beak of the bird, first pointing half left, next points directly at the tree and then reverts to the half left. Major Buxton holds the commonly accepted view that the sound is produced by the rapid striking of the bird's beak against the wood and he observed that the sound varied according to the state of the wood, being much softer on dead wood than on live, and even varying in intensity on different parts of the trunk according to the state of decay. Mr. Parker holds that the drumming sound of the woodpecker is not produced by repercussion but that it is purely vocal and emanates from the bird's throat. He submits that it would be impossible, with so small an instrument as the Spotted Woodpecker's beak, to produce by hammering on any sort of wood the long and sonorous volume of sound which can be heard more than a quarter of a mile away.—EDS.]

X.—THE INDIAN LONG-TAILED NIGHTJAR (*CAPRIMULGUS MACROURUS ALBONONOTUS* TICKELL).

The article on Nightjars contributed by Mr. E. H. N. Lowther to the *Journal*, Vol. xxxix, No. 3, is most interesting, made more so by the admirable photos accompanying it which illustrate the wonderful provision of Nature in self-protection.

The Indian Long-tailed Nightjar is quite common at Dehra Dun. During the hot weather it calls almost incessantly throughout the night. Deep and shady nullahs are features of this place, which are the resort of this bird. It so breeds in them.

About the 15th April 1919, I flushed a bird, in one of these, off a single egg. The nest was just a few leaves scraped together. I marked the spot most carefully, so as to make sure of finding it again. I returned to the spot on the 18th, and although I looked hard and carefully at the spot where I was certain the nest was, I could detect absolutely nothing, so I thought there was 'nothing doing'. I walked slowly towards this spot. When I had arrived there I stopped and with my stick I pointed to the place, practically between my feet, when up flew the bird, disclosing two beautifully fresh eggs. The point of my stick must almost have touched her before she moved. The protection afforded her by her colouration could not have been better.

LONDON,
October 22, 1937.

R. M. BETHAM, C.I.E.,
Brigadier-General.

XI.—ON THE PARASITIC HABITS OF THE PIED CRESTED CUCKOO [*CLAMATOR JACOBINUS* (BODD.)].

Three weeks ago I returned from leave to find many young Pied Crested Cuckoos about the station. Now both Mr. Stuart-Baker in the *Fauna* and Mr. Hugh Whistler in his popular *Handbook of Indian Birds* state that the young *Clamator* has that unpleasant cuckoo habit of pushing the other inmates or eggs out of the nest. In fact, Mr. Stuart-Baker enlarges on the habit by saying that, although at times many eggs may be found in the one nest, obviously the products of more than one female cuckoo, the strongest and first-hatched youngster alone survives.

Hume and Oates (*Nests and Eggs of Indian Birds*, 2nd Edition, page 388) only go so far as to say that 'as a rule' the young cuckoo is the only bird the foster-parents raise, and, on the same page, quote R. M. Adam as follows:—'On the 13th August I observed in a garden in Agra two young birds of this species —being fed by an *Argya malcolmi*. There was also a young *Argya malcolmi* with the party.'

On August 23rd, I saw a Jungle Babbler feeding two young *Clamator* seated close together on a buttress root of a pipal tree close to the door of my office. The babbler first fed one, flew up into the tree, returned almost immediately and fed the other one. It then flew off followed by both young cuckoos.

Two days afterwards I found we had a pair of young Pied Crested Cuckoos in our own garden, obviously just out of the nest. These were moving about together with a crowd of nine (at least) babblers, and are still to be seen together in the compound.

Now are these really cases of two young cuckoos being brought up in the same nest? If so, it would seem that this species is not so black as it is painted. On the other hand I have seen four members of a gang of babblers feed the young babblers in one nest, so it is faintly possible that these young cuckoos actually came from different nests belonging to members of one gang. I wonder if any other members of the Society have anything to say on this subject?

BAREILLY, R. S. P. BATES.
September 6, 1937.

XII.—EGG-LAYING OF THE KHASIA HILLS CUCKOO (*C. C. BAKERI*) IN THE NEST OF THE BURMESE STONE CHAT (*SAXICOLA CAPRATA BURMANICA*).

(May 1937).

Yesterday, May 19, 1937, I went for a walk with my wife and children at about 5 p.m. at Taunggyi, S. Shan States. Elevation about 5,000 feet. On our return we passed a ploughed field just outside my north field and some two hundred yards from my cottage. It was then about twenty minutes past six in the evening and the

sun low. My dogs chased a bird off the plough, and then I noticed that it was a cuckoo. I stood there pondering when the cuckoo returned and perched on the bamboo rails. Two chats were after her, and so I suspected that they had a nest there, and that the cuckoo was going to lay. She then flew off with the chats after her—out of sight. We sat down to wait, and I got my field glasses ready. Back came the cuckoo and she flew low over the centre of the field, almost settling at a place some sixty yards in front of us. She then carried on to perch on the rails quite close to us. Then she flew back over the same area and carried on out of sight.

In a couple of minutes' time she came again with the chats after her and dipping low in flight she settled at about the place I suspected the chat's nest to be. I got my glasses on her, and though the light was failing a little, I could see her very plainly. She had the appearance of a laying cuckoo, being a female with her throat feathers puffed out and her crown feathers raised from time to time. She began to search for the nest, hopping about in an ungainly fashion from clod to clod stretching her neck up looking everywhere. The chats were now mobbing her furiously, causing her to be continually ducking to avoid their onslaughts. As she did this she opened her beak at them and made faces. She did not appear to know exactly where the nest was and began a systematic search for it in an area of about five yards by three. The clods in the field were very large and lumpy with all manner of holes and cavities to conceal a chat's nest in, so that she disappeared from sight from time to time as she hopped into the depressions. Backwards and forwards she went in a very persistent manner, mobbed the whole time. I should have perhaps driven her off and quickly erected a hide there, but it was getting so late and I did not know exactly where the chat's nest was myself. I decided to risk it and continued to watch her with the glasses in the hopes that she would be in sight when she found the nest. With luck I should then be able to see her lay.

She was, I think, *a full ten minutes searching* for the nest. It seemed to me a very long time. Her persistence astonished me. She really did not seem to know where it was as she frequently went to look into holes only to come out disappointed again. At last she dipped out of sight from me and a flutter of her wing tips suggested that she had found the nest and was in the act of laying. She was there just out of my sight for about six seconds—and then away she sped in a great hurry.

She had undoubtedly laid!

When she was about a hundred yards' distance she gave two or three times her bubble note.

We climbed the fence and walked up to the place, and there we found a very well concealed chat's nest of the inaccessible type. The exact situation of it was obvious to me from the cuckoo's feathers—six or seven of which were scattered about the nest entrance—mostly over it. As it was all soft earth thereabouts from recent rain her feathers must have been pecked out by the chats—both of which attacked her furiously at the time of laying.

By stooping down with my head a foot above ground-level I could just make out that the nest contained two eggs—the cuckoo's and one chat's egg. From the outside to the edge of the nest would be about three or four inches—that will be shown in the photograph. It was not a nest that I could get my hand into—although my hand is exceptionally small. By using just the tips of my forefinger and middle finger I was just able to get the cuckooo's egg out—and then after it, the chat's. One at a time and with difficulty. The cuckoo's egg was warm and quite dry—with that lovely mat bloom on it of an egg just laid. The chat's egg was whole and uninjured.

We went home with the cuckoo's egg, intending to photograph the nest next day.

This incident confirms in every respect my observations of last year. The actual egg-laying took about three seconds, if we allow three seconds for the cuckoo to put her head into the chat's nest to take out a chat's egg.

There were the usual preliminary flights to the vicinity of the nest to get her ready for her laying. The only thing that astonished me a little was that she really did not, on this occasion, seem certain of the exact situation of the nest but had to hunt diligently for it—for about ten minutes, and this proves that a cuckoo is able to retain her egg for ten minutes.

The laying took place at six forty—the sun just about to dip behind the hills.

A photo with measurements of the nest concludes my account of this incident.

T. R. LIVESEY.

May 20, 1937.

XIII.—CUCKOO PROBLEMS.

In regard to my paper 'Cuckoo Problems' published in Vol. xxxviii, No. 4 of 25th August 1936, an explanation is called for. The term I used to express my theory of the evolution of parasitism in the Cuckoos and the final adaptation of their eggs was 'Desire'. That was perhaps an unfortunate term to use, as it suggests a sudden and independent volition on the part of the cuckoo amounting to almost conscious reasoning. Many people have given it this meaning, and so completely misread me, in spite of my having fully explained that my 'desire' was an *inherited* desire.

I must therefore explain that 'desire', has to be read as an 'inherited urge to parasitism' in most places where it occurs.

T. R. LIVESEY.

TAUNGGYI,
SOUTHERN SHAN STATES,
BURMA.
October 13, 1937.

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May 20, 1937.

XIII.—CUCKOO PROBLEMS.

In regard to my paper 'Cuckoo Problems' published in Vol. xxxviii, No. 4 of 25th August 1936, an explanation is called for. The term I used to express my theory of the evolution of parasitism in the Cuckoos and the final adaptation of their eggs was 'Desire'. That was perhaps an unfortunate term to use, as it suggests a sudden and independent volition on the part of the cuckoo amounting to almost conscious reasoning. Many people have given it this meaning, and so completely misread me, in spite of my having fully explained that my 'desire' was an *inherited* desire.

I must therefore explain that 'desire', has to be read as an 'inherited urge to parasitism' in most places where it occurs.

TAUNGGYI,
SOUTHERN SHAN STATES,
BURMA.

T. R. LIVESEY.

October 13, 1937.

XIV.—OCCURRENCE OF THE BLACK-CAPPED KINGFISHER [*HALCYON PILEATA* (BODD.)]. IN THE GONDA DISTRICT, U.P.

I am sure you will be both surprised and interested to hear that a specimen of the Black-capped Kingfisher (*Halcyon pileata*) was caught alive in the garden next to mine this morning. It was found to have a very badly broken wing and I think it must have struck the electric light wires in its flight and so got its wing broken. According to the *Fauna of British India*, it has not, with one exception, been known further west than Monghyr on the Ganges and what it was doing up here, I fail to surmise. I have been in the stretch of country from Purneah on the east to Cawnpore on the west for the past 14 years and am always on the watch for birds, but I have never seen this species before. I shall be glad to know if it has ever been recorded from these parts previously, if not, its occurrence here may be of sufficient interest to warrant publication in one of the next issues of the Society's *Journal*. Beyond its broken wing, the bird is in beautiful condition, but I can only get it to eat with difficulty.

BÅRGAON P. O. W. A. HEWITT.
GONDA, U.P.

September 25, 1937.

[In India the Kingfisher is found in forests along the coasts and in the banks of tidal rivers, following these practically up to the hills. Its occurrence in the Gonda district, U.P. is unusual. The bird in question was probably a straggler from its normal habitat.—EDS.]

XV.—ARRIVAL AND STAY OF SNIPE IN ASSAM.

I have read with interest the note on 'Early and Late Snipe' in Vol. xxxix, No. 4 of the *Journal* which I have just received and on turning up my Game register I find the following information which may be of interest:—

(1) In the Rajshahi District in Bengal during the season 1931-32 the first snipe I saw were three birds on the 19th August, but they were very wild and I failed to secure any. I saw another bird on the 25th August, but this also eluded me. It was not until the 30th August that I actually bagged one. Unfortunately I kept no record as to whether it was a Fantail or a Pintail. In the Game Book at the Police Mess at Sardah in the same district the earliest recorded snipe shot was on the 29th August up to the year 1930. The Game Book goes back a number of years.

The latest snipe I secured in this district in this year was on the 3rd April when four couple were bagged all of which were Fantails; but a Pintail was shot by a friend who was shooting with me on the same date. He also got three Fantails.

(2) In the Sylhet District of Assam during the season 1932-33 the first snipe I saw was on the 25th August and I shot it. It

was a Pintail. I know of another Pintail shot in the same district the same year on the 13th August. Snipe have been heard of in Sylhet at the end of April.

(3) During the season 1935-36 in the Sadiya Frontier Tract of Assam I shot a Fantail on the 8th August and a further eight couple Fantails on the 21st August.

(4) In the same District (Sadiya) during 1936-37, I saw a snipe on the 19th August but failed to secure it. I bagged a Pintail on the 20th August, two more on the 21st August and a further 3½ couple Pintails on the 22nd of the same month. Snipe do not appear to stay late in this District and I know of none shot after March. I feel certain however that the first birds reach the district at the end of July for all the birds shot in August have shown no signs of their long journey southwards being in very good condition and very lively. It is interesting to note that, whilst in August 1935 all the first birds shot were Fantails all the first birds shot in 1936 were Pintails!

Further information as to the first arrivals and the latest recorded snipe particularly from areas just south of the Himalayas would be interetsing.

GAUHATI,
KAMRUP DISTRICT, ASSAM.
December 31, 1937.

R. E. PARSONS,
Indian Police.

XVI.—OCCURRENCE OF THE SHELDRAKE (*TADORNA TADORNA*) IN MURSHIDABAD DISTRICT, BENGAL.

It might be of interest to record the occurrence of the Sheldrake (*Tadorna tadorna*) in district Murshidabad, Bengal, a small party of some 5 or 6 of the birds having been seen by a friend and myself on a piece of open water on December 5th 1937. The Sheldrake which were observed at about 100 yards' range through field-glasses were not mixing with the numerous other ducks on the water (mostly Pintail) but formed a small party of themselves near the edge. I understand this species is a somewhat rare visitor to this part of India.

Another fairly interesting occurrence of this season in the same district the Mallard (*Anas platyrhyncha*), two having been obtained on November 21st and one on November 28th, others having been seen on both days.

1, CLIVE STREET,
CALCUTTA,
December 17, 1937.

R. J. CLOUGH.

XVII.—NOTE ON THE PYTHON.

A few days ago I obtained a python near a small 'busti'. The reptile was said to have caught and swallowed a goat the previous afternoon, at the edge of a paddy field, and had moved

a distance of only about twenty-five yards into thick undergrowth, to sleep off the effects of its rather large meal.

In order to lighten the carcase for easy transport to my car, and also so that the owner of the goat might regain his lost property, (for he was of the opinion that it would still be quite good to eat), I opened up the snake and removed the goat, which latter was incidentally a large one and quite above average size.

The goat had been swallowed head foremost and rather more on its back than side, as the sharp points of the horns could be seen in the tightly stretched belly skin of the python. Digestion had only slightly commenced round the head and neck, where some of the hair had gone, and the bare skin had turned a dark colour. This was at 11 a.m. and if my information was correct, about 19 to 20 hours after swallowing. (Pretty slow digestion!) With the exception of this discolouration the goat was absolutely intact, no wounds were visible and no bones appeared to be broken. The python was not a large one, measuring a bare 14 feet 6 inches.

The few books in my possession that mention this subject, would have one believe that the python crushes its victim into a sausage-like mass before swallowing, but in this instance the crushing process had certainly not taken place. Even the legs were unbroken, the fore ones doubled back, and the hind ones *forward*, under the belly.

Questions that seem to need answering, are:—(1) How was the goat killed without wounds being inflicted, or bones broken? (2) How did the hind legs assume the position mentioned above? (3) Why were the usual signs of crushing entirely absent? Is it possible that the goat was swallowed alive, and therefore died of suffocation, thus accounting for the lack of wounds and broken bones, and also the position of the hind legs, in that they were caught in this position by the jaws of the snake during its (the goat's) death struggles? Finally, would a python of this size find the goat small enough to make crushing unnecessary, and only employ this method on larger animals?

It would be of great interest to know if the natural feeding habits of the python have been accurately observed, and also how such an apparently sluggish snake is able to catch wary creatures like wild pig, and barking deer, as they undoubtedly do.

Since writing the foregoing I have discussed the matter with a friend, who is a very keen observer with long experience in Assam, and I quote with his permission, two out of many instances that go to prove his contention of the habits of the python, in obtaining its food.

It is his opinion that the python waits beside a path used by domestic animals or game, near a tree stump or sapling that offers an anchorage for his tail, and lies (perhaps for days), with the fore part of his body in the form of an 'S'. When the unsuspecting victim comes along, this 'S' is straightened out with lightning-like rapidity, and the snake using its head as a battering ram, delivers a blow that 'knocks the wind out' of the animal, if not actually killing it on the spot. It then throws its body upon the animal,

and using the purchase of its tail from the convenient stump or sapling, presses down with terrific force until life is extinct.

In support of this; in each of the two instances mentioned above, a goat was killed by a python, but the reptile was disturbed before swallowing had commenced. In each instance the animal had been killed with no apparent wounds, on a pathway. Again, in each case there was a tree stump or sapling nearby, and from the latter a definite impression of the snake (described by my friend, as resembling a small trench), leading towards the pathway, of about the right length to allow of a turn of the tail round the stump, with the 'S' formation at the head end, within striking distance of the path.

My friend, on both occasions found the reptile lying up just where his experience had led him to expect it, and in the attitude described above. He also mentioned that both goats were found with the eyes wide open and a placid expression, giving no indication of having died in great pain or fear.

TINKONG TEA ESTATE, A. J. YANDLE.
TINKONG P.O.,
ASSAM.

November 4, 1937.

[Snakes being limbless invariably seize their prey with their jaws: but the teeth of snakes are fragile and ill-adapted to hold a struggling animal; movement of the prey is arrested either, with the paralysing effect of poison, or, when this is insufficient or wanting, the snake holds its quarry still by encircling it with its coils. Boas and Pythons deal with their prey according to size. Invariably the victim is seized with the jaws. It is a question of actual seizure; not merely of knocking the animal over with a battering blow of the head. The mouth and head of a python are not built for such usage. When seized in the jaws, if the prey is small and makes no struggle the snake does not attempt to wind its body around it but proceeds to swallow it. Frogs and lizards are frequently swallowed alive and have been rescued little the worse for their experience. If the prey is bulky or struggles, the coils are brought into use to stop movement. There is no intention to crush or break bones, and this seldom happens. The extent to which the quarry is encircled and the amount of pressure exerted is proportionate to the struggles of the victim. But the vice-like grip of the snake, preventing expansion of the lungs or the muscular action of the heart, results in killing the prey by asphyxiation. This explains why in the incident described above the goat was without wounds. The teeth would make little apparent impression on a hairy animal, and why there were no bones broken or apparent signs of crushing—death was brought about in the usual way by asphyxiation; the position of the hind legs was merely incidental to the manner of seizure in the coils of the snake. The python's method of attack both under conditions of captivity or in the wild state has been frequently observed. The snake may make its seizure on

the ground. In forest country it may climb into trees, where it hides so securely that even so alert a creature as a monkey is frequently taken unawares and meets its death, or the snake, with the help of its prehensile tail, suspends itself partly from the branches like a great aerial root, and from this position strikes at the unsuspecting quarry passing below. The element of surprise is part of the attack and the prey is seized and enmeshed in the coils before it is able to realise what has happened.—EDS.]

XVIII.—AN INSTANCE OF 'VIVIPARITY' IN *MABUYA CARINATA* (SCHN.).

Malcolm A. Smith[1] in describing the habits of *Mabuya carinata* says 'It is usually stated that this skink is viviparous, but such is not the case. A female kept by Father Dreckmann in captivity laid twenty-three eggs; from another female he recovered twenty-two eggs. All are about the same size—about 13 by 8 mm.; none of those examined showed any trace of embryo'. My observations show that *Mabuya carinata* is ovoviviparous. Some years back I came across, one morning in a school garden, a partly mutilated skink. On opening the body of the animal I found a number of eggs all of which showed developing embryos. I could observe closely the heart beat and circulation of blood. The stage of development roughly corresponded to a three-day-old chick embryo. Two of these embryos which I stained and mounted are still with me.

Subsequently I came across a case of oviparity in a skink in Annamalainagar. The egg clutch is now in the Zoology Laboratory of the Annamalai University.

R. V. SESHAIYA,
Lecturer in Zoology.

ANNAMALAI UNIVERSITY,
ANNAMALAI NAGAR.

XIX.—A SUPPLEMENTARY LIST OF THE PYRALIDAE OF CALCUTTA.

Some time back (*Journ. Bomb. Nat. Hist. Soc.*, xxxviii, p. 204) I recorded 91 species of Pyralidae taken in Calcutta. One species, *Ercta elutalis*, Wlk., must be deleted from this list, the specimen in question being a particularly pale example of *Ercta ornatalis*, Dup., and two species, *Ramila marginella*, Moore and *Ceratarcha umbrosa*, Swinh. must be corrected to *Ramila acciusalis*, Wlk. and *Phryganodes anal is*, Snell.

I now add a further 33 species, bringing the total to 123 to date.

Mucialla rufivena, Wlk.
Crambus atkinsoni, Zell.
Platytes argentisparsalis, Hmpsn.
Scirpophaga bisignata, Swinh.

---

[1] *Fauna of British India Reptilia and Amphibia* (Vol. ii) by Malcolm A. Smith. (New series.)

Epicrocis aegnusalis, Wlk.
Hypsipyla robusta, Moore.
Etiella zinckenella, Treit.
Orthaga euadrusalis, Wlk.
Endotricha decessalis, Wlk.
Endotricha ruminalis, Wlk.
Stemmatophora pallidella, Hmpsn.
Herculia tenuis, Btlr.
Nymphula foedalis, Guen.
Nymphula responsalis, Wlk.
Nymphula affinialis, Guen.
Cataclysta fuscalis, Hmpsn.
Oligostigma picale, Guen.
Mabra eryxalis, Wlk.
Zinckenia perspectalis, Hbn.
Syngamia abruptalis, Wlk.
Bocchoris rotundalis, Hmpsn.
Bocchoris onychinalis, Guen.
Bocchoris inspersalis, Zell.
Bocchoris artificalis, Led.
Caprinia conchylalis, Guen.
Deba surrectalis, Wlk.
Lygropia amyntusalis, Wlk.
Pachynoa pectinicornalis, Guen.
Pachyzancla phoeopteralis, Guen.
Pachyzancla aegrotalis, Zell.
Phlyctaenodes massalis, Wlk.
Pionea ablactalis, Wlk.
Pyrausta phoenicealis, Hbn.

LONDON. D. G. SEVASTOPULO, F.R.E.S.
November 20, 1937.

XX.—A NOTE ON THE LYCAENID BUTTERFLY *EVERES DIPORA* (MOORE).

(*With a plate*).

During the warmer months (April-September) this delightful little butterfly may be observed in suitable localities between 3,000 ft. and 6,500 ft. in the Simla Hills. It is usually found in open grassy country about which the food plants grow.

In the summer of 1936, I observed the females ovipositing on the leguminous plant *Desmodium parvifolium*. I took some of the eggs but due to the withering of the plant I had no success with the larva.

This year I was surprised to see a female laying her eggs on another plant, *Flemingia fruticulosa* which also belongs to the *Leguminosae*.

A few eggs were collected from time to time and, with the latter plant (see photo of larva), kept in glass-covered tin entomological boxes (which method I would stress keeps the contents

the ground. In forest country it may climb into trees, where it hides so securely that even so alert a creature as a monkey is frequently taken unawares and meets its death, or the snake, with the help of its prehensile tail, suspends itself partly from the branches like a great aerial root, and from this position strikes at the unsuspecting quarry passing below. The element of surprise is part of the attack and the prey is seized and enmeshed in the coils before it is able to realise what has happened.—EDS.]

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November 20, 1937.

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(*With a plate*).

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In the summer of 1936, I observed the females ovipositing on the leguminous plant *Desmodium parvifolium*. I took some of the eggs but due to the withering of the plant I had no success with the larva.

This year I was surprised to see a female laying her eggs on another plant, *Flemingia fruticulosa* which also belongs to the *Leguminosae*.

A few eggs were collected from time to time and, with the latter plant (see photo of larva), kept in glass-covered tin entomological boxes (which method I would stress keeps the contents

of the box perfectly fresh for a week) and several larvae were in due course reared to maturity.

It was interesting to note that the larvae were dimorphic, one brown with self-coloured longitudinal stripes, the other green similarly marked. These were separated, the green in one box, the brown ones in another box, but the pupae were all cream-coloured and the imagoes, irrespective of sex showed no differences.

During the lifetime of the larva it is seldom seen feeding, as this it does entirely on the tiny immature flower buds enclosed by the folded bracts. Pupation also took place in the same safe situation. So that altogether the species is more or less immune from the attacks of would-be enemies.

The sculpture of the egg is much the same as that of *Lycaenopsis huegelii* but is smaller and, whereas the latter's is dead white, this is sea-green.

Pupation lasts nine or ten days; the imago emerges between 10 and 12 a.m.

It would appear that the ants do not enter into the economy of this species.

In conclusion I would like to express my grateful thanks to Col. E. A. Glennie for photographing the specimen.

A. E. JONES.

2, THE MALL, SIMLA.

November 3, 1937.

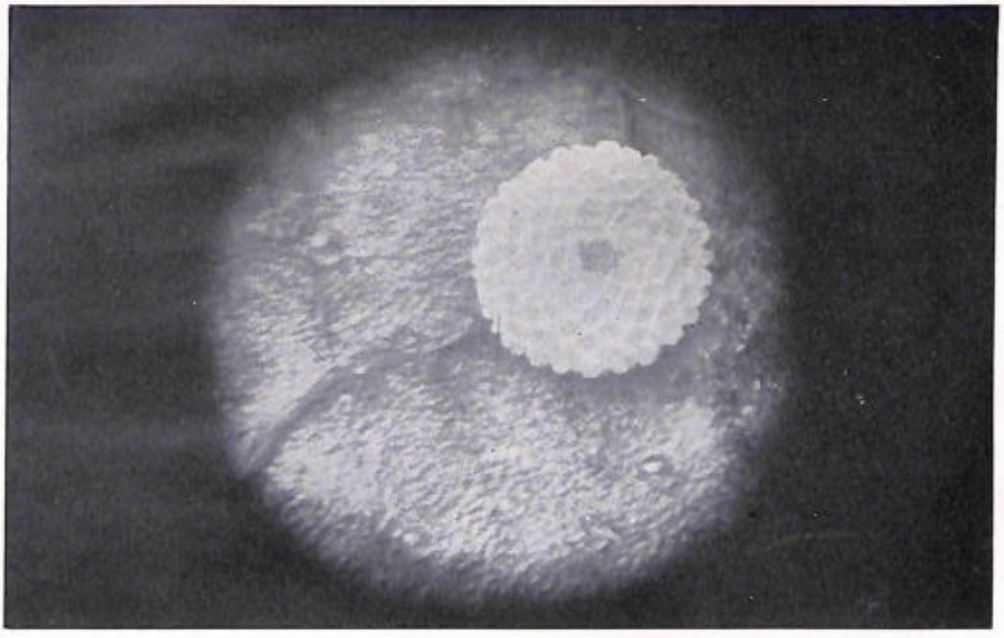
XXI.—ON THE DIFFERENCES BETWEEN *LYCAENOPSIS HUEGELII HUEGELII* AND *LYCAENOPSIS LADONIDES GIGAS*.

(With a plate).

When Brigadier Evans' *Identification of Indian Butterflies* was published in 1927 there was no mention of the latter species, so when the second edition of this very admirable work appeared in 1932, with many additional species included, entomologists in India awoke to the fact that still more intense investigation might be profitably spent on solving some of the problems presented.

The above two species are to the casual collector of Lepidoptera very much alike in the imago stage. Last year, I told Brigadier Evans I had been breeding some of these from larvae; he suggested that further experiments in this direction would be useful. This year more larvae were collected but it was difficult to separate the two species from these and the credit of solving the problem is entirely due to Col. E. A. Glennie who, while hunting for larvae, came across numbers of eggs and herein were found the great differences which will be observed by reference to the photographs. From these eggs, duly separated into their respective boxes, a number of larvae were reared and the imagoes eventually emerged, some were bred by Col. Glennie and some by myself and all came out true to species as discriminated in the egg stage.

From the time the pupa was formed eleven days usually elapsed before the imago emerged.

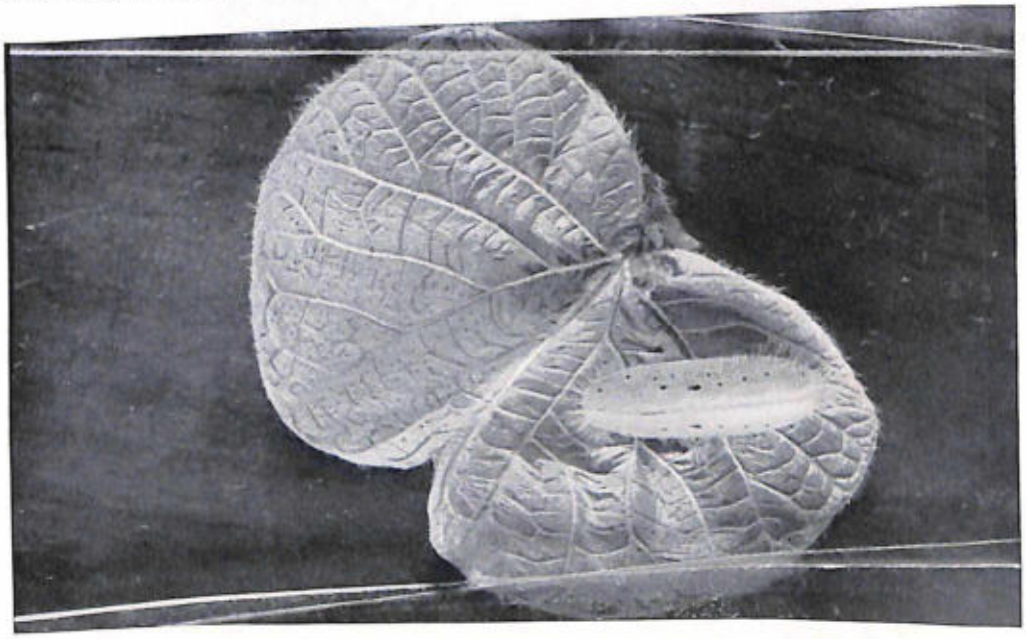


Ova ×40

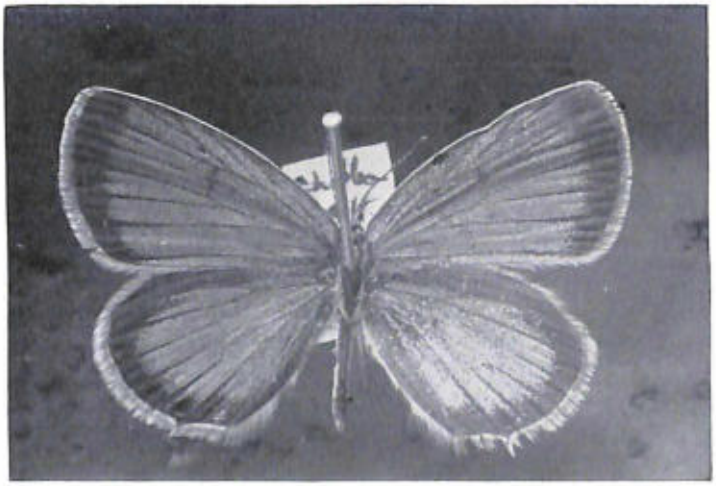


Larva ×3

Stages of *Everes dipora*, Moore.



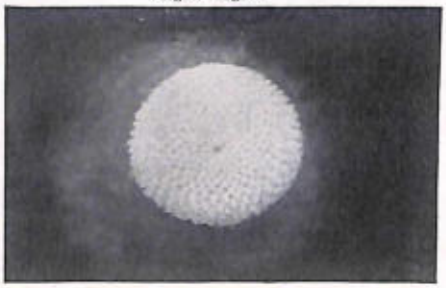
Pupa ×4



Imago, ♂ ×3

Stages of *Everes dipora*, Moore.

Lycaenopsis huegelii huegelii



X 29

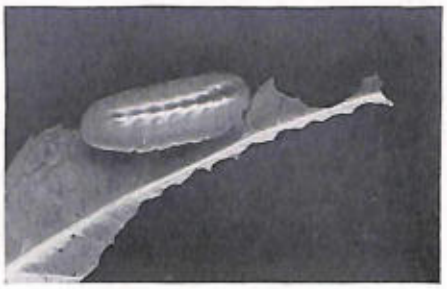
Lycaenopsis ladonides gigas



X 29



X 1½



X 1½



L. huegelii huegelii

X 1½

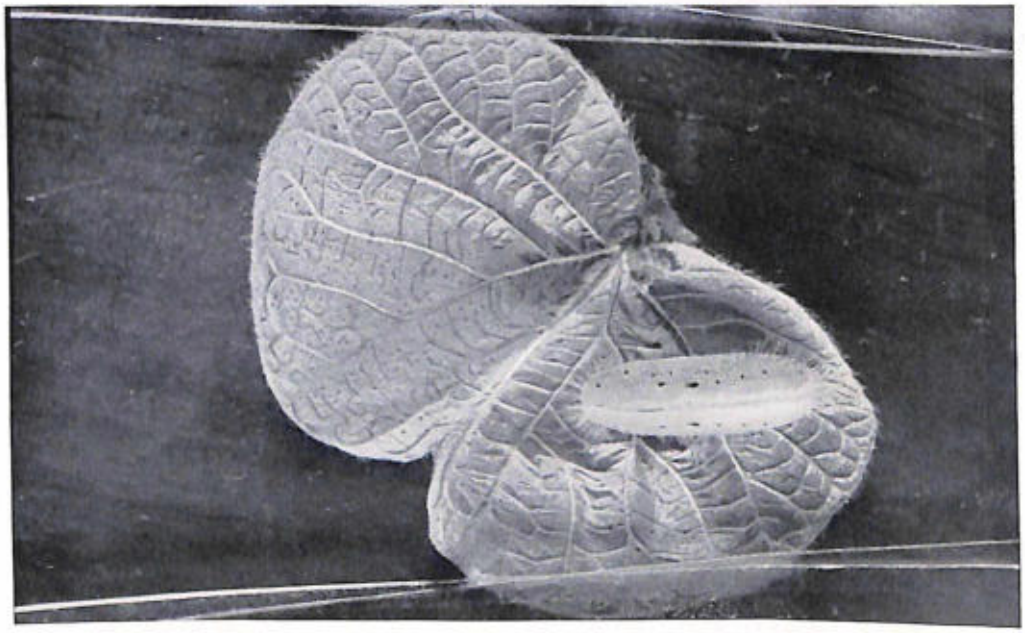


X 1

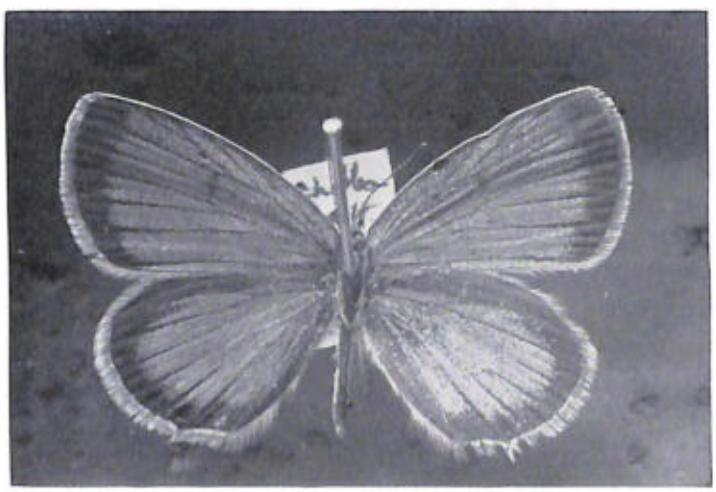


X 1

Comparison of
Stages of *Lycaenopsis huegelii huegelii* (Left) and *Lycaenopsis ladonides gigas* (right).



Pupa ×4



Imago, ♂ ×3

Stages of *Everes dipora*, Moore.

Lycaenopsis huegelii huegelii



X 2

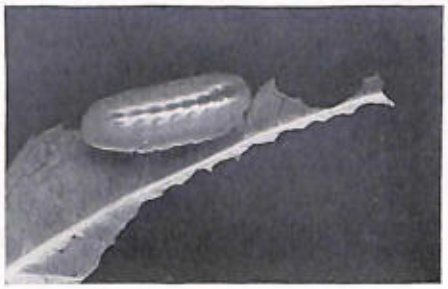
Lycaenopsis ladonides gigas



X 2



X 1½



X 1½



L. huegelii huegelii

X 1½



X 1



X 1

Comparison of
Stages of *Lycaenopsis huegelii huegelii* (Left) and *Lycaenopsis ladonides gigas* (right).

From the photographs the respective larvae look distinct enough, both are green of various shades, the heads only being black. The only difference, as the camera depicts, is that the markings on *ladonides gigas* are somewhat clearer than those of *huegelii*.

The food plant is *Prinsepia utilis*, Royle, Order Rosaceae, a shrubby spiny bush attaining to a height of usually 4 to 5 ft. common in the Simla Hills from about 5,000 ft. to 7,500 ft.

Ants have not been observed attending either of the above species so far as we can ascertain.

2, THE MALL, SIMLA. A. E. JONES.

XXII.—A NOTE ON OUR YALA SANCTUARY.

On May 5th my wife and myself had the pleasure of taking Sir Thomas Comyn-Platt to the wild life Sanctuary at Yala, so that he could get a 'glimpse' and an idea of that lovely country and see, if possible, some of our bigger fauna before his return to England after his visit to the F.M.S. where he was sent to obtain first-hand information for the Society for the Protection of the Fauna of the Empire.

Our visit was very hurried but fortunately conditions were good and this note may be of interest to those who contemplate a visit to this splendid, and the best Sanctuary in Ceylon, before it may be too late.

I knew it would be impossible to attempt it in our own car, but we were fortunate in finding a very ancient Chevrolet at Tissamaharama, which is the last jumping off place and which is some 30 miles from Yala, where the Ranger lives, and where the Sanctuary starts at the other side of the river, the Menik Ganga.

How that old car and the owner driver did that frightful journey would be a surprise to many. It is only a cart track and an apology at that. Every single obstacle where anyone else would have slowed down, or even stopped and got out, our driver simply charged at and over tree stumps and boulders we flew, only twice sticking in very deep and dry sand, where combined efforts of the party made the 'modern' Ship of the Desert continue its weary way.

What propaganda for the make of Chevrolet cars!

The track is only possible for only some makes of cars, during the dry season, which of course is not the best time to see the country at its best or to expect to see very much of all the wild life it holds. One heavy shower of rain, and one might be held up or cut off for many days. Therefore a car is not advisable, and the usual method of travelling in the little bullock carts is the best. The first miles are not very interesting although parts are beautiful open park-country and huge salt pans, like Daytona Beach.

After Palatapana, where the Game Reserve starts, the country soon becomes more interesting and very soon we began to see game, deer, buffalo and wild pig. Many of the deer simply stood and stared at our passing, or tried to race the car.

Reaching Yala at 9 a.m., rather late, we crossed the river where in future, it is hoped, there will be a boat or a canoe or

a raft, as I have recommended for many years. This river very often suddenly comes down in flood when it would not be possible to cross without a boat. Some of my men have been cut off and have had to spend the night up a tree and in heavy rain, simply asking for death by malaria. A raft would be a simple matter and easy to make, but progress moves so slowly!

It was very hot and rather late in the day when we reached the first huge open plain, but still we were lucky in being able to show Sir Thomas many buffalo, deer, pig, etc. while a bear ambled across our path, disturbed in its feeding on the delicious ripe palu fruit, which taste like small fresh dates and are very refreshing and said to be intoxicating, but we noticed no such effects.

On our return a cup of tea with the Ranger was most welcome, when one of the men suddenly called out 'Elephant'. This was luck, and from the small bungalow compound we could show our visitor a fine large bull slowly wandering about the river bank. If we had tied up a tame one, it could not have been arranged better!

It was a pity that time was all too short, as a few days camped in the very heart of the Sanctuary is an experience one never will forget.

The camp-site is on a huge plain under some large shady trees, and from one's camp chair or even camped, one sees the whole plain covered with wild life, practically throughout the whole day except during the hot noon hours. Herds of deer, small lots of sambhur, hundreds of buffalo, many fine lone old bulls, sounders of pig, jackals, peafowl, numerous waders and storks, and often a lone—or some herd elephants. It is an experience few would believe one could find in this world, where Nature and Wild Life are pushed back more and more by our unwelcome and destroying 'civilisation'.

Intending visitors should remember that permission to visit this Sanctuary must be obtained from the Minister for Agriculture in Colombo, while any information as how to arrange such a trip and make all the arrangements, will be gladly given by the writer of this note.

It must be remembered that when the Yala Wild Life Sanctuary has been declared a Strict Natural Reserve, permission to visit it will be most difficult, if not impossible, to obtain. Personally I think that a great mistake, I know that country very well, and I cannot possibly see what harm it could ever do for a small party to visit it and camp there a few days. That cannot disturb the game or the wild life in any way whatsoever, and it will be a sad day if that glorious country will be closed for ever for those who are genuinely interested in wild life and who love beautiful country so little known.

WEST HAPUTALE ESTATE,
OHIYA, CEYLON.

A. C. TUTEIN-NOLTHENIUS,
F.Z.S.

PRINTED AND PUBLISHED BY V. M. PHILIP AT THE DIOCESAN PRESS, 18, CHURCH ROAD, VEPERY, MADRAS

EDITORS: P. M. D. SANDERSON, S. H. PRATER, C. MCCANN, 6, APOLLO STREET, FORT, BOMBAY

JOURNAL

BOMBAY NATURAL HISTORY SOCIETY

GENERAL INDEX OF SUBJECTS AND AUTHORS

FOR VOLS. XXXI—XXXVI

MADRAS
PRINTED AT THE DIOCESAN PRESS
1938

JOURNAL

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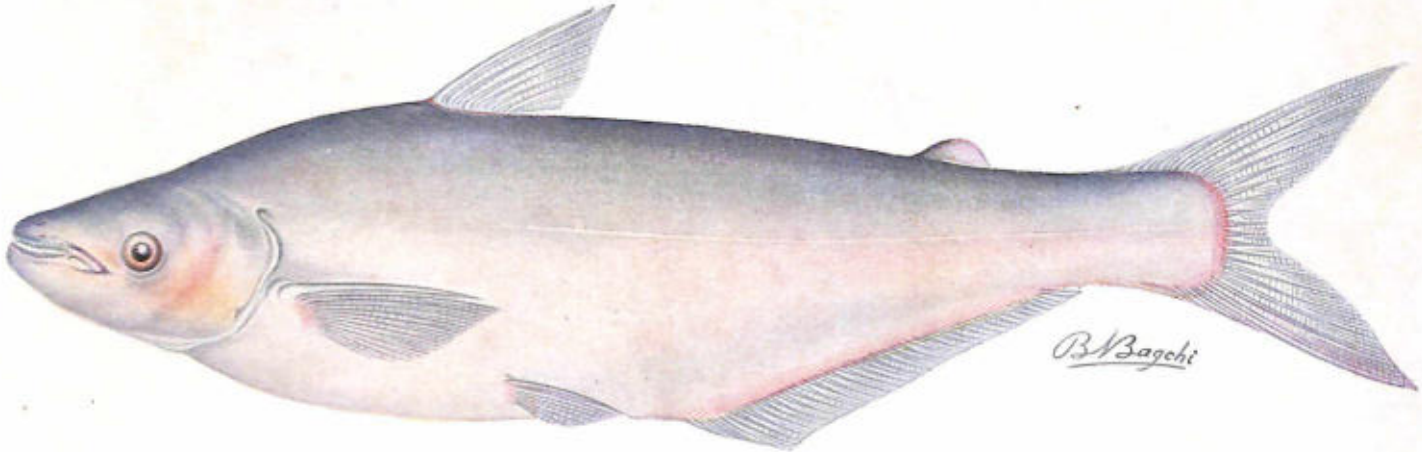
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THE SILOND CATFISH
Silonia silondia (Hamilton).

JOURNAL
OF THE
Bombay Natural History Society.

1938. VOL. XL. No. 2.

THE GAME FISHES OF INDIA.[1]

BY

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(With one plate and four text-figures).

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SILONIA SILONDIA (Hamilton).

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INTRODUCTION.

Among a great variety of Indian Catfishes, there are four species, *viz.*, *Silonia silondia* (Ham.), *Pangasius pangasius* (Ham.), *Bagarius bagarius* (Ham.) and *Wallagonia attu*[2] (Bloch), which attain a size of about five to seven feet in length, and on account of their voracious habits and powerful build are sometimes called 'Freshwater Sharks'. They cause considerable damage to fisheries

[1] Published with permission of the Director, Zoological Survey of India.

[2] Myers (*Copeia*, p. 98, June 1938) has restricted the use of the generic denomination *Wallago* to *W. dinema* Bleeker and has included the Indian species in his new genus *Wallagonia*.

and are very undesirable in several respects. However, they provide considerable sport to anglers, and are regarded game fishes of no mean value. The present article deals with the *Silond* Catfish, which is perhaps the most powerful of all the four species enumerated above and whose flesh is certainly more prized than that of the others. The following three articles will be devoted to the treatment of the three other so-called freshwater sharks.

Nomenclature and Systematic Position.

Hamilton (**3**)[1] who discovered the *Silond* Catfish for science, named it *Pimelodus silondia*, but later workers regarded Hamilton's *Pimelodus* as a generalised, composite genus and split up his group of 33 species into several genera. Swainson (**6**) removed the first two species of Hamilton's *Pimelodus*—*P. silondia* and *P. chandramara*, to a new subgenus *Silonia* of *Ageniosus* (*sic*) which was defined as follows:—

'Body of equal thickness with the head, which is not dilated; eyes very large; cirri two, very minute; adipose dorsal very small, oval; gill-membrane ten-rayed; ventral fin beneath the first dorsal; caudal fin slightly lunate.'

The two species included by Swainson under *Silonia*, *S. lurida* Sw. (=*P. silondia* Ham.) and *S. diaphina* Sw. (=*P. chandramara* Ham.), are quite different from each other, except that both were characterised by Hamilton as possessing only two barbels. *P. silondia* is, however, designated as the type of the species and it is to the fishes of this kind that the generic designation of *Silonia* is now applied.

Probably being unaware of Swainson's classification, Cuvier and Valenciennes (**1**) also proposed a new genus *Silundia* for the same two species of Hamilton's *Pimelodus* and characterised it as follows:—

'Les Silondies sont des siluroïdes, voisines des Bagres, à petite tête lisse, fort semblable à celle des schilbes, à très-petite nageoire dorsale adipeuse, à longue nageoire anale, qui n'ont que deux barbillons maxillaires, et tellement petits, qu'il faut de l'attention pour des découvrir. Leurs rayons branchiostèges sont au nombre de douze. Leurs dents de mâchoires, sur un on deux rangs seulement, sont plus longues et moins semées que dans les autres siluroïdes. Nous n'en connaissons bien qu'une espèce le *pimelodus silundia* de Buchanan; mais il me paraît que le *pimelodus chandramara* du même auteur s'en rapproche au moins beaucoup.'

Cuvier and Valenciennes changed the specific name of *Silond* to *Silundia gangetica* and the later workers adopted this name without any reference to Swainson's earlier work. As *Silonia* Swainson has priority over *Silundia* Cuvier and Valenciennes, in accordance with the International Rules of Zoological Nomenclature the species must now be designated as *Silonia silondia* (Hamilton).

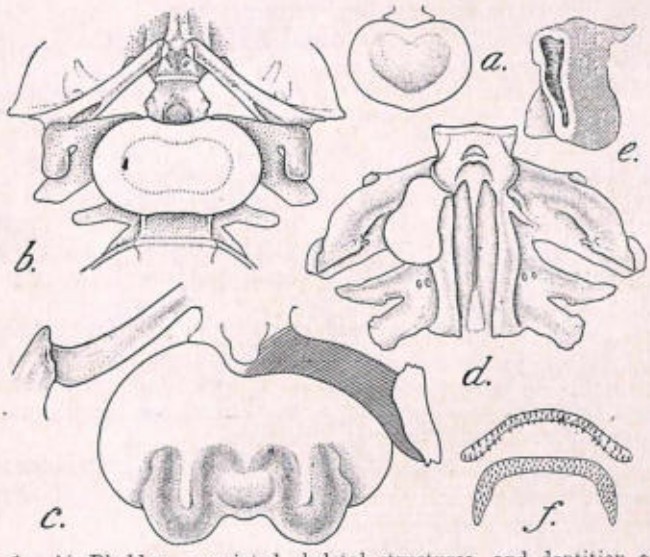
As recognised here *Silonia* is a monotypic genus. Some authors have regarded Sykes' (**7**) *Ageneiosus childreni* as a doubtful member of this genus but I (**4**) have placed it in a separate genus *Silonopangasius* Hora. Day (**2**) described a new species of

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[1] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

Silundia, S. sykesii, from Deccan and was doubtfully of the opinion that it may be synonymous with Sykes' *childreni*. In the collection of the Zoological Survey of India there is a considerable material of the Deccan form. Though both the species possess caniniform teeth which project outside the mouth-opening, *Silonopangasius childreni* has two pairs of barbels while *Silonia silondia* has only one pair. The structure of the air-bladder is also different in the two species. Moreover, the Deccan form rarely exceeds a foot and a half in length.

Taylor, Day, and Bridge and Haddon described the air-bladder of *S. silondia*,[1] but their accounts differ greatly from one another. On dissecting a number of specimens of various sizes it was observed that the form of the air-bladder undergoes considerable



Text-fig. 1.—Air-Bladder, associated skeletal structures, and dentition of *Silonia silondia* (Ham.).

a. Air-bladder of a specimen 53 mm. in length without caudal. ×3; *b*. Air-bladder of a specimen 131 mm. in length without caudal. ×3; *c*. Air-bladder of a specimen 237 mm. in length without caudal. ×2½. The portion shaded by section lines represents a strong fibrous structure by which the bladder is attached to the neighbouring skeletal elements; *d*. Air-bladder of a specimen about 1,070 mm. in length without caudal. ×½. The bladder from the right side is removed to show the nature of the bones to which it is firmly attached; *e*. Longitudinal horizontal section of the air-bladder shown in *d*. ×¾. The portion shaded by section lines represents the solid, fibrous part of the bladder, while its cavity is shaded black with dots; *f*. Upper dentition of a specimen 237 mm. in length without caudal. Nat. size.

changes during growth. I reproduce here (text-fig. 1) four drawings of the air-bladders of specimens 53 mm., 131 mm., 237 mm. and

[1] For references to the accounts of Taylor, Day, and Bridge and Haddon see the synonymy of the species on page 141.

1,070 mm. in length without the caudal, respectively. In both the earlier stages the form corresponds with that described by Bridge and Haddon, while that of the third specimen approaches the type described by Day. Fortunately, Taylor noted that his specimen was about 8 pounds in weight, so he was certainly dealing with a much larger specimen than those examined either by Day or by Bridge and Haddon. Taylor's description more or less corresponds with the form of the bladder of the largest specimen examined by me. Nair (5) has recently given an account of the changes in the internal structure of the air-bladder of *Silonia silondia* during growth.

The genus *Silonia* may now be defined as follows:—

The body is elongated and compressed. The head and body are covered with soft skin. The head is of moderate size and is rounded anteriorly. The median fontanel extends throughout the length of the head. The occipital process is sharply pointed posteriorly and there is a considerable space between it and the basal bone of the dorsal fin. The eyes are situated laterally behind the angle of the mouth and are visible both from above and below; they are provided with circular adipose lids. The mouth is anterior, wide and obliquely directed upwards. The lower jaw is somewhat longer than the upper and broadly pointed in the middle. The teeth in the jaws are large and caniniform; they project outside the mouth-opening. There is a continuous U-shaped band of villiform teeth across the palate. The lips are well developed near the angles of the mouth and are continuous. The post-labial groove is widely interrupted in the middle. The nostrils are situated wide apart and are slit-like; the anterior nostrils are along the front edge of the snout while the posterior ones are placed backwards and inwards. There are only two small maxillary barbels which lie in grooves and are liable to be overlooked. The dorsal fin is situated considerably in advance of the ventrals; it is provided with a moderately developed bony spine which is roughened externally and serrated internally. A small adipose dorsal is present in the last fourth of the body length. The anal fin is very long. The pectoral fin is provided with a strong, bony spine which is roughened externally and serrated internally. The pelvic fins possess 6 rays each. The caudal fin is deeply forked. The gill-openings are wide. The gill-membranes are deeply notched; they are united with each other but are free from the isthmus. There are 11-12 branchiostegal rays. The air-bladder is greatly reduced, thick-walled and uniform in the earlier stages; it has its long axis transversely disposed and lies across the body of the anterior, modified vertebrae. It is not enclosed in bone but is supported laterally by the transverse processes of the fourth vertebrae.

Genotype:—*Silonia lurida* Swainson 1838=*Pimelodus silondia* Hamilton 1822.

Distribution:—Same as of the only species, *vide infra*, p. 143.

Relationships:—*Silonia* belongs to the family Schilbeidae of the order *Siluroidea*. This family is represented by a number of genera both in the Oriental and the Ethiopian Regions. As I (4)

have remarked elsewhere *Silonia* with one pair of barbels is probably a primitive form in the family, though owing to its highly predaceous habits it has developed large caniniform teeth in both the jaws. Its close allies are represented today by forms like *Pangasianodon* Chevy of Siam and Indo-China, and *Silonopangasius* Hora of Southern India. The former, like *Silonia*, grows to a very large size, while the latter rarely exceeds a foot and a half in length.

SYNONYMY AND DESCRIPTION.

Silonia silondia (Hamilton).

1822. *Pimelodus silondia*, Hamilton, *Fish. Ganges*, pp. 160, 375, pl. vii, fig. 50.
1830. *Pimelodus silondia*, Taylor, *Gleanings in Science*, p. 171 (air-bladder).
1838-39. *Silonia lurida*, Swainson, *Nat. Hist. Fish.*, etc., i, p. 345, fig. 85; *ibid.*, ii, p. 305.
1840. *Silundia gangetica*, Cuvier & Valenciennes, *Hist. Nat. Poiss.*, v, p. 49, pl. ccccxxvi.
1853. *Silundia gangetica*, Bleeker, *Verh. Bat. Gen.*, xxv, p. 118.
1858. *Silundia gangetica*, Blyth, *Proc. As. Soc. Bengal*, p. 28.
1863. *Silundia gangetica*, Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 108.
1864. *Silundia gangetica*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 65.
1873. *Silundia gangetica*, Day, *Rep. Freshw. Fish Fisheries India and Burma*, p. 269.
1876. *Silundia gangetica*, Day, *Journ. Linn. Soc. London*, xii, p. 570.
1877. *Silundia gangetica*, Day, *Fish. India*, p. 488, pl. cxiv, fig. 3.
1877. *Silondia gangetica*, Beavan, *Freshw. Fish. India*, p. 136.
1889. *Silundia gangetica*, Day, *Faun. Brit. Ind. Fish.*, i, p. 145, fig. 62.
1894. *Silundia gangetica*, Bridge & Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, pp. 222, 223 (air-bladder).
1937. *Silonia silondia*, Hora, *Curr. Sci.*, v, p. 352 (affinities and distribution).
1938. *Silonia silondia*, Nair, *Rec. Ind. Mus.*, xl, pp. 5-11, 6 figs. (air-bladder).

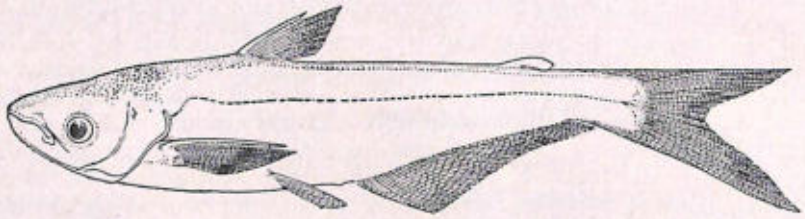
Vernacular Names:—*Silun* (Bengal, for young and half-grown), *Dhāīn* (Bengal, for larger specimens); *Silondia-vacha* (Calcutta); *Silon* (Dinajpore and Rungpur); *Baikar* (Gorakhpur); *Silond* (Punjab); *Ji-lung* and *Silond* (Ooriah and Bengali).

In the higher Bengali dialect this species is known as *Silandha* while its Sanskrit names are *Silendhra* and *Silindha* (*vide* Hamilton's list of Bhagalpur fishes).

B. 11-12; D. 1/7; A. 40-46; P. 11-13; V. 6; C. 17.

Silonia silondia is herring-shaped in its younger stages, but in the adult condition its belly becomes very bulky. The dorsal and ventral profiles are almost equally arched in the young individuals (text-fig. 2 and plate), but in full-grown specimens the ventral profile is greatly arched (text-fig. 3). The length of the head is contained from 5·0 to 5·8 times in the total length and from 4·0 to 4·6 times in the length with the caudal. The head is proportionately shorter in the larger individuals. The width of the head is about two-thirds of its length. The depth of the body undergoes considerable variations with age; it is contained from 4·7 to 7·4 times in the total length and from 4·0 to 6·0 times in the length without the caudal. The eyes are lateral in position and are visible both from above and below; the diameter of the eye is contained from 3·1 to 4·4 times in the length of the head, from

1·2 to 2·0 times in the interorbital width and from 1·0 to 1·5 times in the length of the snout. Proportionately the eyes are much smaller in larger individuals. The eyes are provided with narrow adipose lids. The head is provided with a median fontanel along its entire length which is shallow in front and somewhat



Text-fig. 2.—Lateral view of a young specimen of *Silonia silondia* (Ham.) 72 mm. in total length, collected from the river Hooghly in November 1937.

deeper behind. The occipital process tapers to a fine point posteriorly; it is thrice as long as broad and is separated from the basal bone of the dorsal fin by a considerable distance. The mouth is slightly ascending. The lower jaw is broadly pointed in the middle and is somewhat longer than the upper. There is a pair of small maxillary barbels which lie in grooves and do not extend beyond the eyes. The teeth in the jaws are caniniform and arranged in two series in each jaw; those of the outer series invariably project beyond the mouth-opening. The teeth on the palate are villiform and are arranged in a U-shaped band.

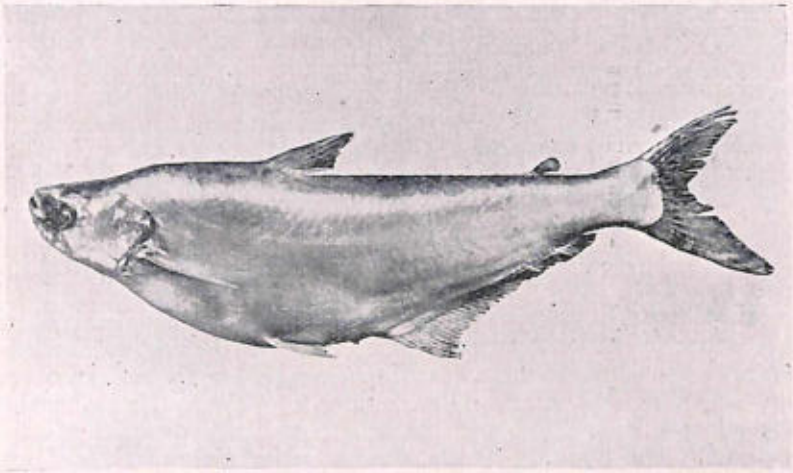
The dorsal fin is considerably, but not wholly, in advance of the ventrals; its forward position is more marked in the young than in the full-grown specimens. The dorsal spine is rather slender; it is rugose anteriorly and finely serrated posteriorly in its upper portion; it is about two-thirds the length of the head. The pectoral fin extends beyond the origin of the ventrals in young and half-grown specimens, but in larger specimens it does not reach to the base of the ventrals. The pectoral spine is similar to that of the dorsal fin. The adipose fin is small, but well-marked; it is situated above the posterior portion of the anal fin. In younger specimens it is in the posterior quarter of the length of the body, whereas in a fully mature specimen it lies in the posterior fifth of the body length. The ventrals just reach the anal opening and are separated from the anal fin by a short distance. The caudal fin is deeply forked; both the lobes are of equal length. The least height of the caudal peduncle is contained from 1·4 to 1·7 times in its length.

Colouration:—According to Hamilton (3) 'The back is of a dusky green *colour*; and, although the sides are like silver, the fish has a dirty lurid appearance, with a shade of livid hue. The back and tail fins are greenish, the others are white.' Some time after the fish is removed from water the back assumes a neutral tint while the ventral surface and sides become silvery. The opercle is shot with orange and yellow which is continued forwards to the mouth-opening. The iris is of an orange colour. The dorsal

fin is of a light neutral tint; the pectoral fin is also of the same colour but is provided with an orange band at the base. The ventrals are slightly tinted with orange. The anal fin is light purple with an orange band at the base. The adipose fin is of a purple colour. The tail fin is much darker and at the base is provided with a band of light Indian red colour.

In young specimens, below 4 inches in length, the dorsal and the pectoral fins after preservation in spirit are deeply stained with black. The posterior margin of the caudal fin and a considerable part of its superior lobe are also stained with black. These colour marks gradually fade away during growth.

Distribution:—Day in his *Fishes of India* states that this species is found in the 'Estuaries of India and Burma, ascending high up the larger rivers to nearly their sources'. The collection in the Indian Museum contains no specimen of *S. silondia* from Burma. Prof. F. G. Meggitt, at my request, sent to the Museum a collection of the local Rangoon fishes, but this species is not



Text-fig. 3.—Photograph of a large specimen of *Silonia silondia* (Ham.), 50 inches in total length, purchased from the Calcutta market.

represented in that collection. It may also be noted that Vinciguerra (8) in his account of the fishes of Burma does not record this species. It seems doubtful, therefore, whether the species is actually found in Burmese waters.[1] If, however, it occurs in Burma, it will be worthwhile to make a detailed study of the Burmese specimens and to compare them with the Indian examples

[1] Macdonald (*Journ., Bombay Nat. Hist. Soc.*, xxxiii, p. 306, 1929) records the occurrence of *Silund* (*Silundia gangetica*) in the higher reaches of the Irrawadi river.

to see the effect of isolation on them, as was found to be the case in *Eutropiichthys vacha* (Ham.) and *Clupisoma garua* (Ham.) (*vide* the second and the third articles of this series).

In South India *Silonia silondia* is replaced by the allied form *Silonopangasius*, and from the information available it seems probable that *Silonia* is restricted only to the Indo-Gangetic basin of Northern India.

As the body proportions vary considerably with growth, I give below in inches the measurements of a specimen over 4 feet in length (text-fig. 3). The measurements are only approximate.

Measurements in inches.

Total length without caudal	42·5
Length of caudal	7·5
Length of head	8·0
Length of snout	2·5
Diameter of eye	1·7
Depth of body	12·5
Length of pectoral	6·7
Length of dorsal	6·5
Length of ventral	4·5
Length of anal base	14·0
Length of caudal peduncle	6·0
Least height of caudal peduncle	3·7
Distance between tip of snout and origin of first dorsal	15·5
Distance between tip of snout and origin of ventrals	15·5
Distance between ventrals and anal fin	8·0
Distance between rayed dorsal and adipose dorsal	17·0

Bionomics and Fishing Notes.

Hamilton (3) noted that *Silonia silondia* 'is very common in the Gangetic estuaries, and is considered by the natives as good eating. It commonly grows to three feet in length, and occasionally to twice that size.' This species is a common food fish of Bengal and in the Calcutta markets large quantities of this fish are sold. The majority of the specimens, as stated by Hamilton, are below three feet in length.

It is a voracious feeder and does considerable harm to the fisheries. The young specimens, below 4 inches in length, collected from the river Hooghly were found feeding on prawns, young fish, etc. while the largest specimen examined had full-grown *Hilsa ilisha* (Ham.) in its stomach. The stomach is a large bag-like structure about twice as long as broad (text-fig. 4); the alimentary canal is only slightly convoluted. In a young specimen about 93 mm. in length, the length of the alimentary canal was about 80 mm. In a specimen 50 inches long, the stomach measured 11 inches in length and 5·5 inches in breadth. The length of the intestine was 62 inches.

Silonia silondia probably breeds in the rainy season as young specimens from three to eight inches in total length were found to be fairly common in November-December in the catches from the river Hooghly at Nawabgunge about 20 miles above Calcutta.

Measurements in millimetres.

Total length excluding caudal	54·0	100·0	108·0	135·0	144·0	155·0	200·0	203·0	330·0
Length of caudal	Damaged	26·0	28·0	32·0	31·0	45·0	48·0	41·0	Damaged
Length of head	13·0	25·0	25·0	30·0	31·0	34·0	45·0	45·0	70·0
Width of head	8·5	15·0	16·0	20·0	21·0	25·0	30·0	31·0	48·0
Width of body	6·0	10·0	12·0	16·0	16·0	20·0	25·0	26·0	42·0
Depth of body	9·6	17·0	20·0	26·0	31·0	39·0	45·0	51·0	76·0
Diameter of eye	4·0	8·0	8·0	9·0	9·0	10·0	11·0	11·0	16·0
Interorbital width	6·0	9·4	11·5	13·0	12·0	15·5	18·0	19·0	32·0
Length of snout	5·0	8·4	9·0	11·0	14·5	13·0	15·0	14·5	24·5
Length of dorsal spine	8·0	14·0	16·0	21·0	16·0	Damaged	31·0	30·0	55·5
Length of pectoral spine	10·0	18·0	20·0	23·0	23·0	27·0	35·0	35·0	56·0
Length of maxillary barbel	3·0	4·0	3·0	3·5	4·0	3·0	5·0	4·0	3·5
Length of caudal peduncle	7·0	11·0	13·0	17·0	19·0	20·0	24·0	27·0	32·0
Least height of caudal peduncle	4·5	6·5	8·0	10·0	11·5	14·5	17·0	17 5	25·0

In the list of Gorakhpur fishes Hamilton noted under *Baikar* that 'in this district it is said never to exceed six inches in length'. Presumably Hamilton was in Gorakhpur after the rainy season when the young fish are common in the river. It also seems probable that *Silonia* ascends rivers for breeding purposes and when the waters fall after the rains it becomes stranded in large pools in the upper reaches of the river. Principally it is an estuarine fish.



Text-fig. 4.—Alimentary canal of *Silonia silondia* (Ham.).

The *Silond* Catfish is a very game fish and fights well. It frequents the same type of habitats as the *Goonch*, but prefers stronger streams and clear white deep waters. The usual bait is a spoon or a fish, but specimens have also been caught on a Mahseer fly and provided good sport with this tackle also.

Though *Silonia silondia* is primarily a fluviatile fish, it can flourish in tanks and large reservoirs as well. In the Settling Tanks of the Calcutta Corporation Waterworks at Pulta the species is very common and attains a large size. It enters these reservoirs in the egg or larval stages. From a practical fisheries point of view its cultivation should be discouraged, as it is very destructive to other types of edible fishes.

ACKNOWLEDGMENTS.

The Bombay Natural History Society very kindly made a grant towards the cost of the illustrations and for this I offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra, M.SC., my assistant in the Zoological Survey of India, has helped me in the preparation of the tables of measurements and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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Explanation of Plate.

Colour sketch of the lateral view of a specimen, 214 mm. in length without caudal, of *Silonia silondia* (Hamilton) from the river Hooghly.

Immediately after the fish is taken out of water its colour is golden, but it fades quickly. The fish then becomes blue-backed with a white belly.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI AND HUMAYUN ABDULALI

PART IV.

(With 2 plates).

(Continued from p. 688 of Vol. xxxix).

The Common Weaver-Bird or **Baya** : *Ploceus philippinus philippinus* (Linn.).

Local name : *Sōn-chiri.*

Field identification : Size of the House-Sparrow. In non-breeding plumage both sexes very like the female of that bird, but with a thicker bill and somewhat shorter tail. In the breeding season the male acquires a golden-yellow head and breast, and the back is suffused with the same colour. The throat and sides of the head are dark brown. Flocks about rice cultivation.

Specimens : *B.N.H.S.* : o? 21-3-24 Chembūr (S.A.); ♀ 14-1-13 Santa Cruz (N. B. Kinnear); *St. Xavier's College* : 63 ♀, 64 ♂, 65 ♂ 3-9-33 Jogēshwari; 186 ♂ 19-3-34 Gōrēgāon; 205 ♀, 206 o? November '34 (H.A.).

Apparently a local migrant to some extent, as it becomes quite scarce in Salsette during January and February. Common on the open outskirts of the city, in the suburbs and throughout the island of Salsette. In the dry season flocks may usually be met with gleaning paddy in stubble fields. At this period, however, they split up into smaller or larger parties and spread far and wide over the countryside. They are also less noisy, and therefore not so conspicuous as when nesting. They do a certain amount of damage to ripening paddy crops. *Erythrina* flowers are largely resorted to in season both for the nectar and for the newly forming pods. Lantana berries are also eaten. At night, large numbers foregather to roost among tall grass patches and the mangroves by our tidal creeks, such as at Mahūl and Gōdhbunder. Here, hundreds of birds may be observed any evening arriving from all quarters. They also roost amongst the reeds and bulrushes round the margin of Powāi Lake.

Breeding : Many males have already acquired breeding plumage by the middle of May, but the nesting is not in full swing until the monsoon is well set. During the rains nest colonies are to be seen dotted about on bēr and babool trees and palmyra and date palms all over Salsette. By the middle of October all the chicks have left the nests.

The retort-shaped, woven, fibre nests are too well known to need description. The building work is done almost entirely by the males. In the earlier stages of a building colony the females are absent. They arrive only after some of the nests are half built, and take possession of these if approved. Thereafter the hen helps the cock in finishing off the interior. When the nest is ready, the eggs laid and the hen brooding, the cock commences to build another nest on a nearby twig which, in due course, may be appropriated by a second roving or prospecting female. In this way some cocks have three or more nests with as many wives, acquired one at a time. The usual number of eggs in a nest in Salsette is 2 to 4. They are pure white in colour.

[**The Black-throated Weaver-Bird** : *Ploceus benghalensis* (Linn.).

We have not come across this species in our area, but Wenden (*N. & E.*, ii, 120) records finding 8 or 10 nests, some containing eggs, at Bhāndūp on 28 August somewhere about 1880 (?).]

[**The Striated Weaver-Bird** : *Ploceus manyar* ssp.

Not met with by us, but there is a specimen listed in the Bombay Natural History Society's Card Catalogue as from Bombay. It is doubtful however, if this was a wild bird or one procured in the local bird market.]

The White-backed Munia : *Uroloncha striata striata* (Linn.).

Field identification : Smaller than the House-Sparrow. A small black-and-white finch with a heavy conical bill and wedge-shaped tail. Sexes alike. Pairs or small flocks in scrub country, about roadside hedges, etc.—often feeding on the ground.

No specimen. Noted : *Salsette* : Chembûr, Andhêri, Borivli.

Resident. Not common in Salsette though pairs and small flocks are occasionally seen. We have observed them feeding on grass seeds both on the ground and from off the stems. They are also very partial to bamboo seeds whenever available.

Breeding : In Salsette and across the Harbour—at Kihim and Alibâg, where it is common—we have found nests in various stages of construction or with eggs and young chiefly between March and November. August and September, however, appear to be the months when most eggs are laid. The nest is an untidy globular structure with entrance-hole on one side, occasionally in the form of a short tube. It is made of fine soft feathery grass, intermixed on occasion with a little coarse grass and even cocoanut fibre. It is placed between 5 and 10 feet up in a small bêr, lime or similar tree or bush, in scrub country and gardens. We have frequently observed four birds working on a single nest, but whether more than one female uses it for laying in at a time is not known. The nests are certainly used as dormitories by the entire family long after the young have flown. The eggs, pure white in colour with a pinkish tinge when fresh, number four to seven. Both parents roost within the nest at night even before the first egg is laid, and continue to do so throughout the incubation period. Brooding seems to commence in earnest only after the laying of the last egg. In one clutch of 5 eggs the incubation period was ascertained to be 13-14 days from the last egg (or 19 from the first). Both parents feed the young, apparently largely by regurgitation. The nests become foul with the excreta of the young, which are not removed.

The White-throated Munia : *Uroloncha malabarica* (Linn.).

Field identification : Size same as the last. A plain earthy-brown, thick-billed little bird with a pointed black tail, whitish underparts and a white rump. Flocks feeding by hedges and along cart tracks in open scrub country, gardens etc.

Specimens : *B.N.H.S.* : o? 5-7-25 Borivli (S.A.); *St. X. C.* : 87 ♂, 88♀ 25-9-33 Jûhû (H.A.).

Resident. Not uncommon in our area but perhaps more plentiful across the harbour in the Kolâba District. It prefers open sparsely scrubbed country and babool jungle. H.A. has noted it as common on the Reclamation at Church Gate (1933-35) and Br. Navarro observed it making abortive attempts at nest-building there in September.

Breeding : We have records of nests from Borivli, Chembûr and elsewhere in Salsette, and from Kihim (across the Harbour, in Alibâg Talûka) for every month in the year except December, January and February. This Munia habitually utilises disused Baya nests for laying purposes. Indeed it may almost invariably be seen haunting Baya nest-colonies even while the legitimate owners are still in occupation, entering the hanging tubes as opportunity offers. Although so far we have never found its eggs in occupied Baya nests but only in old and deserted ones, it is quite conceivable from its behaviour that it may in course of time develop a habit of parasitism on the Baya. When constructed by the bird itself, the nest is an untidy globular affair with a lateral entrance hole, similar to the Striated Munia's but with fine twigs on the exterior and often lined with feathers. Large feathers such as those of egrets and rollers are often used. The nest is placed in a babool, bêr or other thorny bush usually at heights of 6-12 feet. We have found, as a rule, 4-7 white unmarked eggs in a clutch. Both when self-built and when appropriated from a Baya, the nests are used as dormitories when the breeding season is over, as many as 6 or 8 birds—probably parents and their brood—crowding into a single nest to roost.

The Spotted Munia : *Uroloncha punctulata lineoventer* (Hodgson).

Field identification : Shape and size about the same as the last. In breeding plumage head and upper parts chocolate-brown. Underneath white with black speckles. In non-breeding plumage more or less plain brown. Pairs, parties

or flocks, according to season, feeding on ground in open scrub-and-grass country, and by cultivation.

Specimens: *B.N.H.S.*: oo 7-2-24, o 8-3-24 Pāli Hill, Bandra (S.A.); ♂ 1-12-12 Santa Cruz, ♀ 4-12-09 Andhēri (N. B. Kinnear); *St. X. C.*: 62 ♂ 3-11-33 Jogēshwari; 73 o, 74 o, 75 ♂ juv., 76 ♂ 12-11-33 Andhēri (H.A.).

Resident. Common. Often met with in large flocks of 75-100 birds or more. In the cold weather these flocks comprise largely of individuals in the plain brown plumage. A conspicuous change is noticeable by the first week of March when a large number are in the chestnut and spotted phase. This increases gradually until by July or August, when the breeding season is at its height, the majority of birds (if not all) are in the speckled plumage. The flocks have of course then mostly broken up into pairs. When a flock is disturbed feeding on the ground, the birds fly up into trees and bushes uttering feeble chirrups.

Breeding: The season in our area is a prolonged one lasting from about June to December. The nest is the usual globular structure of a Munia, made of grass blades, and is placed in the same sort of situations as that of the two previous species. We have, however, seen several nests in Salsette built at the bases of palmyra leaves, 40 ft. or more up. A normal clutch consists of 4-6 white eggs.

The Indian Red Munia: *Amandava amandava* (Linn.).

Field identification: Slightly smaller than the foregoing, with a square (not pointed) tail. In breeding plumage the male is a beautiful deep crimson with white spots on the breast and flanks. Female brownish with a red bill and crimson rump. The male in non-breeding dress resembles the female. Flocks about tall grassland and amongst reeds.

Specimens not collected.

Status? This Munia is rare in Salsette. We have come across it only on three occasions and it is possible that these were all escaped cage birds. The Red Munia or 'Waxbill' is a favourite with fanciers and large numbers from upcountry are always for sale in the Crawford Market.

Breeding: Aitken (*C.B.B.*, p. 138) saw a pair making a nest at Tārdeo. According to Betham (*J.B.N.H.S.*, xii, 78) it breeds in the neighbourhood of Poona at the beginning of September.

The Common Indian, or Hodgson's Rose-Finch: *Carpodacus erythrinus roseatus* (Blyth).

Field identification: Size about that of the House-Sparrow, with thicker bill and slightly forked tail, the last being a conspicuous feature. The male in full plumage has a beautiful crimson-pink head, breast, back and shoulders; the female is brown with an olive tinge. Flocks in flowering trees, Lantana bushes and sometimes on the ground.

Specimens: *B.N.H.S.*: ♀ 8-12-25 Gōdhbunder, ♂ 3-3-29 Tūlsi Lake (S.A.); ♂ 1-12-23 Andhēri (S. H. Prater); *St. X. C.*: 187 ♂ 21-3-34 Borivli (H.A.).

Winter visitor and passage migrant. Fairly common. Flocks usually arrive in Salsette about mid-November and some individuals stay over till the first week of April. The birds are much more in evidence about March when their numbers are augmented by the return passage from the south. While with us, we have observed Rose-Finches feeding largely on Lantana berries and on nectar from the flowers of *Calycopteris floribunda*, *Erythrina indica* and various other species. Large quantities of *Erythrina* pollen were found on the forehead and chin of specimens shot off the flowers, and the birds doubtless do service in cross-pollination. The call note is a pleasant interrogative whistling *tooee?*

The Yellow-throated Sparrow: *Gymnorhis xanthocollis xanthocollis* (Burton).

Field indentification: Size that of the House-Sparrow. Earthy-brown above, whitish below. The male has a lemon-yellow patch on the throat, two whitish bars on the closed wing and a bright chestnut patch near the shoulder. The female lacks the yellow throat-patch, and the chestnut on her shoulders is duller. Slightly but markedly forked tail. Pairs and flocks, according to season, by village cultivation, and in open deciduous forest.

Specimens: *B.N.H.S.*: ♂ 21-3-24 Chembūr; o? 6-4-24 Sion Causeway (S.A.).

Noted: Elephanta Island, Thāna, Borivli etc. Common on the mainland—across the harbour—at Kihim, Alibāg etc.

The Yellow-throated Sparrow is a common breeding species in our area. It is a local migrant; during the monsoon months practically none are to be seen, but its numbers increase again after about the first week of October. Parties of from 8 to 20 birds may be seen gleaning in harvested paddy-fields and in the vicinity of threshing floors in villages. Along with numerous other bird species, they invariably feed on the nectar from *Bombax* and *Erythrina* flowers in season. During the heat of the day flocks collect in leafy trees and spend the hours in noisy chirping. The call-notes are very like those of the House-Sparrow, somewhat pleasanter.

Breeding: The nesting season lasts from March to May. The nest is a pad of hair and fibres lined with feathers, and placed inside natural hollows in trees, barbet- and woodpecker-holes, pipes, old disused street lamps, etc. Two to four eggs—in appearance very like those of the House-Sparrow—is what we have found to comprise a normal clutch. Both parents share in feeding the young.

The Common House-Sparrow: *Passer domesticus indicus* Jardine & Selby.

Local name: *Chiri*.

Field identification: Too well-known to everybody to need description. A commensal of man.

Specimens: *B.N.H.S.*: ♂ 12-6-07 Worli, Bombay (Mr. Strong); *St. X. C.*: 192 ♂, 193 ♀ 4-4-34 Bombay City (H.A.).

Resident. Abundant alike in city and suburbs, as well as in villages farther afield, and by human habitations of every description. Often feeding in large flocks on the maidans and the Reclamation area. There is a recent record of a sparrow being struck in mid-air and killed by a cricket ball while a match was in progress on the grounds of the Islam Gymkhana! Large numbers collect every evening at sunset to roost in favourite trees and much noise and bickering prevails before the birds finally retire, usually well past dusk. It is difficult to conjecture what determines the choice of a particular roost out of several apparently equally suitable trees. How long the same tree continues to serve as a roost we do not know, but we know one that had been in occupation for three years at least. The Green Whip Snake (*Dryophis mycterizans*) commonly preys upon House-Sparrows in the suburbs, and crows and cats do great destruction amongst their fledglings everywhere. Albinism appears to be a not uncommon disease among the sparrows in Bombay. Several cases of complete or partial albinism have been reported from time to time.

Breeding: Sparrows breed practically throughout the year and make themselves a thorough nuisance in more ways than one to the inmates of the dwellings they select. Holes in the masonry of buildings and wells are most commonly used. Every conceivable site, such as the angle behind a picture hung on a wall and the globes of lamps, is appropriated. The inverted glass bell-jars, so commonly seen in mosques and fire-temples, offer irresistible opportunities for nesting. Gargoyles and drain pipes are everywhere much patronised. We have observed a bird trying to build up in a papaya tree and another on an *Erythrina*. The nest is an untidy collection of grass and feathers, and during its construction a formidable accumulation of rubbish litters the ground below. The usual clutch here consists of 3-5 eggs, greenish-white in ground colour, blotched and speckled with greyish-brown.

The Black-headed Bunting: *Emberiza melanocephala* Scopoli.

Field identification: Slightly larger than the House-Sparrow with a longer and noticeably forked tail. Head black. Bright yellow underparts and much of this colour in the rest of the plumage also. In the female the head appears rufous-brown and the yellow in her plumage is merely a suffusion of greyish-olive. Flocks, in and about cultivation.

Specimens: *B.N.H.S.*: ♀ 30-12-07 Andhēri; ♂ 9-11-12 Santa Cruz (Kinnear).

Winter visitor. This Bunting is very common in the cold weather in Deccan and small numbers may also be met with in our area. Aitken (*C.B.B.*, p. 144) mentions it as a winter visitor to Bombay. We have not come across it actually within Salsette, but in the Kolāba District across the harbour, flocks are not uncommon from the beginning of November up to

March. The birds usually feed on hedged-in cross-country cart tracks, and in fields in the vicinity of villages.

There are no records of the Red-headed Bunting (*Emberiza icterica*) in Salsette, but it is not unlikely to occur here, as in the Deccan, in mixed flocks with the Black-headed Bunting.

[**The Crested Bunting** : *Melophus lathami subcristatus* (Sykes).

There is a specimen of this Bunting in the B.N.H.S. collection from Kalyan. We have come across it at Vāsind. There is no record in Salsette.]

[**The Crag Martin** : *Riparia rupestris* (Scop.).

H.A. has observed this Crag Martin at Karnāla and Panvēl (Kolāba District) on the adjacent mainland in the cold weather (16-2-36), and it is therefore quite probable that it occurs in Salsette also at that season. EHA (*C.B.B.*, p. 41) thought he saw it about Malabar Hill—quite a likely spot in Bombay City. As compared with the next species, which is our common crag martin in this area, it is whitish on the underparts which contrast with the blackish undertail coverts in overhead flight. It is also slightly paler above and larger than the Dusky Crag Martin.]

The Dusky Crag Martin : *Riparia concolor* (Sykes).

Field identification : Somewhat smaller than the House-Sparrow. A uniformly sooty-brown bird with short square tail and swallow-like wings and flight. Usually seen about caves and rock-scarps, and in company with swallows, hawking winged insects.

Specimens : *B.N.H.S.* : o? 2-3-24 Elephanta Island (S.A.); *St. X. C.* : 231 o Bombay (H.A.).

Resident. Not uncommon in Bombay City, the suburbs, and in Salsette generally. In the city it keeps to large and old buildings such as the High Court and the University; farther afield caves—as at Kanhēri, Jogēshwari and Elephanta—and rocky cliffs, ruined forts and buildings are favourite resorts.

Breeding : The nesting season is apparently much prolonged. We have noted nests in various stages of construction or with eggs or young in February, March, April, July, August, October and November. The birds are probably double brooded. H.A. has found them breeding in the city in July, but observes that if the nest is destroyed the birds persist in rebuilding or laying again till they succeed, sometimes as late as October.

The nest is a deepish half saucer of mud pellets collected while damp, at a rain puddle or the like. It is stuck to the perpendicular cliff or wall about 2 inches below the ceiling or rock projection. It is lined with tow or feathers as a rule. The normal clutch consists of 3 eggs. These are white in ground colour, spotted and blotched with purplish-brown. Both sexes share in building the nest, incubating the eggs and feeding the young.

An experiment in the ringing of nesting Crag Martins was tried by H.A. A pair had nested successfully in a ground-floor verandah of St. Xavier's College in the 1932 season. In the following year a pair (then presumed to be the same) built in the verandah of the first floor. They succeeded in raising two young from the second laying, the first clutch having been removed. The parents and young were ringed at the nest at night. In the 1934 season a pair took possession of the identical site, one of which was a ringed bird—obviously one of the four. At the end of the breeding season —during the college vacation—the ringed bird was accidentally destroyed and unfortunately the ring was not read. In the year following a ringless pair took possession of the site. There were no other nests here besides this one in any season. All this shows that where the same site is used year after year, it is not necessarily by the same birds.

The Eastern Swallow : *Hirundo rustica gutturalis* Scop.

Field identification : Smaller than the House-Sparrow. Head and throat chestnut. Upper plumage glossy blue-black with a band of the same colour across breast. Underparts pale. Tail deeply forked—the conventional 'swallow tail'. Gregariously, on telegraph wires, etc. Hawking insects on the wing, especially by water.

Specimens: *B.N.H.S.*: ♂? 8-4-24 Mud Flats, Sion Causeway (S.A.); ♂? 16-12-12 Tūlsi Lake (Kinnear); *St. X. C.*: 159 ♀ 9-10-33 Powāi; 184 ♂ 19-3-34 Jūhū (H.A.).

Winter visitor. Fairly common. Arriving in October in flocks, often quite large, which take up positions over long stretches of telegraph wires here and there. By the middle of April practically all birds have departed. All our specimens belong to this race, but the one from Tūlsi Lake appears to be intermediate between this and *rustica*. *Gutturalis* is therefore evidently the race that visits Salsette and not *rustica* as should be the case according to the distribution given in the *Fauna*, vol. iii, pp. 241-2.

The Indian Wire-tailed Swallow: *Hirundo smithii filifera* Stephens.

Field identification: Size as the foregoing. Glossy steel-blue above white below, with chestnut crown. Two long wires in tail which in the female are shorter. May be differentiated on the wing from other swallows by the pure white underparts and the presence of tail-wires. Small flocks, often in association with other swallows, on telegraph wires, etc. or hawking winged insects usually near water.

Specimens: *B.N.H.S.*: ♂ ♀ 12-12-23 Andhēri (S. H. Prater).

Noted: Mud Flats—Sion Causeway, Gōdhbunder.

Resident? Sparsely distributed throughout North Konkan, being everywhere far less abundant than it is in the Deccan.

Breeding: We have no record of nests in Bombay or Salsette, but on 5-5-35 one was observed under the old pier at Dharamtar Ferry (Kolāba District) which contained young. The nest is a half-cup of mud pellets stuck to the wall about 2 inches below the ceiling or an overhang. It is not unlike that of the Dusky Crag Martin. It is built under bridges and culverts, on cliffs near water, and occasionally in buildings. There is usually a lining of grass and feathers.

The Wire-tailed Swallow breeds in some numbers at Khandala (ca. 2,000 ft. —Western Ghāts) in April and May.

[The Indian Cliff Swallow: *Hirundo fluvicola* Blyth.

Field identification: Much smaller than the other swallows with a short square tail and black-streaked white underparts. Gregarious; usually large numbers.

Not met with by us, but EHA (*C.B.B.*, p. 41) records seeing it in Bombay. It is common in the neighbourhood of Poona and Betham (*J.B.N.H.S.*, xii, 78) found nests there built under arches of a low bridge, 4 or 5 feet above water level.]

Sykes's Striated Swallow: *Hirundo daurica erythropygia* Sykes.

Field identification: Size about that of the House-Sparrow. Upper parts deep glossy blue except for the chestnut half collar on nape and the chestnut rump. Below pale rufous with fine blackish streaks. Tail deeply forked. Gregariously, about old mosques and buildings and on telegraph wires.

Specimens: *B.N.H.S.*: ♂? 8-4-24 Mud Flats, Sion Causeway (S.A.); *St. X. C.*: 58 ♂? juv. 21-8-33 Gōrēgāon (H.A.).

Resident (?) in small numbers. During the cold weather large congregations are seen closely packed on telegraph wires in the early mornings, often covering several hundred yards of the line. Most of these birds are migrants, however, and possibly belong to the race *nepalensis*. Unfortunately we have no specimens collected from such flocks.

Breeding: We have no record from Salsette. For four years in succession we found a nest with eggs on the ceiling of a small rock-cave in the hills near Kihim (Alibāg Talūka) between 15 and 31 May. The nest is retort-shaped, attached to the ceilings of domes, caves, etc. with an entrance passage about 6 inches long. It is made of mud-pellets, and the egg-chamber is lined with grass and feathers. The normal clutch is of 4 eggs, pure white in colour.

The Indian White Wagtail: *Motacilla alba dukhunensis* Sykes.

Field identification: Size about that of the House-Sparrow, slimmer, with a slenderer bill and a much longer tail which is constantly wagged up and down, and longer legs. General colour grey above, white below with a black

nape and bib. Ear coverts *white* at all seasons. Singly or small scattered parties, running about on lawns, maidans and open spaces, picking up insects.

Specimens: *B.N.H.S.*: ♀? 10-2-24, ♀? 16-2-24 Pāli Hill, Bandra (S.A.); *St. X. C.*: 151 ♂ 27-10-33 Jūhū (H.A.).

Winter visitor. Common. The earliest record we have for Salsette is 2 October; the latest 8 April. During the cold weather months the birds may invariably be seen on all our maidans as well as on the grounds of the Willingdon Sports Club and the Race Course at Mahaluxmi, the various Gymkhanas and the Reclamation along Back Bay.

When the inward migration (autumn) is in full swing, the fresh arrivals may frequently be seen 'swarming' in certain localities of the city and suburbs for a day or two, roosting for the night in large numbers among the roadside trees. The majority of birds pass on subsequently, but the remainder disperse over the countryside to spend the winter in our midst. At the commencement of the hot weather, March-April, there are similar waves of passage migrants from the south.

The Masked Wagtail: *Motacilla alba personata* Gould.

Field identification: Similar to the above, but with the ear-coverts *black* at all seasons.

Specimens: *B.N.H.S.*: ♂ 29-11-23 Andhēri (S. H. Prater).

Winter visitor. Much less common than the White Wagtail and, except for the ear-coverts, difficult to distinguish from it in the field.

[The Large Pied Wagtail: *Motacilla maderaspatensis* Gmelin.

Field identification: Larger than the foregoing species—about the size of the Bulbul. Jet black above and on breast, white below, with conspicuous white stripes above the eyes and a broad white patch on the wings. General colour scheme that of the Magpie-Robin. Pairs by rocky streams and near water.

We have not come across this Wagtail in Salsette, neither have we seen any specimens hence. EHA (*C.B.B.*, p. 114) says 'not often seen in Bombay' which would imply that he had seen it occasionally.

We have noted it at Tānsa Lake, and at Rōha, Mahād, Panvēl and elsewhere in the Kolāba District on the mainland opposite.

Breeding: The nearest record we have is from Khandāla (ca 2,000 ft.—Western Ghāts) where Brother Navarro took a c/3 in October 1935.]

The Indian Blue-headed Wagtail: *Motacilla flava beema* (Sykes).

Field identification: Size same as the White Wagtail. Differentiated only in summer plumage from the Grey-headed Wagtail principally by its paler greyish-blue head. Singly or scattered parties, on the wet grassy margins of tanks etc.

Specimen: *St. X. C.*: 78 ♂ 12-9-33 Andhēri (H.A.).

Winter visitor, arriving early.

The Grey-headed Wagtail: *Motacilla flava thunbergi* Billberg.

Field identification: Size as above. In summer plumage distinguishable from the next species by the dark blue-grey head and bright yellow underparts, with no black on throat or breast. Usually several, widely separated, on grassy water-logged ground on the margin of tanks etc.

Specimens: *B.N.H.S.*: ♀ 11-3-24 Pāli Hill, Bandra (S.A.); *St. X. C.*: 115 ♀? 10-10-33 Jūhū (H.A.).

Winter visitor. Fairly common. Earliest date ?; latest 4 May, '34 (Powāi Lake).

The Grey Wagtail: *Motacilla cinerea caspica* S. G. Gmelin.

Field identification: Size as above. Grey above—with greenish-yellow rump—pale sulphur-yellow below, brighter on abdomen and under the tail. Whitish eyebrows. In summer plumage, just before the birds leave us, chin, throat and upper breast black in male, mottled in female. Almost invariably singly, on damp ground or near streamlets etc.

Specimens: *B.N.H.S.*: ♀? 5-2-24 Pāli Hill, Bandra; ♀? 12-10-24 Khār; ♂ 17-3-24 Tūlsi Lake (S.A.); *St. X. C.*: 96 ♀? 28-9-33 Borivli (H.A.).

Winter visitor. Fairly common. Earliest date 28 September; latest 12 April.

The Black-headed Wagtail : *Motacilla feldegg melanogriseus* Homeyer.

Field identification : Size as above. In summer plumage crown, sides of head and nape black without contrasting eyebrows; white throat, yellow underparts. In winter plumage very confusing in the field and almost impossible to tell with certainty from several other species. On water-logged ground or grassy margins of tanks, etc.

Specimens : *B.N.H.S.* : o? 8-3-24, ♀ 11-3-24 Pāli Hill, Bandra (S.A.); o? 7-3-10 Gōrēgāon (N. B. Kinnear); *St. X. C.* : 114 o?, 116 o? 10-10-33, 152 ♀ 27-10-33 Jūnū; 227 o?, 228 ♂ 8-3-35 Andhēri (H.A).

Winter visitor. Common. Noted on open meadows by the seashore about Dānda and the Pāli Hill Golf Course, feeding in company with White Wagtails and Pipits. Latest date 31 March.

The Yellow-headed Wagtail : { *Motacilla citreola werae* Buturlin. / *Motacilla citreola citreola* Pall.

Field identification : Size as above. In summer the male of the race *werae* has a bright yellow head and black back. In *M. c. citreola* the back is not black. The females are duller. Usually by tanks and streams with grassy margins. Commonly on floating vegetation in Powāi Lake, etc.

Specimens : *M. c. citreola. B.N.H.S.* : oo 8-4-24 Mud Flats, Sion Causeway, o? 23-3-29 Tūlsi Lake, o? 10-3-24 Pāli Hill, Bandra (S.A.) ♂ 7-3-10 Gōrēgāon (Kinnear); o? 30-1-21 Santa Cruz (Ellison); ♀♀ 14-3-26 Mud Flats, Bhāyndar Creek; o? 17-3-24 Tūlsi Lake (S.A.).

M. c. werae : *St. X. C.* : 233 o?, 256 o? 22-3-35 Andhēri (H.A.).

Winter visitors. Fairly common.

It may here be remarked that in immature plumage many of the above species of wagtails are impossible to identify with certainty, and while they are probably correctly named as above, we are far from being positive.

The Forest Wagtail : *Dendronanthus indicus* (Gmelin).

Field identification : Size as above. Olive brown above, white below, with a conspicuous black band across breast. Two whitish bands on closed wing. Singly or pairs, feeding on ground under shady trees and vegetable 'māndwas' or bowers.

Specimen : *B.N.H.S.* : o? 30-3-24 Deonar, Chembūr (S.A.).

Not noted elsewhere in Salsette.

Winter visitor or passage migrant? Uncommon. At Kihim (Alibāg Talūka) —across the harbour—we have observed it only at the end of March and in the first week of April, evidently on northward passage.

When disturbed, the bird flies up into a nearby tree and wags its tail slowly up and down. It utters a soft *pink, pink* like the Crested Bunting.

The Tree Pipit : *Anthus trivialis trivialis* (Linn.).

Specimens : *B.N.H.S.* : ♀ 20-2-13 Santa Cruz (Kinnear); ♀ 4-2-24, ♀ 7-2-24 Golf Links, Pāli Hill, Bandra (S.A.).

Witherby's Pipit : *Anthus trivialis haringtoni* Witherby.

Specimen : *St. X. College* : 176 o? Vihār Lake 12-9-34 (H.A.).

Field identification : The Pipits found in Bombay and Salsette are all birds about the size of the House-Sparrow, somewhat slimmer and with a longer tail that is constantly moved up and down like a wagtail's. In general colouration they resemble the female House-Sparrow. They frequent open spaces such as maidans, golf links, the vicinity of tanks, and semi-barren stony ground. They feed entirely on the ground along which they *run* with great agility, unlike the sparrow which *hops*. They are usually seen singly or in small scattered parties. Their food consists mainly of insects. They fly up into trees when disturbed. They have the same undulating flight as wagtails. The different species are often impossible to tell in the field. Only one species, *rufulus*, is resident in our area.

Winter visitor. Earliest date 12 September. Usually found in shady mango topes.

The Indian Pipit : *Anthus rufulus rufulus* Vieillot.

Specimens : o? 17-3-24 ; ♂ 2-4-24 Pāli Hill, Bandra ; ♂ 15-6-25, ♂ 21-6-25 Trombay Hill at ca. 1,000 ft. ; ♂ 10-11-27 Mud Flats, Sion Causeway (S.A.) ; ♀ 20-1-13, ♂ 12-11-12, ♂ 20-2-13 Santa Cruz (Kinnear) ; oo? 12-12-99, 14-12-99 Esplanade, Bombay (J. W. Mason) ; *St. X. C.* : 208 ♀ -12-34 Andhēri (H.A.).

Resident. Common. Seen in open fallow land with short grass, stones, etc.

Breeding : On 15 April (1931) a nest was located on the coarse grass land, inundated during the monsoon but now hard and pitted, adjoining the Santa Cruz Match Works, opposite the Jūhū aerodrome. It was a pad of rootlets and hair placed in an old hoof-print of cattle. It contained 3 chicks about a week old.

The Eastern Tawny Pipit : *Anthus campestris griseus* Nicoll.

Specimens : *St. X. C.* : 14 o? (worn juvenile plumage) 14-10-32 'Salsette' ; 18 ♂ 13-1-33, 166 ♀ 13-11-33, 199 ♀ 27-9-34, 226 ♂ 13-11-35 Andhēri (H.A.).

Blyth's Pipit : *Anthus campestris thermophilus* (Jerdon).

Specimens : *St. X. C.* : 155 ♀ 31-10-33 Jūhū (H.A.).

Both these races of the Tawny Pipit visit our area during the winter. *Griseus* appears to be by far the commoner. H.A. finds that it is possible to differentiate Tawny Pipits from the Indian Pipit in the field by the brighter coloured legs and more 'nasal' notes of the former.

The Small Indian Skylark : *Alauda gulgula gulgula* Franklin.

Field identification : Somewhat smaller than the House-Sparrow but in general appearance not unlike the female of that bird. Rather squat and with a shorter tail. Pairs or small parties, about the tidal mud flats, in the rank grass patches bordering salt pans, and in the surrounding fields. Males soaring, 'hovering' and singing.

Specimens : *B.N.H.S.* : ♂♂ 10-11-27 Mud Flats, Sion Causeway (S.A.) ; ♀ 7-4-24 Andhēri (S. H. Prater) ; *St. X. C.* : 43 o, 198 o, 203 o Salsette (H.A.).

Resident. Common. It is plentiful in short grass near the Golf Course at Andhēri.

Breeding : On 11 April (1934) H.A. flushed a bird off a nest with c/2, slightly set, at Andhēri. The nest was cup-shaped, made of grass and buttressed with pieces of thick grass stems. It was placed in the shelter of a grass tussock. On 26 April he noted flying young, and has a record of a bird feeding fledged young out of nest on 30 September (1935) on the Churchgate Reclamation. On 10 June (1930) S.A. observed an adult feeding a full-fledged young one, about 3 weeks old, in among cut paddy fields. The season, therefore, appears to be a prolonged one in our area, April to October.

The Short-toed Lark : *Calandrella brachydactyla dukhunensis* Sykes.

Field identification : Somewhat smaller than the House-Sparrow and not unlike the Skylark to look at except that it is more whitish underneath. Large flocks in open country, about mud flats and fallow fields.

Specimens : *St. X. C.* : 106 ♂, 107 ♂, 108 ♂, 109 ♂, 110 ♀, 111 ♀, 8-10-33, 165 ♂ 10-11-33 Andhēri (H.A.).

Winter visitor. Fairly abundant in Salsette and on the mainland across the harbour chiefly between November and January. The flocks keep to open, stony, scraggy grass-covered country, tidal mudflats and stubble fields. Occasional chirps are uttered in flight. They drink regularly in the mornings and have favourite watering places at which enormous numbers foregather for the purpose.

The Malabar Crested Lark : *Galerida malabarica* (Scop.).

Field identification : Size about that of the House-Sparrow. General appearance above, streaked brown somewhat like the female of that bird. Breast streaked black. Small parties or scattered flocks on the dry open ground about tidal mudflats and creeks, and on the scraggy grass-covered hills as at Trombay.

Specimens : *B.N.H.S.* : ♂ 22-3-24 Gōdhbunder, o? 6-4-24 Sion Causeway, o? juv. 15-6-25 Trombay Hill at ca. 800 ft. (S.A.) ; ♂ 30-12-23 Andhēri

(Prater); ♀ 5-11-12, ♀ 18-1-13, ♂ 6-4-13 Santa Cruz (Kinnear); *St. X. C.*: 56 ♂, 57 ♀ 21-8-33 Andhēri, 232 ♀, 235 ♂ 24-4-35 Gōrēgāon (H.A.).

Resident. Common. Larger flocks are seen during the cold weather, and at that season evidently some local movements take place in Salsette. We have observed these larks feeding on the seeds of *Spermacoce stricta* picked off the living plant.

Breeding: In Salsette S.A. has noted fledglings out of nest on 15 June. At Thal (Kolāba District) on the sea-coast—across the harbour—H.A. found a nest with 2 young on 25 October. Both parents were bringing in caterpillars. The nest was a shallow cup of grass placed under a stone, in open stony land. The mouth-colour of the nestlings was a bright orange red and the tongue (of the same colour) had 3 conspicuous black spots upon it.

The Indian Rufous-tailed Finch-Lark: *Ammomanes phoenicura phoenicura* (Franklin).

Field identification: Somewhat larger than the House-Sparrow. A plain dark brown sparrow-like bird, rather squat, with a black-tipped bright rufous tail conspicuous in flight. Pairs, running about on fallow land near the tidal mudflats, stubble fields, etc.

Specimens: *B.N.H.S.*: ♀ 10-11-27 Mud Flats, Sion Causeway (S.A.).

Resident. Fairly common. Feeds on the ground upon grass seeds, paddy grains, etc. and also insects. We have frequently observed its habit of rapidly opening and shutting its wings as it moves about in search of food. This manoeuvre is effective in dislodging lurking insects from the little unevennesses of the ground.

Males are usually seen, apparently even in the non-breeding season, rising into the air every now and again and rocketing downwards in steps—nose-diving—with wings pulled in to the sides, and singing on each dive.

Breeding: This is a most elusive and circumspect species when breeding and we have not as yet succeeded in marking down a nest in Salsette although between March and May we have several records of birds carrying building material or food for the young.

The Ashy-crowned or **Black-bellied Finch-Lark**: *Eremopterix grisea grisea* (Scopoli).

Field identification: A squat, finch-like bird, rather smaller than the House-Sparrow, seen in pairs, parties or small flocks on mudflats and open stony country. The male has black underparts, ashy crown and sandy hen-sparrow-like upper plumage. The female is sandy hen-sparrow-like all over.

Specimens: *B.N.H.S.*: o? 27-2-24 Pāli Hill, Bandra; o? 7-6-25 Trombay Hill at ca. 900 ft. (S.A.); ♂ 30-1-21 Santa Cruz (B. C. Ellison); ♂ juv. 11-11-12; ♂♂ 11-10-12, ♀ 19-1-13, ♀ 25-1-13 Santa Cruz (Kinnear); ♂ imm. 21-1-11 Bombay (P. F. Gomes); *St. X. C.*: 67 ♂ 8-9-33 Andhēri (H.A.).

Resident. Common. Males constantly soar into space on quivering wings for about 30 feet or so, and sing. The same sort of aerobatics are indulged in as by the Rufous-tailed Finch-Lark, namely shooting up almost perpendicularly and nose-diving in steps with closed wings. In the final step it looks perilously as if the bird was going to dash itself to smithereens on the ground, but the wings are opened out at the last moment and it alights safely on a clod or stone. The grace and ease with which all these moves are executed are a delight to watch. There is a very marked decrease in the numbers of these larks in Salsette during the monsoon months—June to September—and evidently they then emigrate into drier country as in the Deccan. By about the beginning of October the birds are back again in considerable numbers.

Breeding: We have seen many nests in all stages of construction or with eggs and young in Salsette during March and April. There is a fledgling in the Society's collection dated 11 November and another immature bird 21 January. This indicates that the birds are double brooded, i.e., some breed in the earlier part of the year and some in the latter part. The nest is a tiny cup-like depression in the ground, lined with fine grass or tow, under the shelter of a stone or small bush in open country. It is usually rimmed with gravel or small stones. In our area c/2 seems to be invariable. The commonest colouration of the eggs is a pale yellowish stone, blotched and speckled with brownish-lavender.

The White-eye : *Zosterops palpebrosa occidentis* Ticehurst.

Field identification : Size about half that of the House-Sparrow. A tiny bird greenish-yellow above, bright yellow and greyish-white below, with a conspicuous ring of white feathers round the eyes. Slender slightly curved bill. In flocks, in trees and bushes in wooded country and gardens. A pleasant but feeble tinkling or cheeping call, sometimes like a miniature woodpecker 'laugh'.

Specimens : *B.N.H.S.* : ♂ 25-3-29 Tūlsi Lake (S.A.); *St. X. C.* : 242 o? 24-11-35 Borivli (H.A.).

Noted : *City* : Warden Road, Cumbala Hill ; Government House Grounds, Malabar Hill ; *Salsette* : Gōdhbunder, Chembūr, Powāi Lake environs, Shendūr Hill ; common on mainland across the harbour.

Resident. Not uncommon in suitable localities. Feeding largely on the nectar of various flowers. Almost invariably present on those of *Bombax, Erythrina, Woodfordia, Calycopteris floribunda* and *Loranthus* clumps. Of the last particularly, it is an important cross-pollinating agent. Flocks move about from tree to tree, keeping up their musical cheeping calls and often clinging upside down on the sprigs in search of insects. They are very partial to the sticky exudation from the petioles of Banyan (*Ficus bengalensis*) leaves.

Breeding : Although we have no actual record, we have no doubt that the White-eye nests in Salsette. The specimen of 25 March had enlarged gonads and was evidently preparing to breed. During the breeding season the male develops a pretty, rather feeble, tinkling song reminiscent of the Nilgiri Verditer Flycatcher's. This is uttered from some exposed perch.

Vigors' Yellow-backed Sunbird : *Æthopyga siparaja vigorsi* (Sykes).

Field identification : Size same as the White-eye or the Purple or Purple-rumped Sunbird. A tiny restless gem of a bird with metallic green head, crimson back, bright yellow rump and crimson-scarlet breast. Longish pointed tail. The female is olive-brown and pale dull yellow, not unlike the female Purple Sunbird. Singly, in wooded hilly country, usually on flowers of *Woodfordia, Bombax* and others.

Specimens : *B.N.H.S.* : ♂ 15-11-25, ♂ 29-11-25 Gōdhbunder ; ♂ 8-12-25, o? 3-3-29 Tūlsi Lake Environs (S.A.) ; *St. X. C.* : 158 ♂ 9-11-33 Powāi Lake environs (H.A.).

Noted : *Salsette* : Chembūr, near Kanhēri Caves ; *Adjacent mainland* : Tānsa Lake, Karnāla Fort, Panvēl (Kolāba District).

Resident? Not uncommon in the well-wooded hilly country in North Salsette, especially in the environs of Powāi, Tūlsi and Vihār Lakes, and about Gōdhbunder. All our records seem to be for the winter months only.

Breeding : We have no record from Salsette. In the Western Ghāts, Wenden (*N. & E.*, ii, 250) found a nest—17 September—on the face of a cutting at the upper entrance of Bhōr Ghāt Tunnel No. 19 with c/3, fresh. Another nest was found by him in the same locality on 21 September.

Loten's Sunbird : *Cinnyris lotenia* (Linn.).

Field identification : Size as above. Adult male black with metallic green and purple sheen, a maroon band across the breast and yellow tufts at the 'armpits'. Underparts sooty brown without gloss. Female brown to olive-brown above, pale dull yellow below. Singly or pairs, in wooded country on trees, shrubs, creepers and *Loranthus* clumps in flower.

Specimens : *B.N.H.S.* : ♂ 16-3-24 Vihār Lake (S.A.) ; ♂ 4-1-13 Santa Cruz (Kinnear) ; *St. X. C.* : 99 ♀, 100 ♂ (testes 4 × 3 mm.) 28-9-22 Borivli (H.A.).

Noted : *Salsette* : Chembūr, Andhēri, Powāi, Tūlsi. Marōl : *Adjacent mainland* : Karnāla Fort, Bassein, Alibāg. Aitken (*N. & E.*, ii, 252) describes it as not uncommon at Uran on the island of Karanja (Bombay Harbour).

Resident. Common. We have not observed it within city limits, but while it is certainly more partial to wooded country farther afield, it is just possible that it may have been overlooked here.

Sunbirds of all species feed largely on the nectar of flowers and are directly responsible for the cross-pollination of many species. In probing into the flower tubes for nectar with its well adapted slender curved bill, the forehead comes into contact with the anthers and a quantity of the ripe pollen adheres to the feathers. This is transferred to the stigma of the next flower visited.

Their visits to the flowers are thus of vital benefit to the tree. Spiders and small insects usually taken at the flowers, are also eaten.

Breeding: On 14 July (1934) H.A. observed a ♀ building on a tree in forest at Tūlsi, ca. 20 ft. up. He found a nest at Powāi Lake on 5 March containing 2 fledglings which both parents were busy feeding. It was the usual sunbird structure—an oblong purse of soft grasses, rubbish and cobwebs, draped with pieces of bark and woody refuse,—with a porched lateral entrance—hung 18 inches from the ground in a bare thorny bush. On 3 May a male was observed courting a female. The tufts of yellow feathers under the 'armpit' are erected during the display to such an extent that they become strikingly conspicuous even from over the bird's back. A second nest with c/2 was noted at Mulund on 26 June (32) It was about 7 ft. up, in close proximity to a nest of red ants (*Œcophylla smaragdina*) and apparently at peace with it.

Aitken (*J.B.N.H.S.*, ii, 52) took a nest containing 1 egg and 1 young just hatched at Uran (Bombay Harbour) in November (1886). He describes the eggs as of a dirty brownish-white ground colour with the smaller end covered with dull brown spots passing into large confluent blotches and forming a cap on the broader end.

From the evidence it is clear that the season in Salsette is not well defined.

The Purple Sunbird : *Cinnyris asiatica asiatica* (Latham).

Field identification: In size and general appearance very similar to Loten's Sunbird. Differs from it in having a metallic purple sheen instead of green, in the absence of the maroon band across breast, and in the underparts being glossy purple-black instead of dull sooty-brown. It also has the yellow and scarlet feather-tufts at the armpit. Female very like that of *C. lotenia*. Similar to the foregoing in habits and habitat except that it is met with oftener in gardens, both in the city and suburbs.

Specimens: *B.N.H.S.*: ♂ 2-6-25 Malād (E. Henricks); ♂ 28-8-21 Bhāndūp (G. C. Amore); ♂ 7-2-13 Andhēri (Kinnear); ♂ 17-11-27 foot of Trombay Hill (S.A.); *St. X. C.*: 161 ♂ 9-11-33 Powāi Lake (H.A.).

Resident? Common.

Noted: *City*: Girgaum, Bhūlēshwar, Byculla, Chowpāti, Wālkēshwar, Malabār Hill, Warden Road etc.; *Salsette*: Pāli Hill, Bandra; Khār, Gōrēgāon, Borivli, Kandivli, Chembūr, Gōdhbunder, Thāna and elsewhere generally.

An unfailing attendant on flowering trees, shrubs and creepers in gardens. Along with the Purple-rumped species, it is invariably present on the blossoms of the Drumstick tree (*Moringa oleifera*) and on those of the tree parasite, *Loranthus*. For the latter it is a most important cross-pollinating agent. Breeding males, and those about to breed, habitually perch on the topmost branches of a tree, a telegraph wire or in some other exposed situation and utter their excited 'song' *cheewit-cheewit-cheewit*, repeated in quick succession from 2 to 6 times. While thus engaged the bird pivots from side to side and nervously raises and lowers his wings.

Breeding: Curiously enough we have no record of its nest from our area or from our immediate neighbourhood. Is it a local migrant?

The Purple-rumped Sunbird : *Cinnyris zeylonica* (Linn.).

Mahratti name: *Chūmka*; Hindūstāni: *Shakar-khōra*.

Field identification: Size as last. Head, upper plumage and breast mostly metallic green, crimson and purple. Rump metallic bluish purple. Lower parts bright yellow. Female sober olive-brown and dull yellow as with the other sunbird species. Habits and habitat same as in the previous species, but this is even more common by human habitations.

Specimens: *St. Xavier's College*: 25 ♂? juv. 3-8-33, 26 ♀ juv. 10-9-33 Andhēri; 55 ♂ 20-8-33 Chendevli (H.A.).

Noted: *City*: Girgaum, Khētwādi, Chowpāti, Bhūlēshwar, Byculla, Wālkēshwar, Malabār Hill, Fort (Prince of Wales Museum garden), Warden and Pedder Roads, Apollo Bunder, Colāba and elsewhere. Common everywhere in the suburbs and Salsette.

Resident. Very common. Its notes and song are, with a little practice, easily distinguishable from those of the Purple Sunbird.

Breeding: We have records of numerous nests in Bombay City and Salsette either under construction or with eggs or young in January, February, April,

May, July, August, September and October. The period from July to September, however, is when breeding is at its height. The nest is like that of Loten's Sunbird. It is usually suspended from the tip of an outhanging branch at moderate heights—between 6 and 12 feet. It is frequently built in creepers growing on the trellis work of verandahs of inhabited bungalows and the birds do not seem to mind the proximity of human beings. Building work is done solely by the female, but the male usually accompanies her to and from the nest while she is at work, encouraging her as it were by little snatches of song from a nearby perch. The male does not share in the incubation which takes 14-15 days. Both parents feed the young. These leave the nest when 16-17 days old. We have invariably found 2 eggs or young in our area. In ground colour the eggs are usually grey with a greenish or buff tinge; they are flecked and speckled with greyish-brown, more profusely round the broader end.

Tickell's Flowerpecker: *Dicaeum erythrorhynchos erythrorhynchos* (Latham).

Field identification: Somewhat smaller than a sunbird. A restless olive-brown bird with grey-white underparts and flesh-coloured slender bill. Singly, usually on clumps of the tree parasites *Loranthus* and *Viscum* on mango trees, hopping about energetically and uttering *chip, chip, chip,* etc.

Specimens: *B.N.H.S.*: o? 16-2-24 Pāli Hill; o? 8-12-25 Gōdhbunder (S.A.); *St. X. C.*: 97 ♀ 28-9-33 Borivli (H.A.).

Noted: *City*: Government House Grounds—Wālkēshwar; Victoria Gardens —Byculla, Chowpāti, Colāba, Malabār Hill; *Salsette*: common everywhere.

Resident. Common. Especially plentiful in orchards where *Loranthus* and *Viscum* abound on the mango trees. It fertilises the *Loranthus* blossoms in its attempts to reach the nectar, and eats the berries of both almost exclusively when available. It is thus perhaps the most important agent in the spread of these parasites in Salsette.

Breeding: According to EHA (*C.B.B.*, p. 68) the breeding season here is March and April. H.A. has taken fresh eggs at Andhēri on 4 February ('33) and also on 7 March ('36) at Powāi. On 26 April ('36—Borivli) he observed a bird visiting a nest in a high tree evidently containing young, and on 5 May a young bird just out of nest was being fed by its parents.

The nest of Tickell's Flowerpecker is a hanging oval purse like that of a sunbird but somewhat smaller and of neater appearance. It is made of soft fibres and vegetable down and not draped on the exterior with rubbish. It may be at any height from 10 or 15 to 40 feet. Both sexes build the nest and feed the young. The normal clutch is of 2 eggs, white in colour, unmarked.

The Thick-billed Flowerpecker: *Piprisoma agile agile* Tickell.

Field identification: Size and general appearance of the last, but the underparts faintly streaked brown. The bill is thick and finch-like and of a slaty-grey colour. Singly, in same facies as Tickell's Flowerpecker and very similar to it in habits.

Specimens: [*St. X. C.*: 139 o 21-10-33 Kihim (Alibāg, Kolāba District).] None collected in Salsette.

Noted: *Salsette*: Powāi Lake environs, Chembūr, Andhēri, Borivli. Not within city limits.

Resident. Not uncommon. Its food consists largely of the berries of the tree parasites *Loranthus* and *Viscum*, and it shares with Tickell's Flowerpecker the responsibility for their spread and for the resulting damage to mango orchards. Other berries such as those of *Lantana camara* and *Bridelia retusa* are also greedily taken, as well as Peepal and Banyan figs. *Bombax* and *Erythrina* flowers are regularly resorted to for the nectar, and spiders likewise form part the dietary. It utters *chik, chik* as it restlessly hops about the foliage, but its notes are easily distinguishable from those of the previous species. While thus engaged, it spreads out its stumpy square little tail and screws it nervously edgewise from side to side.

Breeding: On 5 March ('36—Powāi) an adult was observed feeding two juveniles just out of nest. On 24 April ('36—Andhēri) a bird was building ca. 15 ft. up in a *Ficus* of sorts. Red Ants (*Œcophylla*) were swarming on this tree but apparently did no harm to the nest. On 2 May the eggs, c/3 —partly set—were removed from this nest. On 3 May ('36—Borivli) another

nest was noted in an *Erythrina* tree also about 15 ft. up. The nest—a hanging oval purse of reddish vegetable down, about 4 inches long—is not intentionally concealed, but is usually so cryptically coloured that at a casual glance it looks like a dry rolled-up leaf. It is usually suspended from near the tip of an outhanding twig. The attachment is not from a point but is about 2 inches wide along the length of the twig. C/2 or c/3 is the normal. The eggs are pinky-white or salmon in ground colour, speckled and blotched with reddish- or purplish-brown.

The Indian Pitta : *Pitta brachyura* Linn.

Hindūstāni name : *Nowrang* (=9 colours).

Field identification : Size about that of the Myna. Stub tail. A gaudily coloured bird mostly green, blue, crimson, fulvous and black. Singly, on the ground amongst scrub undergrowth in jungle. When disturbed, it flies up into low trees with a whirr of its wings like a slow game bird.

Specimens : *B.N.H.S.* : ♀ 2-6-25 Bombay (J. Azavedo) ; o? 4-6-21 Bombay (B. C. Ellison).

Noted : *City* : Colāba, Malabār Hill ; *Salsette* : Pāli Hill, Bandra ; Gōdhbunder, Powāi Lake Environs. Not uncommon on the mainland across the harbour in the monsoon.

Monsoon visitor. Its arrival in Bombay and Salsette, presumably from South India, synchronizes more or less with the South-west Monsoon. We have noted it here between 15 May and 15 October (one on 28 April at Alibāg !) although by about mid-September most birds have departed. We really know very little beyond conjecture about the local movements of the Pitta, and here is a problem which only the ringing method can help to solve. The House-Crows of the city and suburbs are usually the first to herald the arrival of the birds by their relentless persecution of them. Many a refugee is picked up every year, disabled by these blackguards or caught in a room into which it has blundered to escape its pursuers. Its call is a loud clear double whistle *wheet-tew* heard mostly in the early morning and late evening, and also on cloudy overcast days. These calls are uttered at the rate of about 3 or 4 in 10 seconds and are sometimes kept up for over 5 minutes at a stretch. Each time the bird calls it pulls itself upright and jerks its head well back as when swallowing water. In between the calls the stumpy tail is wagged slowly and deliberately up and down. The bird progresses on the ground in search of insects by long hops, like a thrush.

Breeding : On 3 June ('36—Powāi) H.A. observed a bird building in a *Loranthus* clump on a mango tree about 30 ft. up. The tree was situated in a patch of fairly open country near a village. The bird was busy collecting sticks from the ground nearby, one of which was over a foot long.

The nest of the Pitta is a deep cup of twigs and rootlets, domed and often larger than a football. We have no other record of its nesting in our area.

The Southern Yellow-fronted Pied Woodpecker : *Dryobates mahrattensis mahrattensis* (Latham).

Field identification : Size about that of the Bulbul. Spotted black and white plumage with yellowish-brown crown and scarlet patch on abdomen. In the male the hind crown is also scarlet. Long, stout, pointed bill and stiff, wedge-shaped tail. Singly or pairs, in orchards and wooded country. Clinging to trunks or branches of trees and scuttling upwards in spurts and spirals, tapping the bark at intervals. Flies with rapid wing-beats interspersed with pauses.

Specimens : *B.N.H.S.* : ♂ 11-3-24 Pāli Hill, Bandra (S.A.) ; ♀ 30-1-21 Santa Cruz (Ellison) ; ♂ 19-1-25 Andhēri (H. Hearn). *St. X. C.* : 255 ♀ juv. 8-3-36 Powāi Lake Environs (H.A.).

Noted : *City* : Warden Road, Fort, Colāba. *Salsette* : Chembūr, Gōdhbunder, Borivli, Mulund, etc.

Resident. Fairly common. The call note is a sharp *click click* or *clikr-r-r-r*. We have occasionally observed it feeding on the nectar of *Bombax* and *Erythrina* flowers.

Breeding : EHA (*C.B.B.*, p. 59) says they breed here in February and March. We have seen a nest with young—both parents bringing caterpillars, etc.—on 21 March ('26—Chembūr). It was in a more or less horizontal mango branch about 12 feet above the ground, with the entrance hole on the underside.

May, July, August, September and October. The period from July to September, however, is when breeding is at its height. The nest is like that of Loten's Sunbird. It is usually suspended from the tip of an outhanging branch at moderate heights—between 6 and 12 feet. It is frequently built in creepers growing on the trellis work of verandahs of inhabited bungalows and the birds do not seem to mind the proximity of human beings. Building work is done solely by the female, but the male usually accompanies her to and from the nest while she is at work, encouraging her as it were by little snatches of song from a nearby perch. The male does not share in the incubation which takes 14-15 days. Both parents feed the young. These leave the nest when 16-17 days old. We have invariably found 2 eggs or young in our area. In ground colour the eggs are usually grey with a greenish or buff tinge; they are flecked and speckled with greyish-brown, more profusely round the broader end.

Tickell's Flowerpecker: *Dicaeum erythrorhynchos erythrorhynchos* (Latham).

Field identification: Somewhat smaller than a sunbird. A restless olive-brown bird with grey-white underparts and flesh-coloured slender bill. Singly, usually on clumps of the tree parasites *Loranthus* and *Viscum* on mango trees, hopping about energetically and uttering *chip, chip, chip*, etc.

Specimens: *B.N.H.S.*: o? 16-2-24 Pāli Hill; o? 8-12-25 Gōdhbunder (S.A.); *St. X. C.*: 97 ♀ 28-9-33 Borivli (H.A.).

Noted: *City*: Government House Grounds—Wālkēshwar; Victoria Gardens —Byculla, Chowpāti, Colāba, Malabār Hill; *Salsette*: common everywhere.

Resident. Common. Especially plentiful in orchards where *Loranthus* and *Viscum* abound on the mango trees. It fertilises the *Loranthus* blossoms in its attempts to reach the nectar, and eats the berries of both almost exclusively when available. It is thus perhaps the most important agent in the spread of these parasites in Salsette.

Breeding: According to EHA (*C.B.B.*, p. 68) the breeding season here is March and April. H.A. has taken fresh eggs at Andhēri on 4 February ('33) and also on 7 March ('36) at Powāi. On 26 April ('36—Borivli) he observed a bird visiting a nest in a high tree evidently containing young, and on 5 May a young bird just out of nest was being fed by its parents.

The nest of Tickell's Flowerpecker is a hanging oval purse like that of a sunbird but somewhat smaller and of neater appearance. It is made of soft fibres and vegetable down and not draped on the exterior with rubbish. It may be at any height from 10 or 15 to 40 feet. Both sexes build the nest and feed the young. The normal clutch is of 2 eggs, white in colour, unmarked.

The Thick-billed Flowerpecker: *Piprisoma agile agile* Tickell.

Field identification: Size and general appearance of the last, but the under-parts faintly streaked brown. The bill is thick and finch-like and of a slaty-grey colour. Singly, in same facies as Tickell's Flowerpecker and very similar to it in habits.

Specimens: [*St. X. C.*: 139 o 21-10-33 Kihim (Alibāg, Kolāba District).] None collected in Salsette.

Noted: *Salsette*: Powāi Lake environs, Chembūr, Andhēri, Borivli. Not within city limits.

Resident. Not uncommon. Its food consists largely of the berries of the tree parasites *Loranthus* and *Viscum*, and it shares with Tickell's Flowerpecker the responsibility for their spread and for the resulting damage to mango orchards. Other berries such as those of *Lantana camara* and *Bridelia retusa* are also greedily taken, as well as Peepal and Banyan figs. *Bombax* and *Erythrina* flowers are regularly resorted to for the nectar, and spiders likewise form part the dietary. It utters *chik, chik* as it restlessly hops about the foliage, but its notes are easily distinguishable from those of the previous species. While thus engaged, it spreads out its stumpy square little tail and screws it nervously edgewise from side to side.

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nest was noted in an *Erythrina* tree also about 15 ft. up. The nest—a hanging oval purse of reddish vegetable down, about 4 inches long—is not intentionally concealed, but is usually so cryptically coloured that at a casual glance it looks like a dry rolled-up leaf. It is usually suspended from near the tip of an outhanding twig. The attachment is not from a point but is about 2 inches wide along the length of the twig. C/2 or c/3 is the normal. The eggs are pinky-white or salmon in ground colour, speckled and blotched with reddish- or purplish-brown.

The Indian Pitta : *Pitta brachyura* Linn.

Hindūstāni name : *Nowrang* (=9 colours).

Field identification : Size about that of the Myna. Stub tail. A gaudily coloured bird mostly green, blue, crimson, fulvous and black. Singly, on the ground amongst scrub undergrowth in jungle. When disturbed, it flies up into low trees with a whirr of its wings like a slow game bird.

Specimens : *B.N.H.S.* : ♀ 2-6-25 Bombay (J. Azavedo); o? 4-6-21 Bombay (B. C. Ellison).

Noted : *City* : Colāba, Malabār Hill; *Salsette* : Pāli Hill, Bandra; Gōdhbunder, Powāi Lake Environs. Not uncommon on the mainland across the harbour in the monsoon.

Monsoon visitor. Its arrival in Bombay and Salsette, presumably from South India, synchronizes more or less with the South-west Monsoon. We have noted it here between 15 May and 15 October (one on 28 April at Alibāg!) although by about mid-September most birds have departed. We really know very little beyond conjecture about the local movements of the Pitta, and here is a problem which only the ringing method can help to solve. The House-Crows of the city and suburbs are usually the first to herald the arrival of the birds by their relentless persecution of them. Many a refugee is picked up every year, disabled by these blackguards or caught in a room into which it has blundered to escape its pursuers. Its call is a loud clear double whistle *wheet-tew* heard mostly in the early morning and late evening, and also on cloudy overcast days. These calls are uttered at the rate of about 3 or 4 in 10 seconds and are sometimes kept up for over 5 minutes at a stretch. Each time the bird calls it pulls itself upright and jerks its head well back as when swallowing water. In between the calls the stumpy tail is wagged slowly and deliberately up and down. The bird progresses on the ground in search of insects by long hops, like a thrush.

Breeding : On 3 June ('36—Powāi) H.A. observed a bird building in a *Loranthus* clump on a mango tree about 30 ft. up. The tree was situated in a patch of fairly open country near a village. The bird was busy collecting sticks from the ground nearby, one of which was over a foot long.

The nest of the Pitta is a deep cup of twigs and rootlets, domed and often larger than a football. We have no other record of its nesting in our area.

The Southern Yellow-fronted Pied Woodpecker : *Dryobates mahrattensis mahrattensis* (Latham).

Field identification : Size about that of the Bulbul. Spotted black and white plumage with yellowish-brown crown and scarlet patch on abdomen. In the male the hind crown is also scarlet. Long, stout, pointed bill and stiff, wedge-shaped tail. Singly or pairs, in orchards and wooded country. Clinging to trunks or branches of trees and scuttling upwards in spurts and spirals, tapping the bark at intervals. Flies with rapid wing-beats interspersed with pauses.

Specimens : *B.N.H.S.* : ♂ 11-3-24 Pāli Hill, Bandra (S.A.); ♀ 30-1-21 Santa Cruz (Ellison); ♂ 19-1-25 Andhēri (H. Hearn). *St. X. C.* : 255 ♀ juv. 8-3-36 Powāi Lake Environs (H.A.).

Noted : *City* : Warden Road, Fort, Colāba. *Salsette* : Chembūr, Gōdhbunder, Borivli, Mulund, etc.

Resident. Fairly common. The call note is a sharp *click click* or *clik-r-r-r-r*. We have occasionally observed it feeding on the nectar of *Bombax* and *Erythrina* flowers.

Breeding : EHA (*C.B.B.*, p. 59) says they breed here in February and March. We have seen a nest with young—both parents bringing caterpillars, etc.—on 21 March ('26—Chembūr). It was in a more or less horizontal mango branch about 12 feet above the ground, with the entrance hole on the underside.

The parent birds were very circumspect, and both before and after their visits to the nest-hole kept hopping about the adjacent branches for a considerable while.

The Rufous Woodpecker : *Micropternus brachyurus jerdonii* (Malherbe).

Field identification : Size about that of the Myna. General colour chestnut-rufous. A typical woodpecker with stout straight, pointed bill and stiff wedge-shaped tail. Singly or pairs, in orchards or lightly wooded country.

Specimens : *B.N.H.S.* : ♂ 15-1-24 (Prater), ♀ 9-2-08 (Kinnear) Andhēri ; *St. X. C.* : 167 ♀ 19-11-33 Borivli (H.A.).

Noted : *Salsette* : Chembūr, Trombay, Mulund.

Resident. Fairly common. Its food in our area consists to a very large extent of *Crematogaster* ants and their larvæ. To get at the insects, the bird perches in the passerine manner across a branch adjoining the carton-like arboreal nest of the ants, and digs into it with its bill. The ants are picked off as they swarm to the site of the disturbance. In a garden at Deonar (Chembūr) we have on several occasions observed it clinging on the stems of banana trees and probing into the soft tissues near the bases of the leaves, evidently for the sap. One was noted eating a Banyan fig perched like a barbet across a branch. Its call is a high-pitched *ke-ke-ke-ke* something like the Myna's. The alarm note is a quick, low *qū-ûk*.

Breeding : The Rufous Woodpecker is remarkable for habitually utilising the carton-like nests of *Crematogaster* ants for its own. H.A. has found 2 such nests in Salsette (19 April '35 and 31 March '36—Borivli) at heights of about 20 and 25 feet. Unfortunately both these were empty at the time, but the birds were flushed from within. The ants' nests had been hollowed out and a neat round entrance hole was made in them at the side. H.A. noted that the nests were alive with ants at the time!

N. F. T. Wilson (*J.B.N.H.S.*, xi, 744) found this woodpecker breeding at Thāna in April.

The Golden-backed Woodpecker : *Brachypternus benghalensis puncticollis* (Malherbe).

Mahrātti name : *Bhandāri.*

Field identification : Size slightly larger than that of the Myna. Head black and white, with a crimson crest. Back and upper parts of wings golden yellow. Underparts whitish with black streaks. The female has no crimson in the crest. Singly or pairs, in wooded country, mango orchards and cocoanut groves, clinging to the tree-trunks, running up or backing down them in jerks and spirals and tapping the bark for insects. Flight of rapid wing-beats with pauses, usually accompanied by a loud, harsh chattering call or 'laugh'.

Specimens : *B.N.H.S.* : ♀ 10-4-03 ; *St. X. C.* : 539 o?.

Noted : *City* : Warden Road, Wālkēshwar, Malabār Hill. *Salsette* : Chembūr, Pāli Hill, Khār, Andhēri, Borivli, Gōdhbunder, Tūlsi Lake environs, Jūhū, Māhim.

Resident. Fairly common. Its food consists largely of large black ants (*Camponotus* sp.) picked off the ground or on trees. We have observed it feeding on nectar from the blossoms of *Erythrina indica* and drinking rain water collected in the casing of the inflorescence of a cocoanut palm.

Breeding : The only two nests of this species we have come across in our neighbourhood were at Kihim (Alibāg Talūka) across the harbour. One (9 April) was in a decaying cocoanut trunk about 18 ft. up and contained young which both parents were busy feeding. The nest was evil-smelling and the young made a screechy hissing sound when approached. The second nest was in a hole in the vertical stem of an Oondi tree (*Calophyllum inophyllum*) about 8 ft. from the ground. On 13 May ('31) this contained 3 fresh eggs. The nest hollow was about 15 inches deep and unlined. The brooding bird sat so close that it was caught by hand. The eggs are roundish ovals, glossy china white, unmarked.

The Black-backed Woodpecker : *Chrysocolaptes festivus* (Bodd.).

Field identification : Size as the foregoing. Similar to it in general appearance except that the back is black instead of golden yellow. Upper parts of the wings golden-olive. Crown and crest crimson in male, golden yellow in female. Singly or pairs in thin jungle.



Nest of the Rufous Woodpecker [*Micropternus brachyurus jerdoni* (Malherbe)] in carton-like nest of Crematogaster ants.

(Photograph of an exhibit in the Bird Gallery, Prince of Wales Museum, Bombay.)

Specimens: *St. Xavier's College*: 94 ♂ 28-9-33 Borivli (H.A.).
Noted: In the environs of Powāi and Tūlsi Lakes.
Resident. Not uncommon in parts of N. Salsette. Pairs keep in touch with each other by means of a *ch-chrr-chrk* call. The usual chattering call is something like that of the Golden-backed Woodpecker, but louder and more 'nasal'.
We have no records as yet of its breeding within our area.

The Malabar Heart-spotted Woodpecker: *Hemicircus canente cordatus* Jerdon.
Field identification: Size about that of the Bulbul; squatter and with a shorter and wedge-shaped tail. Black above, including crest, dark olive below. White-speckled forehead in male, buffy-white in female. Whitish rump and some white in wings. Chin, throat and sides of neck buffy white. A smallish pied bird with a large head and thin neck, clinging to, and running up and down or around the branches of trees and shrubs in forested hilly country.
Specimen: *St. X. C.*: ♀ 24-11-35 Borivli (H.A.).
Noted: Tūlsi Lake environs (once only).
Presumably resident. Rare; unknown in these parts until the specimen was obtained.
Breeding: The gonads of the specimen measured 6×4 mm. It was flushed from within a nest-hole in a rotten branch, about 12 ft. up, in light forest.

The Wryneck: *Iynx torquilla torquilla* Linn.
Field identification: Slightly bigger than the House-Sparrow. Above grey-brown with black markings; below whitish with black arrow-head markings producing a cross-bar pattern. Colour scheme of back very like a nightjar's. The peculiar dipping flight and general behaviour rather finch-like. Singly, in small tree- or scrub- jungle especially babool and date. Often hopping on ground in search of insect food.
Specimens: *B.N.H.S.*: ♀ 8-3-24 Pāli Hill, Bandra (S.A.); oo? 21-3-24 Chembūr (S.A.); ♂ 31-8-06 Fort, Bombay (L. H. Saville); *St. X. C.*: 82 ♂ 22-9-33 Jūhū (H.A.).
Noted: Khār, Andhēri, Gōdhbunder.
Winter visitor. Fairly common though unobtrusive. Earliest record 31 August; latest 9 April. Its call is a feeble but rapid, high-pitched *chk-ch-ch-ch*, etc. like that of the smaller woodpeckers. Its food consists largely of the small black terrestrial ants. The stomach of a specimen contained over 500 of these insects. The birds appear to localise themselves and may be found in the same patch of country day after day.

The Bombay Green Barbet: *Thereiceryx zeylanicus inornatus* (Walden).
Mahrātti name: *Kokrus.*
Field identification: About as big as the Myna. An ungainly grass-green bird, paler underneath, with streaked brownish head, neck, breast and upper back. Heavy conical orange-brown bill with coarse bristles at the base. A bright orange naked patch round the eye. Singly or parties, on Banyan and other forest trees in fruit, in well-wooded country. Heavy noisy flight.
Specimen: *St. X. C.*: 93 ♂ 28-9-33 Borivli (H.A.).
Noted: Vihār, Tūlsi and Powāi Lake environs: Borivli, Kandivli, Gōdhbunder.
Resident. Common in the wooded hills of North Salsette and in the 'lake district'. Its call *kr-r-r-r, kūtroo, kūtroo, kūtroo*, etc. resounds in these localities. As soon as one bird begins calling, a second invariably takes it up at once. The sudden report of a gun will set off half a dozen birds calling! Its food consists of *Ficus* figs and berries of many kinds. We have also observed it at the flowers of *Erythrina stricta* for the nectar.
Breeding: We have not taken any nests in Salsette, but on 21 March ('35—Gōdhbunder) a bird was observed entering a nest-hole in a dead stump about 15 feet up.

The Crimson-breasted Barbet or **Coppersmith**: *Xantholoema haemacephala indica* (Latham).
Mahrātti name: *Sonār.*
Field identification: Slightly larger and dumpier than the House-Sparrow. A grass-green bird with bright crimson forehead and a patch of the same colour on the breast. Below, yellowish-white streaked with green. Naked

skin round eye dull crimson. Bill heavy, with coarse hairs at base. Short square tail appearing triangular in flight. Singly or loose parties, in Banyan and other trees in fruit, both within and outside city limits.

Specimens: *B.N.H.S.*: ♂ imm. 28-5-15 Bombay (Kinnear); *St. X. C.*: ♂ 22-2-33 Andhēri (H.A.).

Noted: *City*: Bālārām Street and Sleater Road—near Grant Road; Warden Road, Chowpāti, Bhūlēshwar, Fort, Colāba, Government House Grounds—Wālkēshwar, Victoria Terminus, Cruikshank Road and elsewhere. Common everywhere in Salsette.

Resident. Very common. Its monotonous *tūk-tūk-tūk* as of a coppersmith at work, may be heard in the busiest parts of the city and vies with the shouts of vendors and traffic noises of every description. Its food consists of fruit of which *Ficus* figs form an overwhelming proportion. We have occasionally observed it launching ludicrous sallies after moths and winged termites. Aitken (*J.B.N.H.S.*, viii, 326) has also made a similar observation. We have noted a canary yellow specimen which was particularly conspicuous in its leafy environment.

Breeding: In Bombay City we have seen nests at Warden Road, Bālārām Street, Grant Road, Girgaum, Colāba, near Victoria Terminus, Khētwādi and Bhūlēshwar. Numerous others in the suburbs and Salsette. The principal breeding months here are February, March and April. One in Bombay City was excavating a hole on 25 August so it is probable that some birds breed later in the year also. The nest-holes are excavated in decayed vertical branches of trees usually at moderate heights, between 12 and 20 feet, by the birds themselves. Sometimes horizontal branches are used when the entrance hole is placed on the underside. Softwood trees such as *Erythrina*, *Moringa*, Mango and Karanj (*Pongamia*) are mostly selected for the purpose. The nest-hole is 6 to 8 inches deep; it is unlined and has a round entrance hole about 2 inches in diameter. Usually 2 or 3 eggs are laid, unmarked white, elliptical, and of a smooth texture. Both sexes feed the young.

[**The Cuckoo**: *Cuculus canorus* ssp.

Specimen: *St. X. C.*: ♀? juv. 20-10-33 Rēwas, Alibāg Talūka, Kolāba District (H.A.).

The above was shot off a wire fence near the Dharamtar Creek. As it is in juvenile plumage the race cannot be determined. H.A. has also observed (13 October) a Cuckoo at Bassein on the mainland immediately north of Salsette.]

The Indian Cuckoo: *Cuculus micropterus micropterus* Gould.

Field identification: Size about that of the Pigeon, somewhat slenderer and with a longer tail. Upper parts brown except head and neck which are ashy-grey. Breast pale grey. Underparts whitish, cross-barred with black. A black band across tail, near the tip. Singly, in wooded country.

Specimen: *St. X. C.*: 267 ♀? Powāi (H.A.).

Noted: Tūlsi Lake environs (30 July '35).

Status uncertain. Uncommon. Its call may be syllabified as *Cross-word-puzzle* or *What's your trouble*. H.A. likens it to that of the Scimitar Babbler (*Pomatorhinus horsfieldii*).

The Common Hawk-Cuckoo: *Hierococcyx varius* Vahl.

Field identification: Size and shape as last. Above ashy-grey, below whitish, cross-barred with brown. General colouration very like the Shikra's. Flight and movements also reminiscent of that hawk. Singly, in mango orchards and wooded country.

Specimens: *B.N.H.S.*: ♂ imm. 13-11-08 Pāli Hill, Bandra (Major H. J. Walton); *St. X. C.*: 172 ♂ 19-11-33 Borivli (H.A.).

Noted: Andhēri.

Resident? Not common. Its obstreperous and aggravating *brain-fever* calls usually begin to be heard in early May and continue right up to August or September. The bird is thus always more in evidence at this season and as it is likely to be overlooked at other times of the year, when silent, it is possibly less uncommon in our area than it appears.

Breeding: We have no evidence of its breeding here beyond the immature specimen in the Society's collection.

The Indian Plaintive Cuckoo : *Cacomantis merulinus passerinus* (Vahl.).

Field identification : Size about that of the Bulbul. Above dark ashy-grey, below paler. Tail blackish with white tip. White patch on wing noticeable in flight. Singly, in mango orchards and wooded country.

Specimen : *St. X. C.* : ♂ 7-8-33 Gōrēgāon (H.A.).

Presumably a monsoon visitor. Our records are only from the middle of May to the end of August (once heard 30 October). It is quite common in June in and about the scrub country along the base of Trombay Hills and at Powāi Lake, and its call is then on the air everywhere. It consists of several rather plaintive whistling notes : *Pee-pipee-pee, pipee-pee,* etc. When calling (from some exposed part of a tree) the tail is depressed and the rump slightly arched, with the wings drooping at the sides. Its food consists of grasshoppers, bugs and caterpillars. H.A. noted it gobbling up hairy caterpillars of the moth *Nepita conferta* swarming on a loose stone wall.

Breeding : We have no record from Salsette. In the Deccan it lays commonly in the nests of the Tailor-Bird and the Ashy Wren-Warbler, both of which are also breeding in Salsette while the cuckoo is with us.

The Indian Bay-banded Cuckoo : *Penthoceryx sonneratii* [*sonneratii* (Lath.) ?].

H.A. has only one sight record of a single bird of this species in Salsette : Tulsi-Vihār Lake environs, 10 October.

The Drongo Cuckoo : *Surniculus lugubris lugubris* (Horsf.).

Field identification : Size of the Bulbul or Black Drongo, with the deeply forked long tail of the latter. In colour and appearance it is very like the Black Drongo and liable to be confused with it at a casual glance. If carefully watched, however, its flight and habits are distinctly cuculine. Singly, in well-wooded tracts, especially with an abundance of Tād or Palmyra palms (*Borassus flabelifer*).

Specimens : *B.N.H.S.* : o? 14-6-25 Trombay Hills, o? 21-6-25 Powāi Lake (S.A.); *St. X. C.* : 9♀ ♀ 27-9-33 (H.A.) This last is in heavy moult, hence the sub-species is unconfirmed.

Noted : *Salsette* : Borivli, Kandivli, Chembūr.

Monsoon visitor? We have recorded it here only between 2 June and 27 September. During this period it is greatly in evidence by virtue of its distinctive call of 6 (sometimes 7 or 8) short whistling notes. The notes—1-2-3-4-5-6, etc.—rise in scale and end abruptly. While calling, the body is carried in a horizontal position and its resemblance to the Drongo is then least pronounced. Occasionally it may be heard calling all night, but especially between 2 and 4 a.m. Its food consists principally of caterpillars, the hairy ones being much relished.

We are not satisfied with the suggestion that its close outward resemblance to the Black Drongo is of real advantage to the bird, and are unable to say as yet what the significance of it may be.

Breeding : We have no direct evidence of its breeding in Salsette. The specimen of 27 September, however, had a fully mature ovary with the largest follicles 3 mm. in diameter. This bird was obviously preparing to lay, inspite of the fact that it was in heavy moult at the time. Elsewhere, the eggs of this cuckoo have been recorded from nests of the Black Drongo and from those of the Iora and the Black-fronted Babbler (*Rhopocichla*).

The Pied Crested Cuckoo : *Clamator jacobinus pica* (Hempr. & Ehr.).

Mahrātti name : *Tiu.*

Field identification : Somewhat larger than a dove and with a longer tail. Black above—including crest—white below. A white roundish patch on wings conspicuous in flight. Singly or pairs, in and about groves of trees and in scrub country dotted with large trees. Usually very noisy while with us.

Specimens : *B.N.H.S.* : ♂ 10-6-15 Bombay; o? 1-6-24 Pāli Hill, Bandra (S.A.); o? 7-11-00 Apollo Street, Bombay (E. Comber).

Noted : Khār, Andhēri, Borivli, Gōdhbunder, Chembūr.

Monsoon visitor. Common. Arriving at the end of May (earliest 25th) and leaving again by the end of October (latest 11 November). The birds are most abundant and noisy between 15 June and the end of August. Pairs are usually seen chasing each other and calling—a loud, rather plaintive, tinkling

piu, piu, pee-pee-piu, pee-pee-piu, etc. Its food consists of hairy caterpillars, grasshoppers and other insects.

In Bombay City, the Pied Crested Cuckoos are much persecuted by the local House-Crows. The specimen of 7 November 1900 had taken refuge from them in the Society's Rooms at 6, Apollo Street. Similarly 3 such refugees were caught in St. Xavier's College and 2 in the Prince of Wales Museum between 25 May and 1 June (1936).

Breeding: We have no record from within the limits of Bombay and Salsette, but at Kanim (across the harbour—in Alibāg Talūka) we have found this species breeding from July to September. The usual host there is the Bombay Babbler (*Turdoides s. somervillei*). On 16 August a pair of Pied Cuckoos were observed in copula. A specimen shot on the 29th of that month had a complete oviduct egg of a pale blue colour. The laid egg is a deeper blue and approximates closely to that of the fosterer.

The Indian Koel: *Eudynamis scolopaceus scolopaceus* (Linn.).

Field identification: Somewhat larger than a dove and with a longer tail. Glossy black all over—like a slender Jungle-Crow—with a yellowish-green bill. The female is blackish-brown, spotted above and barred below with white. Singly or pairs, in gardens and groves of trees.

Specimens: *B.N.H.S.*: ♂ 22-5-16 Malabār Hill, Bombay (J. E. Needham); *St. X. C.*: 3♂ ♀ 1-8-33 Andhēri (H.A.).

Noted: *City*: Victoria Gardens—Byculla, Parēl (about Haffkine Institute), Government House Grounds—Wālkēshwar, Ridge Road and the neighbourhood—Malabār Hill, Fort. *Salsette*: Pāli Hill—Bandra, Khār, Borivli, Mulund, Bhāndūp, Gōdhbunder, Thāna, etc.

Resident. Common. It is, on the whole, silent during the winter months but becomes extremely obstreperous from March to July. At that season its shrill shrieking call: *kūoo, kūoo*, etc. resounds through the countryside all day. It begins on a low note, but rises in scale at each successive *kūoo* until at the seventh or eighth it reaches feverish pitch and breaks off abruptly. The bird soon begins it all over again, however. By an imitation of its calls, which the bird insists on answering, village boys are wont to drive the bird frantic and hoarse! It is perhaps the earliest riser amongst our local birds being usually up and calling long before the House-Crow and the Magpie-Robin, who tie for second place. We have frequently heard it as early as 3-45 of a summer morning. The female Koel utters a sharp *kik-kik-kik* as it flies from tree to tree or hops about among the branches. Its food consists of hairy caterpillars and other insects, but a large variety of fruits and berries is also eaten, amongst which *Ficus retusa, F. bengalensis, F. religiosa, Bridelia, Streblus asper* and *Phyllanthus reticulatus* are common. We have observed it plucking and swallowing the nuts of the Fish-tail Palm (*Caryota urens*) and, on another occasion, a full clutch of eggs from a nest of the Red-whiskered Bulbul (*Otocompsa jocosa*).

Breeding: The laying season is in May and June and corresponds with that of its most usual host the House-Crow (*Corvus splendens*). Occasionally the Jungle Crow which nests somewhat earlier, is also victimised. H.A. (see *J.B.N.H.S.*, xxxv, 458) once found a House-Crow's nest at Bhāndūp (9 June) containing 11 Koel eggs exclusively. These belonged to two different types and were probably the product of two females. While crow and Koel *eggs* may often be found together in a nest, it is but rarely—in our experience, never—that one comes across a victimised crow's nest containing both crow and Koel *young*. Usually there is only 1—very exceptionally 2—of the latter in sole possession, from which it would appear that like the Cuckoo, the Koel hatchling also disposes of its rightful foster-brothers by heaving them out of the nest. It is surprising how thoroughly an intelligent bird like the crow will be duped into incubating the impostor's eggs and rearing its young especially when the young Koel, which is speckled and barred with white, is so unlike its own young in appearance.

We have never witnessed a Koel in the act of depositing her egg and there is some doubt as to the actual procedure. From circumstantial evidence, however, it appears that she snatches the opportunity for doing so while the male Koel draws the owners away from the nest by leading them a chase. The eggs of this cuckoo are very like the crow's in appearance—pale greyish-green or stone-colour, speckled and blotched with reddish-brown.

The Common Crow-Pheasant or **Coucal** : *Centropus sinensis parroti* Stres.

Local name (Mahrātti?) : *Kūmar Kaūla.*

Field identification : Size that of the Jungle-Crow. A striking glossy black bird with chestnut wings and long broad tail. Singly or pairs, in scrub jungle, mango groves, etc. Usually stalking along the ground like a pheasant searching the undergrowth for food.

Specimens : *B.N.H.S.* : o? 27-12-23 Andhēri (S. H. Prater); *St. X.C.* : 53 ♀ 20-8-33 Chendevli, Salsette (H.A.).

Noted : *Salsette* : Marōl, Pāii Hill—Bandra, Trombay Hills and Chembūr, Tūlsi Lake environs, Gōdhbunder, Thāna, Malād, etc.

Resident. Common. Its call is the familiar *ook, ook, ook,* etc. so commonly heard on the countryside especially during the hot weather. Besides this it has a large variety of croaks and chuckles—some distinctly weird—which are usually heard in the breeding season. Its food consists of caterpillars, grasshoppers, beetles, bugs and insects of every description. In addition, we have found it greedily devouring mice, frogs, geckos (*Hemidactylus*), skinks (*Mabuia*), Bloodsucker lizards (*Calotes*) and Green Whip Snakes (*Dryophis mycterizans*). It is also highly destructive to the eggs and young of other birds.

Breeding : The Crow-Pheasant is one of the respectable cuckoos that do not foist their domestic responsibilities upon other birds. Its nest is a large globular structure about a foot in diameter, of coarse grasses, strips of palm leaves, etc. placed at moderate heights in a thorny bush or tree. We have not found a nest within the limits of Salsette as yet, but the female shot on 20 August ('33) had soft ovarian eggs, indicating that the breeding season here is during the S.-W. Monsoon.

[The Large Alexandrine Paroquet : *Psittacula eupatria* ssp.

Hindustani name : *Hīraman tōta.*

Field identification : Size about that of the Pigeon. Slenderer and with a long pointed tail. A grass green paroquet with a black and rose-pink collar in the male (absent in female). A conspicuous maroon-red patch on the shoulder. Usually seen in fanciers' cages.

We have only observed the Large Paroquet flying overhead in small parties in various parts of Bombay City, but never in the well-wooded or hilly tracts of Salsette where one would expect to find it in the wild state. From this it would seem that all the birds here are escapes, since it is a favourite cage bird and numbers are always for sale in the Crawford Market. According to Barnes (*J.B.N.H.S.*, v, 13) these imported birds mostly come from the Central Provinces. The race therefore would be the typical one *P. e. eupatria.* It is said to be a good 'talker'. Its call is deeper and more 'sedate' than that of the Rose-ringed Paroquet.]

The Rose-ringed Paroquet : *Psittacula krameri manillensis* (Bechst.).

Local name : *Pōpat.*

Field identification : A somewhat smaller replica of the above, but lacking the red shoulder-patch. Parties, usually noisy, in mango orchards and thinly wooded country; also in gardens and trees in the city. Occupying holes in outer brick walls of buildings and temples. Commonly caged.

Specimens : *B.N.H.S.* : o? 25-3-24 Warden Road, Cumbala Hill (S.A.).

Noted : *City* : Chowpāti (Wilson College neighbourhood), Fort, Elphinstone Circle, Colāba, Churchgate, Bhūlēshwar, Parēl, Byculla, etc. *Salsette* : Pāli Hill—Bandra, Andhēri, Borivli, Gōdhbunder, Powāi Lake environs, Chembūr, Bhāndūp, Thāna, etc.

Resident. Common. Destructive to ripening mangoes and fruit of every kind. Invariably present on *Bombax* and *Erythrina* flowers biting off the petals and eating the nectar. It is destructive in its methods and of no service in cross-pollination. At Dāna Bunder and the Goods sheds of the G.I.P. and B.B. & C.I. Railways, these paroquets may usually be seen clambering about and biting into the grain bags arriving from upcountry, and helping themselves to the contents.

Breeding : The Rose-ringed Paroquet breeds in suitable holes in walls of buildings and trees, both within and without city limits, not excluding the noisiest and most congested parts of the town. February, March and April are the months most favoured for nesting. In trees, woodpecker- and barbet-holes are utilised, as well as those excavated by the birds themselves. The

piu, piu, pee-pee-piu, pee-pee-piu, etc. Its food consists of hairy caterpillars, grassnoppers and other insects.

In Bombay City, the Pied Crested Cuckoos are much persecuted by the local House-Crows. The specimen of 7 November 1900 had taken refuge from them in the Society's Rooms at 6, Apollo Street. Similarly 3 such refugees were caught in St. Xavier's College and 2 in the Prince of Wales Museum between 25 May and 1 June (1936).

Breeding: We have no record from within the limits of Bombay and Salsette, but at Kinim (across the harbour—in Alibāg Talūka) we have found this species breeding from July to September. The usual host there is the Bombay Babbler (*Turdoides s. somervillei*). On 16 August a pair of Pied Cuckoos were observed in copula. A specimen shot on the 29th of that month had a complete oviduct egg of a pale blue colour. The laid egg is a deeper blue and approximates closely to that of the fosterer.

The Indian Koel: *Eudynamis scolopaceus scolopaceus* (Linn.).

Field identification: Somewhat larger than a dove and with a longer tail. Glossy black all over—like a slender Jungle-Crow—with a yellowish-green bill. The female is blackish-brown, spotted above and barred below with white. Singly or pairs, in gardens and groves of trees.

Specimens: *B.N.H.S.*: ♂? 22-5-16 Malabār Hill, Bombay (J. E. Needham); *St. X. C.*: 3♂ ♀ 1-8-33 Andhēri (H.A.).

Noted: *City*: Victoria Gardens—Byculla, Parēl (about Haffkine Institute), Government House Grounds—Wālkēshwar, Ridge Road and the neighbourhood—Malabār Hill, Fort. *Salsette*: Pāli Hill—Bandra, Khār, Borivli, Mulund, Bhāndūp, Gōdhbunder, Thāna, etc.

Resident. Common. It is, on the whole, silent during the winter months but becomes extremely obstreperous from March to July. At that season its shrill shrieking call: *kūoo, kūoo*, etc. resounds through the countryside all day. It begins on a low note, but rises in scale at each successive *kūoo* until at the seventh or eighth it reaches feverish pitch and breaks off abruptly. The bird soon begins it all over again, however. By an imitation of its calls, which the bird insists on answering, village boys are wont to drive the bird frantic and hoarse! It is perhaps the earliest riser amongst our local birds being usually up and calling long before the House-Crow and the Magpie-Robin, who tie for second place. We have frequently heard it as early as 3-45 of a summer morning. The female Koel utters a sharp *kīk-kīk-kīk* as it flies from tree to tree or hops about among the branches. Its food consists of hairy caterpillars and other insects, but a large variety of fruits and berries is also eaten, amongst which *Ficus retusa, F. bengalensis, F. religiosa, Bridelia, Streblus asper* and *Phyllanthus reticulatus* are common. We have observed it plucking and swallowing the nuts of the Fish-tail Palm (*Caryota urens*) and, on another occasion, a full clutch of eggs from a nest of the Red-whiskered Bulbul (*Otocompsa jocosa*).

Breeding: The laying season is in May and June and corresponds with that of its most usual host the House-Crow (*Corvus splendens*). Occasionally the Jungle Crow which nests somewhat earlier, is also victimised. H.A. (see *J.B.N.H.S.*, xxxv, 458) once found a House-Crow's nest at Bhāndūp (9 June) containing 11 Koel eggs exclusively. These belonged to two different types and were probably the product of two females. While crow and Koel *eggs* may often be found together in a nest, it is but rarely—in our experience, never—that one comes across a victimised crow's nest containing both crow and Koel *young*. Usually there is only 1—very exceptionally 2—of the latter in sole possession, from which it would appear that like the Cuckoo, the Koel hatchling also disposes of its rightful foster-brothers by heaving them out of the nest. It is surprising how thoroughly an intelligent bird like the crow will be duped into incubating the impostor's eggs and rearing its young especially when the young Koel, which is speckled and barred with white, is so unlike its own young in appearance.

We have never witnessed a Koel in the act of depositing her egg and there is some doubt as to the actual procedure. From circumstantial evidence, however, it appears that she snatches the opportunity for doing so while the male Koel draws the owners away from the nest by leading them a chase. The eggs of this cuckoo are very like the crow's in appearance—pale greyish-green or stone-colour, speckled and blotched with reddish-brown.

The Common Crow-Pheasant or **Coucal** : *Centropus sinensis parroti* Stres.

Local name (Mahrātti?) : *Kūmar Kaŭla.*

Field identification : Size that of the Jungle-Crow. A striking glossy black bird with chestnut wings and long broad tail. Singly or pairs, in scrub jungle, mango groves, etc. Usually stalking along the ground like a pheasant searching the undergrowth for food.

Specimens : *B.N.H.S.* : o? 27-12-23 Andhēri (S. H. Prater); *St. X.C.* : 53 ♀ 20-8-33 Chendevli, Salsette (H.A.).

Noted : *Salsette* : Marōl, Pāli Hill—Bandra, Trombay Hills and Chembūr, Tūlsi Lake environs, Gōdhbunder, Thāna, Malād, etc.

Resident. Common. Its call is the familiar *ook, ook, ook,* etc. so commonly heard on the countryside especially during the hot weather. Besides this it has a large variety of croaks and chuckles—some distinctly weird—which are usually heard in the breeding season. Its food consists of caterpillars, grasshoppers, beetles, bugs and insects of every description. In addition, we have found it greedily devouring mice, frogs, geckos (*Hemidactylus*), skinks (*Mabuia*), Bloodsucker lizards (*Calotes*) and Green Whip Snakes (*Dryophis mycterizans*). It is also highly destructive to the eggs and young of other birds.

Breeding : The Crow-Pheasant is one of the respectable cuckoos that do not foist their domestic responsibilities upon other birds. Its nest is a large globular structure about a foot in diameter, of coarse grasses, strips of palm leaves, etc. placed at moderate heights in a thorny bush or tree. We have not found a nest within the limits of Salsette as yet, but the female shot on 20 August ('33) had soft ovarian eggs, indicating that the breeding season here is during the S.-W. Monsoon.

[**The Large Alexandrine Paroquet** : *Psittacula eupatria* ssp.

Hindustani name : *Hīraman tōta.*

Field identification : Size about that of the Pigeon. Slenderer and with a long pointed tail. A grass green paroquet with a black and rose-pink collar in the male (absent in female). A conspicuous maroon-red patch on the shoulder. Usually seen in fanciers' cages.

We have only observed the Large Paroquet flying overhead in small parties in various parts of Bombay City, but never in the well-wooded or hilly tracts of Salsette where one would expect to find it in the wild state. From this it would seem that all the birds here are escapes, since it is a favourite cage bird and numbers are always for sale in the Crawford Market. According to Barnes (*J.B.N.H.S.*, v, 13) these imported birds mostly come from the Central Provinces. The race therefore would be the typical one *P. e. eupatria.* It is said to be a good 'talker'. Its call is deeper and more 'sedate' than that of the Rose-ringed Paroquet.]

The Rose-ringed Paroquet : *Psittacula krameri manillensis* (Bechst.).

Local name : *Pōpat.*

Field identification : A somewhat smaller replica of the above, but lacking the red shoulder-patch. Parties, usually noisy, in mango orchards and thinly wooded country; also in gardens and trees in the city. Occupying holes in outer brick walls of buildings and temples. Commonly caged.

Specimens : *B.N.H.S.* : o? 25-3-24 Warden Road, Cumbala Hill (S.A.).

Noted : *City* : Chowpāti (Wilson College neighbourhood), Fort, Elphinstone Circle, Colāba, Churchgate, Bhūlēshwar, Parēl, Byculla, etc. *Salsette* : Pāli Hill—Bandra, Andhēri, Borivli, Gōdhbunder, Powāi Lake environs, Chembūr, Bhāndūp, Thāna, etc.

Resident. Common. Destructive to ripening mangoes and fruit of every kind. Invariably present on *Bombax* and *Erythrina* flowers biting off the petals and eating the nectar. It is destructive in its methods and of no service in cross-pollination. At Dāna Bunder and the Goods sheds of the G.I.P. and B.B. & C.I. Railways, these paroquets may usually be seen clambering about and biting into the grain bags arriving from upcountry, and helping themselves to the contents.

Breeding : The Rose-ringed Paroquet breeds in suitable holes in walls of buildings and trees, both within and without city limits, not excluding the noisiest and most congested parts of the town. February, March and April are the months most favoured for nesting. In trees, woodpecker- and barbet-holes are utilised, as well as those excavated by the birds themselves. The

rotten stems of Palmyra palms standing in the water at Powāi Lake and elsewhere, and cocoanut palms at Jūhū, Māhim, etc. offer suitable sites. The normal clutch is of 3 or 4 eggs, roundish oval, white, unmarked.

The Blossom-headed Paroquet : *Psittacula cyanocephala cyanocephala* (Linn.).

Field identification : Smaller than the last. About the size of the Myna; slenderer and with a long pointed tail. General colour yellowish green. The male has a beautiful bluish-red head which in the female is bluish-grey. The bright maroon-red patch on the shoulder of the male is absent or obsolete in the female. In flight the peculiar sharp single interrogative cry *tooi?* and the yellow tip of the tail are diagnostic features. Small flocks in wooded country, Jāmūn groves, etc.

Specimens : *B.N.H.S.* : oo? 2-12-25 Kūrla (Baretto).

Noted : *Salsette* : Pāli Hill—Bandra (M. Suter !), Andhēri, Chembūr, Borivli, Tūlsi Lake, Powāi. Not in city limits.

Status uncertain. Our records here are only between 7 August and 31 March, but we have noted a flock at Kihim (across the harbour) on 11 June. It is possibly largely a dry season visitor from the Ghāts and Deccan.

The Loriquet : *Coryllis vernalis* ssp.

Field identification : Size about that of the House-Sparrow. A bright yellowish-green little parrot with a red bill, short square tail and a crimson rump. Singly or small parties, among leafy trees in wooded country.

No specimens.

Status uncertain. Not uncommon, but patchily distributed and to some extent undoubtedly also a local migrant. We have no record of it in Salsette between 23 June and 9 September. On the other hand, at Kihim (Alibāg Tālūka) *ca.* 15 miles from Bombay City, across the harbour, they appeared to arrive in the first week of June (1930) and were very common throughout the monsoon, disappearing completely by the beginning of November ! These little birds on account of their small size and wonderfully obliterative colouration are usually visible only when flying across from one tree to another. The flight is swift, consisting of several rapid wing-strokes followed by a short pause and a consequent slight dip. It is invariably accompanied by a sharp trisyllabic *chee-chee-chee*, repeated every couple of seconds or so. Their food consists of *Ficus* figs and other fruits and berries. The nectar of flowers, especially *Erythrina*, is also largely eaten.

We have no record of its breeding in Salsette or on the adjacent mainland.

The Indian Roller : *Coracias benghalensis indica* Linn.

Field identification : Size of the Pigeon. A striking Oxford-and-Cambridge-blue bird with biggish head, heavy bill, rufous-brown breast and blue abdomen and undertail. Singly, perched on telegraph wires or in some other exposed situation such as a fencepost or a tree-stump, in open fallow land and cultivation. Laboured flight with deliberate wing beats.

Specimens : *B.N.H.S.* : ♂ 21-2-21 Santa Cruz (B. C. Ellison); *St. X. C.* : 168 ♂ 19-11-33 Andhēri (H.A.).

Noted : *City* : Churchgate Reclamation. *Salsette* : Matūnga, Kūrla, Chembūr Trombay, Mulund, Borivli, etc.

Resident? Not common. Its food consists of grasshoppers, crickets and other insects usually captured on the ground. When an insect is sighted the bird flies down to it and returns to the same perch or another one nearby, where the victim is battered and swallowed. It has a variety of loud raucous calls and is particularly noisy and demonstrative in the breeding season when the male also indulges in some fantastic aerobatics.

We have no information regarding its breeding in Salsette, but we have once observed the above nuptial display (Borivli) in March which suggests the probability.

According to Aitken (*J.B.N.H.S.*, xiii, 398) the European Roller (*Coracias garrula* ssp.), distinguished from our bird in having the underparts pale blue throughout, has occurred in or near Bombay. H.A. observed this bird at Khandāla in the Western Ghāts on 25-3-34, and obtained two specimens of the Kashmir race (*C. g. semenowi*) in October-November 1935.



The Common Indian Bee-eater (*Merops orientalis orientalis*, Latham).

Photos by



The White-breasted Kingfisher [*Halcyon smyrnensis smyrnensis* (Linn.)].

Sálim Ali.

[**The Common Indian Bee-eater** : *Merops orientalis orientalis* Latham.

Mahrātti name : *Patēri.*

Field identification : Size about that of the House-Sparrow. A bright green bird tinged with reddish-brown on the head and neck. Two pointed feathers sticking out beyond the tail. A narrow black gorget on foreneck. Slender, long, slightly curved bill. Parties, in gardens, open country and near the seashore. Perching on telegraph wires, fence-posts, etc., making graceful sallies and swoops after winged insects, capturing them in mid-air and circling round on motionless wings back to the perch. Often dust-bathing on country roads.

Specimens : *B.N.H.S.* : ♂ 29-12-23 Andhēri (S. H. Prater) ; *St. X. C.* : 41 ♀ 6-8-33 Marōl (H.A.).

Noted : *City* : Malabār and Cumbāla Hills, Wālkēshwar, Mahāluxmi, Victoria Gardens—Byculla, etc. *Salsette* : Pāli Hill, Khār, Jūhū, Versōva, Chembūr Trombay, Borivli, Kandivli, Gōdhbunder, Thāna and elsewhere generally.

Resident and local migrant. Though very common during the dry months, the great majority of Bee-eaters disappear from Bombay and Salsette about the middle of April. During the rainy season, i.e. up to about the end of August, they are only rarely seen.

The birds roost at night in leafy trees into which they begin to collect about sunset. Great noise and bustle prevails, the gathering suddenly flying out in a rabble every now and again and returning after circling about in disorder above the tree. They are late risers, and parties may be seen sleeping huddled together on a branch well after the sun is up.

Breeding : We have no record of nests in Bombay or Salsette, but the birds breed freely at and in the neighbourhood of Alibāg across the harbour. The nest is at the end of a curved tunnel in sandy soil or soft earth. The burrow is either driven horizontally into a bank or cutting or sunk obliquely into more or less level ground. It is usually from 1 to 3 feet deep and about 1½ inches in diameter. Four to six roundish white eggs form the normal clutch. They seem to be laid at longer intervals than 24 hours each, and incubation commences—or perhaps the heat in the tunnel suffices for the purpose?—from the first egg. This is evident from the great disparity between the growth of the oldest and youngest chick in a nest.]

[**The Blue-tailed Bee-eater** : *Merops superciliosus javanicus* Horsf.

Field identification : Somewhat larger than the Common Bee-eater—about the size of the Bulbul—but generally similar to it in appearance. Bright bluish-green with a greenish-blue tail including the pin feathers. A black stripe through the eye.

Specimen : *B.N.H.S.* : o? 19-9-26 Kandivli (S.A.).

Noted : *Salsette* : Santa Cruz, Sāki, Andhēri, Borivli, Thāna. *Mainland* . Kihim, Kolāba District (specimen ♂ 17-10-26).

A passage migrant (to the south?) in September-October. All our records are during these 2 months only. Once (28 April) a bird was heard passing over at Santa Cruz, probably on return passage, but it is evident that for this they follow some other route and the majority at least avoid Salsette. These bee-eaters keep to open country and we have frequently observed parties on the sandy seashore. Its notes are like the Common Bee-eater's, but deeper and readily distinguishable from them.]

[**The Blue-cheeked Bee-eater** : *Merops superciliosus persicus* Pallas.

This race presumably also passes over Salsette in October. We have no specimen from actually within our limits, but a male obtained by H.A. at Bassein (Thāna District) on 13 October ('33) belongs to it. On that date he found the birds to be very abundant there, all perching more or less exclusively on the telegraph wires whence they launched sallies after winged insects. This subspecies differs from *javanicus* chiefly in having the rump and tail more green less blue, and in possessing more conspicuous blue-green cheeks.]

The Pied Kingfisher : *Cēryle rudis leucomelanura* Reichenbach.

Field identification : Size about that of the Myna. A speckled and barred black and white bird with a stout, dagger-shaped bill. Singly or pairs, by streams and tanks, hovering ('standing on its tail') in mid-air and dropping like a bolt upon fishes near the surface.

No specimens.

Noted: *Salsette*: Powāi Lake, Māhim. Across the harbour at Māndwā, Kihim, Alibāg, etc.

Resident? Uncommon. It is usually found by fresh water, but we have frequently observed it fishing on tidal creeks and in salt water pools on the rocky seashore. It utters a sharp *chirruk, chirruk* as it flies.

We are not aware of its nesting in our area or its immediate neighbourhood.

The Common Indian Kingfisher: *Alcedo atthis bengalensis* Gmelin.

Field identification: Size about that of the House-Sparrow, with a short stumpy tail and a long, straight, pointed bill. An attractive blue and green little bird with deep rust-coloured underparts. Singly, by water—stream, tank, puddle or sometimes even a well. Usually seen perched on a bush or rock overhanging water, or in swift direct flight above the surface, uttering a squeaky *chi-chi-chi*. When sitting, bolt upright as is its wont, it bobs its head up and down, turns it from side to side, jerks its stump of a tail and utters little subdued *clicks* from time to time.

Specimens: *B.N.H.S.*: ♀ 16-1-24 Andhēri (S. H. Prater). *St. X. C.*: 38 ♀ juv. 29-7-33 Gōrēgāon (H.A.).

Noted: *City*: Dhōbi Talāo (1913), Scandal Point—Mahāluxmi. *Salsette*: Pāli Hill, Dānda, Bhāyndar, Chembūr, Borivli, Powāi-Tūlsi-Vihār Lakes, etc.

Resident. Common. Its method of fishing differs from that of the Pied Kingfisher in that it seldom hovers. More usually it drops upon the victim from an overhanging perch and returns with it to the same or a nearby one to batter and swallow it.

Breeding: We have found nests in Salsette with eggs or young at Wadaūli (Chembūr), Sāki, Borivli, and Andhēri between the middle of July and the end of August. By the latter date, most eggs have hatched. The nest or egg-chamber is at the end of a tunnel dug into the side of an earth-cutting, 1 to 3 feet deep. A normal clutch consists of from 4 to 7 eggs, roundish, white, unmarked.

The Indian three-toed Kingfisher: *Ceyx erithaca erithaca* (Linn.).

Field identification: Slightly smaller than the Common Kingfisher. A lovely little orange-brown, lilac and blue bird with rusty orange-yellow underparts. A deep blue patch on either side of neck and a rufous patch on the underwing conspicuous—the latter only in flight. Singly, by streams, pools and rain puddles in forest.

Specimens: *B.N.H.S.*: ♂? 18-6-02 Government Dockyard, Bombay (Mrs. A. J. Paterson); ♂? 3-10-10 Bombay City (?); ♂? 12-9-24 Pāli Hill, Bandra (Mrs. Wright).

Noted: *Salsette*: Gōdhbunder, Deonar-Chembūr, Trombay Hills, Powāi.

Monsoon visitor. The specimens as well as all our sight records cover the months June to October only, i.e. the S.-W. Monsoon season. We have no evidence that the bird is with us during the rest of the year.

The White-breasted Kingfisher: *Halcyon smyrnensis smyrnensis* (Linn.).

Local name: *Chingla.*

Field identification: Size of the Myna, slightly bigger. Brilliant turquoise blue above, dark chocolate-brown head neck and underparts. A conspicuous white 'shirt front'. Long, stout, pointed, straight red bill. Singly, on tree stumps, telegraph poles, fence posts, etc. in open thin forest, near tanks, wells, puddles, at fish-yards, etc.—also away from water.

Specimen: *B.N.H.S.*: ♂ 18-10-24, ♂? 13-2-26 Kūrla (D. A. Baretto).

Noted: *City*: Dhōbi Talāo (1913), Byculla, Chowpāti, Warden Road, Malabār Hill, Wālkēshwar. Generally in Salsette.

Resident. Common. Its diet is not confined to fish. Earthworms, insects, frogs, lizards, mice and young birds are all relished. Its call or 'song' is a loud, not unmusical, chattering scream uttered from the top of a tree or some other exposed situation. It ends in a detached, harsh undertone, something like the *pench* of a snipe, audible only at close quarters.

Breeding: The principal breeding months in our area are May, June and July. The nest tunnel, as with the other kingfishers, is dug into the side of an earth cutting or bank 2 to 3 feet deep and ends in a circular egg-chamber about 6 inches in diameter. A normal full clutch consists of 5 or 6 eggs,

more often the former. They are pure white, roundish ovals. H.A. has observed that the nestlings, when pulled out of the nest, back away into the tunnel on their 'hocks'. If replaced in the tunnel head first they invariably back out of it, but if inserted head facing outwards the young will slowly back into the nest! The nestlings seem incapable of forward movement at this early stage. Inglis (*J.B.N.H.S.*, xi, 480) also says that the young of the Common Bee-eater have a curious habit of 'walking backwards when being fed by the hand'. It is significant that both these species are tunnel breeders, and this habit is doubtless of survival value to their chicks.

The Black-capped Kingfisher : *Halcyon pileata* (Bodd.).

Field identification : Size same as that of the White-breasted species. Rich cobalt blue above, buffy-white with rufous tinge below. Top of head or 'cap' velvety black. A prominent white collar round the hindneck. Bright coral red bill. Singly, by tidal creeks and mangroves about the sea-coast.

Specimens : *B.N.H.S.* : o? 31-10-08 Kolsette Bunder, Thāna Creek (L. H. Saville) ; o? 11-11-28 Gōdhbunder (S.A.) ; *St. X. C.* : o? 28-11-? Gōdhbunder (H.A.).

Noted : *City* : Chowpāti (once—flying over, 7-10-26) *Salsette* : Tūlsi Lake (January), Andhēri (January and February).

Presumably, as suggested by Aitken (*J.B.N.H.S.*, xi, 164), a cold weather visitor to Salsette. All the specimens and our sight records are between October and February. We have also met with it in the Rewa Dānda Creek Kolāba District in January ; there is a specimen thence in the Society's Collection dated 13 December, and another one from Kalyān also shot in December. E. H. Aitken often saw it in the vicinity of the seashore and creeks along the Konkan Coast, perched on high trees whence it swooped down with the action of a hawk upon the sand crabs which he believed formed its chief food.

The Great Indian Hornbill : *Dichoceros bicornis* (Linn.).

EHA in the introduction to his *Common Birds of Bombay* writes : '. . . . a misguided hornbill may make its appearance on Malabar Hill'. We do not know of one ever having done so, within recent years at any rate, and it is therefore surprising to read the distribution of the Great Hornbill (new *Fauna*, iv, 284) in South India as 'along the western coast from S. Travancore to Bombay City . . . .'

The Malabar Grey Hornbill : *Tockus griseus* (Latham).

H.A. saw a single hornbill of this species at Gōdhbunder on 17-4-34. It was being chivvied by a pair of Jungle Crows. It took refuge in a tree but was hustled out and chased out of sight. This is the only record we have of the occurrence of any hornbill in Salsette.

The Hoopoe : *Upupa epops* ssp.

Field identification : Size about that of the Myna. A rufous-brown full-crested bird with black and white zebra-like markings on the back and wings. a long slender slightly curved bill and short legs. Singly or pairs, in open scrub country, light jungle or near villages, running about on the ground like quail but with a somewhat waddling gait, and digging with its bill. The crest is erected and opened out fanwise when the bird alights after a short flight.

Specimens : *B.N.H.S.* : ♂ 3-1-24, ♀ 18-1-24 Andhēri (S. H. Prater) ; o? 13-12-08 Andhēri (Kinnear).

Noted : *Salsette* : Pāli Hill, Khār, Chembūr.

Presumably a winter visitor only. We have no record of it in Salsette between 21 March and 12 October. Apparently both the races *orientalis* and *ceylonensis* occur within our limits. While with us, the Hoopoe is mostly silent.

It breeds on the Western Ghāts and in the Deccan. Brother Navarro of St. Xavier's College had a young bird brought to him at Khandāla (2,000 ft.) in May (race *ceylonensis*?).

The Malabar Trogon : *Harpactes fasciatus malabaricus* (Gould).

Field identification : Size about that of a dove. Head, neck and breast grey. A white collar dividing the last from the striking crimson lower plumage. Upper parts (back etc.) yellowish-brown. Fine wavy white bars in the wing. Bill and bare skin round the eye blue. Female duller with the underparts orange-brown instead of crimson. Pairs or small parties, in heavy deciduous jungle.

Specimens : *St. X. C.* : 194 ♂ 31-12-34 Hills N.E. of Borivli (H.A.).

Noted. *Salsette* : Tulsi Lake environs. *Adjacent mainland* : Tungar Hill, Bassein, Thana District.

Evidently a local cold weather immigrant to Salsette. Rare. We have come across it here only on three occasions : 24 November, 30 December and 3 March. The party keeps up a subdued musical chuckle. When the specimen was shot, the female kept uttering a low *krr* in the neighbourhood.

[**The Alpine Swift** : *Micropus melba* ssp.

EHA (*C.B.B.*, p. 41) says he shot this bird 'a few miles from Bombay' (in Salsette?). We have not come across it in our area.]

The Common Indian House-Swift : *Micropus affinis affinis* (Gray).

Field identification : Smaller than the House-Sparrow, but with longer and narrower wings. Smoky-black with white throat and white rump. Short square tail. In overhead flight the backwardly curving narrow wings look like a bow and the body an arrow set in it. Gregariously, hawkinng insects on the wing, near human habitations, open country, above tidal mudflats, etc.

Specimens : *B.N.H.S.* : o? 8-4-24 Mudflats—Sion Causeway (S.A.) ; ♂ -10-15 Bombay (S. H. Prater) ; ♂ 2-10-25 Bombay (C. McCann) ; ♀ 18-9-12 Cumbala Hill ; *St. X. C.* : 66 ♀ 5-9-33 Andheri (H.A.).

Noted : *City* : Bhuleshwar, Fort, Chowpati. *Salsette* : Borivli, Mulund, Thana, Ghatkopar.

Resident. Common. Large numbers occasionally seen about sunset hawking winged insects or 'balling high up in the air with shrill cries.

Breeding : The House-Swift usually builds in colonies, but single nests or just 2 or 3 together are not uncommon. They are, as a rule, plastered helter-skelter along the angle of the wall and ceiling in buildings and porches, both deserted and occupied, in the midst of the busiest part of the town or outside. They are round untidy cups made entirely of feathers, grass, etc. cemented together by the birds' saliva. The entrance-hole is often merely a slit between the wall and the nest. The birds use the nests throughout the year for roosting purposes as well, and so it is difficult to say without examination exactly when they are breeding and when not. H.A. has taken 2 fresh eggs at Andheri on 27 March and found a nestling in the same nest on 10 April of the following year. The same site and nests—repaired if necessary—are used for many years in succession if the birds are left undisturbed. The colony of nests under the entrance archway of Messrs. Greaves Cotton & Co. Forbes Street, Fort, mentioned by EHA (*C.B.B.*, p. 40) in 1880 or thereabouts, is in occupation to this day!

Usually 2 eggs are laid. They are long ovals and pure white in colour.

The Palm Swift : *Cypsiurus batasiensis palmarum* (Gray).

Mahratti name : *Shimri.*

Field identification : Smaller than the House-Sparrow ; considerably slenderer in body with long slender wings. Uniform smoky-brown in colour. Invariably seen on the wing, hawking flying insects in open country. Inseparable from Palmyra palms. The deep cleft or fork in the tail is noticeable when the bird wheels in flight.

Specimens : *B.N.H.S.* : o? 16-2-24 Pali Hill, Bandra (S.A.) ; *St. X. C.* : 48 ♂ 17-7-33 Andheri (H.A.).

Noted : *City* : Malabar Hill, Tardeo, Cumbala Hill, Byculla, Parel. Common everywhere in suburbs and Salsette.

Resident. Common. It has a shrill, joyous quick repeated triple note *ti-ti-tee* uttered on the wing. H.A. observed a pure albino, except for the wings, flying about amongst *Borassus* palms along with normally coloured birds (Powai, 3-6-36).

Breeding: We have records of the following nests in Salsette:
15 April ('34—Andhēri) 1 nearly full-fledged chick (H.A.).
6 August ('35—Tārdeo, Bombay) eggs (Br. Navarro),
20 August ('35—Cumbāla Hill, Bombay) *A* 1 fresh egg; *B* bird brooding,
2nd week September ,, 1 hardset egg.
The nest is a tiny half-saucer, or shallow purse, made of vegetable down and feathers agglutinated with the bird's saliva and cemented into a furrow on the underside of a Palmyra leaf. It measures about 2 inches from side to side. The normal clutch is of 2 eggs—long, pointed ovals and white in colour.

Hume's Nightjar: *Caprimulgus europaeus unwini* Hume.

Specimen: *B.N.H.S.*: ♀ October 1915 Colāba, Bombay City.
An aberrant straggler? This specimen was caught by Mr. Prater in his room wherein it appears to have blundered.

[Sykes's Nightjar: *Caprimulgus mahrattensis* Sykes.

Specimens: *B.N.H.S.*: ♀ 7-12-99 Kalyān (J. Brand).
We have not come across this species in Salsette. The specimen was also most probably an aberrant straggler, but it is worth including in this list in view of the nearness of Kalyān (on the mainland, across Thāna Creek) to our area.]

The Common Indian Nightjar: *Caprimulgus asiaticus* Latham.

Field identification: Size about that of the Myna. Yellowish-grey and pale brown above with black streaks in a complicated camouflaging pattern. Buff and fulvous underneath. White patches on wing conspicuous when flying. Large owl-like head with large eyes and wide gape. Singly, in scrub in compounds, ravines or thin jungle. Lying close on ground invisible amongst dry leaves and rising up when almost trampled upon. Silent, rather leisurely flight. Often seen on suburban roads at dusk, eyes gleaming red in the headlights of an on-coming car.
Specimens: *B.N.H.S.*: ♀ 20-11-99 Bombay, ♂ 20-5-31 Malād; *St. X. C.*: 246 o? 12-12-35 Andhēri (H.A.).
Noted: *Salsette*: Santa Cruz, Vilé Parlé, Chembūr, Gōdhbunder-Thāna Road.
Winter visitor? Our records in Salsette are all between October and May (latest 20th). It is fairly common during December. A low *chūk-chūk* uttered on the wing, is the only call we have heard while the birds are with us. The stomachs of two specimens shot at Andhēri contained the following: 13 Dung Beetles (*Onthophaga* sp.), 1 Disticid Beetle, 1 cricket (*Gryllus* sp.).
It is noteworthy that several of the Dung Beetles were still alive when removed from the birds' stomachs 18 hours after they were shot!

(To be continued).

THE ORIGINAL HOME OF THE COCONUT.

BY

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The origin of most cultivated plants is enshrouded in mystery and few among them have received as much attention at the hands of eminent botanists as the Coconut. Dr. H. N. Ridley, Sir Arthur Hill, Dr. E. D. Merril and others have all made very valuable contributions to our knowledge of the original home and spread of this most useful of palms, pantropic into cultivation. The present paper, while examining most of what has already been said discusses the problem from the standpoint of the antiquity of the Coconut in India and attempts to locate its native home more definitely by taking into consideration the geological history of the regions under discussion. It also supplements botanical and biological evidences with philological and ethnological issues.

That the Coconut has been known in India from the earliest of times is an unquestionable fact. Mention is made of it in several of the Puranas which are the oldest books after the Vedas. The Maha Bhagavata, Vishnu, Matsya, Markandeya and Brahmanda Puranas have references to the Coconut. There is also mention of it in the Ramayana and the Maha Bharata and also in ancient Tamil literature like Porunarattupadai. The above references prove the great antiquity of the Coconut in India but do not show that it is native to the country. Although now an inevitable article used in worship throughout Peninsular India it is significant that the coconut is not included among the fourteen articles sanctioned by the Shastras in the performance of holy sacrifices. Nor is it used by a considerable section of the orthodox Hindus in sradha ceremonies—those performed to propitiate the *manes* of the departed—in which non-indigenous vegetables are tabooed. Again, though an indispensable item in sacrifices offered to Ganapati, it is not in the list of articles favourite with that deity as prescribed in the Dharma Shastras. In all auspicious ceremonies of the Hindus, worship is offered to Varuna, the deity presiding over the water and the oceans. This deity is represented by a pot of water with a coconut placed on its mouth. A text is repeated in praise of the Coconut which says that it is a favourite with God Shiva and a destroyer of inauspiciousness. This text has come from a very remote period but is not Vedic. Such of the observances as are not in the Vedas are traceable to the Tantras which are of a much later origin. The offering of an unbroken coconut to the sea by orthodox Hindus on auspicious occasions is probably suggestive of the idea that the Coconut came from the seas. And there is a Ceylonese legend which says that it was brought to India from Nagaloka, the blissful region beneath

the seas, by an illustrious king for special worship and was thence introduced into Ceylon by a king of that island for a similar purpose.

The Sanscrit name for the coconut is *Nalikera* or *Narikela* the *r* and the *l* being interchangeable according to the rules of Sanscrit grammar. Paucity of names in a language replete with synonymy is indicative of foreign nativity. In Pali also, it is known as *Nalikera*. North Indian languages as well as Arabic and Persian have their names for the coconut derived from Sanscrit. The philological relation of the Malayan names *Kerambil* and *Kelambir* with the Sanscrit is worth investigating. My view is that they have come from the Sanscrit as a result of Hindu influence. In the early centuries of the Christian era the Hindus had conquered and colonized a great part of Malaya and the Malayan Archipelago, and it is natural to assume that the names used by the conquering race were adopted by the sons of the soil with some local variations and that these names have persisted through centuries side by side with the native names. In Sanscrit literature, we come across the word *Kera* in place of *Nalikera* as in *Kera bala phala* which means the fruit of a young coconut tree. The transition from *Kera* to *Kerambil* is recognisable. Further, it may be observed that these names, again with their variants, are used in Sumatra, Java and the smaller adjacent islands. *Kelapa, Kelapo* and *Kalapa* are names for the coconut in Java; in the Malay Peninsula it is *Klapa*. I am of opinion that these names also are after the Sanscrit form *Kela* or *Kela phala*, the fruit. It is significant to note that this series and the one just previously discussed are in use only in the lands once under Hindu colonization. Further, the investigations of Dr. Bartlett[1] help to remove any possible doubts as to whether the Malayan names could have influenced the Sanscritic. He has concluded that the Niu-Niog series is the oldest, that the Kerambil series came into use much later, and that the Kelapa series is the most recent of all. The Sinhalese name *Pōl* has probably originated from the Sanscrit *Phala* which means a fruit, as the coconut is described as the *Purna phala* which means the perfect fruit. Nirali, the name used in ancient Sinhalese works, also comes from Sanscrit. The commercial name *copra* by which the dried kernel is known all over the world has likewise a Sanscritic origin. *Karpara* in Sanscrit means a skull or cranium and there is an etiological story extant in South India which says that the Coconut was created in lieu of a head. Thus *Karpara* has come to mean a coconut among the common people, from the resemblance of the shell to the human skull. In Prakrit which is the colloquial form of Sanscrit the *r* is always elided and hence *Karpara* becomes *Kappara*. From *Kappara* has come the Malayalam *Koppara* the *a* having changed to *o*, just as Sanscrit *Ghata* became *Kota* in Malayalam. *Koppara* has become *Kopra* or Copra, and has gained a place in standard English dictionaries.

The Tamil name for the coconut is *Tengu, Ten* or *Tennai*. It is mere speculation to seek to explain the root meaning of these words. *Kāi* is the name for a fruit. According to the rules of Tamil grammar *Tengu-Kāi* becomes *Tēnkāi* which is the name by

which the fruit is known throughout the Tamil country. That the Tamils knew the coconut earlier than any other section of people in South India is evidenced by the fact that other languages of South India have derived their names for it from Tamil. The Malayalam *Tengu* and *Tēnga*, the Telugu *Tenkāya* and the Kanarese *Tengu* and *Tengina Kāyi* have all originated from Tamil. The Sinhalese name for a dry waterless coconut, *Kotta pōl*, and that for an immature fruit—*Kurumba*, must have come from the Tamil *Kotta Tēnkai* and *Kurumai* respectively. The Tamils were an enterprising race who had attained maritime importance in ancient ages and had crossed the seas to trade with distant islands of the Eastern Archipelago. Traces of their age-long civilization are discernible in the islands they had conquered in the distant past. Possibly they brought back several varieties of coconut to South India.

From Marquesas Island to Madagascar the coconut is known by one or more variants of the name, *Niyu* which has multiplied into local forms like *Nia, Nio, Niog, Nijol* and a host of derivatives too numerous to mention, testifying that the name has travelled with the plant itself. Of these some like *Noera, Njor, Noora, Noro, Nor,* extant in the Malay Archipelago, are of some interest. Whether these latter names have any relation with the Sanscrit *Narikela* is again a problem for the comparative philologist. My impression is that the latter series are derivatives from the Sanscrit *Nari-kela.* It is interesting to note that the name *Nore,* which obviously belongs to the latter series, in the jargon of some of the backward classes of the Malabar Coast means the fresh kernel of a coconut. A list of all the recorded oriental names for the coconut would run through several pages. Heyne[2] records 180 names from the Netherlands East Indies alone. It is apparent that philologists have not so far paid any attention to the wealth of material available and the value of contributions based on its study should not be underrated.

The original home of the Coconut should be a region where the nuts would freely germinate without watering, where its cultivation would demand the least care, where the plant could provide for itself, and where it would grow very prolifically as is the case in Malaya, the Eastern Archipelago, or the islands of the West and Central Pacific Ocean in the equatorial belt where coconuts grow as densely as bristles in a brush. These are regions of heavy and constant rainfall with a warm moist climate. That it is a sea-side plant is evidenced by its high tolerance for saline moisture, by its nuts being adapted to efficient dispersal by sea and by the rare attribute of vivipary. The original form of the Coconut must have been one with viviparous adaptations and the inland form of today should be a retrograde from the original. Coastal swamps which are the home of the mangroves provide a habitat in which the Coconut cannot grow. A sea-washed well-drained coast with constant fresh moving water in the soil is genial tō the palm. A region of light wind is more conducive to its growth than a region of violent winds. The area of equatorial calms characterized by light and varied winds, heavy and constant rainfall,

extreme humidity, equable climate, and warmth without heat, provides ideal conditions for the nurture and growth of the Coconut. This then is the region where its place of origin should lie.

Cocos is an American genus; with the exception of the Coconut there is no living representative of that genus anywhere except in the Continent of America. This had led many a botanist into presuming that America was the original home of the Coconut. But the discovery of fossil *Cocos*[3] in the Pliocene deposits of North Auckland in New Zealand proves that the genus *Cocos* in bye-gone ages had a far wider distribution than it has today. The Spanish traveller Oviedo[4] found a large grove of coconuts on the shores of the Isthmus of Panama in 1515. Thus the Coconut was already established on the west coast of Central America when Europeans first landed there. Oviedo's discovery lent support to the view that the Coconut was evolved in America. But the west coast lands of America are dry and it is not at all likely that a species with so strong a predilection to a moist climate and heavy rainfall should have originated in the dry zone of Central America in preference to the moist eastern zone which is better suited to its growth. Actually the Coconut was unknown on the east coast of America until the Spaniards introduced it. This argument, however, involves a supposition that the west coast and the isthmian region of Central America always had a generally dry climate despite any climatic pulsations through the distant past. The grove of coconuts seen by Oviedo may have originated from nuts carried thither by Polynesian immigrants. The soil there was a fine loam well drained by the tides for a considerable distance without stagnating. There was adequate rainfall and sufficient protection against violent winds. Under such surroundings the Coconut could easily establish itself. When we attempt to trace the home of any species the place of its original discovery may mean nothing or very little. It is the whole area of dispersal that counts. Peter Martyn,[5] who in the year 1520 explored the East Indies, wrote that in the island of Moluchas (Moluccas) he saw the Coconut (Coccus) growing 'quite accidentally'. His statement is of value in settling the issues. Further, the fact that at the time of their discovery, when they were uninhabited, the Cocos Keeling Islands of the Indian Ocean were wooded with coconut trees, evidently started from ocean-borne nuts, has also to be taken into account. There are yet other islands of the Indian Ocean which stand as outposts of oceanic flora to which the coconut has extended its range naturally and bear testimonies of their own. That one fails to notice the use of the coconut among the aborigines of Central America, when it forms an integral part of the ceremonials, culture and technology of the islanders of the Pacific and Indian Oceans and even more the lack of native American names for the coconut are sufficient proofs that it is not of American origin. And conceding for a moment that it started from America one asks how it reached India millenniums ago when it is an established fact that the American aborigines had neither the incentive, nor the need, nor the skill to journey beyond the vicinity of their native shores.

The Polynesian islands and the numerous small islands of the

Western Pacific are all either of coralline or volcanic formation and as such represent geologically new lands. Hence the first plant-colonists of these islands should have reached thither by the agency of air or water. The Coconut could not therefore have evolved on those islands though most of them are admirably adapted for its growth. Though established in other lands it is in Polynesia that the Coconut has attained its highest development. It is here that its many varieties were perfected as insular climates always favour endemism. Storm-swept islands of small size should give rise to several dwarf forms and Brown[6] enumerates over fifty varieties of coconuts in Marquesas Island, where every variety is known under a distinct native binomial. Incidentally it may be mentioned that not more than two or three varieties are known from America. The Polynesians must have known the Coconut ever since their islands came to be inhabited and a coconut civilization such as theirs should be as old as their race. With them the Coconut has always occupied a high ceremonial status, being worshipped as one of their Gods, the only other botanical God, though occupying a lesser status being the Taro, *Colocasia antiquorum*. The cult of the Coconut is so ingrained in the daily life of the Polynesians that they like the Malays have definite names for the nut pertaining to various stages of its growth. According to Te Rangi Hiora,[7] the Polynesian ethnologist, thirteen names distinguish the stages of the coconut from the female flower to the dried seed nut.

De Candolle[8] in 1883 expressed the view that the Coconut most probably belongs to the Indian Archipelago; and his opinions have seldom been challenged. O. F. Cook[9] accepting the infallibility of the present classification of the genus *Cocos* put forth a strong plea in favour of its American origin and among the adherents to his theory were leading botanists. Beccari[10] cut the Gordian knot by splitting the existing genus into several genera and reducing *Cocos*, sensu stricto, to a monotypic genus with a single species, *Cocos nucifera*, the Coconut. The writer of this paper who has been engaged on this problem for several years could not find a way out of the difficulty till the discovery of fossil *Cocos* nuts from New Zealand was announced. Dr. Merril[11] writing in 1937 says that the actual place of origin of this palm is somewhat of a mystery although it is indubitably native to some part of the Old World Tropics. Prof. Emilio Chiovenda[12] in an Italian publication has interpreted certain references in the works of Arabian historians like Ibn Wahab, *fide* Abu Zaid, and Albiruni to indicate that the original home of the Coconut is not far from India. He says that it had its origin somewhere in the 'lands now under the sea which existed in the western parts of the Indian Ocean'. It is not altogether safe to base conclusions on the works of historians when we have to go back millenniums anterior to the dawn of any history when the configuration of land and sea was altogether different from what we see on a modern map. It is a happy state of things when conclusions drawn from historical data are in agreement with those based on biological grounds. However, all are agreed that the home of the coconut is somewhere between

Zanzibar and New Caledonia. No one ever thinks that Africa was its home. And all know that the Dutch East Indies, the islands of the Western Pacific and British Malaya are the great centres of coconut cultivation.

The claim of Malaysia comes in next for consideration. The geological history of this great equatorial group of islands, which extends from Northern Sumatra to Eastern New Guinea, a distance of about 4,000 miles, as discussed by Dr. Mollengraff, the eminent Dutch geologist, has been accepted by biologists and adopted by Dr. Merril[13] in his paper on the phytogeography of this region. According to these authors Malaysia is divided into two continental areas and an intermediate insular group the several islands of which are surrounded by deep straits and seas. The continental areas are the Asiatic bank—which includes the Malay Peninsula, Sumatra, Java, Bali, Borneo and the Palawan-Calamian group of the Philippines and the Australian bank which includes the ancient continent of Papua. These areas are the two great centres of origin and dispersal of plant and animal life. The intermediate and unstable area between the continental banks consisting of the Lesser Sunda Islands, the Moluccas, Gilolo, Celebes and all the Philippines except the Palawan-Calamian group, has been subject to great upheavals and depression from the earliest times. Its flora and fauna are made up partly of infiltrations from the two continental areas and partly of relic species and their descendants. Judging from its geologic history the Coconut could not have evolved in this intermediate area. The flora and fauna of the Asiatic bank is Asiatic or Malay-Asiatic in character. The Coconut having no affinities with the Asiatic genera of palms could not have evolved in the Asiatic bank.

The ancient Papuan land includes the island continent of New Guinea as we know it today and parts of it that have since been submerged. Biological evidence goes to prove that there were older lands connected with New Guinea that are now entirely submerged. It is submitted on grounds heretofore covered that the home of the Coconut should lie here. The nature of the sea shelf on the north-west of New Guinea in the region now occupied by the Geelvink Bay, of the area just to the north of it, and the level of the adjoining shore tell us that in past ages, this huge land mass extended farther in this direction than the present day map indicates. Alfred Wegener[14] and others are of opinion that the climate of the whole of Malaysia, at any rate, of the regions of low altitude, has been constant through ages. As shown by the modern map the northern fringe of the submerged platform referred to lies in the equatorial belt and before it was deluged by the ocean possibly was the cradle of the Coconut. Our present knowledge of the New Guinean flora is scanty. A greater part of its mountainous interior which rises to a height of 16,000 ft. has not been trodden by civilized man. A little known pygmy race inhabits its inaccessible recesses. Exploration of its flora has just begun and until we know what it contains we cannot draw conclusions. But from what we know of its floristics we understand that its affinities are with the Australian-New Zealand-

New Caledonian cycle. And we know that fossil *Cocos* has been discovered in New Zealand. When palæobotanical explorations are taken up in New Guinea we may expect to find fossil species of *Cocos* with closer affinities to the Coconut than its living or extinct congeners in Tropical America or New Zealand. The claim of New Caledonia, if any, is set aside on climatic grounds as it lies far too remotely from the equator, near to the tropic of Capricorn.

The Papuans of New Guinea take pride in calling themselves the coconut people and hate the non-Papuans of their island who, they say, are not of the coconut people. A very fantastic legend[15] is current among them regarding the origin of the Coconut. Incidentally it also throws light on the abominable practice of head hunting which according to these savages is an act of religious merit. Even before the creation of Man their God killed another God, Somoali by name, who later became the god of the bushmen and the nomads. He placed the head of his victim on the bank of the river Wamaga. After sleeping six nights he returned to see the head of his enemy and found leaves sprouting from it. He then planted the sprouting head in the earth and from it grew the first coconut. The mortal feud between the two gods—if the two can go by that name—has been continued by their respective followers. The Papuans who are *orang laut*—people of the sea—take the heads of bushmen—who are *orang hutan*—people of the forest—and who are followers of Somoali to please their god. Mythical as this story is, it tells us in the words of the aborigines that the Coconut was created in the land of the Papuans and that its creation is prior to that of Man.

It would appear that the Coconut having evolved on the submerged land to the north-west of New Guinea move eastwards and westwards as drift nuts over calm tropical waters, and spread from islet to islet. This mode of accidental transportation, however, could not have successfully carried the species through long stretches of seas. Weaver and Clement[16] basing their remarks on a paper of O. F. Cook have indicated that the seed nuts lose their viability after some days due to salt water infiltration. This handicap has been largely overcome by the agency of man—the amphibious Polynesians and the wandering Malays. The migratoriness of the Polynesian seafarers must have been the main cause of the wide distribution of the palm over the islands of the Pacific Ocean. Either as a result of subsidence of their island homes for which evidence is not lacking, or pressure of population in their inelastic confines which tends to drive oceanic islanders to seek new lands, or as vanquished parties in the frequent wars which were a main feature of Polynesian life, these islanders had attempted distant colonization and had overrun parts of Melanesia in early ages. They developed singular navigational skill and nature's bounty in their quest for a new home in the unknown eastern waters, had given them timber and fibre to build huge crafts. A party of these adventurous mariners, remarkable for their powers of endurance and having their native methods of assuaging hunger and thirst in long voyages were probably the pioneers that first planted the Coconut

in the New World. The consensus of opinion among eminent authorities on the problem of the Pacific basin today is that contact between the Old World and the New across the Pacific Ocean did not begin till about the close of the fifteenth century though there is probability of some accidental contact earlier than that period. Competent ethnologists including the late Baron Nordenskiold concede the possibility of Polynesian mariners having reached the shores of America within comparatively recent times—recent in an anthropological sense which according to Diamond Jenness[17] is still pre-Columbian. I. H. Burkill[18] cogently points out the improbability of the arrival of the coconut in America much earlier than its discovery since it had not then spread even to the opposite coast of such a narrow isthmus as Panama. The Malays were active sea-farers who had spread to the Eastern Archipelago in the distant past and traces of their emigration are seen throughout Polynesia. They, as well as the once maritime Tamils, together with the ancient mariners of the Bengal coast, have been responsible probably for a much wider distribution of the Coconut into the lands of the Indian Ocean and in this spread ocean currents and the monsoon drifts have undoubtedly played their part. The natural dispersal of the Coconut from the lands of the West Pacific to the islands of the Indian Ocean was rendered easy as there is a strong flow of water from the former to the latter ocean during the North-East monsoon. Of course man has carried the plant all over. But everything seems to point out to some island of the West Pacific as its original home and this as far as we can see is possibly the land now under the waves but which once formed part of the ancient Papua.

So old is the Coconut in India that the Arabs from early times upto now called it the Indian Nut. John of Monte Corvino and Marco Polo, both of the thirteenth century, both named it so. Cosmas in the sixth century described it under its Sanscrit name. To the orthodox Hindu it is the *Kalpaka vriksha* or Tree of Heaven and hardly will he agree when told that it is an alien species come to this land ages ago. The explanation of its vast antiquity is as simple as it is natural. It started from the shores of the ancient Papuan land. The strong eastward current during the North-East monsoon carried it through the Straits of Malacca into the Bay of Bengal and primitive man brought it over to the shores of India in pre-historic ages.

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Photo: *R. S. P. Bates*

HIMALAYAN TURTLE DOVE (*Streptopelia orientalis meena*).
Wurjwan, 8300 feet, 3rd July 1937

ROSE-FINCHES AND OTHER BIRDS OF THE WARDWAN VALLEY.

BY

MAJOR R. S. P. BATES.

(*With 6 plates*).

To anyone interested in bird study I can thoroughly recommend a trip through the upper Wardwan Valley in the Kashmir province of Kishtwar. Last year, feeling it to be high time to try my luck with birds breeding at the higher elevations, I took two months' leave from June 15th, but in view of our experiences, set forth in the following account, I would advise an earlier start, say June 1st at the latest.

We chose Achhabal as our base, motoring direct from Jammu over the Banihal and meeting servants and kit there on the afternoon of June 18th. On the 22nd we took the Kishtwar trail but on coming over the first gali into sight of the Sinton Pass we bore off to the left, finally camping at Gurdraman in the park-like Upper Naubug Valley, an easy but definitely hot march. After a day's halt we pushed on, meaning to camp at 10,000 ft. for a week on a marg called Naokan where I hoped to get my eye in in preparation for the birds of the Wardwan.

The least said about that camp the better. We hunted for a patch of clean level ground for an hour and a half. Eventually we had to pitch the tent at a fearsome angle which entailed a restless night, being prevented from rolling out of bed only by the judiciously stacked store boxes. Shortly before dark the wind veered into the West immediately filling the air with the horrid stench of putrefying flesh; a dead cow was found forty yards distant in the midst of a patch of viburnum. Seven of the coolies with the aid of a rope soon trundled the carcase down the steep hillside, leaving it where we hoped it would do its worst on the Gujars and Bakribans whose flocks had befouled the only level spots.

It would have been a good place for birds, but we left it the next morning with no regrets. A noisy pair of Variegated Laughing Thrushes in the viburnum bushes saw us off and in a small patch of juniper I found a Hedge-Sparrow's nest with one fresh egg in it. It was an interesting and to begin with a thoroughly enjoyable march but take heed and put not your faith in the half-inch map. It was constructed by a humourist who put a little note in the margin 'Inshan 6 miles'. And so it may be, as the crow flies, but at the end of the day we reckoned we had tramped little short of 20 miles, exclusive of playing about for a couple of hours on the summit of the Margan Pass.

A two thousand foot climb up a fairly steep boulder-strewn slope had brought us to a heavenly two mile stretch of almost level marshy ground. The meadows were covered with blue and

white anemones, buttercups and a blue corydalis. Round the marshes bright yellow trollius and rose primulas were much in evidence. Straight ahead a fine series of snowy peaks proclaimed Nun Kun, while on our right a further two thousand feet of steep slope was stippled in shaded stretches of vast extent with the tiny cream flowers of the dwarf Rhododendron anthopogon. Marmots shrilled from every patch of rocks making the dogs quite wild with excitement, while for me there were birds in plenty. I disturbed a flock of feeding Rose-Finches. It was to cope with Rose-Finches in particular that I had chosen the Wardwan.

It was 6 p.m. before we got down to the river after tramping round bare shadeless spurs for six or eight miles at an elevation of never less than 11,000 ft. before coming to the abrupt drop through the forest to Inshan. The only redeeming feature was that we came on a primula new to us, the charming white *Primula involucrata* which grew in little clusters in damp spots between the spurs.

On reaching the Wardwan river we hailed with joy the news that upstream was the last forest hut in the valley. Wearily we dragged ourselves the extra mile and a half and took possession, thankful to get out of pitching the tents.

At this point, and in fact for most of its length, the Upper Wardwan is a comparatively open wide vale. Villages are spaced at increasing intervals as far as Suknes. Up to there the stony soil is tilled with but fair success, rice being imported in exchange for home-spun blankets to supplement the insufficient crops. Above the point we had reached, to work the dwindling forests is no longer an economical proposition, but I confess that did not depress me; it is a grand country for birds.

In the mornings the pine wood sheltering the F.R.H. was filled with their voices. In front of the hut was a 'kuth' nursery, the ripening heads of which attracted many Goldfinches. Kashmir Sooty Flycatchers were exceedingly common: I marked down four nests within a hundred yards radius. Two pairs of Blue-headed Rock-Thrushes lived near by but the young ones had just left their nests, one of which I found—of pine needles as usual—tucked into the buttress roots of a tall tree. We were also visited by those mysterious Red-browed Finches but if they had nests, as usual they were not giving away their positions. Meadow Buntings were common both within and without the forest. One pair actually had a family of large young ones, fifteen feet from the ground in a thick fir tree. In the fields a few pairs of Larks were often singing, but Greenfinches were the most numerous birds in the open lands.

By the side of a stream I obtained some good photos of a White-capped Redstart, whose nest we found on June 27th with large young ones in it. I was also most successful with a Himalayan Turtle Dove which had built a scanty nest of roots only a foot from the ground on some brushwood at the foot of a sapling in a small spinney. The light seemed hopeless in such a sheltered position but the bird sat still enough for time exposures.

The most interesting birds of all however were by the river.



Photo: *R. S. P. Bates*

KASHMIR SOOTY FLYCATCHER (*Hemichelidon sibirica gulmergi*).
Wurjwan, 8300 feet, 1st July, 1937.



Photo: *R. S. P. Bates*

DELTA AT JUNCTION OF BASMEN NULLAH WITH WARDWAN RIVER WHERE LARGE NUMBERS OF HODGSON'S ROSE-FINCHES WERE NESTING IN JULY.

Around Inshan and for a few miles upstream there are many bush-covered islands with stony margins. Some were easily accessible and of considerable size. Grey and Hodgson's Pied Wagtails and Sandpipers galore were naturally the commonest denizens here, but it was not long before I realized that the strange Ibisbill was by no means rare. For some days I watched four pairs of these curious birds but eventually I was reluctantly forced to the conclusion that their nidification was over for the year, in spite of the fact that they used to fly backwards and forwards crying peevishly whenever we invaded their particular haunts.

On one occasion, on July 9th, while searching one of the largest islands, I came upon a Japanese Wryneck feeding young ones in a crevice near the top of a thirty foot tree. Stepping back into the cover of some bushes in order to watch it unobserved, I almost fell over a down-covered young Himalayan Brown Wood Owl. It could only fly a few yards at a time so must have been reared on the island. While photographing it, one of the parents arrived using the most obnoxious language.

On June 26th I thought I was at last to be permitted to photograph a Monal Pheasant at the nest but returning to erect the hiding tent not half an hour after Guffara, the Shikari, had discovered it, we found the eggs gone. A search resulted in the recovery of a piece of wet shell beneath a stump 40 yards distant. A thieving Jungle Crow was probably responsible for the disaster. There had been only three eggs in it, but we found the stained remnants of two others in a leaf-filled hollow 10 ft. below the nest which was on a steep forest-clad hillside between two close-growing pine trees where undergrowth was conspicuous by its absence.

The day after arriving at Wurjwan I noticed a Buzzard circling above our wood, and a couple of days later picked up half an egg-shell a hundred yards behind the hut. I was not therefore particularly surprised to come across a fledgeling on June 30th sitting not fifteen feet up on a dead branch just as I was turning into the wood. It was quite unafraid and I doubt if it had been twenty-four hours out of the nest. Next day I shot it, its death being unfortunately necessary in order to determine the breeding race of the North-West Himalayas. That problem is now solved satisfactorily but to fathom what name this race should bear is evidently a harder task.

The only other bird I photographed with fair success at Wurjwan was a Skylark. On alarm it was amazingly quick in its movements and although I pressed the release when its bill was inside a young one's gape, the photograph shows the head up and the wings commencing to open.

On July 11th we moved to Basmen about eight miles further up the valley at approximately the same elevation, 8,500 ft. Within an hour of starting we passed through the most charming glade just short of Tsuidraman village. It looked the most delightful of camping spots and I was sorely tempted to curtail the march.

We reached Basmen early, so while setting the camp in order and while my wife was ministering to the needs of the halt and the maimed and the pathetic little ill gujar babies brought in by

their trusting parents, I sent the shikari out to prospect. He returned with the most amazing news. He had found a nest of the Simla Streaked Laughing-Thrush with three eggs in it and seven other nests, all, he said, containing blue eggs with black spots on them. Had we come up with the Rose-Finches at this low elevation? We certainly had. Within the next couple of days we must have found a score of nests of this, Hodgson's Rose-Finch, which was excessively common breeding in bushes of various kinds from about 2½ to 7 feet from the ground. Most of them were pretty well concealed but I saw two quite exposed in willows and one on the outer edge of a wild rose-bush. The eggs were incubated; I was quite unable to find fresh ones. All these birds must have finished laying about the last week in June. Some of them contained only three eggs, the majority four. I managed to obtain one photograph with both parents at the nest. The male seemed bent on feeding his three newly-hatched chicks on regurgitated seeds but the female swallowed all his offerings, thereafter proceeding to bring them up as required for the next half hour when more fully digested.

The reason for this concentration of Rose-Finches is evident from the photograph taken as we were leaving Basmen. Here a side river of considerable importance flows into the Wardwan, and as the valley at this point is comparatively wide and flat, it has formed a considerable delta. Every channel is bordered by willows, the islands and strips of land between being at times densely clothed with bushes of many kinds. Nowhere else either up or down the valley did I see any spot like it. However, Rose-Finches were by no means uncommon from here upwards breeding mostly in tall weeds and bracken. Amongst the bushes in the Basmen delta was a delightful small-leafed rose-bush bearing deep yellow single blooms. A double white cottage rose was also not uncommon.

At Basmen we had pitched the tent amongst some boulders a little way up the side nullah to get away from the village. Alas we were intruders on the preserve of a pigmy hare—a quaint reddish-fronted little chap the size of a guinea pig. Nothing daunted by our intrusion he used to waggle his whiskers at us from the top of a rock close to the tent door. I was actually able to take four photographs of him, the last at only 3½ feet. Twice in spite of the dogs I found him nibbling grass inside the bathroom portion of our canvas home.

On July 17th we moved up a thousand feet to Suknes, the very last hamlet in the valley. The headman wished us to camp on a hilltop overlooking his village, but fortunately we made for the opposite side of the river, the left bank, where there were still a few woods and hopes of an uncontaminated water supply. We crossed the tumultuous river by a rickety wooden bridge of the usual type and explored some barren fields along the edge of a steep wood commencing in clumps of deciduous trees—a charming piece of country. Finding only one rather muddy trickle of water we moved up half a mile over a long spur and found ourselves in a charming little side valley which did not begin its



Photo: *R. S. P. Batet*

HODGSON'S ROSE-FINCHES (*Carpodacus erythrinus roseatus*).
Basmen, 8500 feet, 16th July, 1937.

abrupt upward sweep for a thousand yards from the main river. A narrow tongue of forest ended close to a series of springs, so here in the shade of the last trees we pitched our camp.

Somehow the character of this part lying at 9,300 ft. above sea-level struck me as being different from other Kashmir valleys I have explored. The herbage was rank—there is no other word for it. Patches of a tall fleshy weed bearing large flowering heads packed both slopes and level spaces between the sketchy fields. In places these weeds must have been six feet high. The steeper slopes were clothed in bracken. Before we could pitch camp we had to slash away deep grass and weeds through which glorious flowers were pushing their way—Canterbury Bells, tall Monkshoods, deep blue Delphiniums. Stately Mallows and Himalayan Scabious were just coming into flower, and within a few feet of the back of the tent where the deeper forest shade commenced Polyphyllum lilies were almost profuse. One such plant I found with a dozen blooms upon it and as many buds, growing on a stem nearly six feet high. This I photographed in colour.

Other evidence of a danker climate was to be found in the particularly hefty mosquitoes which in the evenings necessitated a lavish use of citronella. Fortunately they seemed to be active only round about dusk. We could therefore put up with them but loathsome earwigs were an absolute pest. Every night I used to brush dozens of them off the top of the tent immediately over our beds and it became almost impossible to cope with them in the store-boxes. From Suknes we were never free from these vile insects until we left Kishtwar behind us. There seems no doubt that the Wardwan enjoys a definite monsoon period. Throughout almost every morning of July we could see the heavy clouds piling up from the South and creeping in between the curve of the Pir Panjal range and the massive slopes to the North-East.

I have dwelt particularly on the character of this part of the valley as it was here that I made a discovery of some importance. On July 23rd returning from the river towards camp along the spur with weed patches on either flank, I noticed a little bird singing lustily from the top of the tallest weed in view. I could hardly believe my eyes. It was undoubtedly a Reed-Warbler. A careful search revealed a nest twenty yards down the hillside with the female sitting on two eggs, one of which was definitely abnormal, being very small. The nest had a heavy list as it was built round the main stem of the weed with no further support of any kind. I put the hide up immediately and got a fine series of negatives with very little trouble, after which I proceeded to shoot the female off the nest to make certain of identification. A quotation from my diary sums up the position. 'From the excellent vocal efforts of the male I first thought it might be *dumetorum* but the wing formula does not agree at all. Is it a *concinens* after all and is there still a mix-up over these races?' It was a *concinens* and what is more the same bird as the one which breeds so profusely in all the swamps of the main vale of Kashmir. I gather this discovery has confirmed Mr. Hugh Whistler's suspicions that the Kashmir bird which he separated a few years ago as

hokrae is in reality *Acrocephalus concinens harringtoni*, the race found breeding on open hillsides of the North-West Frontier.

Subsequently I found that most of the larger weed patches were each occupied by a pair of these Reed-Warblers. They must breed here mainly during June and July, commencing as soon as the weeds are sufficiently tall as I was able to find only one more nest still occupied. This had three large but almost naked young ones in it on July 25th. Unlike the first one this nest was a typical Reed-Warbler's in construction; a deep grass cup, one side twined firmly round the main stem of a weed 18 inches from the ground with two smaller stems supporting it at other points of the rim. It was near the edge of a patch growing on level ground between two of the stony fields.

I really had a very successful time at Suknes as I also obtained good photographs of a Jerdon's Hedge-Sparrow and a Hodgson's Shortwing at their respective nests. Unfortunately the light was particularly bright on both occasions causing very strong contrasts. As ill luck would have it, just as the negatives were due to come out of the developer I spilt the whole of the fixing solution. By the time I had prepared a fresh supply they were of course over-developed. As I was developing for as soft a negative as possible under the circumstances, this was indeed a mild disaster.

A pair of Hodgson's Rose-Finches were building on our arrival in a little perrottia bush 15 feet behind the servants' tents. We quite expected them to desert but they had three eggs before we moved on. I also found two nests of this species in thick bracken both with 4 well-incubated eggs in them.

We had intended moving up to the foot of the Bhotkol glacier, where I hoped to find Redstarts and Rubythroats breeding and with any luck White-browed Rose-Finches whose nesting habits remain a mystery. But the weather had deteriorated so much that we hung on at Suknes longer than intended. Time was getting short and no signs of a break in these monsoon conditions appeared imminent. We therefore reluctantly decided to make straight for Rangmarg, cross the Gulol Gali (14,500 ft.) on the first good day and drop into the East Lidar where conditions might be less inimical to bird photography. I knew from previous experience that around Zojpal there are Redstarts, Rubythroats and Tickell's Willow-Warblers in plenty. We fixed on July 27th to push our camp a few miles up the river to Wanhoi preparatory to crossing the ridges to Rangmarg. Wanhoi consists of a small stony space just large enough to hold a camp. Just beyond the river forks. The East branch rises steeply to a wide scored-out valley lying at about 11,500 ft. left by the retreat of the glacier's snout. This is the head of the Wardwan and the road to Suru. The West or rather North-West branch flows from the Sain Nullah through abrupt cliffs, consequently one has to climb a few thousand feet over the obstruction to get into this sequestered little vale.

Our luck was out. Every time we moved we got soaked to the skin. It started to rain soon after leaving Suknes and kept it up until after we had pitched camp near the snow-bridge which is now the sole means of crossing to the Suru path. The bridge which



Photo: *R. S. P. Bates*

WITHERBY'S PADDY-FIELD WARBLER (*Acrocephalus concinens haringtoni*).
Suknes, 9100 feet, 24th July 1937.

B. B. Osmaston writes of building during his return from Suru (vide *Journal* vol. xxxi, p. 194) has since been swept away and no one has been enterprising enough to rebuild it.

Next morning we started to climb immediately to circumvent the junction cliffs. Nearing the top of a ridge a cruising Eagle put up a Monal Pheasant which went whistling close over my head. It was followed shortly by a couple of chicks.

We had hoped for fine views of the glaciers around Nun Kun, but down came the clouds and we were soon almost lost in wreathing mists and driving rain. Lush grass and fields of dripping flowers, columbines, Jacob's ladders, asters, brushing against us whenever we left the ill-defined path soaked us to the thighs, while cold blasts of wind and rain helped to add to our sorry plight. Descending greasy shale slopes under these conditions was most unpleasant. A dozen times I saw visions of finding myself at the bottom in record time but minus the seat of my pants. However, after crossing two unpleasantly swollen streams, where one of the dogs, after first nearly pulling me into an uncomfortably turbulent pool, dislodged a stone from the steep bank which caught me a resounding crack on the knee-cap, we arrived at the flat space called Rangmarg just as the rain ceased.

We put our tents on a narrow fold near the Gulol stream where there were tufts of large gentians of two kinds growing within twenty yards of one another, the pale blue wide-mouthed Moorcroft's Gentian on the Southern face and the taller narrow Gentiana decumbens where the trend of the ground was to the North.

But for a few patches of birch the Sain Nullah is devoid of trees. Even the juniper is represented only by a few straggling patches. This state of affairs I suspect to be due to the depredations of the large flocks of goats. The bottom of the valley however provides good pasturage for some Gujars' buffaloes. Here I saw a number of Hodgson's Yellow-headed Wagtails, but during the one day we spent there it became obvious that I was unlikely to find the Rubythroats and Rose-Finches nesting there.

Our day of rest was brilliantly fine, so of course we decided to do the stiff 4,500 ft. climb to the Gulol Gali the very next morning. At dawn patches of blue sky showed through occasional rifts in a thick mist. We soon lapped up the first thousand feet and crossed the slope of broken rocks flowing down between the steep cliffs we had seen from below. Here I saw a Wall-Creeper feeding a large young one seated on a ledge. After that birds were conspicuous by their absence except for a few Yellow-billed Choughs and a flight of Snow-Pigeons. But the Gulol Gali is a disappointing pass. It consists largely of unstable disintegrating shale slopes where few plants can ever get a hold, and with nothing about it to attract birds, particularly in such weather as we encountered.

Just as we got safely over the stone shoot, which must be rather dangerous in wet weather, the blackest clouds I have ever seen rolled up from the Junction and from across the valley. They met soon afterwards, resulting in the rest of that toilsome ascent

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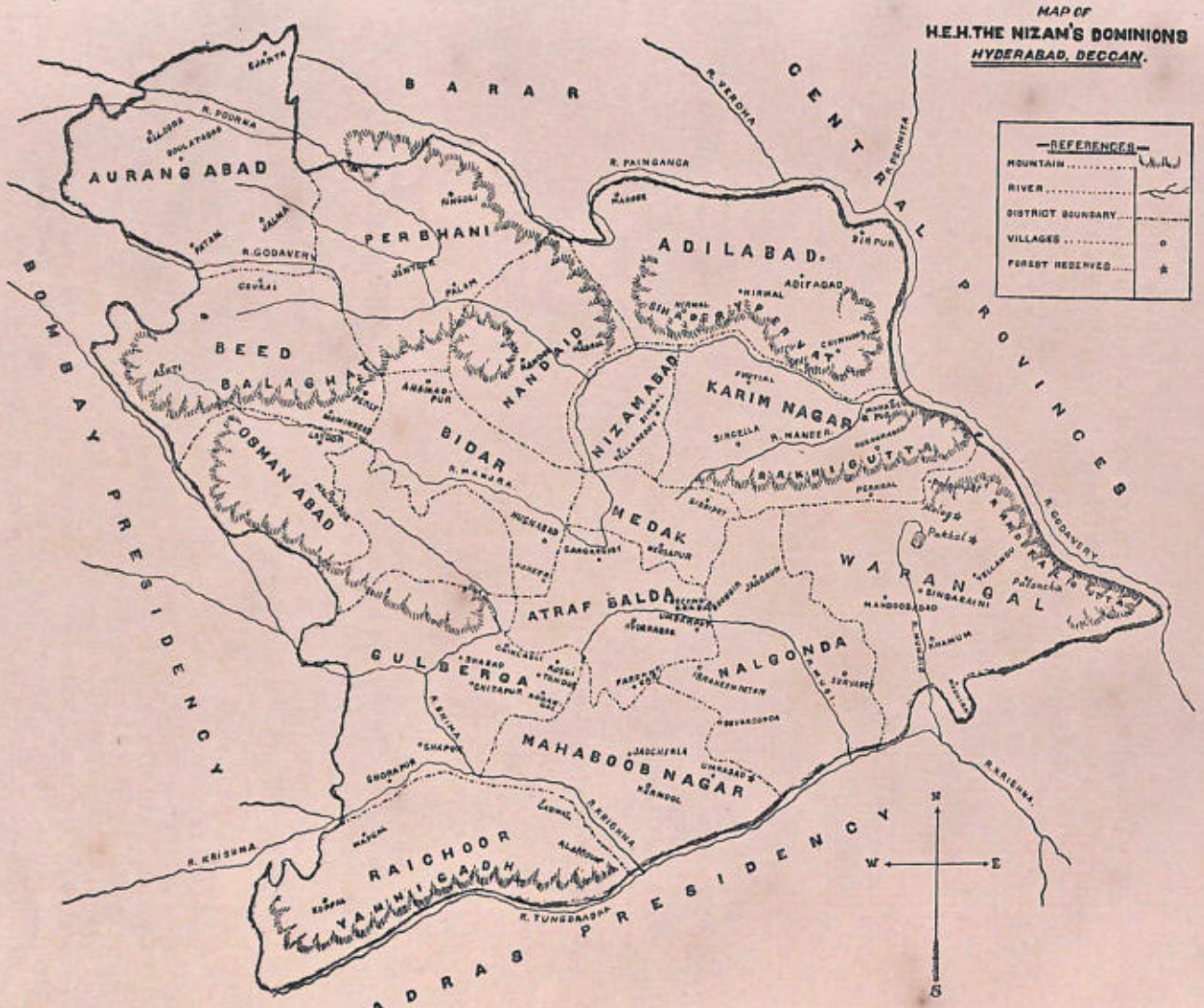
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Just as we got safely over the stone shoot, which must be rather dangerous in wet weather, the blackest clouds I have ever seen rolled up from the Junction and from across the valley. They met soon afterwards, resulting in the rest of that toilsome ascent

being carried out in a series of heavy downpours and with all the hoped-for distant views blotted out.

The narrowest of cols which forms the summit was reached at midday. It was most curious to crouch down in an almost dry still pocket with swirling mist and rain driving almost vertically upwards from the further side blown in furious gusts of wind from the East Lidar valley. We pulled down our earflaps, put down our heads, and charged over the ridge down the further slope until we had dropped four or five hundred feet and found the shelter of a large boulder. We reached Zojpal three hours later just as the rain at last stopped, and were settled into camp in time to watch one of the most heavenly sunsets I have ever seen. Our adventures in the Wardwan were over.



(Issued as an accompaniment to 'Flowering Plants of Hyderabad State.')

A FURTHER CONTRIBUTION TO SOME OF THE COMMON FLOWERING PLANTS OF THE HYDERABAD STATE; THEIR DISTRIBUTION AND ECONOMIC IMPORTANCE.

DICOTYLEDONS

BY

M. SAYEEDUD-DIN.

(With a map).

INTRODUCTION.

The present paper places on record some of the dicotyledonous plants collected and identified by the author since the publication of his last paper[1] on dicotyledons. In order to widen the scope of this paper some of the commonly cultivated plants are also listed. Its scope is further widened by the inclusion of material from several representative districts—representative in the sense of their floristic characteristics—of H.E.H. The Nizam's Dominions.

The two large distinct divisions of this extensive land, viz., the Marathwari and the Telangana are not only distinct as regards their geology but are also markedly different in their floristic composition. Out of the places visited for the collections for this paper Aurangabad District is typical of the Marathwari side, and Warangal District typical of the Telangana side. Plants from the following places are listed in this paper—Ajanta, Phoolmari, Doulatabad, Khuldabad (Aurangabad District); Nizamabad District; Mulug, Pakhal (Warangal District); Vikarabad, and the suburbs of the Hyderabad City.

A few words must be said regarding the topography and ecology of some of the important localities, if the reader is to get a general idea of the floristic composition with reference to the different habitats. In the vicinity of the Hyderabad city, Adigmet presents an interesting flora, and is therefore worthy of a little consideration. It is an open country full of characteristic boulders, and the highest place, 1,725 feet above sea level is occupied by the Osmania University. The soil is gravelly with sheets of big rocks underneath at several places. Naturally the soil does not retain water for any considerable length of time, and the plants show marked xerophytic characters. The following communities are readily distinguished: the *Turf-community*, consisting of small herbs which are found in a marked association on

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[1] The Paper published in *J.A.S.B.*, vol. i, p. 9 (1935), is 'Dicotyledons—Part I.'

untrodden portions of lawns and grassy places; the *Sand-binders*, which are in abundance and serve to bind the sand; the so-called *Mat-plants* which spread out like a mat without much binding the sand. Then there are the cosmopolitan weeds and shrubs. Trees are scarce. The majority of the trees found round about Adigmet are those planted for shade. The natural growths are perhaps only the Acacias, Ficus and a few other plants belonging to different families. In summer the ground lies bare except for a few hardy herbs and grasses. A great damage is being done to the natural vegetation by the grazing of cattle. The effect of grazing on the vegetation of Adigmet will form the subject of a subsequent paper. So far about Adigmet.

As I have to a great extent already dealt with the Warangal District on the Telangana side in my last paper, I shall now briefly describe the topography and ecology of the Aurangabad District on the Marathwari side. Aurangabad lies north-west of Hyderabad. Travelling along the Marathwari side towards Aurangabad one comes across with very poor tree-vegetation, except for the several species of *Acacia* along vast expanse of cultivated land and for distantly scattered patches of forests. The soil is typical black-cotton soil and apart from cotton many useful crops already detailed in the last paper are grown. The chief Hill Range—the Sahyadri Parvat—running along the north, from Nirmal in Indur District in the east, reaches Ajanta after passing Parbhani. Hundred miles of its length are styled as the Ajanta Hills. It is here that thick vegetation is met with, and some of our collections were made along this region. The flora of the river-beds in this part of the country is very interesting. Further collections were made along the country between Doulatabad and Ellora. The vegetation of the valleys near the Ellora caves presents a marked contrast to the vegetation met with in scrub jungle. The forest on this side seems to be a Rain-forest and a transitional form between rain and monsoon-forest in contrast to the mixed deciduous forest and Rain-forest on the Telangana side. Apart from these the typical thorn-forest consisting of the dominant members of the Leguminosæ family, and the open forests are also readily distinguishable.

The families have been arranged in accordance with the classification adopted by Bentham and Hooker in *Genera Plantarum*. Altogether 255 species belonging to 70 families have been recorded. Apart from the economic uses mentioned the plants of medicinal importance have been marked as such, and their medicinal properties may be referred to in the literature cited and to any further literature existing on the subject. Regarding the botanical names of plants the most common and well-known names are given, although in some cases synonyms have also been given especially when different names are used for the same plant in standard works, thus making the work of reference comparatively easier.

ACKNOWLEDGMENTS.

I am indebted to my assistants Messrs. M. A. Waheed and Sri Ram Loo, and particularly to Mr. M. Abdus Salam who has

been of great help to me in my tours for the collection of the material. My thanks are due to Mr. Mayuranathan of the Madras Museum who has kindly confirmed some of the doubtful species after comparing them with the type-specimens. I am very much thankful to Dr. B. Sahni for his suggestions and appreciation of the work on the flora of Hyderabad. I cannot adequately express my thankfulness to Sir Arthur Hill and Prof. F. E. Fritsch for their encouragement.

Systematic Account.

I. RANUNCULACEÆ.

1. **Clematis Gouriana** Roxb., *H.F.B.I.*, i, p. 4.
(Indian Travellers' Joy).
Vernacular name.—*Morvel* (Mar.).
Habitat.—Western Himalayas to Ceylon, extending to Java and the Philippines; throughout the Bombay Presidency both in the Konkan and Deccan. I have not so far found it wild in Hyderabad, but it is successfully cultivated in gardens.[1]
Uses.—Leaves are medicinal.

II. DILLENIACEÆ.

2. **Dillenia indica** Linn., *H.F.B.I.*, i, p. 36.
Vernacular name.—*Chalta* (Hind.); *Karmbel* (Mar.); *Kalinga* (Tel.).
Habitat.—Himalayas, from Nepal to Assam; Behar and Ceylon. Cultivated as an ornamental tree.
Uses.—Bark, leaves and fruits are medicinal.

III. MAGNOLIACEÆ.

3. **Magnolia grandiflora.**
Habitat.—Cultivated. Flowers in April.

IV. MENISPERMACEÆ.

4. **Cocculus macrocarpus** W. & A., *Cooke. Fl. Bomb. Pres.*, Pt. I, p. 20
Habitat.—Wild on the Anantgiri Hill, Vikarabad.

V. BERBERIDACEÆ.

5. **Nandina domestica** Thunb., *Willis's Flow. Plts. and Ferns*, p. 443.
Habitat.—Native of China and Japan. Cultivated.

VI. NYMPHÆACEÆ.

6. **Nymphæa stellata** Willd., *H.F.B.I.*, i, p. 114.
Vernacular name.—*Nilkamal* (Hind.).
Habitat.—Common in ponds and tanks. The collection was made towards Kamareddy side. Flowers in October.
There are two varieties:—
(*a*) *parviflora* H.F. & T.—flowers small, blue.
(*b*) *versicolor* H.F. & T.—flowers large, white, blue, purple or flesh-coloured.
Uses.—Roots and seeds are edible, especially in famines. Rootstock and flowers are medicinal.

7. **Nelumbium speciosum** Willd., *H.F.B.I.*, i, p. 116.
Vernacular names.—*Nilofar, Kanwal.*
Habitat.—Common throughout India. Extensively cultivated for its magnificent flowers.

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[1] This plant has since been collected from the Telangana forests.

Uses.—Filaments, seeds, leaves and roots are medicinal. Underground stems are eaten. The flowers are considered sacred and are worshipped by the Hindus.

VII. FUMARIACEÆ.

8. **Fumaria parviflora** Lamk., *H.F.B.I.*, i, p. 128.
Vernacular names.—Pitpapada (Hind.); *Tura* (Tam.); *Chatarashi* (Tel.).
Habitat.—A common weed on cultivated ground.
Uses.—Except the root entire plant is used in medicine.

VIII. CAPPARIDACEÆ.

9. **Gynandropsis pentaphylla** DC., *H.F.B.I.*, i, p. 171.
Vernacular names.—Hulhul, Hurhur (Hind.); *Mambli* (Mar.); *Vela-kura* (Tel.).
Habitat.—A common weed in waste places.
Uses.—Seeds, leaves and roots are medicinal.

10. **Capparis spinosa** Linn., *H.F.B.I.*, i, p. 173.
Vernacular name.—Kabra (Hind.).
Habitat.—A prostrate shrub often seen in dry places.
Uses.—Root and root-bark are medicinal.

IX. VIOLACEÆ.

11. **Viola odorata** Linn., *H.F.B.I.*, i, p. 184.
(Sweet Violet).
Habitat.—Kashmir etc. Cultivated for its flowers.

12. **Viola tricolor** Linn.
(Pansy).
Habitat.—Cultivated for its handsome flowers.

X. BIXACEÆ.

13. **Cochlospermum Gossypium** DC., *H.F.B.I.*, i, p. 199.
Syn.—Bombax gossypium Linn.
Vernacular names.—Kumbi, ganiar, gangal (Hind.); *Gungu, gondugogu* (Tel); *Kalir-gond, Kathalya gonda* (Mar.).
Habitat.—May be it is wild, but I have not found it so far. It is cultivated.
Uses.—A kind of silk cotton obtained from the seeds is of economic importance. Gum, leaves and flowers are medicinal.

14. **Flacourtia Ramontchi** L'Hérit., *H.F.B.I.*, i, p. 193.
Vernacular names.—Bilangra, Katti (Hind.); *Kangregu* (Tel.).
Habitat.—Wild in many parts of India, also in the Hyderabad forests. Cultivated.

15. **Hydnocarpus Wightiana** Blume., *H.F.B.I.*, i, p. 196.
Vernacular names.—Kowti (Hind.); *Niradivittulu* (for seeds Tel.).
Habitat.—The Konkans and Kanara chiefly on hill ranges near the coast. Cultivated for its medicinal importance.
Uses.—The oil from the seeds is medicinal.

16. **Oncoba spinosa.**
Habitat.—Cultivated.

XI. POLYGALACEÆ.

17. **Polygala chinensis** Linn., *H.F.B.I.*, i, p. 204.
Vernacular names.—Miragu (Hind.); *Negli* (Mar.).
Habitat.—A very common weed at Adigmet and elsewhere.
Uses.—The root is medicinal.

XII. TAMARICACEÆ.

18. **Tamarix articulata** Vahl., *H.F.B.I.*, i, p. 249.
Vernacular names.—Faras, Sarru, (Hind.); *Farwa, Marlei* (Pb.).

Habitat.—Common in river beds on the Marathwari side, viz., in the river bed at Phoolnari in Aurangabad.
Uses.—The bark and galls are used in medicine.

XIII. GUTTIFERÆ.

19. **Calophyllum inophyllum** Linn., *H.F.B.I.*, i, p. 273.
(Alexandrian Laurel.).
Vernacular names.—*Sultana Champa, Surpan* (Hind.); *Surangi, Undi, nagchampa* (Mar.); *Ponna-chettu* (Tel.).
Habitat.—Concan and Orissa, Ceylon, etc. Cultivated for its flowers.
Uses.—Bark and seeds medicinal.

XIV. TERNSTROEMIACEÆ.

20. **Camellia japonica** Linn., *H.F.B.I.*, i, p. 292.
Habitat.—A cultivated plant.

XV. MALVACEÆ.

21. **Sida acuta** Burm., *H.F.B.I.*, i, p. 323.
Syn.—*Sida carpinifolia* Linn.
Vernacular names.—*Kareta* (Hind.); *Jangli-methi* (Bomb.); *Vishaboddee* (Tel.).
Habitat.—Extremely common.
Uses.—Root and leaves are medicinal.

22. **Hibiscus Abelmoschus** Linn., *H.F.B.I.*, i, p. 342.
Vernacular names.—*Hab-ul-mishk* (Arab.); *Lata-kasturika* (Sans.); *Mushk-dana* (Hind.); *Kattuk-kasturi* (Tam.); *Karpura-benda* (Tel.); *Kasturi-bhenda* (Mar.).
Habitat.—It was found in a field at Mulug. I am unable to say whether it is really wild or is an escape from cultivation.
Uses.—Root, leaves and seeds are medicinal.

XVI. STERCULIACEÆ.

23. **Sterculia fœtida** DC., *H.F.B.I.*, i, p. 354.
Vernacular names.—*Jangli-badam, Chinee-badam* (Hind.); *Pinari* (Tam.); *Gurapu-badam* (Tel.).
Habitat.—Often planted. Flowers: March-May.
Uses.—The seeds are eaten. Leaves, seeds and capsules are medicinal.

24. **Sterculia urens** Roxb., *H.F.B.I.*, i, p. 355.
Vernacular names.—*Gulu, Kulu* (Hind.); *Pandruka, Karai* (Bomb.); *Kavalee talbsu* (Tel.); *Vellay putali* (Tam.).
Habitat.—Common in most of the Hyderabad forests.

25. **Heritiera littoralis** Dryand., *H.F.B.I.*, i, p. 363.
Vernacular name.—*Sundri.*
Habitat.—Fruits were collected from the Mulug forest.

26. **Helicteres Isora** Linn., *H.F.B.I.*, i, p. 365.
Vernacular names.—*Marorphali, Marosi* (Hind.); *Murad Shing* (Mar.); *Known, Kewan* (Bomb.); *Valum-birikai* (Tam.); *Gubadarra* (Tel.).
Habitat.—Wild in many of the forests.
Uses.—A strong fibre is extracted from the bark. Bark, root, and fruits are medicinal.

27. **Kleinhovia Hospita** Linn., *H.F.B.I.*, i, p. 364.
Habitat.—A cultivated tree—Botanic Garden, Osmania University and elsewhere. Flowers: Aug.-Sept.

28. **Pterospermum acerifolium** Willd., *H.F.B.I.*, i, p. 368.
Vernacular names.—*Kaniar, Kanak-champa* (Hind.); *Matsu Kanda* (Tel.).
Habitat.—Doubtfully indigenous. Often planted in gardens.
Uses.—Leaves, bark and flowers are medicinal.
The following are also cultivated:—

29. **Dombeya angulata.**

30. **Guazuma tomentosa** Kunth., *H.F.B.I.*, i, p. 375.
(Bastard Cedar).
Vernacular names.—Nipal tunth (Beng.); *Rudrakshi* (Bomb.); *Tain-puchli-pattai* (Tam.); *Udrik-patta* (Tel.).
Uses.—It yields a good fibre suitable for rope-making. Bark is medicinal.

XVII. TILIACEÆ.

31. **Grewia hirsuta** Lamk., *H.F.B.I.*, i, p. 391.
Habitat.—Wild. Collection was made from a forest near Kamareddy. Flowers: Aug.-Sept. Fruits in Oct.

32. **Corchorus acutangulus** Lamk., *H.F.B.I.*, i, p. 398.
Habitat.—A common herb round about Adigmet and elsewhere. Flowers in September.

33. **Elæocarpus Ganitrus** Roxb., *H.F.B.I.*, i, p. 400.
Habitat.—Often planted in gardens. (Botanic Garden, Osmania University.)

XVIII. LINACEÆ.

34. **Erythroxylum Coca** Lamk., *Willis's Dict. Flowering Plants and Ferns.*, p. 253.
Habitat.—Cultivated.
Uses.—Cocaine is obtained from leaves.

XIX. RUTACEÆ.

35. **Murraya Koenigii** Spreng., *H.F.B.I.*, i, p. 503.
Vernacular names.—Harri, Katnim, Karripak (Hind.); *Karu-veppilai* (Tam.); *Kari-vepa-chettu* (Tel.).
Habitat.—Probably wild, but generally cultivated for its leaves.
Uses.—The leaves are used to flavour curries. Bark, root and leaves are medicinal.

XX. SIMARUBACEÆ.

36. **Balanites Roxburghii** Planch., *H.F.B.I.*, i, p. 522.
Vernacular names.—Hingan, hingota (Hind.); *Nanjunda* (Tam.); *Gari* (Tel.).
Habitat.—Common in the Mulug forest.
Uses.—The seeds, bark, leaves and fruit are medicinal.

XXI. OCHNACEÆ.

37. **Ochna squarrosa** Linn., *H.F.B.I.*, i, p. 523.
Vernacular name.—Kanak-champa.
Habitat.—Throughout tropical Asia and Africa. Planted in gardens for its flowers.

XXII. BURSERACEÆ.

38. **Filicium decipiens** Thwaites., *H.F.B.I.*, i, p. 539..
(Fern-leaved tree.)
Habitat.—Western Ghats, Ceylon etc. It is often cultivated for its foliage.

XXIII. MELIACEÆ.

39. **Chloroxylon swietenia** DC., *H.F.B.I.*, i, p. 569.
(The Indian Satin wood.)
Vernacular names.—Dhoura, Girya (Hind.); *Halda, Billu* (Bomb.); *Halda, Bheria* (Mar.); *Billu-chettu* (Tel.).
Habitat.—Common in many forest reserves.
Uses.—Bark and leaves are medicinal. Wood is of an excellent quality and is used in making furniture.

40. **Soymida febrifuga** A. Juss., *H.F.B.I.*, i, p. 567.
Vernacular names.—Rohan (Hind).; *Ruhin* (Mar.).
Habitat.—Wild in forests on the Telangana side.
Uses.—Bark is medicinal.

41. **Cedrella Toona** Roxb., *H.F.B.I.*, i, p. 568.
(The Toon or Indian Mahogany tree.)
Vernacular names.—Tun, Mahanim (Hind.); *Nandi-chettu* (Tel.); *Deodari, Kuruk* (Mar.).
Habitat.—Common in ravines. Flowers in January.
Uses.—The wood is used for furniture. Flowers yield a dye. Bark is medicinal.

XXIV. OLACACEÆ.

42. **Olax scandens** Roxb., *H.F.B.I.*, i, p. 575.
Vernacular names.—Dheniani (Hind.); *Harduli* (Mar.).
Habitat.—A common forest tree on the Telangana side.
Uses.—Bark is said to be medicinal.

43. **Cansjera Rheedii** Gymel., *H.F.B.I.*, i, p. 582.
Habitat.—Also a forest tree.

XXV. RHAMNACEÆ.

44. **Ventilago calyculata** Tulasne, *H.F.B.I.*, i, p. 631.
Syn.—Ventilago madraspatana Roxb.
Vernacular names.—Rai ohani (Hind.); *Sakal yel* (Mar.); *Zerra chiotali* (Tel.).
Habitat.—The material was collected from a valley near the Ellora caves (Aurangabad District).
Uses.—The bark and shoots are medicinal.

45. **Zizyphus Œnoplia** Mill., *H.F.B.I.*, i, p. 634.
Vernacular names.—Jangli ber, Jhar beri (Deccan); *Burgi* (Bomb.).
Habitat.—Wild throughout the dominions in scrub-jungle.

46. **Zizyphus xylopyrus** Willd., *H.F.B.I.*, i, p. 634.
Vernacular names.—Locally the name *Jangli ber* is used indiscriminately for all the wild species of Zizyphus; *Guti* (Bomb.).
Habitat.—Common in many dry places.

XXVI. AMPELIDACEÆ.

(*Vitaceae*).

47. **Vitis quadrangularis** Wall, *H.F.B.I.*, i, p. 645.
Syn.—Cissus quadrangularis Linn.
Vernacular names.—Harshankar, Kandawel, Kharbuti (Hind.); *Pirandal* (Tam.); *Nulle rotigeh* (Tel.).
Habtiat.—Very common.
Uses.—Young stems are eaten in curries. Stem and leaves are medicinal.

48. **Vitis pallida** W. & A., *H.F.B.I.*, i, p. 647.
Habitat.—Rather rare.

49. **Vitis lanata** Roxb., *H.F.B.I.*, i, p. 651.
Syn.—Cissus vitiginea Roxb.
Habitat.—Wild.

50. **Leea aspera** Wall., *H.F.B.I.*, i, p. 665.
Habitat.—Wild in the Ghats at Khuldabad (Aurangabad District).

XXVII. SAPINDACEÆ.

51. **Cardiospermum Halicacabum** Linn., *H.F.B.I.*, i, p. 670.
(Heart-pea or Balloon-vine).
Vernacular names.—Lata phatkari, noaphutki, kapalphodi, khibjal (Bomb.); *Muda-cottan* (Tam.); *Kanakaia, budha-kakara* (Tel.).
Habitat.—Common in hedges and fields.
Uses.—Roots, leaves and seeds are used in medicine.

52. **Nephelium Litchi** Camb., *H.F.B.I.*, i, p. 687.
Vernacular names.—Litchi, Lichi.
Habitat.—A native of S. China, occasionally cultivated in Hyderabad. (It is growing in the Botanic Garden, Osmania University.)

Uses.—The leaves are said to be used in China as a remedy for the bites of animals.

XXVIII. LEGUMINOSÆ.

53. **Crotalaria ramosissima** Roxb., *H.F.B.I.*, ii, p. 80.
Habitat.—The material was collected from a field in Mulug.

54. **Desmodium pulchellum** Benth., *H.F.B.I.*, ii, p.162.
Habitat.—Very common in forests, viz., near Kamareddy towards Nizam Sagar.

55. **Clitoria Ternatea** Linn., *H.F.B.I.*, ii, p. 208.
Vernacular names.—Asphota (Sans.); *Kalizer, Visnukranti* (Hind.); *Gokaran* (Bomb.); *Kakkanam-kodi* (Tam.); *Dintana, tella-dintana* (Tel.).
Habitat.—Common in hedges and fields.
Uses.—The root, leaves and seeds are medicinal.

56. **Pterocarpus Marsupium** Roxb., *H.F.B.I.*, ii, p. 239.
Vernacular names.—Bija (Hind.); *Bibla, asan* (Bomb.); *Vengai* (Tam.); *Peddagi* (Tel.).
Habitat.—Fruits were collected from the Mulug forest.
Uses.—Gum and bark are medicinal.

57. **Cæsalpinia coriaria** Willd., *Cooke. Fl. Bomb. Pres.* Pt. iii, p. 413.
(The American Sumach.)
Habitat.—Native of S. America which is often cultivated.

58. **Peltophorum ferrugineum** Benth., *H.F.B.I.*, ii, p. 257.
Habitat.—A cultivated road-side tree.

59. **Cassia grandis** Linn., *Cooke. Fl. Bomb. Pres.*, Pt. III, p. 426.
Habitat.—Commonly planted.

60. **Cassia nodosa** Ham., *H.F.B.I.*, ii, p. 286.
Habitat.—Also a cultivated species.

61. **Xylia dolabriformis** Benth., *H.F.B.I.*, ii, p. 286.
Syn.—Inga xylocarpa DC.
Vernacular names.—Jambhai, Yerul.
Habitat.—Wild in the forests on the Telangana side.
Uses.—The wood which is hard and durable is useful for making poles and rafters.

62. **Adenanthera pavonina** Linn., *H.F.B.I.*, ii, p. 287.
Vernacular names.—Ronta-chandan, ranjan (Hind.); *Thorla-gunj* (Bomb.); *Manjadi* (Tam.); *Bandi-guruina* (Tel.).
Uses.—Leaves and seeds are medicinal.
Habitat.—Often planted.

63. **Dicrostachys cinerea** W. & A., *H.F.B.I.*, ii, p. 288.
Syn.—Mimosa cinerea Linn.
Vernacular names.—Vurtuli (Hind.); *Segumkati* (Mar.); *Yeltu, Veturu* (Tel.); *Vadatalla* (Tam).
Habitat.—Wild in many of the Hyderabad forests.
Uses.—Young shoots are said to be medicinal.

XXIX. ROSACEÆ.

The following are cultivated :—

64. **Eriobotrya japonica** Lindl., *H.F.B.I.*, ii, p. 372.
(Loquat.)

65. **Pyrus communis** Linn., *H.F.B.I.*, ii, p. 374.
(Pear.)

66. **Pyrus malus** Linn., *H.F.B.I.*, ii, p. 373.
(Apple.)

67. **Prunus amygdalus** Baill., *H.F.B.I.*, ii, p. 313.
(Almond.)

68. **Prunus persica** Benth., *H.F.B.I.*, ii, p. 313.
(Peach.)

XXX. CRASSULACEÆ.

The following are cultivated :—

69. **Kalanchoe spathulata** DC., *H.F.B.I.*, ii, p. 414.
Vernacular names.—Tatara, Haiza-ka-patta (Hind.).
Uses.—Leaves are medicinal.

70. **Kalanchoe laciniata** DC., *H.F.B.I.*, ii, p. 415.
Vernacular names.—Tukhmhyat, Parna-bij (Bomb.); *Mala-kullie* (Tam.).
Uses.—Leaves are medicinal.

XXXI. COMBRETACEÆ.

71. **Terminalia Chebula** Retz., *H.F.B.I.*, ii, p. 446.
Vernacular names.—Harara (Hind.); *Kadukai-maram* (Tam.); *Karakaia* (Tel.).
Habitat.—Very common in the forests on the Telangana side.
Uses.—Fruits are medicinal.

72. **Anogeissus latifolia** Wall., *H.F.B.I.*, ii, p. 450.
Vernacular names.—Dhaoya (Hind.); *Dhavada, Dabria* (Bomb.); *Vallai-naga* (Tam.).
Habitat.—Very common in dry forests.
Uses.—The wood is strong and may be utilised in making several useful articles. A useful gum is also obtained.

XXXII. MYRTACEÆ.

The following are cultivated :—

73. **Eugenia Michelii** Lamk., *Cooke. Fl. Bomb. Pres.* Pt. III, p. 495.
(Brazil Cherry.)
Habitat.—Native of South America.

74. **Callistemon rigidus** (bottle-brush).

75. **Callistemon lilacinus.**

76. **Callistemon lanceolatus.**

77. **Eucalyptus citriodora.**
(Lemon-scented Eucalyptus).

XXXIII. MELASTOMACEÆ.

78. **Memecylon edule** Roxb., *H.F.B.I.*, ii, p. 563.
Vernacular names.—Limba (Mar.); *Alli chettu* (Tel.); *Cashamarum* (Tam.).
Habitat.—Eastern Peninsula and Ceylon, very common at Mahabaleshwar. Cultivated as an ornamental tree.
Uses.—The leaves and root are medicinal.

79. **Dalcnia speciosa.**
Habitat.—Also cultivated.

XXXIV. ONAGRACEÆ.

80. **Jussiæa repens** Linn., *H.F.B.I.*, ii, p. 587.
Habitat.—Common on the margins of tanks and in rice-fields.

81. **Trapa bispinosa** Roxb., *H.F.B.I.*, ii, p. 590.
Syn.—Trapa quadrispinosa Wall.
(Water chestnut).
Vernacular names.—Singhara (Hind.); *Parigadda* (Tel.); *Shingada* (Mar.); *Shingara* (Tam.).
Habitat.—Commonly cultivated in tanks.
Uses.—Fruit is eaten. It is also medicinal.

XXXV. CUCURBITACEÆ.

82. **Mukia scabrella** Arn., *H.F.B.I.*, ii, p. 623.
Syn.—Melothria maderaspatana Cogn.

Vernacular names.—*Bilari, Gwala-kakri* (Hind.); *Musu-musuk-kai* (Tam.); *Kutaru-budama* (Tel.).

Habitat.—Common in hedges and fields. Flowers in July.

Uses.—Root, leaves and seeds are medicinal.

XXXVI. CACTACEÆ.

The following are cultivated :—

83. **Trichocereus candicans** Gill.

84. **Echinopsis aurea** Rose.

85. **Echinocereus sp.**

86. **Echinocactus multiflorus** Hook.

87. **Arocarpus retusus** Scheidw.

88. **Epiphyllum sp.**
(Phyllocactus.)

XXXVII. ARALIACEÆ.

89. **Hedera Helix** Linn., *H.F.B.I.*, ii, p. 739.
(The Ivy.)

Vernacular names.—*Dudela* (Nepal); *Lablab* (Behar).

Habitat.—Throughout the Himalayas. Cultivated and thrives well.

Uses.—Leaves and fruits are medicinal.

XXXVIII. CORNACEÆ.

90. **Alangium Lamarckii** Thwaites, *H.F.B.I.*, ii, p. 741.

Vernacular names.—*Akola, thaila ankul* (Hind.); *Akar-kanta* (Beng.); *Alangi, Azhinji* (Tam.).

Habitat.—Very common in the forest at Mulug.

Uses.—Root, root-bark and fruits are medicinal.

XXXIX. CAPRIFOLIACEÆ.

91. **Lonicera Periclymenum** Linn, *Willis's Dict. Flowering Plants and Ferns.*
(Honey-suckle or woodbine.)

Habitat.—Cultivated.

XL. RUBIACEÆ.

92. **Hymenodictyon excelsum** Wall., *H.F.B.I.*, iii, p. 36.

Vernacular names.—*Bhaulan* (Hind.); *Kalakurwah, Bhorsal* (Bomb.); *Chetippa, Bandara* (Tel.); *Bhoursal* (Mar.); *Sagapu* (Tam.).

Habitat.—I mentioned in *J.A.S.B.*, Sc., I, p. 1, 1935 that this tree was recorded by Paztridge. Now I have to remark that I have found it very common in the Telangana forests.

Uses.—Bark is medicinal. Wood is durable and close-grained, and is employed in making agricultural implements.

93. **Wendlandia exserta** DC., *H.F.B.I.*, iii, p. 66.

Habitat.—It is found in some of the dry forests, but it is not so common as the preceding plant.

94. **Oldenlandia umbellata** Linn., *H.F.B.I.*, iii, p. 66.

Vernacular names.—*Chirval* (Hind.); *Cherivells, Chiruveru* (Tel.); *Imbural* (Tam.).

Habitat.—Extremely common in the vicinity of the Osmania University. Prefers rather hard and dry soil.

Uses.—Root and leaves are medicinal.

95. **Morinda citrifolia** Linn., *H.F.B.I.*, iii, p. 155.

Vernacular names.—*Al* (Hind.); *Al, Bartondi* (Bomb.); *Molagha, Maddichettu* (Tel.); *Noona-maram* (Tam.).

Habitat.—It is pretty common, but I am unable to say whether or not it is really wild.

Uses.—The roots furnish a valuable red dye. They are also medicinal.

96. **Hydroflax maritima** Linn., *H.F.B.I.*, iii, p. 199.
Habitat.—Extremely common at Adigmet. It may be classed as a sand-binder.

97. **Spermacoce hispida** Linn., *H.F.B.I.*, iii, p. 200.
Syn.—*Borreria hispida* K. Sch.
Vernacular names.—*Madana ghanti* (Hind. and Tel.); *Nuttee-choorie* (Tam.).
Habitat.—Same as that of the preceding species.
The following are commonly cultivated :—

98. **Mussænda frondosa** Linn., *H.F.B.I.*, iii, p. 89.
Vernacular names.—*Asari* (Nepal); *Sarvas, Bhuta-kesa* (Bomb.); *Shivardole* (Mar.); *Vellaellay* (Tam.).
Uses.—Root and leaves are medicinal.

99. **Nauclea cadamba** Linn.

100. **Hamelia patens** Jacquin.

101. **Cinchona Catlisaya** Wedd.

102. **Cinchona Ledgeriana** Moens.

103. **Cinchona officinalis** Linn.

XLI. COMPOSITÆ.

104. **Grangea maderaspatana** Poir, *H.F.B.I.*, iii, p.247.
Syn.—*Artemisia maderaspatana* Roxb.
Vernacular names.—*Mustary* (Hind.); *Afsanteen* (Arab.); *Baranjasif kowhi* (Pers.); *Namuti* (Beng.); *Mashi pattiri* (Tam.); *Savi* (Tel.).
Habitat.—A very common 'mat plant', spreading flat like a spider's web.
Uses.—Leaves are medicinal.

105. **Cæsulia axillaris** Roxb., *H.F.B.I.*, iii, p. 291.
Habitat.—A common herb.

106. **Vicoa auriculata** Cass., *H.F.B.I.*, iii, p. 297.
Syn.—*Vicoa indica* DC.
Habitat.—A common herb found in dry situations.

107. **Pulicaria Wightiana** Clarke, *H.F.B.I.*, iii, p. 298.
Syn.—*Callistephus Wightianus* DC.
Habitat.—Very common round about Adigmet and at other places.

108. **Xanthium strumarium** Linn., *H.F.B.I.*, iii, p. 303.
Vernacular names.—*Chota-gokhru* (Hind.); *Bun-okra* (Beng.); *Shan-keshvara, Dhupa* (Bomb.); *Marlumulta* (Tam.); *Veritel-nep* (Tel.).
Habitat.—Common in the compounds of houses.
Uses.—The whole plant is said to be medicinal.

109. **Eclipta alba** Hassk., *H.F.B.I.*, iii, p. 304.
Syn.—*Eclipta erecta* Linn.
Vernacular names.—*Kesaraja* (Sans.); *Maka, Bhangra* (Bomb.); *Kaikeshi* (Tam.); *Goontagelinjeroo* (Tel.).
Habitat.—Pretty common all over.
Uses.—Leaves and juice are described as medicinal.

110. **Glossocardia linearifolia,** *H.F.B.I.*, iii, p. 308.
Vernacular names.—*Parapalavum* (Tel.); *Pitpapda, Phattarsuva* (Bomb.).
Habitat.—Very common.
Uses.—The plant is described as medicinal.

111. **Emilia sonchifolia** DC., *H.F.B.I.*, iii, p. 336.
Vernacular name.—*Sadhi-mandi* (Bomb.).
Habitat.—A common herb all over.
Uses.—Medicinal.

112. **Echinops echinatus** DC., *H.F.B.I.*, iii, p. 358.
Vernacular names.—*Utali* (Sans.); *Utkatara* (Hind.).
Habitat.—Abundant throughout.
Uses.—Medicinal.

113. **Carthamus tinctorius** Linn., *H.F.B.I.*, iii, p. 386.
(The Safflower.)
Vernacular names.—*Karar, Kusum* (Hind.); *Kusumbha* (Sans.); *Kardai, kurdi* (Mar.); *Sendurgam, Kushumbavittu-lu* (Tel.).
Habitat.—Cultivated.
Uses.—The oil from the seeds is used in Hyderabad to adulterate sesamum-oil. Seeds, oil and flowers are medicinal.
The following are commonly cultivated:—

114. **Spilanthes Acmella** Linn., *H.F.B.I.*, iii, p. 307.
Habitat.—Although found throughout India I have not met with in a wild state so far.
Uses.—The flower-heads when chewed have a hot burning taste and cause profuse salivation. Medicinal.

115. **Aster Amellus** Linn.
(The Michaelmas Daisy.)

116. **Callistephus hortensis** Cass.
(German or Chinese Aster.)

117. **Zinnia elegans** Jacq.

118. **Helianthus annus** Linn.
(The common Sun-flower).

119. **Coreopsis tinctoria** Nutt.

120. **Dahlia variabilis** Desf.

121. **Cosmos bipinnatus** Cav.

122. **Tagetes erecta** Linn.

123. **Gaillardia aristata** Pursh.

124. **Calendula officinalis** Linn.
(The common Marigold).

125. **Polymnia grandis.**

126. **Lactuca Scariola** Linn.
(The garden lettuce).

127. **Artemisia argentea** Buch.

XLII. ERICACEÆ.

The following are cultivated:—

128. **Rhododendron arboreum** Sm., *H.F.B.I.*, iii, p. 465.
Uses.—Medicinal.

129. **Rhododendron Aucklandii.**

XLIII. PLUMBAGINACEÆ.

130. **Plumbago zeylanica** Linn., *H.F.B.I.*, iii, p. 480.
Vernacular names.—*Agni-shikha, Chitraka* (Sans.); *Chitra* (Hind.); *Shitaraj* (Arab.); *Shitaruk* (Pers.); *Chitu* (Beng.); *Tella-chitra* (Tel.); *Venchittira* (Tam.); *Chitrak* (Bomb.).
Habitat.—Wild.
Uses.—Root is considered medicinal.

131. **Plumbago capensis** Thunb., *Cooke, Fl. Bomb. Pres.*, Pt. II, 1, p. 78.
Habitat.—Cultivated for its profuse blue flowers.

XLIV. EBENACEÆ.

132. **Maba buxifolia** Pers., *H.F.B.I.*, iii, p. 560.
Habitat.—Wild in the Mulug forest.

133. **Diospyros Chloroxylon** Roxb., *H.F.B.I.*, iii, p. 560.
Habitat.—A common forest tree.

134. **Diospyros tomentosa** Roxb., *H.F.B.I.*, iii, p. 564.
Habitat.—Same as that of the preceding species.

135. **Diospyros kaki** Linn., *H.F.B.I.*, iii, p.555.
Habitat.—Khasia Mountains. Cultivated.

XLV. OLEACEÆ.

136. **Jasminum Roxburghianum** Wall, *H.F.B.I.*, iii, p. 595.
(Perhaps a variety of *Jasminum arborescens* Roxb.)
Vernacular name.—Jangli Chambeli (Local).
Habitat.—Common in scrub jungle and forests.

137. **Syringa vulgaris** Linn.
(The Lilac).
Habitat.—Cultivated.

XLVI. APOCYNACEÆ.

138. **Vinca pusilla** Murr., *H.F.B.I.*, iii, p. 640.
Syn.—Lochnera pusilla K. Sch.
Habitat.—A common weed in the beginning of the rainy season.

139. **Vallaris Heynei** Spreng., *H.F.B.I.*, iii, p. 650.
Syn.—Echites dichotoma Roxb.
Vernacular names.—Ramsar (Hind.); *pala malle tivva* (Tel.); *Bhadravalli* (Sans.).
Habitat.—Although found in abundance in many parts of Hyderabad I doubt if it is really wild here.
Uses.—The milky juice is medicinal.

140. **Tabernæmontana coronaria** Br., *H.F.B.I.*, iii, p. 646.
Vernacular names.—Tagara (Sans.); *Chandni, Taggar* (Hind.); *Nandi-vardana* (Tel.).
Habitat.—Not indigenous, but very commonly cultivated for its white and fragrant flowers.
The following are occasionally grown in gardens :—

141. **Roupellia grata** Wall, *Cooke. Fl. Bomb. Pres.*, II, 1, p. 143.
A climber with pale rose-coloured flowers.

142. **Strophanthus Wallichii** A. DC., *Cooke, Fl. Bomb. Pres.*, II, 1, p. 143.
A climber with red and white flowers.

XLVII. ASCLEPIADACEÆ.

143. **Sarcostemma brevistigma.** W. & A., *H.F.B.I.*, iv, p. 26.
Syn.—Asclepias acida Roxb.
Vernacular names.—Somalata (Hind.); *Soma* (Bomb.); *Tigatshumoodoo* (Tel); *Ran sher* (Mar.).
Habitat.—A wild xerophytic plant common round about Adigmet.
Uses.—Water passed through a bundle of this plant and a bag of salt seems to extirpate white ants from a field watered by it (Kirtikar).

144. **Dregea volubilis** Benth., *H.F.B.I.*, iv, p. 46.
Syn.—Asclepias volubilis Linn.
Vernacular names.—Nak-chhikni (Hind.); *Tita-kunga* (Beng.); *Ambri* (Mar.); *Kodie-palay* (Tam.); *Dudi-palla* (Tel).
Habitat.—A wild climber in most forests on the Telangana side.
Uses.—Roots, leaves and tender stalks are medicinal.

145. **Leptadenia reticulata** W. & A., *H.F.B.I.*, iv, p. 63.
Habitat.—A common twiner with greenish-yellow flowers.

146. **Ceropegia juncea** Roxb., *H.F.B.I.*, iv, p. 68.
Vernacular name.—Kanvel (Mar.).
Habitat.—Very common. The specimens were obtained from Amir Pet.
The following are cultivated :—
(Both are growing in the Botanic Garden, Osmania University.)

147. **Pergularia minor** Andr., *H.F.B.I.*, iv, p. 38.
Syn.—Pergularia odoratissima W.
Flowers in April.

148. **Stephanotis floribunda** Brongn, *Cooke. Fl. Bomb. Pres.*, ii, 1, p. 180.

XLVIII. LOGANIACEÆ.

149. **Buddleia asiatica** Lour., *H.F.B.I.*, iv, p. 82.
Habitat.—Although very common throughout India it is not found wild in *Hyderabad*, but is commonly grown in gardens.

XLIX. GENTIANACEÆ.

150. **Enicostema littorale** Blume, *H.F.B.I.*, iv, p. 101.
Vernacular names.—*Chota kirayata* (Hind. & Bomb.); *Kadavimyi* (Mar.); *Vellurugu* (Tam.); *Nela-gulamidi* (Tel.).
Habitat.—Very common in *morum* soil and dry places at Adigmet and elsewhere.
Uses.—Medicinal.

151. **Limnanthemum cristatum** Grieseb, *H.F.B.I.*, iv, p. 131.
Habitat.—Extremely common in ponds and canals. Flowers in April.

152. **Limnanthemum indicum** Thwaites, *H.F.B.I.*, iv, p. 131.
Habitat.—It is not so common as the preceding species.

L. POLEMONIACEÆ.

The following is commonly cultivated :—

153. **Phlox Drummondii.**

LI. BORAGINACEÆ.

154. **Heliotropium paniculatum** R. Br., *H.F.B.I.* iv, p. 151.
Habitat.—Very common at Adigmet, growing in patches. Flowers : April.

155. **Heliotropium indicum** Linn., *H.F.B.I.*, iv, p. 152.
Syn.—*Tiaridium indicum* Lehm.
Vernacular name.—*Bhurundi.*
Habitat.—A common weed in waste places.—Flowers—Oct.-Dec.

156. **Heliotropium zeylanicum** Lamk., *H.F.B.I.*, iv, p. 148.
Habitat.—Same as that of the preceding species.
The following are cultivated :—

157. **Cordia Sebestina** Linn., *Cooke. Fl. Bomb. Pres.*, II, 1, p. 202.

158. **Heliotropium peruvianum** Linn., *Cooke. Fl. Bomb. Pres.*, II, 1, p. 213.

159. **Borago officinale.**

LII. CONVOLVULACEÆ.

160. **Ipomœa Quamoclit** Linn., *H.F.B.I.*, iv, p. 199.
Vernacular Names.—*Vishnukrant* (Mar.); *Kamlata* (Hind.); *Ganesh-vel, Sita che kesh* (Bomb.).
Habitat.—Native of tropical America, commonly grown in gardens throughout India.
Uses.—Leaves are said to be medicinal.

161. **Ipomœa pes-tigridis** Linn., *H.F.B.I.*, iv, p. 204.
Habitat.—Common in hedges.
Uses.—Medicinal.

162. **Ipomœa aquatica** Forsk., *H.F.B.I.*, iv, p. 210.
Vernacular names.—*Kalambi* (Sans.); *Nari, Nali* (Pb.); *Nalichibhaji* (Bomb.); *Koilangu* (Tam.); *Tuti-kura* (Tel.).
Habitat.—Wild, growing in shallow ponds and marshy ground.
Uses.—The juice is described as medicinal.

163. **Ipomœa biloba** Forsk., *H.F.B.I.*, iv, p. 212.
Syn.—*Convolvulus Pes-caprae* Linn.
Vernacular names.—*Dopti-lata* (Hind.); *Marjadvel* (Bomb.); *Balabandi tige* (Tel.).
Habitat.—Found in dry sandy or *morum* soil.
Uses.—Root and leaves are medicinal.

164. **Porana paniculata** Roxb., *H.F.B.I.*, iv, p. 222.
Habitat.—It is wild in many parts of India, and is commonly grown in Hyderabad, and is also found as an escape.
The following are commonly cultivated :—

165. **Jacquemontia caerulea** Choisy, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 236.
Habitat.—Native of South America.

166. **Ipomœa Leari** Purt., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 251.
Habitat.—Native of tropical America, a favourite ornament of verandahs. The large blue flowers become reddish on fading.

LIII. SOLANACEÆ.

167. **Solanum indicum** Linn., *H.F.B.I.*, iv, p. 234.
Vernacular names.—Barhanta (Hind.); *Mulli* (Tam.); *Kuk-machi* (Tel.); *Dorli, Ringani* (Bomb.).
Habitat.—A common undershrub.
Uses.—The root and leaves are medicinal.

168. **Physalis minima** Linn., *H.F.B.I.*, iv, p. 238.
Vernacular names.—Kupanti (Tel.); *Chirboti, Ran-popati* (Bomb.).
Habitat.—A common weed in fields and hedges.
Uses.—Medicinal.

The following are commonly cultivated :—

169. **Solanum macrophyllum** Hort., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 269.
Habitat.—Native of Mexico with large leaves and showy blue flowers which turn white on fading.

170. **Physalis peruviana** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 270.
(Cape Goose-berry).
Habitat.—Native of Tropical America.

171. **Cyphomandra betacea** Sendt., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 275.
Cooke mentions on the authority of Woodrow that it has been unable to resist the south-west monsoon in the Deccan, but in the Botanic Garden, Osmania University, it seems to have adapted itself.

172. **Cestrum nocturnum.**
Flowers greenish-yellow, very fragrant.

173. **Petunia nyctaginiflora** Juss., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 276.

174. **Petunia violacea** Lindl., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 276.
Both are natives of the Argentine. Several varieties are grown in gardens.

LIV. SCROPHULARIACEÆ.

175. **Herpestis Monniera** H. B. & K., *H.F.B.I.*, iv, p. 272.
Syn.—Moniera cuneifolia Michaux.
Vernacular names.—Brahmi, jal-nim (Hind.); *Beami nirpirimie* (Tam.) *Sembrani-chettu* (Tel.).
Habitat.—Common in damp places, particularly on untrodden portions of lawns. Flowers—Feb.-April.
Uses.—Root, stalks and leaves are medicinal.

176. **Vandellia crustacea** Benth., *H.F.B.I.*, iv, p. 279.
Habitat.—Quite common. Flowers in August.

177. **Striga orobanchioides** Benth., *H.F.B.I.*, iv, p. 299.
Habitat—A common root-parasite. It was found on *Lepidagathis cristata*. It dries black. Flowers—October-November.

178. **Sopubia delphinifolia** G. Don., *H.F.B.I.*, iv, p. 302.
Vernacular name.—Dudhali (Bomb.).
Habitat.—Very common in cultivated fields. Flowers at the close of the rains—August-October.

Uses.—The juice of the plant is said to be medicinal.
The following are cultivated :—

179. **Russelia juncea** Zucc., *Cooke. Fl. Bomb. Pres.*, Vol. II. Pt. II, p. 310.
A Mexican plant grown in gardens for its handsome showy scarlet flowers.

LV. GESNERIACEÆ.

The following are grown in gardens :—

180. **Achimines hirsuta** DC., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 325.
A native of Brazil. Several varieties are grown.

Gloxinia maculata L'Herit, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 325.

LVI. BIGNONIACEÆ.

181. **Dolichandrone falcata** Seem., *H.F.B.I.*, iv, p. 382.
Vernacular names.—*Mersinge* (Bomb.); *Mersingi* (Mar.); *Kodatathie* (Tam.); *Udda, Wodi* (Tel.).
Habitat.—Rather rare.
Uses.—Fruit and bark are said to be medicinal.

182. **Stereospermum chelonoides** DC., *H.F.B.I.*, iv, p. 382.
Vernacular names.—*Padri, Parral* (Hind.); *Dharmar* (Beng.); *Padal* (Bomb.); *Kirsel, padhri* (Mar.); *Padri, Appu* (Tam.); *Moka-yapa, Pisul* (Tel.).
Habitat.—Common in moist forests.
Uses.—Roots, leaves and flowers are medicinal.
The following are commonly cultivated :—

183. **Tecoma undulata** D. Don., *H.F.B.I.*, iv, p. 378.
Syn.—*Tecomella undulata* Seem.

184. **Tecomaria capensis** Spach., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 335.
Syn.—*Tecoma capensis* Lindl.

185. **Parmentiera cereifera** Seem., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 336.
(Candle tree of Panama).

186. **Jacaranda mimosæolia** D. Don.

LVII. PEDALIACEÆ.

187. **Sesamum laciniatum** Klein., *H.F.B.I.*, iv, p. 387.
Habitat.—It was in abundance at Adigmet in 1935, but owing to grazing and clearance of weeds it has not been seen last season, that is, at the close of rains about September. It has dark purple flowers.

LVIII. ACANTHACEÆ.

188. **Ruellia prostrata** Lamk., *H.F.B.I.*, iv, p. 411.
Habitat.—A common weed. Flowers after the rains.
Uses.—Leaves are medicinal.

189. **Blepharis molluginifolia** Pers., *H.F.B.I.*, iv, p. 479.
Habitat.—Wild. The material was collected from a field in Mulug.

190. **Barleria Prionitis** Linn., *H.F.B.I.*, iv, p. 482.
Vernacular names.—*Karuntaka* (Sans.); *Katsareya* (Hind.); *Korhanti, Vijradanti* (Bomb.); *Piwala koranta* (Mar.); *Varamulti* (Tam.); *Muli-goranta* (Tel.).
Habitat.—Common throughout the Dominions, also often planted as a hedge. Flowers, October-January.
Uses.—Medicinal.

191. **Barleria cristata** Linn., *H.F.B.I.*, iv, p. 488.
Vernacular names.—*Jhinti* (Sans.); *Thanti, Sada-jati; Gokran* (Bomb.); *Bansa siyah* (Pb.).
Habitat.—A common plant with purple-blue or white flowers.
Uses.—Root, leaves and seeds are said to be medicinal.

192. **Andrographis echinoides** Nees., *H.F.B.I.*, iv, p. 505.
Habitat.—Wild, very common in the vicinity of Adigmet and elsewhere.
Uses.—Medicinal.

193. **Adhatoda vasica** Nees., *H.F.B.I.*, iv, p. 540.
Syn.—*Justicia Adhatoda* Linn.
Vernacular names.—*Arusak, Vasa etc.* (Sans.); *Arusha* (Hind.); *Bakas, vasaka* (Beng.); *Bansa* (Pers.); *Adhadode* (Tam.); *Adasara* (Tel.).
Habitat.—A common hedge plant about villages near Aurangabad and elsewhere.
Uses.—A yellow dye is obtained from the leaves. The leaves and root are medicinal.

194. **Rungia repens** Nees., *H.F.B.I.*, iv, p. 548.
Syn.—*Justicia repens* Linn.
Vernacular names.—*Kodaga saleh* (Tam.); *Ghatipitpada* (Bomb.).
Habitat.—An extremely common weed. Flowers, October-January.
Uses.—Medicinal.

195. **Justicia diffusa** Willd., *H.F.B.I.*, iv, p. 538.
Syn.—*Rostellularia diffusa* Nees.
Habitat.—As common as the preceding species.
The following are garden favourites :—

196. **Meyenia erecta** Benth., *Cooke. Fl Bomb. Pres.*, Vol. II, Pt. II, p. 343.
Syn.—*Thunbergia erecta* T. Anders.

197. **Eranthemum bicolor** Schrank, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 390.
(Several varieties are grown.)

198. **Graptophyllum hortense** Nees., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 416.
Uses.—Leaves are medicinal.

199. **Crossandra undulæfolia** Salisb., *H.F.B.I.*, iv, p. 492.

200. **Sanchezia nobilis** Hook, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. II, p. 416.

LIX. VERBENACEÆ.

201. **Lippia nodiflora** Rich., *H.F.B.I.*, iv, p. 563.
Vernacular names.—*Vashira* (Sans.); *Bhin-okra* (Hind.); *Ratolia* (Bomb.); *Podutabi* (Tam.); *Bokenaku* (Tel.).
Habitat.—Very common on untrodden portions of lawns and grassy places. Flowers: February-April. Cooke mentions that they are found more or less all the year which is true, but in Hyderabad they are seen in abundance during the months of February and March.
Uses.—Medicinal.

202. **Stachytarpheta indica** Vahl., *H.F.B.I.*, iv, p. 564.
Habitat.—A common herb. It is so common that it can easily be taken as indigenous, although, perhaps, it is not.

203. **Premna integrifolia** Linn., *H.F.B.I.*, iv, p. 574.
Syn.—*Premna serratifolia* Linn.
Vernacular names.—*Ganikarika, Agnimantha* (Sans.); *Agetha, arni* (Hind.); *Ganiari* (Beng.); *Erumaimullai, Munnay* (Tam.); *Pinnanelli* (Tel.); *Chamari* (Mar.).
Habitat.—I am doubtful about its being wild here, although it is very common near the sea. Flowers in July.
Uses.—Medicinal.
The following are commonly cultivated :—

204 **Verbena officinalis** Linn., *H.F.B.I.*, iv, p. 656.
Uses.—Medicinal.

205. **Verbena incisa** Hook., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 436.

206. **Clerodendron inerme** Gaertn., *H.F.B.I.*, iv, p. 589.
Uses.—Medicinal.

207. **Aloysia citriodora** Orteg., *Cooke. Fl. Bomb. Pres.*, vol. II, Pt, III, p. 436.
Syn.—Lippia citriodora H. B. (Lemon-scented Aloysia or Verbena).

208. **Petrea volubilis** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 436

209. **Citharexylum subserratum** Sw., *Cooke. Fl. Bomb. Pres.* Vol. II, Pt. III, p. 437.
Vernacular name.—Din-ka-Raja (local).

LX. LABIATÆ.

210. **Coleus aromaticus** Benth., *H.F.B.I.*, iv, p. 625.
Vernacular names.—Pashana Chedi (Sans.) *Pathar chur* (Hind. and Bomb.); *Karpura valli* (Tel.); *Panacha onva* (Mar.).
Habitat.—Commonly cultivated.
Uses.—Medicinal.

211. **Anisochilus carnosus** Wall., *H.F.B.I.*, iv, p. 627.
Vernacular names.—Ajapada, indupurni (Sans.); *Panjiri-ka-pat* (Hind.); *Ajvan-ka-patta* (local); *Karpuravalli* (Tel.); *Panajiren* (Mar.).
Habitat.—Wild in many parts of India. Cultivated.
Uses.—Leaves and oil are medicinal.

212. **Leucas diffusa** Benth., *H.F.B.I.*, iv, p. 689.
Habitat.—Very wild in gravelly soil at Adigmet and elsewhere.

213. **Leucas aspera** Spreng., *H.F.B.I.*, iv, p. 690.
Vernacular names.—Tamba (Bomb.); *Tunbai-chedi* (Tam.); *Thumma-chettu* (Tel.).
Habitat.—The same as that of the preceding species.
Uses.—Leaves are said to be medicinal.

214. **Leonotis nepetæfolia** Br., *H.F.B.I.*, iv, p. 691.
Vernacular names.—Dipmal, Ekri (Mar.); *Rana bheri* (Tel.).
Habitat.—Commonly found, but doubtfully indigenous.
Uses.—Flowers are considered medicinal.

The following are commonly cultivated :—

215. **Lavendula vera** D.C., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 453.
(True Lavender).
Cooke is right in remarking that it sometimes drags out a sickly existence as a pot plant. I have to add that it often does so in Hyderabad. Economically and medicinally important.

216. **Salvia involucrata** Cav., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 475.

217. **Origanum Marjorana** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 475.
(The Marjorum).
Vernacular names.—Murva (Hind.); *Maroo* (Tam.).
Uses.—An essential oil is distilled from the leaves and is used as a perfume. Seeds, leaves and oil are medicinal.

LXI. AMARANTACEÆ.

218. **Celosia cristata** Linn., *H.F.B.I.*, iv, p. 715.
(Cock's comb).
Vernacular names.—Murgha-ka-phul, Pila-murgha, Lal-murgha (Hind.).
Habitat.—Cultivated.
Uses.—Medicinal.

219. **Allmania nodiflora** Br., *H.F.B.I.*, iv, p. 716
Habitat.—A common weed. It is very variable, and hence there are many varieties.

220. **Amarantus viridis** Linn., *H.F.B.I.*, iv, p. 720.
Habitat.—A common weed in gardens and waste places.

221. **Amarantus polygamus** Linn., *H.F.B.I.*, iv, p 721.
Syn.—Amarantus polygonoides Willd.
Habitat.—Also a common weed.

The following species of Amarantus are cultivated :—

222. **Amarantus caudatus** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 491.
(Love-lies-bleeding).

223. **Amarantus hypochondriacus** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 491.
(The Prince's Feather).

244. **Nothosærua brachiata** Wight., *H.F.B.I.*, iv, p. 726.
Habitat—Pretty common.

225. **Aerua lanata** Juss., *H.F.B.I.*, iv, p. 728.
Syn.—Achyranthus lanata Linn.
Vernacular names.—Kapur-madhura (Mar.); *Sirru-pulay vayr* (Tam.); *Pindie-conda* (Tel.).
Habitat.—Quite a common weed. Flowers : September-November.
Uses.—Medicinal.

226. **Aerua Monsonia** Mart., *H.F.B.I.*, iv, p. 728.
Syn.—Achyranthus Monsonia Pers.
Habitat.—Very common. Flowers : October-January.

227. **Alternanthera sessilis** Br., *H.F.B.I.*, iv, p. 731.
Syn.—Alternanthera triandra Lam.
Vernacular names.—Kanchri, Jaljamba.
Habitat.—A very common weed at Adigmet and other places. Flowers : August-January.

The following are commonly cultivated in gardens :—

228. **Telanthera ficoidea** Moq., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 499.
Syn.—Alternanthera amabilis of gardeners.
It makes an excellent edging for small beds.

229. **Gomphrena globosa** Linn., *Cooke. Fl. Bomb. Pres*, Vol. II, Pt. III, P. 499.
(The Globe Amaranth).
Vernacular name.—Jafri-gundi.

LXII. CHENOPODIACEÆ.

230. **Suæda maritima** Dumort., *H.F.B.I.*, v, p. 14.
Habitat.—Apparently a common weed in grassy places.

231. **Beta vulgaris** Linn., *H.F.B.I.*, v, p. 5.
(The Beet-root).
Vernacular names.—Chukhander (Hind.); *Palak* (Bomb.).
Uses.—It is much used in curries and salads.

LXIII. POLYGONACEÆ.

232. **Polygonum plebejum** Br., *H.F.B.I.*, v, 27.
Habitat.—A common herb, very variable.
Uses.—Medicinal.

233. **Antigonon leptopus** H. & Arn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 519.
Habitat—A native of South America, commonly cultivated.

LXIV. NEPENTHACEÆ.

234. **Nepenthes khasiana** Hook., *H.F.B.I.*, v, p. 70.
(The Pitcher-plant).
Habitat.—Khasia and Jyntea mountains. It is seldom cultivated. It is being grown in the Botanic Garden, Osmania University. But the climate does not seem to suit it, as it often puts on a sickly appearance.

207. **Aloysia citriodora** Orteg., *Cooke. Fl. Bomb. Pres.*, vol. II, Pt, III, p. 436.
Syn.—Lippia citriodora H. B. (Lemon-scented Aloysia or Verbena).

208. **Petrea volubilis** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 436

209. **Citharexylum subserratum** Sw., *Cooke. Fl. Bomb. Pres.* Vol. II, Pt. III, p. 437.
Vernacular name.—Din-ka-Raja (local).

LX. LABIATÆ.

210. **Coleus aromaticus** Benth., *H.F.B.I.*, iv, p. 625.
Vernacular names.—Pashana Chedi (Sans.) *Pathar chur* (Hind. and Bomb.); *Karpura valli* (Tel.); *Panacha onva* (Mar.).
Habitat.—Commonly cultivated.
Uses.—Medicinal.

211. **Anisochilus carnosus** Wall., *H.F.B.I.*, iv, p. 627.
Vernacular names.—Ajapada, induparni (Sans.); *Panjiri-ka-pat* (Hind.); *Ajvan-ka-patta* (local); *Karpuravalli* (Tel.); *Panajiren* (Mar.).
Habitat.—Wild in many parts of India. Cultivated.
Uses.—Leaves and oil are medicinal.

212. **Leucas diffusa** Benth., *H.F.B.I.*, iv, p. 689.
Habitat.—Very wild in gravelly soil at Adigmet and elsewhere.

213. **Leucas aspera** Spreng., *H.F.B.I.*, iv, p. 690.
Vernacular names.—Tamba (Bomb.); *Tunbai-chedi* (Tam.); *Thumma-chettu* (Tel.).
Habitat.—The same as that of the preceding species.
Uses.—Leaves are said to be medicinal.

214. **Leonotis nepetæfolia** Br., *H.F.B.I.*, iv, p. 691.
Vernacular names.—Dipmal, Ekri (Mar.); *Rana bheri* (Tel.).
Habitat.—Commonly found, but doubtfully indigenous.
Uses.—Flowers are considered medicinal.

The following are commonly cultivated :—

215. **Lavendula vera** D.C., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 453.
(True Lavender).
Cooke is right in remarking that it sometimes drags out a sickly existence as a pot plant. I have to add that it often does so in Hyderabad. Economically and medicinally important.

216. **Salvia involucrata** Cav., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 475.

217. **Origanum Marjorana** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 475.
(The Marjorum).
Vernacular names.—Murva (Hind.); *Maroo* (Tam.).
Uses.—An essential oil is distilled from the leaves and is used as a perfume. Seeds, leaves and oil are medicinal.

LXI. AMARANTACEÆ.

218. **Celosia cristata** Linn., *H.F.B.I.*, iv, p. 715.
(Cock's comb).
Vernacular names.—Murgha-ka-phul, Pila-murgha, Lal-murgha (Hind.).
Habitat.—Cultivated.
Uses.—Medicinal.

219. **Allmania nodiflora** Br., *H.F.B.I.*, iv, p. 716
Habitat.—A common weed. It is very variable, and hence there are many varieties.

220. **Amarantus viridis** Linn., *H.F.B.I.*, iv, p. 720.
Habitat.—A common weed in gardens and waste places.

221. **Amarantus polygamus** Linn., *H.F.B.I.*, iv, p 721.
Syn.—Amarantus polygonoides Willd.
Habitat.—Also a common weed.

The following species of Amarantus are cultivated :—

222. **Amarantus caudatus** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 491.
(Love-lies-bleeding).

223. **Amarantus hypochondriacus** Linn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 491.
(The Prince's Feather).

244. **Nothosærua brachiata** Wight., *H.F.B.I.*, iv, p. 726.
Habitat—Pretty common.

225. **Aerua lanata** Juss., *H.F.B.I.*, iv, p. 728.
Syn.—Achyranthus lanata Linn.
Vernacular names.—Kapur-madhura (Mar.); *Sirru-pulay vayr* (Tam.); *Pindie-conda* (Tel.).
Habitat.—Quite a common weed. Flowers: September-November.
Uses.—Medicinal.

226. **Aerua Monsonia** Mart., *H.F.B.I.*, iv, p. 728.
Syn.—Achyranthus Monsonia Pers.
Habitat.—Very common. Flowers: October-January.

227. **Alternanthera sessilis** Br., *H.F.B.I.*, iv, p. 731.
Syn.—Alternanthera triandra Lam.
Vernacular names.—Kanchri, Jaljamba.
Habitat.—A very common weed at Adigmet and other places. Flowers: August-January.

The following are commonly cultivated in gardens :—

228. **Telanthera ficoidea** Moq., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 499.
Syn.—Alternanthera amabilis of gardeners.
It makes an excellent edging for small beds.

229. **Gomphrena globosa** Linn., *Cooke. Fl. Bomb. Pres*, Vol. II, Pt. III, P. 499.
(The Globe Amaranth).
Vernacular name.—Jafri-gundi.

LXII. CHENOPODIACEÆ.

230. **Suæda maritima** Dumort., *H.F.B.I.*, v, p. 14.
Habitat.—Apparently a common weed in grassy places.

231. **Beta vulgaris** Linn., *H.F.B.I.*, v, p. 5.
(The Beet-root).
Vernacular names.—Chukhander (Hind.); *Palak* (Bomb.).
Uses.—It is much used in curries and salads.

LXIII. POLYGONACEÆ.

232. **Polygonum plebejum** Br., *H.F.B.I.*, v, 27.
Habitat.—A common herb, very variable.
Uses.—Medicinal.

233. **Antigonon leptopus** H. & Arn., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 519.
Habitat—A native of South America, commonly cultivated.

LXIV. NEPENTHACEÆ.

234. **Nepenthes khasiana** Hook., *H.F.B.I.*, v, p. 70.
(The Pitcher-plant).
Habitat.—Khasia and Jyntea mountains. It is seldom cultivated. It is being grown in the Botanic Garden, Osmania University. But the climate does not seem to suit it, as it often puts on a sickly appearance.

LXV. ARISTOLOCHIACEÆ.

235. **Aristolochia indica** Linn., *H.F.B.I.*, v, p. 75.
Vernacular names.—Rudrajata, Ishvari (Sans.); *Isharmul* (Hind.); *Sapsund, Sampsum* (Bomb. and Mar.); *Perumarindu* (Tam.); *Ishvara-veru, govila* (Tel.).
Habitat.—Common in bushes.
Uses.—Root and leaves are medicinal.

236. **Aristolochia elegans** Masters, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 525.
Habitat.—A native of Brazil, commonly cultivated.

LXVI. LAURACEÆ.

237. **Cassytha filiformis** Linn., *H.F.B.I.*, v, p. 188.
Vernacular names.—Akas Valli (Sans.); *Amarbeli* (Hind.); *Akaswel, Amarvellu* (Mar).; *Cottan* (Tam.); *Paunch figa* (Tel.).
Habitat.—A common parasite on trees and shrubs. It is often mistaken for *Cuscuta*.
Uses.—Medicinal.

The following are cultivated :—

238. **Cinnamomum zeylanicum** Breyn., *H.F.B.I.*, v, p. 131.
(The Cinnamon of commerce).
Vernacular names.—Dalchini (Hind.); *Karruwa* (Tam.); *Sanalingul* (Tel.).
Uses.—The bark (*Dalchini*) is used to flavour curries and some sweets. Officinal.

239. **Cinnamomum camphora** F. Nees., *H.F.B.I.*, v, p. 134.
(The Camphor tree).
Vernacular name.—Kafoor-ka-jhar.
Uses.—Medicinal.

LXVII. EUPHORBIACEÆ.

240. **Euphorbia antiquorum** Linn., *H.F.B.I.*, v, p. 255.
Vernacular names.—Sihunda (Sans.); *Tindhara schund* (Hind.); *Naraseja* (Mar.); *Shadhurak-kalli, Tirikalli* (Tam.); *Bonta-chemudu* (Tel.).
Habitat.—Common in dry places.
Uses.—Medicinal.

241. **Euphorbia hypericifolia** Linn., *H.F.B.I.*, v, p. 249.
Vernacular names.—Hazardana (Pb.); *Nayeti Dudh mogra* (Bomb.); *Dhaktidudhi* (Mar.).
Habitat.—Wild.
Uses.—Medicinal.

242. **Euphorbia hirta** Linn., *H.F.B.I.*, v, p. 250.
Syn.—Euphorbia pilulifera Linn.
Vernacular names.—Dudhi (Hind.); *Nayeti* (Bomb.); *Dudhi* or *mothidudhi* (Mar.); *Amumpatchay-arissi* (Tam.); *Nanabala* (Tel.).
Habitat.—A very common weed.
Uses.—Medicinal.

243. **Euphorbia microphylla** Heyne., *H.F.B.I.*, v, p. 252.
Habitat.—Wild throughout.
Uses.—Medicinal.

244. **Euphorbia thymifolia** Burn., *H.F.B.I.*, v, p. 252.
Vernacular names.—Rakta vinda chada (Sans.); *Dudhi, Chotka dudhi* (Hind.); *Hazardana* (Pb.); *Chinamam* (Tam.); *Biduru nana biyyam* (Tel.); *Nayeti* (*Bomb.*); *Mathi-dudhi* (Mar.).
Habitat.—Also a common weed.
Uses.—Medicinal.

245. **Jatropha Curcas** Linn., *H.F.B.I.*, v, p. 383.
Vernacular names.—Nepalam (Tel); *Mogali-eranda* (Tel. and Bomb.).
Habitat.—Common near villages.
Uses.—Medicinal.

246. **Jatropha multifida** Linn., *H.F.B.I.*, v, p. 383.
Habitat.—A native of America. Cultivated.

247. **Jatropha podagrica** Hook., *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. III, p. 598.
Habitat—A native of Grenada. It has a curious gouty stem. Often cultivated.

248. **Cleistanthus collinus** Benth., *H.F.B.I.*, v, p. 274.
Vernacular names.—Korsi, kurchi-chettu (Tel.); *Woadugu mayam* (Tam.); *Garari* (Mar.).
Habitat.—Fruits were collected from the Mulug forest.
Uses.—Outer crust of capsule is said to be exceedingly poisonous. Medicinal.

249. **Phyllanthus reticulatus** Poir., *H.F.B.I.*, v, p. 288.
Vernacular names—Krishna-kamboji (Sans.); *Panjoli, Kala mahmooda* (Hind.); *Pavan, Datvan* (Bomb.); *Pillanji, Karappu-pillanji* (Tam.); *Purugudu, phulser* (Tel.).
Habitat.—Common in the vicinity of the city, and extremely common in Doulatabad and Khuldabad (Aurangabad District).
Uses.—The berries are edible. Leaves and bark are medicinal.

250. **Tragia involucrata** Linn., *H.F.B.I.*, v, p. 465.
Vernacular names.—Vrischi-kali (Sans.); *Barhanta* (Hind.); *Kan-churi* (Tam.); *Kauch kuri* (Bomb.); *China-dulagondi, druda-gunti* (Tel.); *Kauch-kuri* (local name, but the real Kauch-kuri is *Mucuna Pruriens* of the Leguminosae family).
Habitat.—A common twining herb in many hill-forests. The material was collected from a hillock near Kamareddy.
Uses.—Medicinal.

251. **Codiæum variegatum** Blume, *Cooke. Fl. Bomb. Pres.*, Vol. II, Pt. IV, p. 626—the croton of gardens.

252. **Aleurites moluccana** Willd., *H.F.B.I.*, v, p. 384.
(The Belgaum Walnut).
Vernacular names—Akosta (Sans.); *Jangli-akhrot* (Hind.); *Girdagane hindi, Chahar maghze hindi* (Fers.); *Jangli akhrota Japhala, Akhod* (Mar.); *Nattu akrotu kottai* (Tam.).
Uses.—Medicinal.

LXVIII. URTICACEÆ.

253. **Ficus Tsiela** Roxb., *H.F.B.I.*, v, p. 515.
Habitat.—Common near villages in Aurangabad.

LXIX. CASUARINACEÆ.

254. **Casuarina equisetifolia** Forst, *H.F.B.I.*, v, p. 598.
Habitat.—Extensively planted, but not indigenous.

LXX. CERATOPHYLLACEÆ.

255. **Ceratophyllum demersum** Linn., *H.F.B.I.*, v, p. 639.
Habitat.—A very common water-plant.

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THE ORNITHOLOGICAL SURVEY OF JODHPUR STATE.

BY

HUGH WHISTLER.

In 1933 His Highness the Ruler of Jodhpur State suggested that our Society should make arrangements for an ornithological survey of Jodhpur State on the lines of the previous surveys undertaken by the Society and he further expressed his willingness to defray the cost of such a survey for a period of three months. Needless to say this handsome offer was gratefully accepted and the work in the field was put into the hands of Mr. V. S. La Personne, one of the Society's officers who had already taken part in the Eastern Ghats Survey.

It was not expected that any novelties would be discovered in Jodhpur State. This was quite unlikely in view of the arid and semi-desert character of the greater part of the State and its close correspondence with the neighbouring areas of Sindh, Rajputana and the Punjab, of which the birds were already very generally known. But it was felt that careful collecting over a period of three months could hardly fail to add something to our knowledge of an area of which so little was on record, even though it could only furnish a picture of part of the bird year.

Our previous knowledge of the birds of Jodhpur State is derived from three main sources. The first is the work of Mr. R. M. Adam who was resident at Sambhur for several years. About 1870-74 he was a correspondent of A. O. Hume's and made a large collection of birds which are now in the British Museum. The result of his observations was recorded in *Stray Feathers* as follows:—'Notes on the Birds of the Sambhur Lake and its vicinity', *Stray Feathers*, vol. i, pp. 361-404. 'Additional Note on the birds of the Sambhur Lake and its vicinity', *Stray Feathers*, ii, pp. 337-41 and pp. 465-6.

Sambhur Lake cuts across the north-east boundary of Jodhpur State and Adam treated of the area of the lake as a whole without considering political boundaries. As many of the birds mentioned are water birds and the area is not typical of Jodhpur State proper and as there is nothing to show in many cases which side of the boundary the birds came from this list has to be used with some discretion by the student of Jodhpur State.

The second authority for Jodhpur is Dr. King who collected at Mount Aboo and in Jodhpur for nearly two years. His birds are also in the British Museum. He unfortunately published no account of his observations but he supplied Hume with a manuscript list of species obtained in the plains of Jodhpur in spring, summer and autumn and that was largely drawn on by Hume in his notes to Captain Butler's paper, to be mentioned below (vide *S.F.*, iii, p. 440).

The third authority for the State is Allen Octavian Hume himself. He appears to have been in Jodhpur on more than one occasion but his only paper dealing with his own collecting in the area will be found in *Stray Feathers*, vol. vii, pp. 52-68, 'The Birds of a Drought'. This deals with a stay at Jodhpur city from 15 January to 15 February and with intensive collecting in an area of 8 to 10 miles round the city. Conditions were not however normal owing to the severe drought. He did however contribute a series of notes on the neighbouring areas, including Jodhpur, to an important paper by Captain E. A. Butler, 'Notes on the avifauna of Mount Aboo and Northern Gujerat' (*Stray Feathers*, iii, pp. 437-500 and iv, pp. 1-41). To this paper Hume also contributed one of his customary regional analyses which is of interest to the student of Jodhpur.

From these three sources I have abstracted as far as is practicable—for many of the references are in very general terms—the information which refers to Jodhpur State and adding it to the information which has been obtained by the present survey have thus prepared what can only be regarded as a very imperfect nominal list of the birds of Jodhpur State. My hope is that it may serve as a starting point for any fresh observer who may be stationed in Jodhpur and is able and willing to study the birds of the State in the way that they should be studied.

Mr. La Personne collected 361 birds during the survey. The following list shows the serial numbers of the specimens collected at each camp together with the period spent there.

Nos. 1-18; 8 Oct. 1933—9 Oct. 1933; Pali, Marwar District.
Nos. 19-140; 10 Oct. 1933—31 Oct. 1933; Hamavas Lake, Pali.
Nos. 141-211; 2 Nov. 1933—10 Nov. 1933; Jalor.
Nos. 212-238; 13 Nov. 1933—16 Nov. 1933; Bhinmal.
Nos. 239-300; 21 Nov. 1933—2 Dec. 1933; Sunda Hill, Jaswantpura District.
Nos. 301-316; 2 Dec. 1933—5 Dec. 1933; Jawar, Jaswantpura District.
Nos. 317-330; 6 Dec. 1933—21 Dec. 1933; Tilwara.
Nos. 331-351; 1 January 1934—5 January 1934; Phalodi.
Nos. 354-361; 8 January 1934—14 January 1934; Pichiak Lake, Bilara District.

It will be realised, therefore that Mr. La Personne must have worked very hard in collecting and skinning. He did not however furnish any field notes of importance on the collection or any notes on the collecting areas so I fear that my report can be little but a nominal list of the specimens collected, supplemented by such notes as I have procured from the three main sources outlined above. Critical discussions of races have not been called for as whatever might have been said on these particular species has already been said by Dr. Ticehurst in his Sind papers or by myself in connection with the Punjab or in the various survey papers.

Any Gazetteer may be consulted for a general description of Jodhpur State. With these few preliminary remarks I now proceed to enumerate the species and subspecies either procured by the survey or otherwise recorded as occurring in Jodhpur State.

Corvus corax laurencei Hume.

Specimen collected :—338 ♀ 2-1-34 Phalodi ; 358 ♀ 12-1-34 Pichiak Lake, Bilara.

Found throughout the whole State in the winter months. Hume remarks on the boldness of this Raven. 'Our camp, he says, was a large one perhaps containing a thousand souls and in amongst the tents from dawn till dark, familiar and fearless as sparrows, were at all times from 50 to 100 of these Ravens, stalking about singly and croaking vigorously to each other'. La Personne also remarks on the tameness of the bird in the desert towns. In Phalodi they actually entered the bungalow verandas and no. 338 was caught with a basket and string trap. A nest with 2 fresh eggs was seen on 19 December on a signal platform of the railway at Tilwara, the birds being but little disturbed by passing trains. Many old nests were seen in the desert outside Chanod, mostly placed on acacia trees barely 6 foot high.

Corvus macrorhynchos Wagler.

La Personne reports that a single Jungle-Crow was seen in His Highness' garden at Jaswantpura, no doubt as a straggler from the Aravallis. Hume and Adam failed to meet it either at Jodhpur or Sambhur.

Corvus splendens splendens Vieillot.

Specimens collected :—187 ♂ ad. 6-11-33, ♀ ad. 10-11-33 Jalor 500 ft.

Hume found the House-Crow rare at Jodhpur under drought conditions, but La Personne says it occurs throughout the greater part of the State except in the more arid regions. It was common at Barmer in December. In some localities, such as Puchbunddra, according to Hume the House-Crow is only a rains visitor (*S.F.*, iii, 493).

La Personne furnishes an interesting note on the roosting flight of this species in Jaswantpura district. The evening flight passed over his camp at 3,400 ft. on Sunda Hill and from that elevation he could see the birds leaving the plains in huge flocks and crossing the hill at one particular dip in the ridge, making for the Abu range. The first flock would cross (at the end of November and beginning of December) about 5.30 p.m. and then with intervals of a minute or two between each flock the flight would continue until about 6-45 to 7 p.m. The morning flight was over before sunrise. Some of these birds doubtless came from great distances, as when the survey was at Jalor and Tilwara the start of the evening flights was noticed.

Both specimens collected belong to the typical form and La Personne particularly remarks that throughout the survey he noticed that all House-Crows were typical in colour and not of the paler *zugmayeri* form.

Dendrocitta vagabunda pallida Blyth.

Specimens collected :—♀ imm. 10-10-33 Hamavas Lake ; 306 ♀ ad. 4-12-33, 313 ♂ ad. 5-12-33 Jawar, Jaswantpura District.

The Indian Tree Pie was common in and around Jodhpur town but the specimen collected at Hamavas Lake appeared to be the only individual in the strip of Babul jungle growing along the dam. A pair visited the camp on Sunda Hill, 3,400 ft.

Specimens collected will pass in colour as *pallida* though their measurements (♂♀ ad. wing 161, 150 tail 259, 235 mm.) are a little on the small side. Lal Personne remarks, however, that the pair on Sunda Hill appeared to be larger with longer tails.

Parus major mahrattarum Hartert.

Specimens collected :—244 ♀ 245 ♂ 21-11-33, 248 sex ? 22-11-33, 262 ♂ 23-11-33, 271 ♀ 25-11-33, 286 ♂ 28-11-33, 294 ♀, 295 ♂ 29-11-33,- Sunda Hills, 3,400 ft., Jaswantpura.

The Indian Grey Tit was plentiful on Sunda Hill frequenting the ravines and old watercourses and being found in the hunting parties with White-eyes and Willow-wrens. There is a specimen in the Hume collection obtained on the Desuri Road from Jodhpur on 10 February 1878 and it is also found in the Marot and Koochamun jungles to the north of the Sambhur Lake.

Parus nuchalis Jerdon.

The survey unfortunately failed to meet with the White-winged Black Tit but it occurs along the eastern borders of the Jodhpur State as Adam found it quite common towards Marot and Mokrana, and Hume (*S.F.*, iii, 492) obtained it from the neighbourhood of Pali.

Turdoides somervillei sindianus (Ticehurst).

Specimens collected :—279 ♀ 27-11-33, Sunda Hill, 3,400 ft.

This specimen of the Jungle Babbler was secured from a family party on Sunda Hill. The species was not otherwise observed though Hume included the bird in his Jodhpur list.

Argya caudata caudata (Dumont).

Specimens collected :—4 sex ? juv., 9 ♀ ad. 10 ♂ juv., 8-10-33 Pali; 118 ♂, 119 ♂, 120 ♀ 21-10-33 Hamavas Lake, Pali district; 323 ♂ 19-12-33 Tilwara, 348 ♀ ad., 349 ♀ imm. 5-1-34 Phalodi.

The Common Babbler is one of the most common and generally distributed birds in the State though it was not found in the hill area of Jaswantpura district. Young and eggs were noted in October.

Argya malcolmi (Sykes).

Specimens collected :—142 ♂ 31-10-33, 164 ♀ 3-11-33, 170 ♀ 4-11-33 Jalor.

The Large Grey Babbler is very common at Jodhpur and extends to Balotra, Siwaria and Jalor, though it is absent according to La Personne from the desert region further west and from the hills of Jaswantpura.

Chrysomma sinensis hypoleucos (Franklin).

Specimens collected :—19 ♂ 10-10-33, 34 ♂ 11-10-33, 49 ♂ 13-10-33, 138 ♀ 25-10-33 Hamavas Lake; 259 ♂, 260 ♂, 261 ♂ juv., 23-11-33, 267 ♀ 25-11-33, Sunda Hill, 3,400 ft.; 301 ♂, 302 ♀ 2-12-33, Jawar, Jaswantpura district; 354 ♂ 355 ♀ 8-1-34, Pichiak Lake.

The Yellow-eyed Babbler is common on Sunda Hill in the bamboo-jungle and was also found on the plains in Tamarisk and Babool forests and in the reed beds and grass lands round the larger lakes, but was met by the Survey nowhere west of a line roughly through Jodhpur, Jalor, Bhinmal and Jaswantpura. Adam obtained it from the hills near Koochamun. The young male no. 261 was probably not more than a month old and was secured from family party.

Aegithina nigrolutea (Marshall).

Aegithina tiphia (L.).

Specimens collected :—268 ♂ imm. 25-11-33, Sunda Hill, 3,000 ft.

La Personne says that an Iora was not uncommon on Sunda Hill. When Hume wrote in 1875, before the two species of Iora had been differentiated, he said that the Iora was common in the eastern portions of Jodhpur but occurred for the most part only in the rains in western Jodhpur. The solitary specimen obtained by the Survey—which was in company with a party of White-eyes in a large Banyan tree—is immature and therefore cannot be identified subspecifically but it appears to me to be of the species *tiphia*. A specimen in the Hume collection from the hills near Koochamun is, however, *nigrolutea* to which species also belong the Ioras collected by Adam at Sambhur and a specimen from Anadra (just over the Jodhpur border near Mount Aboo) in the Hume collection. It is evident, therefore, that both forms of Iora occur in Jodhpur State but their status and distribution and the exact relationship between them remain to be worked out.

Molpastes haemorrhous pallidus Stuart Baker.

Specimens collected :—108 ♀, 109 ♂ 20-10-33, 116 ♀ 21-10-33, Hamavas Lake, Pali.

The Red-vented Bulbul is common on the hills of the Jaswantpura district and extends into the plains, as at Jodhpur, Barmer and Phalodi where conditions are suitable. In western Jodhpur, according to Hume it occurs for

the most part only in the rains. Fledged young were seen being fed by their parents on 18 October.

Molpastes leucogenys leucotis (Gould).

Specimens collected :—26 ♂ 11-10-33, 64 ♀ 15-10-33, 105 ♂ 20-10-33, 117 ♀ 21-10-33, 126 ♂ 22-10-33, 130 ♀ 132 sex ? 23-10-33; Hamavas Lake, Pali; 163 ♂ 3-11-33, Jalor.

The White-eared Bulbul is one of the most familiar and widely spread birds in the State, inhabiting light babul forest, cactus-covered land and the semi-desert country round villages. It is plentiful at Barmer and Phalodi and about Nawa and Mata Pahar on the Sambhur Lake. La Personne remarks that both species of Bulbul were common on the hillside at Hamavas which was thickly covered with cactus, and on more than one occasion individuals of the two species were observed in company, though no hybrids were observed.

Salpornis spilonota rajputanae Meinertzhagen.

There are a pair of specimens of the Spotted Grey Creeper in the British Museum collected by Adam on the 6th and 25th of June 1873 and labelled Sambhur. These are presumably the two specimens which Adam says he obtained in the jungle near Koochamun.

Saxicola caprata bicolor Sykes.

Sepcimens collected :—38 ♀ 12-10-33, 72 ♂ 16-10-33, 79 ♂ 17-10-33, 88 ♂ 18-10-33; Hamavas Lake; 161 ♂ 3-11-33, 165 ♂ 4-11-33, 173 ♂, 174 ♂, 175 ♀ 5-11-33, 184 ♂ 6-11-33; Jalor; 232 ♀ 16-11-33, Bhinmal.

The Pied Bush-chat is very common and generally distributed in Jodhpur, occurring both in the desert country and on the hill top at Sunda.

Saxicola torquata indica (Blyth).

Specimens collected :—87 ♂ 18-10-33 Hamavas Lake; 178 ♂ 5-11-33 Jalor; 212 ♂ 13-11-33, 244 ♂ 15-11-33 Bhinmal.

The Stone-chat is a common winter visitor.

Saxicola macrorhyncha (Stoliczka).

Stoliczka's Whin-chat was not procured by the Survey but Hume found it 'extremely common in the thin, stunted scrub jungle that here and there studs the sandy, semi-desert, waterless tracts that occur all round Jodhpur'. He procured a large series of over 30 specimens (now in the British Museum) at the end of January and during the first week in February and wrote an interesting note on them (*S.F.*, vii, 55). It is no doubt resident.

Oenanthe picata (Blyth).

Specimens collected :—2 ♂ 8-10-33 Pali; 150 ♂ 2-11-33 Jalor.

Although scarce at the beginning of October the Pied Wheatear, says La Personne, increased in numbers with the colder weather and was very generally distributed except in the forested areas. At Jalor and other rest-houses they often rested on the doors and windows during the heat of the day and at Jalor a fine male roosted regularly on the 'kass-kass' door.

Oenanthe opistholeuca (Strickland).

Strickland's Wheatear was not procured by the Survey but Hume says it occurs here and there throughout Jodhpur, of course as a winter visitor only.

Oenanthe isabellina (Temm.).

Specimens collected :—1 ♂ 3-10-33, 7 ♂ 8-10-33 Pali.

The Isabelline Wheatear is said by La Personne to be very generally distributed except in the hill tracts of Jaswantpura.

Oenanthe deserti atrogularis (Blyth).

Specimens collected :—146 ♀ 1-11-33, 183 ♂ 6-11-33 Jalor; 337 ♀ 2-1-34 Phalodi.

The Desert-Wheatear was found to be very common at Barmer and Phalodi.

Oenanthe xanthoprymna chrysopygia (De Filippi).

The Red-tailed Wheatear was not procured by the Survey but Hume obtained it in the neighbourhood of Jodhpur and wrote a long note on its correct name (p. 57).

Cercomela fusca (Blyth).

Specimens collected :—162 ♂ 3-11-33, 188-9 ♂♂ 6-11-33, 191 ♂ 194-5 ♀♀ 7-11-33 Jalor; 240 ♀, 243 ♂ 21-11-33, 275 ♂ 26-11-33 Sunda Hill, 3,400 ft.

La Personne says that the Brown Rock-chat is very irregularly distributed in Jodhpur State. He found it common at Phalodi, at Jalor and on the Sunda Hill whereas it was not observed at Marwar Pali or at Barmer and further west of the latter place.

Phoenicurus ochrurus phoenicuroides (Horsfield and Moore).

Specimens collected :—45 ♀ 12-10-33 Hamavas Lake; 167 ♂ 4-11-33, 182 ♀ 6-11-33, 208 ♂ 10-11-33 Jalor.

The Black Redstart was found to be very generally distributed.

Cyanosylvia suecica pallidogularis (Sarudny).

Specimens collected: 46 ♂ 12-10-33, 61 ♀ 14-10-33, 62 ♀ 15-10-33, 112 ♂ 21-10-33, 127 ♂ 22-10-33 Hamavas Lake.

La Personne says that a large influx of Bluethroats was observed on the 21 October at Hamavas where there is most suitable ground for them covered with reeds and tamarisk beyond the lake-dam. Many were flushed from chilli crops at Jalor and a single bird was seen in a patch of pulse in the Rest-house garden at Barmer. Hume remarked long ago that in the more desert portions of Jodhpur the Bluethroat seems to be chiefly found towards the close of the rains, that is on the autumn passage.

The identification of Bluethroats in winter plumage in India is largely a matter of guess work but these specimens apparently belong to the race *pallidogularis*.

Saxicoloides fulicata cambaiensis (Latham).

Specimens collected :—83-84 ♀♂ 17-10-33, 107 ♂ 20-10-33 Hamavas Lake; 151 ♂ 2-11-30 Jalor.

The Brown-backed Indian Robin is absent from the desert areas, such as Barmer and Phalodi, but seems to be generally distributed and common on the eastern side of the State. Hume was of opinion that specimens from western Jodhpur (*S.F.*, iii, 474) were of the type which I have since named *intermedia* but the Survey specimens are clearly *cambaiensis*.

Copsychus saularis saularis (Linnaeus).

Specimen collected :—310 ♂ 4-12-33 Jawar, Jaswantpura District.

Local and apparently absent from the desert tracts, the Magpie Robin is said by La Personne to occur at Chanod, along the Jawai River and at Jodhpur, Balotra and Pali.

Monticola cyanus pandoo (Sykes).

Specimens collected :—133 ♂ 23-10-33 Hamavas Lake; 186 ♂ 6-11-33 Jalor.

The Blue Rock Thrush was first seen on 20 October at Hamavas. It was noted on Sunda Hill. Hume includes it in his list from the neighbourhood of Jodhpur.

Muscicapa striata neumanni Poche.

The autumn passage route of the Spotted Flycatcher includes Jodhpur as Hume received specimens collected in the State on September 8th and 16th. The Survey was too late to meet with it.

Siphia parva parva (Bechstein).

Specimens collected :— 55 sex ? 14-10-33, 58 ♂ 12-10-33 Hamavas Lake.

The Red-breasted Flycatcher is also included in Hume's Jodhpur list.

Leucocirca aureola aureola (Lesson).

Specimens collected :—53 ♂ 14-10-33 Hamavas Lake; 314 ♀ 5-12-33 Jawar, Jaswantpura district.

The White-browed Fantail-Flycatcher is a common bird in the gardens of Jodhpur town and in the Babul groves of the eastern side of the State. Adam met a few pairs about Nawa and Marot. According to La Personne it does not occur west of Balotra.

Lanius excubitora lahtora (Sykes).

Specimens collected :—3 ♂, 8 sex ?, 15 ♂ 8-10-33 Pali; 144 ♂ 1-11-33 Jalor.

The Indian Grey Shrike is extremely common throughout the State except in the forests of Jaswantpura and the wetter areas round the lakes. Occurs on Sunda Hill.

Lanius vittatus Valenciennes.

Specimens collected :—70 ♂ juv. 16-10-33 Hamavas Lake; 305 ♂ 4-12-33 Jawar, Jaswantpura district.

According to La Personne the Bay-backed Shrike is found all along the eastern side of the State, and also wherever suitable conditions occur on the western side though it avoids the desert country. Noted at Barmer and Phalodi and in most Rest-house gardens. Adam found it breeding commonly in the Marot jungles on 1 August 1872.

Lanius schach erythronotus (Vigors).

Specimens collected :—80-81 ♀♂ 17-10-33 Hamavas Lake.

The Rufous-backed Shrike was fairly generally distributed, being also noted by the Survey at Phalodi, Godra Road and Barmer and in the Jaswantpura district.

Lanius isabellinus Hempich Ehrenberg.

Specimens collected :—25 ♀ 11-10-33, 111 ♂ 20-10-33 Hamavas Lake; 160 ♂ 3-11-33 Jalor; 216 ♂ 14-11-33 Bhinmal; 328 ♀ 21-12-33 Tilwara.

The Isabelline Shrike is common throughout the whole State, according to La Personne, in all the drier and semi-desert areas.

Tephrodornis pondicerianus pallidus Ticehurst.

Specimens collected :— 168 sex ? 4-11-33, 176 ♀ 5-22-33 Jalor; 281 ♂ 27-11-33 Sunda Hill 3,400 ft.; 308-309 ♂♂ 4-12-33 Jawar, Jaswantpura district.

The Common Woodshrike occurs wherever there is suitable Babul forest or bush-covered country and it was noted in the tamarisk forest at Tilwara.

The specimens collected are intermediate between the typical race and *T. p. pallidus* but on the whole are closer to the latter.

Pericrocotus brevirostris (Vigors).

Hume states that the Short-billed minivet appears in winter in the southern portions of Jodhpur but it was not procured by the Survey.

Pericrocotus erythropygius (Jerdon).

No minivets were collected by the Survey but Hume procured the White-bellied Minivet in the neighbourhood of Jodhpur town and Adam collected specimens in the jungles near Marot and Koochamun.

Dicrurus macrocercus albirictus (Hodgson).

Specimens collected :—56-7 ♂♀ 14-10-33 Hamavas Lake, Pali; 153-4 ♂♂ 2-11-33 Jalor, 500 ft.; 235 ♀ 16-11-33 Bhinmal.

The King Crow is very generally distributed throughout the State in suitable country.

Dicrurus longicaudatus Jerdon.

Specimen collected :—297 ♂ 29-11-33 Sunda Hill, 3,400 ft.

This specimen appears to provide the only record of the Grey Drongo for Jodhpur State. It is doubtless a winter visitor only.

Agrobates galactotes familiaris (Ménétries).

As in the case of certain other species which take the Arabian route to their winter quarters in Africa, the Rufous Warbler appears in Jodhpur on passage in September in which month in 1868 Dr. King obtained two specimens now in the British Museum (vide *S.F.*, iii, 476 and *Ibis*, 1869, 355).

Acrocephalus stentoreus brunnescens (Jerdon).

Specimens collected :—45-48 ♂♂♀♂ 13-10-33, 63 ♂ 15-10-33, 69 ♂ 16-10-33, 75 ♀, 77 ♂ 16-10-33, 113 ♂ 20-10-33, 115 ♂ 21-10-33 Hamavas Lake, Pali.

The Great Reed Warbler was abundant in the extensive reed beds that were examined by Hamavas Lake and they were found to visit the neighbouring tamarisk forest. All the specimens are undergoing a complete moult and it seems extremely probable that the birds breed where they were found, though no old nests were remarked by the Survey, and there are no juveniles amongst the specimens collected.

Acrocephalus dumetorum Blyth.

Specimens collected :—30, 32 sex ? 11-10-33 Hamavas Lake.

Mr. La Personne is of opinion that Blyth's Reed Warbler was very generally distributed in gardens and other suitable places. It was probably on passage.

Orthotomus sutorius guzerata (Latham).

Specimens collected :—123-124 ♂♀ 22-10-33, 134 ♂ 23-10-33 Hamavas Lake; 155 ♂ 2-11-33, 192 ♂ 7-11-33, 197-198 ♂♂ 8-11-33 Jalor; 250-251 ♂♀ 22-11-33 Sunda Hill, 3,400 ft.

The Tailor-bird was not observed westwards of Tilwara and it does not occur in the desert areas.

Cisticola juncidis cursitans (Franklin).

Specimens collected :—104 juv. 20-10-33 Hamavas Lake; 220-222 ♀♂ sex ? 14-11-33, 229 ♀ 15-11-33, 231 ♂ 16-11-33 Bhinmal.

In addition to the above localities the Fantail Warbler was noted, a single specimen only, at Tilwara. It is of course absent from the desert tracts.

Franklinia gracilis (Franklin).

Specimens collected :—246-7 ♀♂ 21-11-33, 249 ♀ 22-11-33, 256-7 juvs. 23-11-33 Sunda Hill, 3,400 ft.; 316 ♂ 5-12-33 Jawar, Jaswantpura.

Franklin's Wren-Warbler was found in the grasslands which grow to a height of over 4 feet in places, on the Sunda Hill. Adam's collector found it fairly common in the hills near Koochamun.

Franklinia buchanani (Blyth).

Specimens collected :—6 ♂ juv. 8-10-33 Pali; 27 ♂ 11-10-33, 99 sex ? 102 juv. 19-10-33, 106 ♀, 110 ♀ juv. 20-10-33, 122 juv. 22-10-33, 131 ♂ 23-10-33, 137 ♀ 24-10-33 Hamavas Lake; 141 ♂ 31-10-33, 152 ♀, 156 ♂ 2-11-33, 199 ♂ 8-11-33 Jalor; 329 ♂ 21-12-33 Tilwara; 343 ♂ 3-1-34 Phalodi.

Hume stated that the Rufous-fronted Wren-Warbler was very common about Jodhpur. and La Personne adds that it is very widely distributed in the State, being there as elsewhere more particularly addicted to the semi-desert tracts thickly studded with the *Zyziphus* bush.

Hippolais rama rama (Sykes).

Specimen collected :—29 ♀ 11-10-33 Hamavas Lake.

Syke's Tree Warbler is probably a passage migrant.

Sylvia communis rubecula Stresemann.

According to Hume (*S.F.*, iii, 488) Dr. King collected specimens of the Common White-throat at Jodhpur itself and near Pali in September. The specimens are not in the British Museum but they doubtless belong to this race. This is another of the species that pass through north-west India on

the autumn passage to take the Arabian route to Africa and their winter quarters.

Sylvia crassirostis jerdoni (Blyth).

Specimens collected :—136 ♀ 24-10-33 Hamavas Lake, Pali. Hume procured the Orphean Warbler at Jodhpur but considered it rare.

Sylvia nana nana (Hemprich & Ehrenberg).

Specimens collected :—331-333 ♂♀♀ 1-1-34 Phalodi.

The desert areas of Jodhpur State are particularly suited to the requirements of the Desert Warbler and Hume found it extremely abundant in the low scrub round Jodhpur.

Sylvia curruca blythi Ticehurst & Whistler [*Sylvia affinis* auct.].

Specimens collected :—14 ♂ 8-10-33 Pali; 21 ♂ 10-10-33, 35 ♂ 11-10-33, 121 ♂ 22-10-33 Hamavas Lake, Pali; 159 ♂ 3-11-33 Jalor; 241 ♀ 21-11-33 Sunda Hill, 3,400 ft.

Sylvia curruca minuta Hume.

Specimen collected :—219 ♀ 14-11-33 Bhinmal.

These two subspecies of the Lesser White-throat were 'excessively common' when Hume was collecting at Jodhpur in January and February. His paper contains very important notes on the discrimination and distribution of these two subspecies and of the allied *Sylvia althaea*.

Phylloscopus collybita tristis Blyth.

Specimens collected :—33 ♂ 11-10-33, 39 ♀ 12-10-33, 140 sex ? 25-10-33 Hamavas Lake, Pali; 330 ♀ 21-12-33 Tilwara.

Phylloscopus griseolus Blyth.

Specimens collected :—252 ♂ 22-11-33, 263 ♀ 24-11-33 Sunda Hill, 3,400 ft.

Prinia gracilis lepida Blyth.

Hume says that the Streaked Wren Warbler was very common about Jodhpur but it was not procured by the Survey.

Prinia socialis stewarti Blyth.

This race of the Ashy Wren Warbler is said by Hume to occur in Jodhpur though he adds that it is nowhere common. It was not procured by the Survey.

Prinia sylvatica gangetica (Blyth).

Specimens collected :—239 ♂ juv. 21-11-33, 253-4 ♀♂ juv. 22-11-33; 258 ♂ 23-11-33, 265 ♂ juv. 24-11-33, 270 juv. 25-11-33, 272 ♀ 26-11-33, 278 ♀ juv. 27-11-33, 285 ♂ juv., 287 ♀ ad. 288 juv. 28-11-33 Sunda Hill, 3,400 ft.

These specimens of the Jungle Wren-Warbler are of particular interest in that they confirm my opinion, given in full in *Jour. Bom. Nat. Hist. Soc.*, xxxvi, 575, that birds from Mount Aboo could not be separated from those of the rest of northern India. Specimens were procured by Adam in the Koochamun jungles and by Dr. King at Jodhpur.

Prinia inornata terricolor (Hume).

Specimens collected :—28 ♂ 11-10-33, 47 ♀ juv. 12-10-33, 82 ♀ juv. 17-10-33, 86 juv. 18-10-33, 128 ♂ juv. 22-10-33 Hamavas Lake, Pali.

The specimens of the Indian Wren-Warbler are all either juveniles or adults in heavy moult and therefore cannot be identified racially with complete certainty. They presumably belong to the northern race.

Oriolus oriolus kundoo Sykes.

The Golden Oriole was not procured by the Survey. Hume however states that it is 'common in the eastern, rare in the western portions of Jodhpur'.

Pastor roseus (Linnaeus).

The Rosy Pastor is said by Hume to be common in Jodhpur in the cold weather. It was not procured by the Survey.

Sturnus vulgaris Linnaeus.

Hume says that the Starling is a very common visitor to Jodhpur but I have seen no specimens from the area and cannot say what race or races occur.

Temenuchus pagodarum (Gmelin).

Specimens collected :—11 ♀ 8-10-33 Pali ; 139 ♀ 25-10-33 Hamavas Lake ; 185 ♀ 6-11-33 Jalor.

Hume considered the Brahminy Mynah to be fairly common in Jodhpur.

Acridotheres tristis tristis Linnaeus.

The Common Mynah is not represented among the specimens collected by the Survey but Hume says it is common in the State.

Acridotheres ginginianus (Latham).

Hume says that the Bank Mynah is common in the State.

Ploceus philippinus philippinus (Linnaeus).

Specimens collected :— 13 ♀ 8-10-33 Pali, 22 ♀ 10-10-33, 40, 43, 44 juvs. 12-10-33 Hamavas Lake, Pali.

According to Hume the Baya is common during the rains but less plentiful and more local during the rest of the year.

Uroloncha malabarica (Linn.).

Specimens collected.—37 ♂ 11-10-33, 65 ♂ 66 ♂ 68 ♂ 15-10-33 Hamavas Lake ; 223 ♀ 14-11-33 Bhinmal.

Judging by the organs of the specimens collected the White-throated Munia was about to breed at Hamavas Lake.

Amandava amandava amandava (Linnaeus).

Specimens collected :—51-52 ♂♀ 13-10-33, 78 ♀ 16-10-33, 90-92 ♂♂♂ 18-10-33, 100-101 ♂♀ 19-10-33 Hamavas Lake, Pali.

The Red Avadavat was evidently breeding at Hamavas Lake as the males had the organs enlarged and the females were laying eggs.

Carpodacus erythrinus (Pallas).

Recorded by Hume for Jodhpur State.

Bucanetes githaginea crassirostris (Blyth).

Hume saw and obtained a single male of the Trumpeter Bullfinch near Jodhpur and it also occurs in Jaisalmer but the Survey failed to meet with it.

Gymnorhis xanthocollis transfuga Hartert.

Specimens collected :—71 ♂, 76 ♀ 16-10-33, 129 ♂ 22-10-33 Hamavas Lake, Pali ; 172 ♂ 4-11-33 Jalor.

These specimens of the Yellow-throated Sparrow are somewhat intermediate in colour between the typical race and *G. x. transfuga*, but they are on the whole closer to the latter.

Passer domesticus parkini Whistler.

Specimens collected :—217 ♀, 218 ♂ 14-11-33, 225 ♂ 15-11-33 Bhinmal.

No. 218 with a wing measurement of 81 mm. clearly belongs to the large race of the House-Sparrow. So the probability is that the other two birds, which are on the larger side of the overlap of measurements common to both *parkini* and *indicus*, belong also to *parkini*. No doubt it is a winter visitor here as I found a marked passage through Jhang in September (*Ibis*, 1922, 272).

Passer hispaneolensis (Temminck).

Adam informs us that he found the Spanish Sparrow very plentiful in the "Keggara" jungles near to the town of Koochamun during the cold season.

Emberiza stewarti Blyth.

Specimens collected :—264 ♀ 24-11-33, 280 ♂ 27-11-33, 283 ♀ 28-11-33, 291-2 ♂ ♀ 29-11-33 Sunda Hill, 3,400 ft.

The White-headed Bunting is of course only a winter visitor to Jodhpur.

Emberiza buchanani Blyth.

Specimens collected :—18 ♂ 8-10-33 Pali; 346 ♂ 5-1-34 Phalodi.

The Grey-necked Bunting was found 'in huge flocks' at Pali according to the label of the specimen. Adams procured specimens in the low range of hills close to Nawa and about Koochamun.

Emberiza melanocephala Scopoli.

Specimen collected :—143 ♂ 1-11-33 Jalor.

The survey specimen is completing an entire moult. Hume says that at Soojut (north-east of Pali) he found the Black-headed Bunting in 'simply millions' at the time of the spring harvest.

Emberiza icterica Eversmann.

Specimen collected :—179 ♂ 5-11-33 Jalor, 500 ft.

This bird is also completing an entire moult. Hume says that he procured the Red-headed Bunting at Soojut and Pali where it was closely associated with the Black-headed Buntings. Both species occurred in joint flocks.

Emberiza striolata striolata Lichtenstein.

Specimen collected :—196 ♂ 7-11-33 Jalor, 1,000 ft.

Hume met with the Striolated Bunting near Jodhpur but says that it was only found on the flanks of the rocky hills. Adams found it in the scrub jungles about the hills near to Nawa and Marot.

Melophus lathami subcristata Sykes.

Specimens collected :—268 ♂ 25-11-33, 276 ♂ 26-11-33, 293 ♀ 29-11-33 Sunda Hill, 3,400 ft.

Adam's collector found the Crested Bunting common in the Koochamun hills.

Riparia paludicola brevicaudata Horsfield.

According to Hume the Indian Sand Martin is found in Jodhpur but is comparatively rare.

Riparia concolor (Sykes).

Specimens collected :—190 ♀, 193 ♂ 7-11-33 Jalor, 1,000 ft.

Hume met with the Dusky Crag Martin near Jodhpur but says that it was rare. Adam obtained it near Mata Pahar and the western end of the Sambhur Lake, and at Mata Pahar it was found by Hume to be breeding.

Hirundo rustica rustica Linnaeus.

Specimen collected :—95 ♀ 19-10-33 Hamavas Lake.

Hume obtained the Common Swallow at Jodhpur in the winter. From his remarks (*S.F.*, iii, 451) it seems that the Eastern race *H. r. gutturalis* may also occur in Jodhpur.

Hirundo daurica erythropygia Sykes.

Specimens collected :—200-202 ♂ ♂ ♀ 8-11-33 Jalor.

All three specimens are completing an entire moult. Hume remarks that this Red-rumped Swallow is common during the rains in Jodhpur but rare in the hot season.

Hirundo daurica nepalensis Hodgson. [?].

Specimen collected :—93 ♀ 19-10-33 Hamavas Lake.
This is a poor specimen, probably immature, very worn and with the wings commencing to moult but it seems to me to belong to the Himalayan race of Red-rumped Swallow.

Motacilla alba dukhunensis Sykes.

The White Wagtail was procured by Hume at Jodhpur in the winter but the Survey did not obtain it.

Motacilla maderaspatensis Gmelin.

The Large Indian Wagtail is said by Hume to occur about Jodhpur town but only sparingly.

Motacilla cinerea caspica (S. G. Gmelin).

The Grey Wagtail is said by Hume to occur in Jodhpur.

Motacilla feldegg melanogriseus (Homeyer).

The Black-headed Wagtail is said by Hume to occur in Jodhpur.

Motacilla flava subsp ?

Specimens collected :—67 ♀ 15-10-33, 103 ♀ 19-10-33 Hamavas Lake.
It is not possible to identify these female wagtails subspecifically.

Motacilla citreola calcarata Hodgson.

Hume received the Yellow-headed Wagtail from Jodhpur.

Anthus trivialis Linnaeus.

Recorded by Hume from Jodhpur.

Anthus rufulus waitei Whistler.

Specimen collected :—230 ♂ 16-11-33 Bhinmal.
Hume remarks that he had received no specimen of the Common Indian Pipit from Jodhpur.

Anthus spinoletta blakestoni Swinhoe.

There are no Jodhpur examples in the British Museum but Hume recorded this species and the race may be inferred.

Anthus campestris (Linnaeus).

The Survey curiously enough did not procure the Tawny Pipit but Hume includes it in his Jodhpur list.

Melanocorypha bimaculata (Ménétries).

Specimens collected :—344-345 ♂♂ 4-1-34, 350-353 ♂♂♂♂ 5-1-34 Phalodi.

Calandrella brachydactyla longipennis (Eversmann).

Specimens collected :—145 ♂, 147-8 ♂♂ 1-11-33, 204-206 ♂♂♂ 10-11-33 Jalor; 226-7 ♂♀ 15-11-33 Bhinmal; 318 ♂ 19-12-33 Tilwara; 341-2 ♂♀ 2-1-34, 347 ♂ 5-1-34 Phalodi.
Hume found the Short-toed Lark very common at Jodhpur, and it is no doubt general and common as a winter visitor as King procured it at Pali on 16 September 1868 and Blanford got it east of Bahmir-Malani on 10 February 1876.

Alauda gulgula (Franklin).

Said by Hume to occur in Jodhpur.

Mirafra cantillans (Blyth).

According to Hume the Singing Bush-Lark occurs sparingly in the western parts of Jodhpur.

Mirafra erythroptera sindiana Ticehurst.

Specimen collected :—94 ♂ 19-10-33 Hamavas Lake.
Hume considered the Red-winged Bush-Lark common in Jodhpur.

Galerida cristata chendoola (Franklin).

Specimens collected :—319-321 ♀♀♂ Tilwara, R. Luni.
The Crested Lark was very common at Jodhpur according to Hume.

Ammomanes phoenicura (Franklin).

The Rufous-tailed Finch-Lark is said by Hume to be common in Jodhpur.

Eremopteryx grisea grisea (Scopoli).

Specimens collected :—17 ♀ 8-10-33 Pali ; 157-158 ♂♀ 3-11-33, 166 ♀ juv. 4-11-33, 177 ♀ 5-11-33, 207 ♀ 10-11-33, 209 ♂ imm., 210 ♀ juv. 10-11-33 Jalor ; 214 ♂ 13-11-33, 215 juv. 14-11-33 Bhinmal.
The above specimens of the Ashy-crowned Finch-Lark are intermediate in colour between the typical race and *E. g. siccata* but they are if anything closer to the typical race. Hume got no specimens of this Lark at Jodhpur but it was collected there by Dr. King and is said to be common.

Eremopteryx albicollis affinis (Blyth).

Specimens collected :—334-336 ♀♂♂ 1-1-34, 339-340 ♂♀ 2-1-34 Phalodi.
Hume found the Black-crowned Finch-Lark extremely common in the sandy wastes about Jodhpur and he says that it extends into Jaisalmer. He collected a good series and gives a detailed note on the various plumages.

Zosterops palpebrosa occidentis Ticehurst.

Specimens collected :—242 ♂ 21-11-33, 273 ♂ 25-11-33 Sunda hill, 3,400 ft. ; 303-4 ♂♀ 2-12-33 Jawar, Jaswantpura.

Cinnyris asiatica asiatica (Latham).

Specimens collected :—16 ♂ 8-10-33 Pali ; 114 ♂ 21-10-33, 135 ♂ 24-10-33 Hamavas Lake ; 315 ♂ imm. 5-12-33 Jawar, Jaswantpura.
Hume says of his specimens collected at Jodhpur that they are 'short-billed and green, closely approaching the *brevirostris* form'. He collected in a year of extreme drought which may have brought in birds from further west, but the specimens collected by the Survey appear to me to be closer to the typical form.

Chrysocolaptes festivus (Boddaert).

Adam collected a single specimen of the Black-backed Woodpecker in the Koochamun jungles.

Brachypternus benghalensis benghalensis (Linnaeus).

Specimens collected :—298 ♂, 300 ♂ 2-12-33 Jawar, Jaswantpura District.
These specimens of the Golden-backed Woodpecker definitely belong to the typical form. The bird is evidently not common as in the Sambhur area. Adam only saw one individual in the Koochamun jungles.

Dryobates mahrattensis aurocristatus (Tickell).

Specimens collected :—41-42 ♂ ♀ 12-10-33, 54 ♂ 14-10-33, 74 ♀ 16-10-33, 125 ♂ 22-10-33 Hamavas Lake ; 266 ♂ 25-11-33, 289-290 ♂ ♂ 29-11-33, 299 ♂ 2-12-33 Sunda Hill, 3,400 ft., Jaswantpura.

Hume also procured the Yellow-fronted Pied Woodpecker near Jodhpur.

Jynx torquilla torquilla (Linnaeus).

Specimens collected :—31 ♀ 11-10-33, 73 ♂ 16-10-33, 89 ♂ 18-10-33 Hamavas Lake ; 180 sex ? 5-11-33 Jalor ; 274 ♂ 25-11-33, 284 ♀ 28-11-33 Sunda Hill, 3,400 ft.

Hume procured the Wryneck at Pali in April.

Xantholaema haemacephala indica Latham.

Specimen collected :—296 ♀ 29-11-33 Sunda Hill.

Hume records the Crimson-breasted Barbet from Jodhpur State.

Hierococcyx varius Vahl.

Hume includes the Common Hawk-Cuckoo in his Jodhpur list as a monsoon straggler.

Clamator jacobinus (Boddaert).

Hume says that the Pied Crested Cuckoo is only found in Jodhpur in the rains.

Eudynamis scolopaceus (Linnaeus).

The Koel is included by Hume in his Jodhpur list.

Centropus sinensis (Stephens).

The Crow-Pheasant is included by Hume in his Jodhpur list.

Taccocua leschenaultii sirkee (Gray).

Specimen collected :—60 ♀ 14-10-33 Hamavas Lake.

The ovary of this Sirkeer Cuckoo was much enlarged as if the bird was just about to lay. Adam considered the Sirkeer rare as he only met and procured a pair in a patch of jungle near Marot. Dr. King obtained the bird at Jodhpur in the rains.

Psittacula krameri manillensis (Bechstein)

No specimen of the Common Indian Roller was preserved by the Survey but Hume includes it in his Jodhpur list.

Psittacula cyanocephala (Linnaeus).

The Blossom-headed Parrakeet is included in Hume's Jodhpur list.

Coracias benghalensis (Linnaeus).

No specimen of the Common Indian Roller was preserved by the Survey but Hume includes it in his Jodhpur list.

Coracias garrula semenovi Loudon and Tschusi.

Specimen collected :—24 ♀ 10-10-33 Hamavas Lake.

An immature specimen of the Roller, evidently on passage.

Merops orientalis orientalis Latham.

Specimens collected :—233-234 ♂ ♂ 16-11-33 Bhinmal.

Hume remarks that the Little Green Bee-eater was 'scarce' near Jodhpur in January and February.

Merops superciliosus persicus Pallas.

Specimens collected :—97 ad. ♀, 98 juv. ♂ 19-10-33 Hamavas Lake, Pali.
According to Hume the Blue-cheeked Bee-eater is a summer visitor only to Jodhpur. Adam found it common in the Marot hills.

Ceryle rudis leucomelanura Reichenbach.

Hume includes the Pied Kingfisher in his Jodhpur list.

Alcedo atthis pallasii Reichenbach.

Specimen collected :—59 ♂ 14-10-33 Hamavas Lake.
This specimen of the Common Kingfisher is an adult in complete moult but it appears to belong to the above migratory race and not to the resident *bengalensis*.

Halcyon smyrnensis Linnaeus.

The White-breasted Kingfisher was not procured by the Survey. Hume met with it by some little tanks near Jodhpur, though he called it 'very rare'.

Upupa epops epops Linnaeus.

Specimen collected :—12 ♀ 8-10-1933, Pali.
Hume also noted the Hoopoe at Jodhpur.

Micropus affinis (Gray).

The Common Indian Swift is included by Hume in his Jodhpur list.

Caprimulgus europaeus unwini Hume.

Specimens collected :—36 ♂ 11-10-33, 50 [♀] 13-10-33, Hamavas Lake.

Asio flammeus flammeus (Pontoppidan).

Specimens collected :—273 ♀, 238 ♂ 17-11-33, Bhinmal.

Strix occellata (Lesson).

Specimen collected :—312 ♂ 5-10-33 Jawar, Jaswantpura.

Ketupa zeylonensis leschenaulti (Temminck).

The Fish-Owl was not procured by the Survey but Hume saw and collected a single specimen near Jodhpur.

Bubo bubo bengalensis (Franklin).

Specimens collected :—85 ♀ 17-10-33 Hamavas Lake; 359 ♂ 12-1-34 Pichiak Lake, Bilara.
Hume considered the Rock Horned Owl rare in Jodhpur.

Bubo coromandus (Latham).

Specimen collected :—356 ♂ 12-1-34 Pichiak Lake, Bilara.
The Dusky Eagle-Owl is included in Hume's list.

Athene brama indica (Franklin).

Specimens collected :—20 ♂ 10-10-33 Hamavas Lake; 326 ♂ 21-12-33 Tilwara.
Hume met with the Spotted Owlet near Jodhpur.

Sarcogyps calvus (Scopoli).

Hume met with the King Vulture near Jodhpur and Adam mentions a rock nest in March in the hills near the town of Nawa.

Gyps fulvus fulvescens Hume.

Hume shot the Indian Griffin himself at Jodhpur.

Gyps indicus pallescens Hume.

Also procured by Hume at Jodhpur where it is apparently common. No specimens of Vultures were preserved by the Survey.

Pseudogyps bengalensis (Gmelin).

Noted by Hume near Jodhpur and apparently common.

Neophron percnopterus ginginianus (Latham).

The Egyptian Vulture is very common in Jodhpur State. Hume records it as of this form.

Falco jugger Gray.

Specimens collected :—307 ♂ 4-12-33 Jawar, Jaswantpura; 327 ♂ 21-12-33 Tilwara.

Hume met with the Lugger Falcon at Balmeer and Jodhpur but considered it rare.

Falco checquera Daudin.

The Torumti was noted by Hume near Jodhpur but no specimen was procured by the Survey.

Falco tinnunculus tinnunculus Linnaeus.

Specimen collected :—203 ♀ 8-11-33, Jalor.

Hume called the Kestrel rare in the neighbourhood of Jodhpur.

Aquila rapax vindhiana Franklin.

Specimens collected :—149 ♂ 1-11-33 Jalor; 228 ♀ 15-11-33 Bhinmal; 317 ♀ 6-12-33 Jawar, Jaswantpura; 325 ♂ 20-12-33 Tilwara.

Hume also records the Tawny Eagle from the neighbourhood of Jodhpur.

Aquila clanga Pallas.

Specimen collected :—360 ♀ imm. 14-1-34 Pichiak Lake, Bilara District.

The Large Spotted Eagle is included by Hume in his Jodhpur list.

Hieraëtus fasciatus fasciatus (Vieillot).

Specimen collected :—361 ♀ 14-1-34 Pichiak Lake, Bilara District.

Hume had a specimen of Bonelli's Eagle from the State.

Circaëtus ferox (S. G. Gmelin) [*gallicus* auct.].

Hume states that he took the nest and saw several specimens of the Short-toed Eagle in Jodhpur. For the change of the name of this Eagle see *Ibis*, 1934, p. 645.

Butastur teesa (Franklin).

Specimens collected :—311 ♂ 4-12-33 Jawar, Jaswantpura; 236 ♂ imm. 16-11-33 Bhinmal.

The White-eyed Buzzard is included by Hume in his list.

Haliaëtus leucoryphus (Pallas).

Pallas' Fishing Eagle is said by Hume to occur in Jodhpur but it is necessarily rare there.

Milvus migrans govinda Sykes.

No specimen of the Common Pariah Kite was brought back by the Survey but Hume includes the bird in his Jodhpur list and it is presumably common.

Elanus caeruleus vociferus (Latham).

Specimen collected :—171 ♂ 4-11-33 Jalor.
Included by Hume in his Jodhpur list.

Circus macrourus (S. G. Gmelin).

Specimen collected :—277 ♀ 26-11-33 Sunda hill, 3,400 ft.
The Pale Harrier is said by Hume to be common.

Circus aeruginosus aeruginosus (Linnaeus).

Specimen collected :—357 ♂ 10-1-34 Bilara.
Also said by Hume to be common but suitable jheels are scarce in the State.

Buteo rufinus rufinus (Cretzschmar).

Specimens collected :—322 ♀, 324 ♂ 19-12-33 Tilwara.
Hume found the Long-legged Buzzard 'rather scarce' in the neighbourhood of Jodhpur.

Buteo buteo burmanicus Hume.

Specimens collected :—255 ♂ 23-11-33, 282 ♂ 27-11-33 Sunda Hill, 3,400 ft.
In attributing these two Buzzards to the above race I am following conventional usage rather than any profound conviction of my own as the whole question of the identity of Indian Buzzards seems to be uncertain. No. 282 is the smallest Buzzard I have ever seen (bill from skull 32.5, wing 342, tail 182 tarsus 7.5 mm.) and smaller than the measurements given by Witherby for *vulpinus* (♂ wing 350-85 mm.) and by Hartert for *japonicus* (=*burmanicus*) (♂ wing 355-87 mm.). It seems to me equally likely to belong to either form. It will be remembered that Hume was very puzzled by a small Buzzard with a wing of 13.4 ins.=340 mm. obtained on the Brahmagherries. *S.F.*, x, pp. 159, 327 and 338.

Astur badius dussumieri (Temminck).

Specimens collected :—181 ♂ 6-11-33 Jalor ; 213 ♀ 13-11-33 Bhinmal.
Hume records the Shikra from Jodhpur but considered it local and absent from the more barren areas.

Accipiter nisus (Linnaeus).

Hume says that the Sparrowhawk occurs in Jodhpur but is apparently very rare.

Crocopus phoenicopterus chlorogaster (Blyth).

The Southern Green Pigeon is stated by Hume to occur in Jodhpur.

Columba livia subsp.

No specimen of the Blue Rock-Pigeon was procured by the Survey. Under the name of *intermedia* Hume stated that he found this species extraordinarily scarce in Jodhpur even though its killing was strictly forbidden. This was in a year of drought and he was informed that it was more common in normal years.

Streptopelia senegalensis cambayensis (Gmelin).

Streptopelia chinensis suratensis (Gmelin).

Streptopelia decaocto decaocto Frivalsky.

Oenopopelia tranquebarica tranquebarica (Hermann).

No specimens of doves were preserved by the Survey but Hume includes these four species in his Jodhpur list.

Pterocles orientalis (Linnaeus).

The Imperial Sandgrouse is said by Hume to be very common in Jodhpur and he describes (*Game Birds*, i, 49) how he came upon a pack of fully two thousand, grouped together in a clump little, if at all, more than thirty yards long by ten wide.

Pterocles indicus (Gmelin).

Adam found the Painted Sandgrouse common in the Koochamun Hills in March 1871 and gives a full account (*S.F.*, i, 391) of how he shot them over water there. He subsequently obtained eggs from that locality in April and May.

Pterocles alchata caudacutus (S. G. Gmelin).

According to Stuart Baker (*Game Birds*, ii, 283) the Large Pin-tailed Sandgrouse has been obtained in Jodhpur but no details are given.

Pterocles exustus ellioti Bogdanow.

The Common Sandgrouse is common in Jodhpur according to Hume.

Pterocles senegallus (Linnaeus).

Dr. Newman obtained the Spotted Sandgrouse at Pokurun and found it very common between that place and the town of Jaisalmer as well as throughout the country for about 20 miles south of Jaisalmer. This tract is hard and stony but intermingled with sand. A male skin and the wing of a female were sent to Butler in verification of this record (cf. *S.F.*, iv, 508 and v, 60).

Pavo cristatus Linnaeus.

In spite of the drought and famine Hume found a few Peafowl still at Jodhpur and he remarks that as the bird is more or less sacred in Rajputana it becomes very common wherever there is suitable cover.

Perdicula argoondah meinertzhageni Whistler.

Specimen collected :—1♀ 4-11-33 Jalor, 500 ft.

The Rock Bush-quail is said by Hume to be common. Either this or *P. asiatica* occurs in the Koochamun Hills.

Francolinus pondicerianus (Gmelin).

Included by Hume in his Jodhpur list.

Coturnix coturnix (Linnaeus).

In Hume's Jodhpur list.

Coturnix coromandelica (Gmelin).

According to Hume the Black-breasted quail is found in western Jodhpur only in the rains.

Turnix tanki tanki Blyth.

Hume states that the Button-quail has been obtained in Jodhpur towards the close of the rains in August and September.

Turnix sylvatica dussumieri (Temm. & Lang.).

The Little Button-quail is included by Hume in his Jodhpur list.

Gallinula chloropus (Linnaeus).

The Waterhen is given in Hume's list.

Porphyrio poliocephalus (Latham).

Very rare in Jodhpur (Hume).

Fulica atra Linnaeus.

Given in Hume's list.

Hydrophasianus chirurgus (Scopoli).

Given in Hume's list.

Rhynchaea benghalensis (Linnaeus).

Occurs in Jodhpur according to Hume but is more common in the rains.

Grus grus (Linnaeus).

The Common Crane is more or less common in the cold season according to Hume.

Antigone antigone (Linnaeus).

Common in Jodhpur according to Hume.

Anthropoides virgo (Linnaeus).

The Demoiselle is common in Jodhpur according to Hume. Adam mentions seeing a flock near Nawa on 13 March 1873.

Choriotis nigriceps (Vigors).

In Hume's day the Great Bustard was 'uncommon' in Jodhpur.

Chlamydotis undulata macqueenii (Gray)

Common in Jodhpur (Hume).

Sypheotides indica (Miller).

Common in Jodhpur as a rain's visitor according to Hume.

Burhinus oedicnemus saharae (Reichw).

Specimen collected :—96 ♂ 19-10-33 Hamavas Lake, Pali.

Adam says that he met with the Stone-curlew in the scrub jungle near to Mata Pahar and in the low range of hills to the west of Nawa; in the latter place he saw a party of four. Mack-worth-Praed and Grant (*Ibis.*, 1936, p. 200) have come to the same opinion which I reached independently that *saharae* and *astutus* are only sandy and greyish phases of the same bird, phases which Ticehurst has suggested (*Ibis.* 1937, pp. 406-407) may have some connection with soil and locality as in the case of various larks. Bates' suggestion (*Ibis.*, 1937, p.308) that the sandy phase was connected with immaturity is refuted by this specimen which is very sandy in colour and is an adult undergoing the complete post-nuptial moult.

Esacus recurvirostris (Cuvier).

The Great Stone Plover is found in saitable river beds in Jodhpur (Hume).

Cursorius cursor (Latham).

According to Hume the Cream-coloured Courser replaces the next species throughout the greater part of Jodhpur.

Cursorius coromandelicus (Gmelin).

Hume notes that he saw the Indian Courser near Jodhpur town.

Larus brunneicephalus Jerdon.

Chlidonias leucopareia indica (Stephens).

Gelochelidon nilotica (Gmelin).

Sterna aurantia Gray.

Hume notes that these 4 species occur in Jodhpur.

Squatarola squatarola (Linnaeus).

'In Jodhpur I do not know of its occurring except when migrating in autumn and spring when stragglers are met with at many large pieces of water' (Hume).

Leucopolius alexandrinus (Linnaeus).

Included on Hume's authority.

Charadrius dubius jerdoni (Legge).

Specimen collected :—5 ♂ 8-10-33 Pali.
According to Hume the Little Ring Plover is common in Jodhpur.

Cirrepedesmus mongolus (Pallas).

Cirrepedesmus leschenaultii (Lesson).

According to Hume both these Plovers may be met on migration in Jodhpur between 15 August and 15 September or during April and May.

Pluvialis dominicus fulvus (Gmelin).

Hume states that he has only seen one specimen of the Eastern Golden Plover from Jodhpur and that was taken at Pali.

Vanellus vanellus (Linnaeus).

Adam says that he only saw the Lapwing twice at a lake near Koochamun and only obtained one specimen.

Chettusia gregaria (Pallas).

A cold weather visitor and common according to Hume.

Chettusia leucura (Lichtenstein).

Included in Hume's list.

Lobivanellus indicus (Boddaert).

Although the Red-Wattled Lapwing was not procured by the survey it is common in Jodhpur according to Hume and during the drought he found a pair or two about every hamlet. The little village ponds, around which these birds usually live, were then empty and Hume describes in amusing language how they had in consequence betaken themselves to the village Golgathas, living on the maggots and the flesh of the carcases of dead animals.

Himantopus himantopus (Linnaeus).

Common (Hume).

Recurvirostra avocetta Linnaeus.

Comparatively rare in Jodhpur (Hume).

Numenius arquata Linnaeus.

Rare in Jodhpur where the localities suited to it are few (Hume).

Limosa limosa (Linnaeus).

Common according to Hume.

Tringa stagnatilis (Bechstein).

Not uncommon in suitable localities in Jodhpur (Hume).

Tringa glareola Linnaeus.

Tringa totanus (Linnaeus).

Tringa erythropus (Vroeg).

Glottis nebularia (Gunnerus).

These four species are all included by Hume in his list.

Philomachus pugnax (Linnaeus).

The Ruff is common according to Hume.

Erolia minuta (Leisler).

Erolia temminckii (Leisler).

Both these Stints are included in Hume's list.

Capella gallinago (Linnaeus).

Lymnocryptes minutus (Brünnich).

Both these Snipe are included in Hume's list, the former being said to be common.

Pelicanus philippensis Gmelin.

Hume includes the Spot-billed Pelican in his Jodhpur list.

Phalacrocorax carbo (Linnaeus).

Included in Hume's list.

Phalacrocorax fuscicollis Stephens.

Dr. King noted the Indian Shag from Jodhpur but Hume says that he personally had not examined any specimen from there.

Phalacrocorax niger (Vieillot).

Said by Hume to be common in suitable localities.

Anhinga melanogaster Pennant.

Included in Hume's list.

Platalea leucorodia Linnaeus.

Threskiornis melanocephalus (Latham).

Pseudibis papillosus (Temm. & Laug.).

All three species are included by Hume in his list apparently as more or less common birds.

Plegadis falcinellus (Linnaeus).

'Very rare in Jodhpur' (Hume).

Querquedula querquedula (Linnaeus).

Spatula clypeata (Linn.).

Netta rufina (Pallas).

Nyroca ferina (Linnaeus).

Nyroca rufa (Linnaeus).

Nyroca fuligula (Linnaeus).

The above ducks are all included by Hume in his Jodhpur list.

Podiceps ruficollis capensis Salvadori.

Finally the Little Grebe is also included by Hume in his Jodhpur list.

Ciconia ciconia (Linnaeus).

Hume did not think the White Stork was very rare in parts of Jodhpur suited to its tastes.

Ciconia nigra (Linnaeus).

The Black Stork has been obtained in Jodhpur (Hume).

Xenorhynchus asiaticus (Latham).

Rare in Jodhpur (Hume).

Leptoptilos dubius (Gmelin).

Hume says that the adjutant in his day was scarcely seen in Jodhpur except during the rains, but I imagine that it is no longer found there.

Ibis leucocephalus (Pennant).

Common in Jodhpur according to Hume.

Anastomus oscitans (Boddaert).

Hume says that the Open-bill is not uncommon in Jodhpur.

Ardea purpurea Linnaeus.

Ardea cinerea Linnaeus.

Egretta alba (Linnaeus).

Egretta garzetta (Linnaeus).

Bubulcus ibis coromandus (Boddaert).

Ardeola grayii Sykes.

Butorides striatus javanicus (Horsfield).

Nycticorax nycticorax (Linnaeus).

All the above species of Heron are included by Hume in his Jodhpur list.

Phoenicopterus ruber Linnaeus.

According to Hume Dr. King obtained the Flamingo at Pali in October.

Sarkidiornis melanotus (Pennant).

The Nukta is common in Jodhpur according to Hume.

Dendrocygna javanica (Horsfield).

Very rare in Jodhpur (Hume).

Casarca ferruginea (Pallas).

Occurs in Jodhpur (Hume).

Anas platyrhyncha (Linnaeus).

'I have only seen one killed in Jodhpur near Pallae' (Hume).

Anas poecilorhyncha Forster.

Chaulelasmus streperus (Linnaeus).

Nettion crecca (Linnaeus).

Dafila acuta (Linnaeus).

Querquedula querquedula (Linnaeus).

Spatula clypeata (Linn.).

Netta rufina (Pallas).

Nyroca ferina (Linnaeus).

Nyroca rufa (Linnaeus).

Nyroca fuligula (Linnaeus).

The above ducks are all included by Hume in his Jodhpur list.

Podiceps ruficollis capensis Salvadori.

Finally the Little Grebe is also included by Hume in his Jodhpur list.

ON A NEW COCCIDIUM *ISOSPORA MINUTA* n. sp. FROM THE INTESTINE OF A COBRA *NAJA NAJA* LINN.

BY

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(*From the Dept. of Zoology, University of Calcutta*).

(*With three text-figures*).

INTRODUCTION.

In July 1935, some specimens of Cobra *Naja naja* bought from local dealers who captured them from Sunderbans, Bengal, were examined. Oocysts of a coccidium belonging to the genus *Isospora*, were directly recovered from the natural droppings and rectal contents on dissection of some of the specimens kept in captivity. From the literature on the subject the following species of *Isospora* from snakes are found to have been recorded:— *Isospora* sp. Grassi (1881) from *Coronella austriaca*; *I. laverani* Hagenmuller (1898) from *Coelopeltis lacertina; I. fragilis* Leger (1904) from *Vipera aspis; I. crotali* (Triffitt, 1925) Hoare from *Crotalus confluentus; I. neivai* Pinto and Maciel (1929) from *Bothrops jararaca; I. naiae* Fantham (1932) from *Naja flava; I. dirumpens* Hoare (1933) from *Bitis arietans; I. phisalix* Yakimoff and Gousseff (1934) from *Elaphe quatuor lineata sauromotes; I. lenti* Pinto (1934) from *Bothrops jararaca*.

The development of the oocysts of this coccidium took place outside the body of the host and thus it differs from *I. dirumpens* Hoare in which the oocysts become mature in the wall of the intestine (intra and sub-epithelial regions). It also differs from *I. naiae* Fantham by the absence of oocystic residue and the presence of sporocystic one. This parasite obtained from cobra differs from other known species of *Isospora* from snakes by its shape, size and nature of the oocysts and the name *Isospora minuta* n. sp. is proposed for it.

MATERIAL AND METHODS.

Rectal contents diluted with saline was examined systematically in sealed preparations. The oocysts were transferred to 1 per cent chromic acid solution where the development was completed in three days. Portions of the intestine were fixed in Buin's fluid and then cut sections 6 μ thick and stained in Heidenhain's hæmatoxylin. Measurements of oocysts were taken from samples both fresh and in chromic acid solution.

OBSERVATIONS ON *Isospora minuta* n. sp.

In the sub-epithelium of the sections of the intestine oocysts were found with two sporocysts containing ripe sporozoites (Fig. 1).

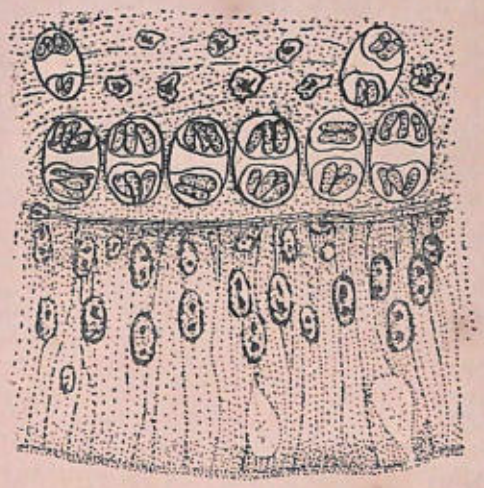


Fig. 1

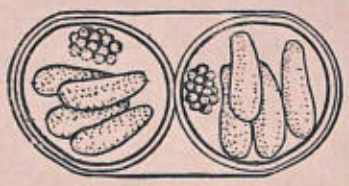


Fig. 2

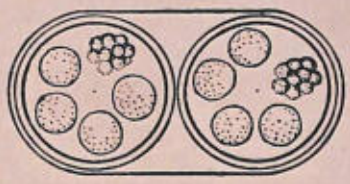


Fig 3

Isospora minuta n. sp.

(For explanation see end of article).

No other endogenous stages were observed. The fully matured oocysts in chromic acid solution measure $15 \times 7.5 \mu$ (Fig. 2). The oocystic membrane is very thin and there is no oocystic residue. The two thick-walled sporocysts (Fig. 3) are spherical and measure 7.5μ in diameter. A small sporocystic residue is present. The sporozoites are arranged in a regular manner and lie on one side of the small sporocystic residue. The presence of innumerable mature oocysts in the sub-epithelium and the total absence of a single ripe oocyst or any sporocysts in the fæces and the absence of the other endogenous stages of the parasite may be accounted for. In one stage in the life of this parasite the ripe sporozoites by rapturing the sporocystic wall, may infect the neighbouring cells and then by some of them oocysts are formed which come out with the fæces to infect a new host.

Diagnosis.— Systematic position *Isospora minuta* n. sp. (Coccidiida, Eimeriidae).

Oocysts very small, thin-walled, development extra corporal, no oocystic residue; sporocyst spherical, thick-walled; small sporocystic residue present; unsegmented oocysts discharged from host; sporulation time 3 days.

Habitat.—Small intestine of cobra *Naja naja*.

Locality.—Sunderbans, Bengal.

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Explanations of Figures.

All the drawings were made under camera lucida.

1. Section of intestine with sporoblasts containing sporozoites. ×750.
2. Mature thin-walled oocyst with two thick-walled spherical sporoblasts. ×2700.
3. Oocyst with two sporoblasts each containing 4 ripe sporozoites and a small residue. ×2700.

THE BIRDS OF RAMESWARAM ISLAND.

BY

C. H. BIDDULPH

(*With a map*).

Rameswaram Island, situated at the southern end of the Ramnad District in the Madras Presidency and forming the Indian end of Adams Bridge between India and Ceylon, is of importance, other than as regards the bird life which is found on it. Besides being a spot venerated by Hindus it is the terminus, at the Indian end, of the Indo-Ceylon rail connection between Dhanushkodi and Talaimannar.

The island, which is roughly triangular in shape, is approximately seventeen miles in length and seven miles in width at the widest part. It is separated from the mainland of India by the Pamban Pass which is something over a mile in width and is bridged to enable trains to cross over to the island and proceed to the rail terminus at Dhanushkodi.

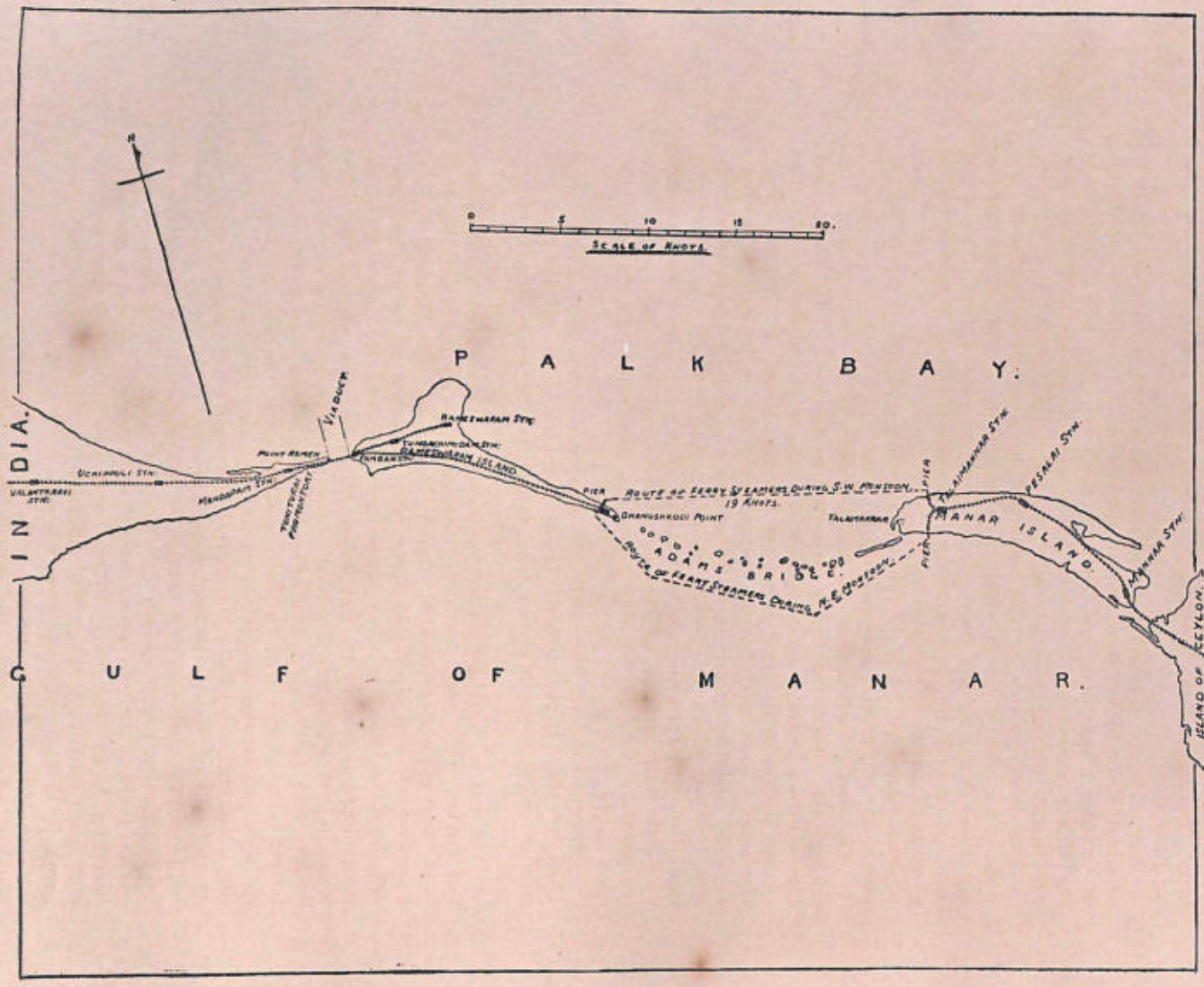
The northern half of the island is really the only portion with any appreciable width and elevation above the sea and is sparsely covered with trees and vegetation, the vegetation being thicker where the swamps and backwaters occur. Practically the entire southern half consists of bare sandy plains and sand hills, which are continually moving during the heavy seasonal winds. The vegetation in this area consists of a few babool trees with coarse grasses and a few stunted bushes.

The common trees are the tamarind, neem, casuarina and mango with coconut and palmyrah palms. All the above have been planted by the inhabitants of the island. The remaining vegetation, which has not been cultivated, consists of babool trees, dwarf date palms, screwpine, various thorn bushes, creepers, mangrove in the swampy areas, cactus in the drier areas and various varieties of coarse grasses, which in some parts cover considerable areas.

All the commoner birds are found in the northern, or wooded half of the island, whereas the southern half is admirably suited to the Plovers, Gulls, Terns, Flamingoes and Waders. The Flamingoes are restricted to the extreme southern end of the island, where it tapers to a point and the low-lying sand flats become shallow lagoons during the north-east monsoon.

Apart from the bird life the island is singularly devoid of animals, squirrels and mongooses only being seen. The only reptiles observed were the common bloodsucker and a few rat and water-snakes.

The sea surrounding the island is one of the few areas in which the Dugong is found and occasionally caught by the fishermen. Turtles, both Green and Hawk-billed, are also caught in fairly



Birds of Rameswaram Island.

large numbers; the former for food and the latter for the tortoise shell.

The average rainfall for the past sixty years is 36.81 inches, of which 27.90 inches is accounted for during the north-east monsoon in October, November and December. June, July and August are the driest months of the year, the rainfall being under an inch per month during this period.

The heavy winds at the time of the south-west monsoon are responsible for a great deal of the drifting sand which forms big sand-dunes which move from west to east across the island until anchored by encountering trees and being covered by a growth of grasses and shrubs.

The island is fairly healthy except for malarial fever which is prevalent at certain seasons of the year.

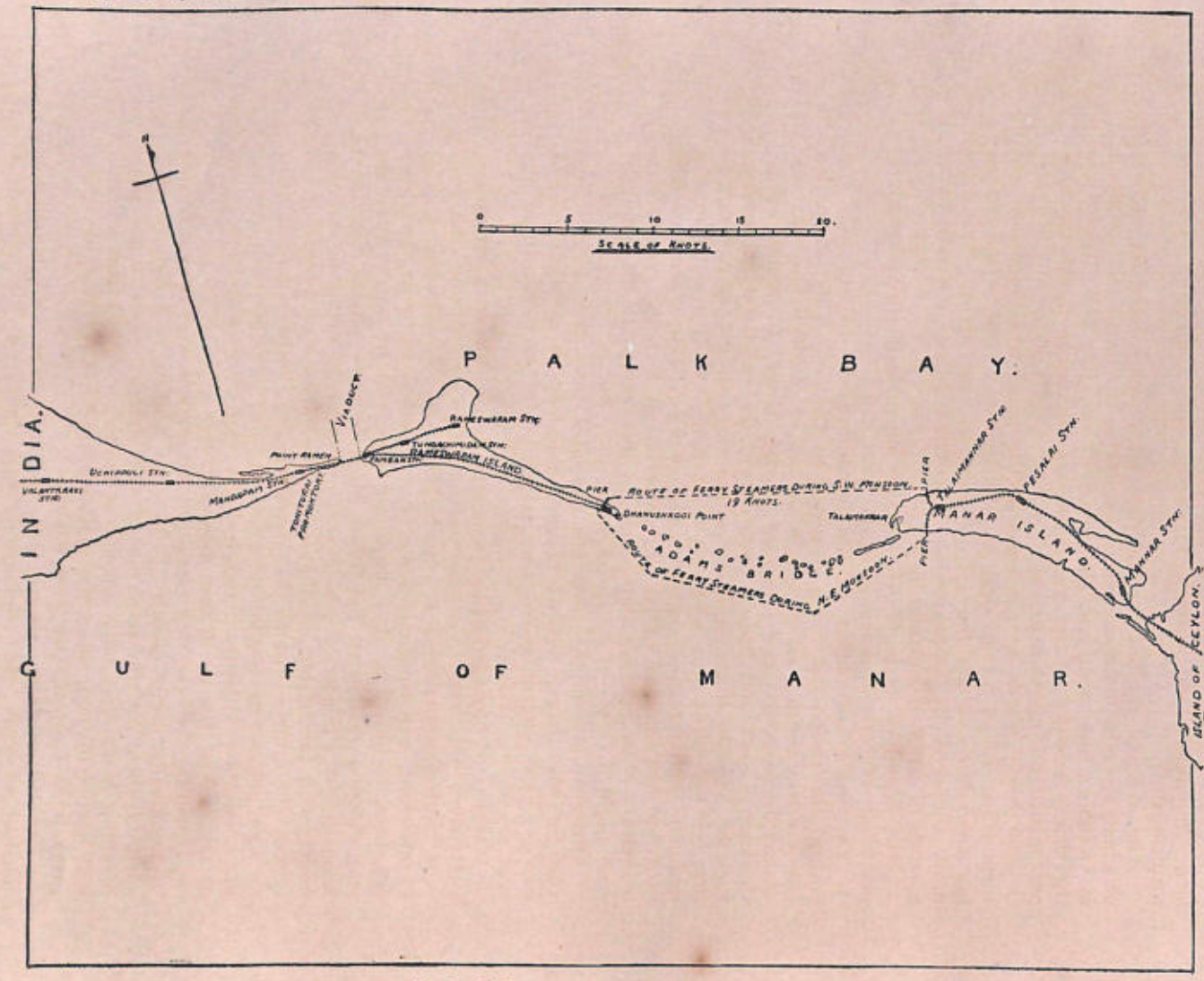
The main occupation of the inhabitants is fishing and fish curing, the salted fish being exported to Ceylon. This occupation has a direct bearing on a certain section of the bird life. At this season there is a large influx of Pariah Kites, Brahminy Kites, Common Crows and Jungle Crows from the mainland. They can then be seen in large numbers where the fish are spread out to dry. These birds are seen each morning flying over from the mainland and returning again in the evening. These non-resident birds do not appear to consider the island a home, or even a temporary home, during this period as they return to the mainland each night.

Observations of the bird life extended over the period June 1929 to May 1931, records being maintained of all the resident species, local migrants and true migrants for each month of the year.

The list of birds furnished is not to be considered as complete, but covers only such birds as were readily seen during the two-year period under review. Such birds as the Golden Oriole, Coppersmith and Spoonbill have been reported to occur, but have not been included as they were not observed by me. Attention was directed mainly to the water birds because of the restricted area in the Presidency where their movements could be studied under such favourable conditions. These birds appear to find the island admirably suited to their requirements, both as a permanent or semi-permanent feeding ground, as also a convenient resting place on their journeys through India to Ceylon and back again at the end of the north-east monsoon.

It will be observed that certain of the waders have been recorded in practically every month of the year and it is presumed that such of them as are seen during the summer months are non-breeding birds that have found conditions on the island suitable and have remained, when the majority have left for their breeding grounds in Central Asia and Siberia.

The list of birds shows that the permanent bird population consists of only the commoner birds seen on the plains of the mainland of India, but there appears to be scope for a detailed examination of all the resident birds, as also the local migrants, as there would be every possibility of finding inter-



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mediate races between the true Indian and Ceylon forms on the island.

It is regretted that a series of skins of all the birds under these classes was not secured at the time, as a detailed paper was not contemplated with a view to establishing the existence of local races, but merely to cataloguing the number of species found on this small island. This paper may be considered as an introduction to a more detailed examination of the resident bird life on the island by an investigator with more time at his disposal, who can obtain a series of skins for comparison with collections of skins from India and Ceylon already available in the British Museum collection.

A perusal of the articles in the Bombay Natural History Society's *Journal*, in connection with the 'Vernay Scientific Survey of the Eastern Ghats', shows that considerable information is still required in connection with some of the commonest birds found in the Madras Presidency. It is hoped that information furnished against some of the species found on Rameswaram Island may in a measure supplement what has so far been placed on record. In Volume xxxv, No. 3, page 505 of the *Journal*, in the first article in connection with the Survey the attention of members has been drawn to this lack of knowledge and it is felt that although Rameswaram Island lies outside the actual area of the Eastern Ghats that it is still one of the interesting areas where careful bird-watching will result in clearing up some of the problems before investigators interested in a detailed study and comparison of the birds of India and Ceylon.

The only other reference to a study of the bird life of Rameswaram Island which I have been able to find, through references given in the published accounts of the Vernay Scientific Survey, is a list of twenty-four birds secured by Doctor Armstrong near Pamban in March 1875. The skins of these birds were sent to Hume and published in *Stray Feathers*, 1876, pp. 457-459. Twenty-three of these birds have been marked with an asterisk in the list of birds now furnished.

One bird, *Otocompsa emeria fuscicaudata*, appears unusual as it was never seen on the island by me and is practically a permanent resident in the hills. It may be presumed that the bird secured was a very rare stray migrant or else an escaped cage-bird which had been brought to the island.

I have to acknowledge reference to the *Manual of the Birds of Ceylon* by W. E. Wait of the Ceylon Civil Service, from which I have quoted in certain instances where it is thought that observations recorded in the case of the Ceylon birds confirmed those of the birds from Rameswaram Island; or accounted for certain uncommon birds which may have come, or been blown over from Ceylon during the monsoons.

I have also to acknowledge the valuable assistance and advice given me by Mr. N. B. Kinnear, M.B.O.U., of the British Museum of Natural History, South Kensington, in the preparation of this paper. It was with his permission that I was able to consult reference books in the Museum Library and study the valuable

collection of birds' skins secured by the collectors of the Vernay Scientific Survey of the Eastern Ghats of the Madras Presidency.

In this paper Rameswaram Island has been considered as lying with its longest length due north and south; actually the map shows that it lies almost due east and west. It is however not considered sufficiently important to alter the notes to agree with its actual situation.

The Jungle Crow *Corvus macrorhynchos culminatus* (Sykes).

A common bird seen everywhere on the island. Greater numbers are seen during the months of May and June and again in August and September when fish curing operations are in progress.

A pair of these birds were seen building a nest on a palmyrah palm on 12-6-1930.

The Common House Crow *Corvus splendens splendens* (Vieillot).

A common bird seen everywhere on the island. As in the case of the Jungle Crow much larger numbers are observed on the island during the months of May and June and August and September.

The birds breed freely on the island and five nests were seen in June 1929. Coconut palms were used in two instances, casuarina trees in two instances and one nest in a tamarind. In one case the nest was only 9 feet off the ground in a casuarina tree. In every instance the birds were sitting on the nests and four eggs were taken from one of the nests in a coconut palm on 11-6-1929. Three of the eggs were heavily incubated but the fourth, which was much smaller, was practically fresh and was thought to be that of a Koel. It will be noticed however that Koels have only been observed on the island during the months of October, November and December.

Crows were again seen building in September and on 1-10-1930 a nest with young was seen in the steel lattice jib of the pier crane at Dhanushkodi.

Baker and Inglis in *The Birds of Southern India* give the breeding season of the Crow as February to August.

***The White-headed Babbler** *Turdoides striatus polioplocamus* (Oberholser).

A common bird found in the northern half of the island. These birds are more in evidence during the months of July, August and September.

***The Common Babbler** *Argya caudata caudata* (Dumont).

A fairly common bird, but not nearly so common as the preceding species. They are seen in small parties, in every month of the year, in the northern half of the island.

***The Ceylon Iora** *Ægithina tiphia zeylonica.*

A fairly common bird in the northern half of the island. The birds seen are generally very dark in colour and are almost certainly the Ceylon Iora, although this matter cannot be settled satisfactorily until a series of skins has been examined.

The Red-vented Bulbul *Molpastes cafer cafer* (Linn.).

A common bird seen in the northern half of the island. These birds are more in evidence during the months of November, December, January and February.

The Yellow-browed Bulbul *Iole icterica* (Strickland).

A fairly common bird seen moving about the undergrowth, in small parties, in the northern half of the island. The numbers seen are fairly constant for every month of the year.

A bird was shot on 29-9-1930 for purposes of identification.

The Black-backed Indian Robin *Saxicoloides fulicata fulicata* (Linn.).

A rare bird on the island as a male of this species was only once seen on 31-1-1930.

It is reported as abundant all over the low country in Ceylon and may have been a stray bird blown over during the heavy winds of the north-east monsoon.

***The Magpie Robin** *Copsychus saularis ceylonensis.*

A very uncommon bird only seen on two occasions in May and August. On each occasion only a single bird was seen in the northern half of the island.

Hume however had a skin which was obtained from Pamban in March 1875.

The Red-breasted Flycatcher *Siphia parva albicilla.*

A rare bird seen during the month of October near Rameswaram town in the thick babool scrub jungle. Four birds were seen on the same day.

It is suggested in the account of the 'Vernay Scientific Survey of the Eastern Ghats' that this bird should be omitted from the Madras Presidency list. I am of the opinion however that it should be considered one of the Presidency birds as it has been frequently seen by me in the Villupuram, Tanjore and Madura Districts during the winter months.

Wait remarks that it would appear to migrate down the centre of the Indian peninsula and that it has been observed in the Deccan in October.

***The Paradise Flycatcher** *Tchitrea paradisi paradisi* (L.).

A fairly common bird seen in the northern half of the island in gardens near dwellings at Pamban. Usually seen during the months of October, November, December and January. I have a single record of one seen on 29-3-1930, which appears to be late for the island.

None of the pure white and black males were observed, nor did any of the males have the median chestnut tail feathers fully developed.

Reported by Wait as only being seen in its white and black plumage on one occasion although a common resident bird in Ceylon.

The Bay-backed Shrike *Lanius vittatus* (Valenciennes).

A fairly common bird seen in the northern and central portions of the island where it was drier and babool trees and thorn bushes were found. The numbers appear to increase during the months of July, August and September.

The Grey-backed Shrike *Lanius schach caniceps* (Blyth).

A fairly common bird which is seen in the same areas as the preceding one, but not in the same numbers. My notes do not record the bird in the month of September, but this may be due to the one or two birds usually seen being in some other part of the island during that month.

***The Common Wood Shrike** *Tephrodornis pondicerianus pondicerianus* (Gmelin).

An uncommon bird on the island, three being the greatest number seen on a single day. Usually found in the same area as the two preceding species.

My records show that these birds were not observed on the island during the months of March, April and May and again in November and December.

Hume records this bird from the island in March 1875. There appears to be no reason why it should not be resident.

The Large Indian Cuckoo Shrike *Graucalus javensis macei* (Lesson).

An uncommon bird only seen during the months of January and February and in a single instance one was observed in October.

Three birds was the largest number seen on any single day. It is possible that the birds seen on the island were the Ceylon type *Graucalus macei layardi*.

***The Ashy Swallow Shrike** *Artamus fuscus* (Vieillot).

A fairly common bird which is seen almost everywhere on the island where palmyrah palms are growing. These birds are very numerous during the period June to September, the numbers falling off considerably during the remaining months of the year. The fewest birds are seen during the period January to March.

Reported as appearing to be a partial migrant in parts of Ceylon.

***The Black Drongo** *Dicrurus macrocercus peninsularis* (Ticehurst).

A common bird seen over the greater part of the island. The numbers appear to increase during the period June to September and it is during the latter month that numbers of young birds are seen without their long outer tail feathers. The breeding season on the island would therefore agree with that shown by Baker and Inglis in *The Birds of Southern India*.

Some of the drongos on the island should be shot and examined as it is possible that the Ceylon Black Drongo may also occur.

***The Indian Tailor Bird** *Orthotomus sutorius guzurata* (Latham).

A bird which is not seen in any numbers due to its skulking habits and size. Birds were seen in every month of the year excepting November and December and this may have been due to the fact that they were keeping under cover during the north-east monsoon.

The Ashy Wren-warbler *Prinia socialis socialis* (Sykes).

This bird was not seen during the period February to May. It is never really common and three is the greatest number seen on any single day.

The Rosy Pastor *Pastor roseus* (Linn.).

These birds only visit the island during the winter months when they are seen in small flocks during December, January and February. Most birds are seen in the month of December.

It is thought that these birds are migrants on their way to Ceylon that spend as short a time as possible on the island due to the scarcity of suitable food.

Reported as a rather uncertain migrant to the north and west of the island of Ceylon.

***The Brahminy Mynah** *Temenuchus pagodarum* (Gmelin).

These birds only visit the island during the winter months. The scattered birds collect into small parties which are seen flying about in December and January. Usually seen in the northern and central parts of the island. No birds are seen during the period April to September.

The Common Mynah *Acridotheres tristis tristis* (Linn.).

A common bird seen practically all over the island.

A pair of these birds were seen entering a nest in a hole in a palmyrah palm on 21-6-1930.

The White-throated Munia *Uroloncha malabarica* (Linn.).

This bird was not seen during the summer months of April to September. A few were however seen on one occasion in June 1929.

The greatest number seen together was twelve, the usual being three or four birds. It cannot be considered to be a common bird on the island.

The Yellow-throated Sparrow *Gymnorhis xanthocollis xanthocollis* (Burton).

Seen on only one occasion on the island on 19-2-1931.
Reported as a mere straggler to Ceylon.

The House Sparrow *Passer domesticus indicus* (Jardine and Selby.).

A very common bird which is found wherever there are dwellings on the island. They have gathered in large numbers even at the extreme end of the island and nest in the verandahs of the Post Office building at Dhanushkodi during July and August. Large numbers also breed in dwellings at Pamban and Rameswaram town.

The Grey-headed Wagtail *Motacilla flava thumbergi* (Billberg).

A fairly common bird found on the island from September to March each year. They are never seen in great numbers and are usually found near the railway line in the lower and more sandy part of the island, frequenting the railway borrow-pits which contain water.

These birds are commonest during January and February, when from twenty to thirty may be seen in a single day.

It is observed in the account of the 'Vernay Scientific Survey' that it is suggested that these wagtails may reach Ceylon by way of the Andaman Islands. This is not considered by me to be the usual route as large numbers are seen during the period December to February, in the Tanjore District, which appear to be migrating. In some instances, especially in the evenings, flights consisting of from two to three hundred birds were seen resting on house tops and even on large trees before resuming their flight at sunset.

Reported as one of the commonest migrants arriving in Ceylon in September and abundant during the north-east monsoon.

***The Indian Pipit** *Anthus rufulus rufulus* (Vieillot).

A bird which is never really common, although a greater number are seen in December, January and February. This pipit is usually found in the southern half of the island where there are large areas of very flat land covered with coarse grasses.

The Madras Bush-lark *Mirafra affinis* (Jerdon).

A fairly common bird which is found practically all over the island, but more especially in the area referred to when dealing with the pipit.

There does not appear to be a period in the year when they are more numerous.

Sykes' Crested Lark *Galerida deva* (Sykes).

A fairly common bird which is found in the southern half of the island where there are large areas of level grass land.

Birds were not actually observed in May and November, but it cannot be assumed that they leave the island for two short periods in the year.

The Rufous-tailed Finch-lark *Ammomanes phoenicura phoenicura* (Franklin).

A fairly common bird which visits the island during the period May to October. It is usually found in the southern half of the island, although not entirely confined to that area as it is frequently seen along the railway line in the northern half. The largest numbers were seen in the months of July and October.

***The Ashy-crowned Finch-lark** *Eremopterix grisea grisea* (Scopoli).

A very common bird seen practically all over the island during every month of the year. Larger numbers appear to be seen during the period October to January.

***The Indian Purple Sunbird** *Cinnyris asiatica asiatica* (Latham).

A fairly common bird which is confined to the northern half of the island. Has not been observed breeding on the island although it must do so.

The Purple-rumped Sunbird *Cinnyris zeylonica* (Linn.).

A fairly common bird which is confined to the northern half of the island. More birds appear to be seen during the months of July, August and September.

Baker and Inglis in *The Birds of Southern India* state that the breeding season extends from January to March, whereas my observations on the island show that they breed from August to December. It would therefore be more correct to say, as Baker and Inglis do in the case of the Purple Sunbird, 'breeds practically all the year round in some portion or other of its habitat.'

5-8-1929. Nest with two fresh eggs on a babool tree.
19-11-1929. Nest with one fresh egg on a babool tree, about three feet off the ground.
2-12-1929. Nest being constructed on the end of a palmyrah palm leaf, about twelve feet off the ground.

'The Scientific Survey of the Eastern Ghats' mentions February, March, August and December as months during which breeding has been recorded in the Madras Presidency.

***The Southern Golden-backed Woodpecker** *Brachypternus benghalensis puncticollis* (Malherbe).

A fairly uncommon bird which has not been observed by me in March and November. It is possible that the bird found on the island is *intermedius*, the Ceylon race, but this can only be established by securing a series of skins. It may also be found that both birds occur on Rameswaram Island.

The Indian Plaintive Cuckoo *Cacomantis merulinus passerinus* (Vahl.).

A very uncommon bird seen during the period September to December in the northern and north-eastern portions of the island.

A very shy retiring bird which was occasionally seen when flying from one tree to another. One bird only was usually seen, but from my notes it is observed that on 19-11-1929 four birds were seen on the same day.

Reported as a migrant appearing during the north-east monsoon in Ceylon.

***The Pied Crested Cuckoo** *Clamator jacobinus jacobinus* (Boddaert).

A fairly common bird which was observed during all the months of the year excepting May. More birds appear to have been seen from August to February than in the other months of the year. Usually found in the northern half of the island in the scrub jungle.

A pair of these birds were seen mating on 29-3-1930.

The Koel *Eudynamys scolopaceus scolopaceus* (Linnaeus).

A fairly uncommon bird only observed during October, November and December. This period corresponds with the north-east monsoon and the birds were seen eating a red fruit on a creeper that was found growing on some of the bushes and babool trees at this season.

My notes show that on 24-10-1930 a Koel was seen flying from the mainland to the island across the Pamban Pass.

In the note on the Common House Crow a record is furnished, dated 11-6-1929, in which a fresh egg was found along with three hard-set eggs. This small egg exactly resembled a Koel's in size and colouring and would point to the presence of this bird on the island during June.

It is reported to be a resident bird in Ceylon.

***The Small Green-billed Malkoha** *Rhopodytes viridirostris* (Jerdon).

A fairly common bird which is seen skulking in the bushes and undergrowth in the northern half of the island. A couple of these birds can be seen any day in the year, although their numbers appear to increase during the period August to October, when from five to eight birds have been seen in a single day.

Reported as resident in Ceylon and breeding from January to November.

The Southern Crow Pheasant *Centropus sinensis parroti* (Stresemann).

While not being observed during five months of the year (i.e.) February, April, May, September and November I consider this bird is one of the more uncommon resident species on the island. Its skulking habits and the thick undergrowth in the northern half of the island must have accounted for its not having been recorded during the months previously referred to in the note.

Usually only a single bird is seen in a day, but there is a record in my notes of three having been seen on 17-12-1929.

The Green Parakeet *Psittacula krameri manillensis* (Bechstein).

A common bird which is seen practically all over the island.

These parakeets appear to breed during the months of January, February, March and June on the island as will be observed from the particulars furnished.

11-6-1929. Two birds seen entering a hole in a coconut palm, about ten feet off the ground, near Rameswaram town.
Another bird observed entering a hole in a coconut palm which was being gradually covered by a large sand-dune. The height of the hole above the sand-dune was only about five feet.

21-6-1929. Nest in a coconut palm near Rameswaram town containing two very young birds and one chipped egg, with the chick about to hatch.

31-1-1930. Two or three pairs of birds seen entering or leaving nest holes in coconut or palmyrah palms.

29-3-1930. Many birds seen entering and sitting at holes in palm trees.

19-2-1931. Several birds seen at nest holes in palm trees.

The above notes have been given in detail as it is noticed in the records of 'The Vernay Scientific Survey' that mention is made of the lack of precise details of the breeding of these birds in the Madras Presidency.

Baker and Inglis refer to February or March as the breeding season.

The Blossom-headed Parakeet *Psittacula cyanocephala cyanocephala* (Linnaeus).

A very uncommon bird only seen during May, July, August and September and then only in small numbers. The greatest number seen was five on 16-7-1930.

Usually seen sitting on the topmost branches of tall casuarina trees near Rameswaram town.

Reported as a resident bird on the island of Ceylon.

The Southern Indian Roller *Coracias benghalensis indica* (Linnaeus).

A common bird seen almost all over the island.

A nest with four young birds found in a hole in a palmyrah palm, about eight feet off the ground, on 21-6-1930. This date appears to agree with the period April to June given by Baker and Inglis in *The Birds of Southern India*.

The Little Bee-eater *Merops orientalis orientalis* (Latham).

A common bird which is seen all over the island. During July and August most of the birds appear to be without the two middle tail feathers, or these

feathers have not developed so as to be longer than the rest of the tail and with the narrow terminal portions visible. By September practically all the birds had these feathers fully developed.

The Blue-tailed Bee-eater *Merops superciliosus javanicus* (Horsfield).

A fairly common bird which is seen during the period September to March. When the birds commence arriving in September nearly all of them appear with the two middle tail feathers undeveloped. By December the majority still have these feathers undeveloped, although they can be seen growing out. Towards the end of January all birds have fully developed tails. It will be seen that these bee-eaters are about from four to five months behind the previous species in attaining the full adult plumage.

The Common Ceylon Kingfisher *Alcedo atthis taprobana* (Kleinschmidlt).

A fairly uncommon bird only seen during the period May to September on the island. Usually found near ponds in the northern half of the island and along the backwaters.

The White-breasted Kingfisher *Halcyon smyrnensis fusca* (Boddaert).

A fairly common bird which breeds on the island, selecting sand banks near some of the small streams. Details in my notes show that a pair were seen working on their nest hole on 21-1-1930 and two pairs were doing the same in another bank on 31-1-1930.

Baker and Inglis record the breeding period for Southern India to be from March to July. This period may be extended to from January to July.

***The Ceylon Hoopoe** *Upupa epops ceylonensis* (Reichenbach).

A fairly common bird seen all over the northern and central portions of the island.

Baker and Inglis give the breeding season as January to May, with the remark that the early months are on the plains and the later ones on the hills. It would appear more correct to extend this period to include the month of June and to omit the remarks about the later months being on the hills.

Breeding particulars :—

9-1-1931. A bird seen entering its nest in a hole in a stone wall.
21-1-1930. Bird seen carrying food in its beak and flying towards a building.
29-3-1930. Bird seen carrying food in its beak and flying towards a building.
21-6-1930. Bird seen carrying food in its beak and flying towards a building.

The Alpine Swift *Micropus melba bakeri* (Hartert).

This bird is found on the island during the periods December to March and again from August to October. Usually found in the central and southern portions of the island. The numbers increase from December to March when parties of from twenty to forty may often be seen seated on the telegraph wires alongside the railway line. The account of these birds in the 'Vernay Scientific Survey' is interesting as both Legge and more recently Phillips suggest that the birds that visit Southern India may be daily visitors from Ceylon, where it is resident in the higher hills.

The Palm Swift *Cypsiurus parvus batassiensis* (Griffith).

A common bird seen everywhere on the island where there are palmyrah palms. Most birds are seen during the period June to September.

The Common Indian Nightjar *Caprimulgus asiaticus asiaticus* (Latham).

A rare bird only seen on one occasion on 5-6-1929 in the scrub jungle in the northern end of the island and quite close to Pamban.

Reported as a resident bird in Ceylon.

***The Southern Spotted Owlet** *Athene brama brama* (Temminck).

A fairly common bird which is usually found near Pamban.

Hume procured a pair of skins of this bird which had been collected for him on 17-3-1875 near the town of Pamban.

A bird was seen seated in a hole in a palm tree on 30-1-1930, but it is not certain if it was breeding or merely using the hole as a shelter.

Although not seen by me in July, August and November it must be presumed that this was only due to the birds skulking habits and the fact that observations were not made on the island in the late evenings and nights due to the risk of fever.

The Osprey *Pandion haliaëtus haliaëtus* (Linn.).

Usually seen in the Pamban Pass during the period December to May. Birds were sometimes also seen in the extreme south of the island, flying along the coast line.

The birds seen were usually perched on navigation posts or discs in the Pamban Pass, from which they made their attacks on large fish as they went past.

The Jugger Falcon *Falco jugger* (Gray).

A very uncommon bird which was usually seen on the island during the period June to November. A single bird was also seen on 27-2-1930, this being an unusual month.

These birds were seen in the wooded portions of the island, as also along the sea coast and it is presumed that they visit the island at seasons when they are able to procure the smaller migrant waders.

***The Indian Kestrel** *Falco tinnunculus objurgatus* (Stuart Baker).

A moderately common bird which is seen on the island during the period October to March. It usually frequents the northern and central portions of the island, where it can be seen hovering over the more open grassy spaces on the look out for small birds, animals and reptiles.

On one occasion a single bird was seen at the extreme southern end of the island.

A skin of this bird was procured for Hume from Rameswaram island in March 1875.

The Greater Spotted Eagle *Aquila clanga* (Pallas).

A very uncommon bird seen on three occasions on the island, in the northern half, during the months of February, July and August.

The White-bellied Sea Eagle *Haliaëtus leucogaster* (Gmelin).

A fairly common bird which was seen in every month of the year but April round the coast of the island and occasionally inland. Only one or two birds at the most were seen on any single day, but they appeared to be more numerous during the period September to November. I have been unable to find any evidence of the bird nesting on the island. Nests have however been found at Cuddalore on the east coast of the Presidency and in two instances on 28-11-1933 and again on 22-11-1934 a single fresh egg was obtained.

A detailed note on this bird has been submitted to the Bombay Natural History Society as it was noticed that the information published in the reports of the 'Vernay Scientific Survey' did not furnish full details of the distribution and breeding season. This note will appear in the journal and should be read in conjunction with these particulars.

The Brahminy Kite *Haliastur indus indus* (Boddaert).

A very common bird seen all over the island throughout the year. The number of birds seen during the two periods May to June and August to September is very much greater than at other times and is due to the fishing

and fish curing operations then in progress. Most of the birds that appear at these times are non-resident birds which come over to the island from the mainland. The breeding season is mainly in January, the nests being built on coconut palms. Young birds, without the adult plumage, are commonly seen during July and August.

The Common Pariah Kite *Milvus migrans govinda* (Sykes).

A very common bird seen all over the island. The numbers increase during the same periods as recorded for the Brahminy Kite and for the same reason.

The breeding season on the island appears to be in March and again in September as my notes record a pair building on 18-2-1931 and two pairs building on 17 and 18-9-1929. In all three instances coconut palms were selected.

The Pale Harrier *Circus macrourus* (Gmelin).

An uncommon bird only seen during the period December to March. Usually seen flying over the marshy areas in the central and southern portions of the island. Two birds was the maximum number seen on any day.

The Marsh Harrier *Circus aeruginosus aeruginosus* (Linnaeus).

A fairly common bird which is seen on the island during the period October to June. As in the case of the Pale Harrier these birds are found flying over the grassy areas and marshy portions in the centre and south.

More birds are seen during November, December and January than at other times. Nine birds have been recorded in one day.

The Ceylon Shikra *Astur badius badius* (Temminck and Lang.).

A moderately common bird which has been recorded on the island during February, the period June to October and in the month of December. The largest number seen on any single day was two, in June 1929.

These birds are seldom seen on the island as they keep to the thicker babool and scrub jungle tracts in the northern part of the island.

The Indian Blue Rock-Pigeon *Columba livia intermedia* (Strickland).

A rare bird seen on two occasions on the island. A flight of about twenty being recorded on 25-10-1929 and a single bird on 9-1-1931.

The old temple at Rameswaram town is almost certain to have some resident birds which can hardly be considered to be wild, other than that they are ownerless.

The Ceylon Spotted Dove *Streptopelia chinensis ceylonensis* (Reichenbach).

A fairly common bird seen all over the northern or wooded area of the island. As some doubt existed as to whether the birds were *suratensis* or *ceylonensis* two birds were shot and measured. The result showed that it was the Ceylon Spotted Dove which was found on the island.

Length 10.5 inches. Wing 5 inches. Beak 0.63 inches.

The Indian Little Brown Dove *Streptopelia senegalensis cambayensis* (Gmelin).

A fairly uncommon bird which is found in small numbers in the northern half of the island during the period June to January. Most birds however are seen during the month of October.

***The Southern Grey Partridge** *Francolinus pondicerianus pondicerianus* (Gmelin).

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***The Southern Grey Partridge** *Francolinus pondicerianus pondicerianus* (Gmelin).

A fairly uncommon bird which has however not been recorded by me during the periods March to May and again in the months of September and October.

The Port Officer at Pamban shot three partridges on 5-6-1929 and one of them was only half grown, showing that these birds breed on the island.

The Banded Crake *Rallus eurizonoides amuroptera* (Jerdon).

A rare bird on the island as only one was seen on 31-1-1930 near a dense screwpine thicket adjoining a large pool of water.

Reported as a rare but constant migrant to Ceylon during the period October to February.

The White-breasted Waterhen *Amaurornis phoenicurus phoenicurus* (Pennant).

A fairly uncommon bird seen during the month of June on two occasions. and again during the period December to February. Usually found in the northern and central portions of the island near pools which have dense cover adjoining.

Reported as a resident bird in Ceylon.

The Indian Moorhen or **Waterhen** *Gallinula chloropus indicus* (Blyth).

An uncommon bird seen in small numbers during the months of June, December and January. Usually found in the same areas as the previous bird.

The Indian Stone Curlew *Burhinus oedicnemus indicus* (Salvadori).

An uncommon bird which is only found on the island during the period June to October and then only in very small numbers in the area where babool trees and scrub jungle is found. Six birds were seen together in a patch of scrub jungle on 17-6-1929. One was shot on 23-7-1929 for identification.

It is believed to be a resident bird in Ceylon.

The Great Stone Plover *Esacus recurvirostris* (Cuvier).

A fairly common bird on the island although it was not observed by me during the months of February, May and November. More birds were however seen during June and the period October to December.

Usually seen along the sea-shore at the southern end of the island, but not always confined to this area, as birds have been seen in the sandy scrub covered tracts in the centre of the island adjoining the railway line. Usually only two birds are seen together.

Two birds were shot at different periods for identification and on examining the stomach contents it was found to consist almost entirely of small sea crabs which had been broken up and swallowed. Even the large clippers of the crabs had been swallowed by these birds.

I have a note of a nest with two eggs having been found on the island in June 1928, but cannot say that the information is correct as I did not examine the eggs.

The Great Black-headed Gull *Larus ichthyaëtus* (Pallas).

A very uncommon bird seen during October and December on the island. One bird was shot for identification on 1-10-1930. A party of twenty was seen near the coast on 5-12-1929.

It is reported as an occasional storm-driven visitor to Ceylon during the north-east monsoon.

The Brown-headed Gull *Larus brunnicephalus* (Jerdon).

A very common bird seen on the island along the coast, at the southern end, during the period September to March. Only a few birds are seen during September and October, but in November the numbers increase until in December, January and February thousands are seen on the shallow lagoons on both sides of the line near Dhanushkodi.

A few birds were shot for identification on 18-12-1929 and were found to be feeding on small prawns which collect in considerable numbers in the shallow lagoons at this season.

When the birds arrive in August many still have the brownish black heads of the breeding season and again by the end of March many birds are seen to be assuming the breeding plumage.

The Yellow-legged Herring Gull *Larus argentatus cachinnans.*

A fairly common bird which is found on the island duirng the period September to March. The numbers gradually increase until a few hundreds are seen during the period October to December. The numbers are greatly reduced in February and March, but my notes show a return of these birds on 10-3-1931, which is a late date to see more than a few stray birds. Found in the same locality as the preceding species.

The Gull-billed Tern *Gelochelidon nilotica nilotica* (Gmelin).

A fairly common bird which is found during the period July to March. The numbers gradually increase, most birds being seen during the period October to February in the same area of the island as all the gulls. It is reported that some of these terns remain all the year in Ceylon.

The Indian Lesser Crested Tern *Thalasseus bengalensis bengalensis* (Lesson).

A common bird which has been seen on the island in all the months of the year except November. The greatest number of these birds is seen during the months of June and July and it is presumed that they are then breeding on the drier sandy portions at the southern end of the island.

Eggs have never actually been taken by me at the time the eggs of the Little Tern were found, but the shell of a typical Tern's egg, which was larger than the Little Tern's, was picked up in the same area. This egg had been opened at one end by a crow or rat and emptied.

The White-cheeked Tern *Sterna repressa* (Hartert).

A very rare bird on the island, only seen on two occasions in October 1929.

The Little Tern *Sterna albifrons* (Sub-sp. ?).

A common bird which has however not been recorded during the months of September and November. Found in large numbers all along the coast line of the island and in the breeding season on the drier sandy plains at the southern end. The numbers increase conisderably during the months of June and July, when practically all the birds are breeding.

Particulars of nests found are as follows :—

10-6-1929.	1 egg, fresh, no nest but merely a depression in the sand.
19-6-1929.	1 egg, slightly set, no nest but only a depression.
21-6-1929.	1 egg, fresh, no depression in the sand and egg almost covered by drifting sand.
29-6-1929.	1 egg, hard-set, the depression containing the egg was amongst a collection of bleached bones of a cow.
9-5-1930.	Birds appeared to be considering laying and could be seen leaving the sand singly or in pairs. No birds had laid at this time.
13-6-1930.	2 eggs, fresh, no nest but only depression in the sand.
13-6-1930.	2 eggs, slightly set, no nest, only the usual depression in the sand.

It is interesting to note in 1929 that in the case of four nests found only a single egg had been laid, whereas in 1930 both nests found had two eggs each.

Many more nests could have been found in the same area without any difficulty.

***The Turnstone** *Arenaria interpres interpres* (Linnaeus).

Although this bird is a migrant some non-breeding birds are seen during every month of the year. The period during which these birds are most numerous is August to March. The birds seen and shot in July and August were in their summer plumage, while all those shot in December were in their winter plumage. By May most of the birds were assuming their summer plumage.

Hume records this bird from the island in March 1875.

Always seen in the southern half of the island along the sea-shore in company with other waders. A few birds are however occasionally seen on rocks in the Pamban Pass.

***The Eastern Grey Plover** *Squatarola squatarola squatarola* (Linnaeus).

Although a migrant some non-breeding birds are seen during every month of the year. The period during which these birds are most numerous is October to January. Many of the birds have changed into their darker, or breeding, plumage by the beginning of May and in September the change back to their winter, or lighter, plumage is observed. By the first week of October only one bird was seen in its darker plumage.

The Kentish Plover *Leucopolius alexandrinus alexandrinus* (Linnaeus).

A very rare bird that was seen on only two occasions, along with Sand Plovers, during September 1930. As the birds were not shot for identification it is not possible to say if they were of the sub-species *leggei*.

Jerdon's Little Ring Plover *Charadrius dubius jerdoni* (Legge).

A fairly common bird which was not observed in July and November. As however observations of their breeding on the island were recorded in June it must be assumed that the birds were on the island with their young in July.

These birds are reported to breed in Ceylon in June. Although they breed on Rameswaram Island in June most birds are seen in the period December to February. The numbers appear to increase somewhat in May.

Two nests were found on 10-6-1929. One nest had one and the other two eggs; the eggs in both nests being fresh.

The Lesser Sand Plover *Charadrius mongolus atrifrons* (Wagler).

A fairly common bird seen usually near the coast at the southern end of the island. Most birds are seen during the periods September to March and again in June and July. Some non-breeding birds are resident on the island the whole year.

The Greater Sand Plover *Charadrius leschenaulti* (Lesson).

This bird is seen in small numbers throughout the year. Usually found along with the preceding species, but are really uncommon on the island. No more than six birds were ever seen on a single day.

The Eastern Golden Plover *Pluvialis dominica fulva* (Gmelin).

A fairly common bird which visits the island from September to March each year. Usually found at the southern end of the island, but not entirely confined to this area, as they are seen in small flocks on the grassy moist areas in the centre and western side.

I have noticed birds with the darker summer plumage on their arrival in September, but the change to the breeding plumage has not been noticed before they leave the island.

These birds evidently stay longer in Ceylon as they are reported to arrive in August, when some bear traces of the summer plumage, and leave again in April, having a large amount of black on the breast.

The Yellow-wattled Lapwing *Lobipluvia malabarica* (Boddaert).

A fairly uncommon bird which was seen during the months of January and February, July and August and October and November. Usually seen on the eastern side of the island, between Pamban and Rameswaram town, on large flat sandy plains covered with a light growth of grass and some scattered thorn bushes. The largest number seen on a single day was fourteen, but it was usual to see only from two to four birds.

The Black-winged Stilt *Himantopus himantopus* (Linnaeus).

A fairly uncommon bird which is seen in the south of the island, near the coast, during the period January to March. A few stray birds have however been recorded in July and November and may be resident birds from Ceylon which had come over to Rameswaram Island.

These birds are reported as resident in Ceylon and breed from April to June in large colonies round certain lagoons along the east coast. Some birds are also reported to breed in India.

Most birds are seen on Rameswaram Island during February and I have a record of seeing over a hundred on 27-2-1930.

Very little has been said about this bird being found in the Presidency in the report of the Vernay Scientific Survey.

The Avocet *Recurvirostra avocetta* (Linnaeus).

A rare bird which was recorded on one occasion on 2-9-1930. When about eighty were seen in a shallow sheet of water along the railway line at the southern end of the island, near Dhanushkodi. The birds were observed for some time and no mistake was made in their identification.

It is stated in the report of the Vernay Scientific Survey that further evidence, to that recorded in it, is required before this bird can be admitted to the Presidency list.

This information, together with the record of September 1930, should be sufficient to admit this bird, as an uncommon migrant, to the list of birds of the Madras Presidency.

Wait, in *The Manual of Birds of Ceylon*, refers to the Avocet as a rare straggler, in winter, which has been obtained near Jaffna.

The Easten Curlew *Numenius arquata* (Linnaeus).

A fairly common bird which is found throughout the year on the island. The numbers seen during the period of the north-east monsoon do not appear to exceed by very much those seen at other times of the year. Perhaps the smallest numbers seen are in the period April to July, although I have records of having seen twenty-five and twelve on two days in June 1929. There must however be a large number of non-breeding birds which remain on the island each year to account for the birds seen in the dry season. Curlews are confined to the southern area of the island and are usually found along the coast line.

***The Whimbrel** *Numenius phaeopus phaeopus* (Linnaeus).

A fairly common bird which is seen during the period September to February in the same areas of the island as the Curlew. As I have records of stray birds in June and July it points to the fact that certain non-breeding birds remain on the island all the year, or else that some birds arrive at least three months in advance of the usual migrants.

The Green Sandpiper *Tringa ochropus* (Linnaeus).

A moderately uncommon bird seen during the period October to March by the side of shallow borrow pits along the railway line in the northern and central areas of the island. The maximum number seen on any single day was six, two or three being the usual.

The Marsh Sandpiper *Tringa stagnatilis* (Bechstein).

A fairly common bird seen during the period September to March in the same areas as the preceding species and also in the southern half, where it is commonly found in small flocks along with other waders. Very few birds are seen in September and October, but the numbers gradually increase until in January thirty to forty birds may be seen in a day.

The Common Sandpiper *Tringa hypoleucos* (Linnaeus).

A fairly uncommon bird seen during the period September to March and usually confined to the northern coast line of the island. Only a few birds were seen on any single day, the majority were seated on the sandstone rocks alongside the railway bridge over the Pamban Pass.

Tha Wood Sandpiper *Tringa glareola* (Linnaeus).

A fairly common bird seen during the period October to March almost throughout the island where there are pools of water. The greatest number was observed during January and February.

The Redshank *Tringa totanus* (Linnaeus).

A fairly uncommon bird seen during the period September to February along the south coast of the island on the margins of the shallow lagoons on both sides of the railway line. Most birds were seen during the months December and January.

Birds were shot in September and December for identification.

The Spotted or **Dusky Redshank** *Tringa erythropus* (Vroeg).

A very rare bird only once seen on the western side of the island, in a backwater, on 18-9-1929. Eight birds were seen on this occasion.

This bird has been reported from the Jaffna Peninsula in Ceylon.

The Greenshank *Tringa nebularia* (Gunnerus).

A moderately common bird seen during the period September to March in the southern half of the island along the coast and on the margins of the shallow lagoons in the same area. I find one record in my notes of having seen three of these birds on 12-7-1929, which seems an unusually early date. Most birds are seen during the period December to February.

Wait, in the *Manual of the Birds of Ceylon*, mentions that a good many immature birds remain in Ceylon during the south-west monsoon.

The Sanderling *Crocethia alba* (Vroeg).

Although this bird has been reported to be rare in Ceylon, only one specimen being obtained, it can be said to be common on Rameswaram Island as I have records of it for every month of the year.

Baker and Inglis refer to the bird as a rare winter visitor and quote Jerdon as having obtained it on the sea coast at Nellore. The account of the Vernay Scientific Survey gives the same reference, but states that Jerdon reports it as tolerably abundant on the Nellore coast.

My notes show that the season when these birds are found in large numbers is August to February, when on occasions more than a thousand have been seen in flocks along the sea coast and flooded sand flats at the southern end of the island. Usually seen along with Little Stints and Curlew Stints, but also found in large flocks consisting of Sanderlings alone.

A bird was shot as early as 10-6-1929, which shows that certain non-breeding birds remain on the island the whole year.

The Little Stint *Erolia minuta minuta* (Leisler).

A very common bird which is seen in large numbers during the period September to March. Confined to the southern end of the island and found in the same areas as the preceding species.

Non-breeding birds remain on the island during the other months of the year and have been shot for identification during these months.

Reported to be a common bird all round the coast of Ceylon, a few immature birds staying on the island during the summer.

The Eastern Little Stint *Erolia minuta ruficollis.*

This bird is found on the island along with the preceding species, as a bird shot along with a big flock on 30-9-1930 proved on identification to be the Eastern Little Stint with black legs.

I am unable to say if this species is more uncommon than the preceding as a sufficient number were not shot to arrive at any correct estimation.

The Curlew Stint *Erolia testacea* (Pallas).

A very common bird which is seen on the island throughout the year. The period during which the greatest numbers are recorded is August to March, but numerous birds are seen at other times.

Two birds were shot on 10-6-1929 which still retained their winter plumage, although all birds shot early in August were in their summer or breeding plumage. Twelve birds were shot on 18-12-1929, all being in their winter plumage.

Wait reports that these birds are abundant all round the coast of Ceylon and that immature birds in considerable numbers stay on the island during the summer.

The Pin-tailed Snipe *Capella stenura* (Bonaparte).

An uncommon bird seen in small numbers in the month of January, in the northern area of the island where there are marshes with undergrowth, such as screw-pine and other shrubs.

It is presumed that some of the snipe that usually visit Ceylon during the north-east monsoon occasionally rest on Rameswaram Island for a short period.

A Snipe was shot by me on 20-1-1930 and identified as belonging to this species.

The Open-bill Stork *Anastomus oscitans* (Boddaert).

A fairly uncommon bird which was recorded from the northern half of the island, where there are some swamps and tanks, during the period October to January. One stray bird was recorded on 10-7-1929 in the southern half of the island and may have been blown over from Ceylon, where they are reported as resident, by the south-west monsoon winds.

The Eastern Gray Heron *Ardea cinerea rectirostris* (Gould).

A very rare bird which was recorded on only one occasion, on 31-1-1930, when a single bird was seen seated near a pond in the north of the island near Pamban.

The Indian Smaller Egret *Egretta intermedia intermedia* (Wagler).

A very rare bird which was recorded on only one occasion, on 31-1-1930, when seven birds were seen together, on a sand flat, on the western side of the island.

The Indian Reef Heron *Demiegretta asha* (Sykes).

A rare bird seen on two occasions on the western coast of the island where they were feeding in shallow sea water just off the coast. Six birds were seen together on 6-12-1929 and eighteen in one batch in the same area on 31-1-1930.

It is recorded that this heron has been found breeding, near Chilaw on the Island of Ceylon, about the end of May. The birds seen on Rameswaram Island may possibly be from Ceylon. These herons are reported as being rare in Ceylon.

The Common Pond Heron *Ardeola grayii* (Sykes).

A fairly common bird on the island, found during the periods October to March and May and June, in the northern half of the island where there are pools of water or marshy areas. Fairly large numbers are seen during the north-east monsoon period, whereas only one or two birds were recorded in May or June.

The Black Bittern *Dupetor flavicollis flavicollis* (Latham).

An uncommon bird seen usually on the western side of the island, along the backwaters, where there are dense screw-pine and mangrove thickets. Usually only seen singly, seated on the twisted mangrove roots or flying across the narrow backwaters.

The months during which I have records are June, July, September and December, so that it is possible that this bird is resident and breeds on the island as it is suited to its requirements both as regards food and cover.

The Flamingo *Phoenicopterus ruber roseus* (Pallas).

A fairly common bird seen on the island during the period November to March each year. Only found at the extreme southern end where shallow lagoons are formed on both sides of the railway line. Most of the birds frequent the lagoons along the eastern shore, but some parties cross over to the western side later in the season.

They usually arrive at the end of November, when a few hundred birds are suddenly seen one morning. The numbers rapidly increase until it is estimated that about three thousand birds gather in this area.

The winter of 1929-30 apparently suited the birds better than that of 1930-31, as they were very numerous and never left the island for short periods once they arrived. They finally left on 12-3-1930.

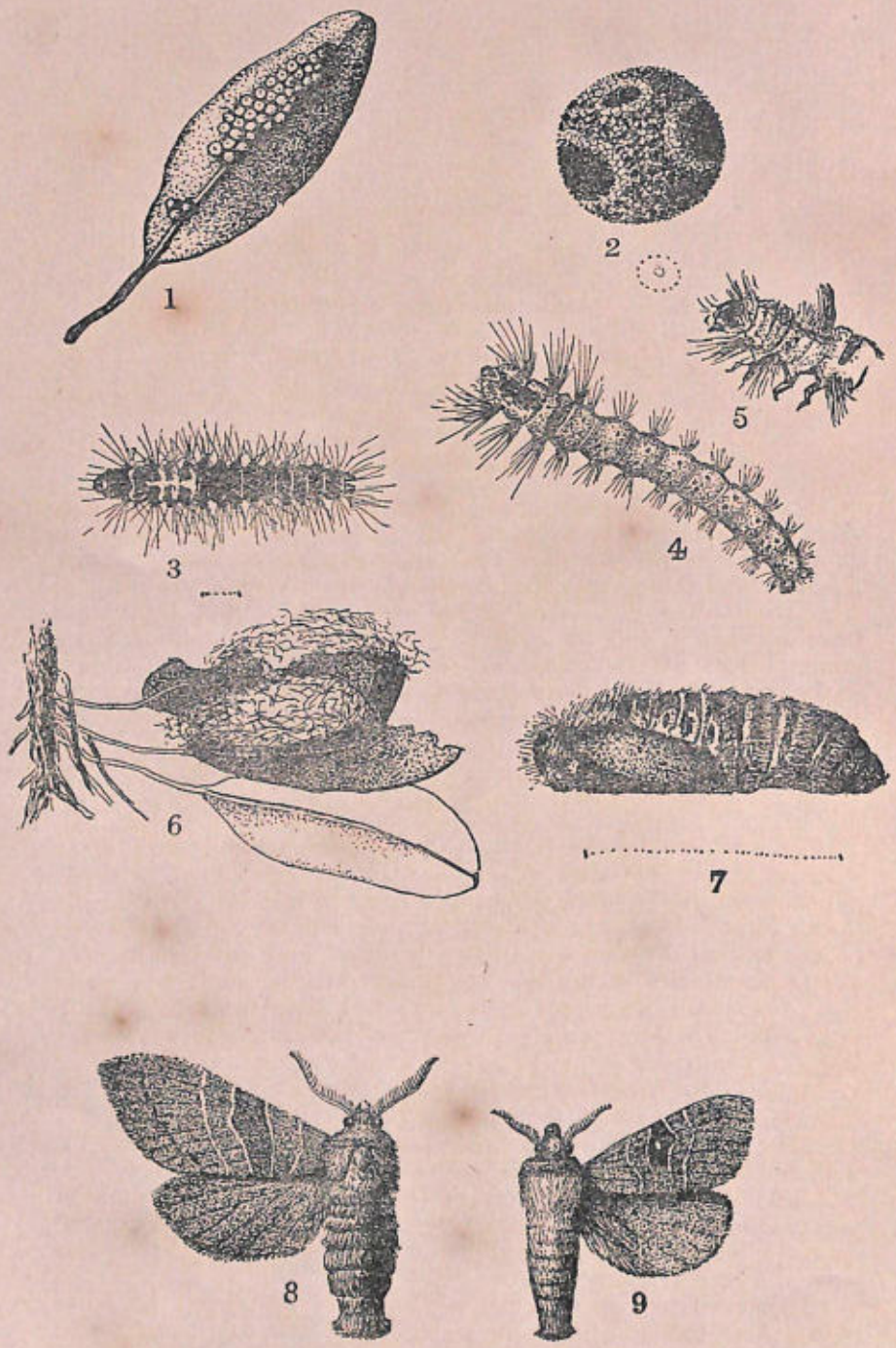
In the winter of 1930-31 the birds arrived on 13-11-1930, but left after a week and only returned again during the first week of December. On 8-1-1931 three or four hundred birds were seen to have collected and this number was not exceeded that season. All the birds again left about 31-1-1931, when the lagoons almost dried, but returned once again in much smaller numbers about 16-2-1931. Only about fifty birds remained on 10-3-1931 and these left shortly after.

When these flamingoes leave the island they usually fly north and spend some days near Mandapam Camp and are finally seen in fairly large numbers on a tank at Ramnad.

Wait reports that flamingoes are migrants to Ceylon, arriving in October and leaving in April. He states that some birds must loiter as they have been seen near Trincomalee in June. He also refers to a tradition that they are supposed to breed in the extreme south of the Eastern Province, but states that this has not been verified.

The Little Grebe *Podiceps ruficollis capensis* (Salvadori).

An uncommon bird which is only seen during January and February on the island at the northern end and in the centre. Usually found in the borrow pits adjoining the railway line and in smaller ponds and swampy areas to the north-east. More birds are seen in January than in February, but not more than five birds were seen on any single day.



Metanastria hyrtaca Cram.
(For explanation see end of article).

A NOTE ON *METANASTRIA HYRTACA* CRAM.

BY

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(*With a Plate*)

INTRODUCTION.

Of the members of the family *Lasiocampidæ* very few are serious pests of cultivated crops in South India. *Taragama siva* and *Trabala vishnu* are the only two, appearing occasionally in large numbers and doing appreciable damage to economic plants; and even these are rather rare. *Metanastria hyrtaca* probably comes third in the list. In the year 1934 this insect appeared in large numbers and the caterpillars almost completely defoliated a few Sapota plants in the orchard of the Central Farm of the Agricultural Research Institute at Coimbatore. The following is a short account of the observations made by the authors at that time.

THE MOTH.

The adult moth is fairly big with grey brown wings and rather thick-set body. The male is smaller than the female, has pectinate antennæ and has a black patch on the forewing with a white spot in the centre of it. The abdomen is long and slender and extends behind beyond the wings and has a brush of long hairs at its end. In the female the wings are longer and broader and have short wavy lines or bands across them; the black patch on the forewing is absent. The antennæ are thinner and smaller. The moths are sluggish and do not fly.

Hampson in *Fauna of British India*, 'Moths', Vol. I. gives the following description of the moth on page 410:

'Male: Pale or dark red brown; palpi dark below. Forewing with two ante-medial pale lines and two post-medial angulated lines, with an almost black patch between the upper part of the ante- and post-medial lines crossed by the pale veins and with a white lunule on it; a lunulate sub-marginal line. Underside of the hind wing with two pale lines.

'Female: Forewing with the two ante-medial and the two post-medial lines more distinct and without the dark patch and white lunule; the sub-marginal lunulate line very indistinct. Hind wings with an indistinct pale line.'

Moore's *Lepidoptera of Ceylon*, Vol. II, page 148 has the following description of the moth:

'Dark purplish ferruginous. Male: Forewing with a transverse ante-medial and a post-medial slightly waved ferruginous-grey line, and two similar medial lines, the outer one being convexly angular beyond the cell; between the two lateral lines is a dark purple brown patch extending from the costa to the lower median vein, this patch being marked by a pure white lobate spot; exterior border darker, crossed by a very indistinct submarginal row of dark brown speckled spots. Female: Forewing with four similar transverse ferruginous grey equidistant lines; the basal area between the medial lines, and the outer border darker coloured, the submarginal row of spots more distinct and grey speckled. Front of thorax, head, palpi and antennæ greyish ferruginous. Expanse: Male $1\frac{7}{8}$ in. Female 3 in.'

Life History.

The moths copulate the very next day after emerging from the pupæ and the female lays eggs in groups or rows on the surface of the leaves or twigs of the food plant. Each female is capable of laying about 140 eggs, which it does in several batches in the course of two or three days. The eggs hatch in nine to twelve days. The caterpillars are active from the second day and lead a gregarious life. They move about on the leaves and stem in single file. They feed on the tender leaves by scraping the surface for three to five days and then undergo the first moult. There are generally six or seven moults during the caterpillar stage, though, in exceptional cases, the number may go up to ten or be reduced to four; but there is no marked change in them after the fifth moult. Just before moulting the caterpillars remain motionless on the stem or the leaf, having ceased feeding a day or two earlier. In the actual process of moulting the head shield is first pushed forward by the formation of fresh growth below and gradually gets detached; this is followed by the rupture of the outer skin all along the body and the caterpillar emerging out of the larval skin, which is often left almost entire. The new larva is smaller in size but regains the normal size in a short time. The caterpillars feed voraciously, and become full grown in 45 to 60 days. The larval period may be reduced to 43 and increased to over 100 days in rare cases. A few prolong their larval period by cessation of growth for a long time after the fourth moult, so that in the same brood some caterpillars grow in advance of others, a good number lagging behind. The full grown caterpillars construct loose cocoons of silk inter-woven with hairs from their bodies and pupate inside. The cocoons are generally attached to the stem or leaf; and often two or more cocoons are found grouped together. The pupal period varies from 9 to 18 days. Thus, the whole life cycle from egg to adult takes 75 to 109 days depending on weather and other conditions.

Egg: The egg is spherical in shape and about $1\frac{1}{2}$ mm. in diameter, i.e., about the size of a mustard seed. It is dull white

in colour with two big brownish black round markings and a smaller one between. It is covered with dirty grey irregular faint markings making the colour appear ashy grey at a distance. The shell is hard and finely sculptured on the surface.

Larva (*1st stage*): The newly hatched larva is about 2½ mm. long with the head 7/10 mm. broad. The segments of the head and the thorax are slightly bigger than the remaining segments so that the body appears to taper slightly towards the hind end. The head is black and covered with minute hairs. Segment I is blackish with a dorsal prothoracic chitinous shield bounded by a thin greyish white area. This is separated from segment II by a double ring, greyish pale white in colour with a black transverse streak in the middle. The three thoracic segments have a fairly broad dorso-median longitudinal blackish grey band with a central whitish area or streak which broadens towards the third segment. Each segment has on the ventral side a pair of well developed black legs covered with minute velvety hairs. The abdomen is black with the dorsal side of the first three segments slightly greyish as a continuation of the thoracic longitudinal streak. The greyish colour is interrupted by the inter-segmental rings which are dirty pale white. On the ventral side are the four pairs of brownish black slender prolegs on the third to the sixth abdominal segments and a fifth pair on the last or anal segment. The whole body of the caterpillar is covered with numerous hairs arising singly or in tufts from black tubercles. On the prothorax are a large number of long hairs directed forwards and sideways. The spiracles are seen as small dots on the sides of the body on segment I and the first eight segments of the abdomen, the first pair being slightly bigger than the rest. The caterpillar leads a very active and gregarious life, feeding on the tender leaves for three to five days and attains a length of nearly 6 mm. Then it ceases feeding and undergoes the first moult.

Larva (*2nd stage*): The caterpillar is now about 8 mm. long. The thoracic segments are only slightly broader than the rest of the body and the anterior portion appears a little tapering as the head is narrower than the thoracic segments. The head is blackish with three slight ashy grey bands extending from the prothoracic region down to the clypeus. There are a large number of short hairs arising from the head near the jaws. The dorsal side of the prothorax is black with a pair of light grey longitudinal bands on either side of the median line. The black chitinised area is bounded by greyish brown patches in front and behind; and there are more irregular patches on the sides. The prothoracic processes are short, thick and black with numerous short soft whitish hairs extending forward. Some of these hairs are black or brownish. In the prothorax are also numerous isolated smaller and thinner brown hairs along the middle frontal fringe, the sides and the posterior edges. The mesothorax is black with greyish brown mottlings; the dorsal tubercle on each side of the median line is bluish black covered with short irregular hairs; two small erect groups of hairs are found on the dorsal side of the segment marking the position of the transverse groove. Segment III is greyish

brown with irregular black spots and patches and with bluish black tubercles. Towards the posterior end of the segment a transverse slit is visible, its inner sides are lined with very minute shining velvety hairs of a brick red colour. In the abdominal segments the mid-dorsal double line of the previous stage is broken up into irregular ash coloured mottlings and the lateral whitish bands are continued behind upto the eighth segment. The first two segments appear greyish brown and the rest are darker. The eighth, ninth and tenth segments are black with white thick intersegmental transverse patches or rings. The abdominal tubercles are bluish black and more prominent with blackish hairs arising from them. One sub-dorsal and one ventro-lateral row of tubercles are seen on each side of the body, the latter row being on short blunt protuberances of the skin on the sides. The whole body is covered with irregularly distributed short brown hairs. The hairs on the sub-dorsal tubercles arise erect while those on the ventro-lateral tubercles are directed sideways. They are directed forwards in the anterior segments and backwards in the posterior or anal segment. The prolegs which are more conspicuous than in the previous stage are slender, long, pale red, and are beset with numerous small hairs.

The caterpillar during this stage is more active and feeds voraciously. It grows to a size of 10 or 11 mm. in the course of 4 to 6 days and then undergoes the second moult.

Larva (3rd stage): The average caterpillar is about 16 mm. long. It is black grey with reddish and brown dots and pale white streaks irregularly distributed over the body. The newly moulted caterpillar has its head as broad as the thorax so that there is no tapering towards the head as in the previous stage. The head, the first and second segments of the thorax, and the eighth, ninth and tenth abdominal segments are black and separated from their neighbouring segments by whitish double transverse bands. The three whitish grey bands of the first thoracic segment are continued into the head region. The prothoracic processes are more pronounced with tufts of hairs. Over the second thoracic segment the paired tufts of small hairs on the mid-dorsal line, one behind the other, enclose between them a transverse depression which is lined black. The third thoracic segment has the red streak more pronounced and the posterior border of the segment is whitish as a distinct transverse band. Similarly between segments 4, 5 and 7 and 8 whitish transverse bands appear borne on the posterior border of the one and the anterior border of the following segment. Segment 8 is black and bears a somewhat conspicuous pair of dorsal tubercles more prominent than others. Segments 9 and 10 and the legs are black. The prolegs are yellowish with a black patch on the outer side. The spiracles are white vertically oval spots with black borders situated in a line on the sides of the body wall. The ventro-lateral processes from the body wall are more prominent with denser and longer hairs. The hairs are of varying length, shape and shade; they are at first whitish turning brown or brownish black later on. The hairs on the dorsal side of the body are generally shorter than the rest. The ventral side of the body is blackish or of cement colour.

The caterpillar feeds gregariously and grows to about 20-22 mm. and, as it grows, the head appears a little narrower than the body. The white central band in the region of the head bifurcates near the front and three more parallel lines of whitish tinge on each epicranium extend down to the ocellar region the one next to the central streak being more prominent than the others. It is not uncommon to find caterpillars at this stage reaching a length of 30-40 mm.

Larva (*4th stage*): Immediately after emerging from the moult the caterpillar is 25-40 mm. long. The brown colour of the hairs on the surface of the body becomes more pronounced. Secondary hairs appear all over the body, the base of the legs, the prolegs and the head, making the tubercles rarely visible. The erect comb-like hairs over segment II and the lateral hair groups on the ventro-lateral processes on the body are more prominent than in the previous stage. Besides the soft hairs there are also whitish or yellowish brown shorter flattened spatulate hairs arising in the midst of the ventro-lateral tufts. Segment III is the biggest and the thoracic segments are progressively smaller anteriorly, with the head appearing smallest. The dorsal bands on the thorax are darker and are continued into the head region. The general colour is greyish brown with irregular mottlings, simulating the bark of the stem of the food plant. Beyond this stage the caterpillars show no marked changes except in size. They remain on the stem in groups closely packed together. Some of the larvæ moult at the end of 5 to 7 days and reach a size of nearly 40-50 mm. But the length of this stage and the size of the larvæ at the end of it vary greatly.

Larva (*5th stage*): This is generally the last stage in the growth of the larva, the caterpillar becoming full grown at its end. Beginning with a size of nearly 40 mm. it finally reaches about 65 mm. The body is stout and hairy and is cylindrical though slightly flattened on the ventral side. The head is small when compared with the other segments of the body, and black with whitish, brownish and dark bands. A dorso-median brownish band extends from the erect mid-dorsal tufts on segment II over the thorax into the head region and merges with the colour pattern of the head. The ad-frontal area is whitish and is in continuation of the central white streak on the cranial suture. The front is small and black. The ocelli are black and surrounded by brownish black patches at the sides. Numerous small brownish soft hairs are found over the head and mouth region. The skin of the body is tough and leathery beset with various kinds of hairs. The general colour varies, being greyish black or greyish dark brown. The hairs are of different colours and sizes. The longest hairs found in bunches rising from the vento-lateral body processes are soft and brownish. Some of the hairs rising from bluish black tubercles on the dorsal surface are fairly long and spike-like, are easily detached from the body and run into the fingers of the operator when the caterpillars are handled. Thinner, shorter and greyish dark hairs are seen in the region of the thoracic segments, legs, prolegs, lateral processes and posterior ends. A few yellowish

white spatulate hair-like structures arise in front of the dorsal tuft in segment II and irregularly in the midst of the lateral tufts in all the segments. Several groups of very soft minute hairs are found in the dorsal transverse grooves in segments II and III and in the intersegmental areas on the dorsal side. The ventro-lateral processes from the body wall are more prominent and the tufts of hairs are directed forwards in thoracic segments, horizontally over the sub-stratum in the abdominal region and backwards in the posterior segments. The latero-ventral processes on the prothorax are very long and thickset with hairs. These processes simulate prolegs and hide the true legs when viewed from above. The dorsal setae are comparatively small and reduced. In segment II the transverse cleft of skin placed dorsally about the middle of the segment exposes a jet black area bounded in front by a short tuft of whitish yellow hairs and behind by a shorter erect tuft of black hairs. In segment III the transverse slit placed about the posterior third of the segment, is broader and longer, extending to the sides and exposes a crimson red surface with a black streak in the middle. The skin in the slit is lined by very minute hairs and is smooth. The slit is exposed to view with its vivid colouration when the caterpillar is disturbed. The legs are black, well chitinised and covered with numerous hairs. The abdomen is long and stout with tufts of hairs on the sides. The dorsal hairs and setae are reduced in number and size. There are two pairs of bluish black tubercles on each segment; the front pair are subdorsal and the hind pair posterior-lateral in position. In the mid-dorsal region two blackish brown bands begin to appear in some specimens and this band is produced into angular projections outwards in segments III to VIII. In some specimens a lateral pale grey streak continued from the first to the eighth abdominal segment appears as a faint band and persists during the later stages of the caterpillar. The prolegs are long and slender with the crotchets biordinal and arranged in meso-series. The spiracles are clearly seen as long vertical slits, more or less oval in shape, whitish in the centre and bounded by a thick black rim enclosing a thin black streak in the central line; the spiracle in segment I is the biggest and that on segment VIII bigger than the rest; they are located on the sides, just above the region of the ventro-lateral processes.

Pupa : When full grown the caterpillars construct loose cocoons of silk interwoven with hairs detached from their bodies and pupate inside. The cocoon is generally attached to the stem or leaf and often two or more are found grouped together. The pupa is dark brown and covered with numerous short hairs irregularly distributed in front, but in rows round the pupa behind. The moth emerges by splitting open the pupal skin at the dorso-median anterior end. The pupal period lasts from 9 to 18 days.

Other Food Plants.

The caterpillars which are characteristic in their appearance and habits and are easily distinguished from others have been recorded to breed on *Guazuma tomentosa* H.B. & K., *Terminalia catappa*

Linn. (Country almond), *Mimusops elengi* Linn., *Nyctanthes Arbor-tristis* Linn. (Tam. Pavizha mall), *Bassia longifolia* Linn. (Tam. Iluppai), *Schima Wallichii* Choisy, *Eugenia Jambolana* Lam., *Acacia arabica* Willd., *Albizzia stipulata* Boiv., and *Anthocephalus morindaefolius* Korth.

Remedial Measures.

As already pointed out the insect has not been noted to be a serious economic pest and as such no elaborate arrangements are necessary for its control. But if and when it becomes a pest, the gregarious nature of the caterpillars makes it easy to handpick and destroy them. In more severe cases a stomach poison may be tried.

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Explanation of Plate.

1. A leaf showing eggs on it.
2. One egg magnified.
3. A young caterpillar.
4. A full grown caterpillar.
5. The anterior portion of a grown up caterpillar showing the hairs.
6. Cocoon on a leaf.
7. Pupa.
8. Moth (female).
9. Moth (male).

THE MEDICINAL AND POISONOUS SPURGES OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The EUPHORBIACEÆ represent almost all habits of growth, and exhibit a high degree of adaptability to varying environments. This large family includes 220 genera, and about 4,000 species distributed all over the world, except in arctic and antarctic regions. About half the species inhabit equatorial America; they are much rarer in temperate America. In the Old World they are more abundant in the Mediterranean region and in temperate Asia than between the tropics.

The properties of the spurgeworts are as distinctive as their botanical characters, and the ancients had so accurately recognized this, that all plants with a 3-coccus fruit were regarded by them as hurtful and suspicious. The members of the family secrete a very acrid milky juice, varying in strength with the species, the organ of the plant, and the climate. In some this juice is one of the most deleterious of poisons, in others its acridity is so far neutralized by mucilage and resins as to reduce it to a simple purgative and diuretic. Some species are slightly narcotic-acrid, others aromatic. The albumen usually contains a fixed bland oil, without the acridity which is found in the embryo and the integuments of the seed. It is to a liquid resin and a volatile principle that all the properties of the spurgeworts are due; they are thus strongest in alcoholic tinctures, but are dissipated or weakened by the application of heat. The root of the Manihot offers a remarkable example: there is scarcely a more poisonous juice than this, yet the action of fire converts the plant into very wholesome food.

Enormous though it be, the research work purporting to deal with the juice has not yet been crowned with success, and the literature regarding the toxic principles isolated from spurges is but one great mass of confusion.

The medicinal and poisonous spurges of the world belong to 76 genera:—ACALYPHA (tropics and subtropics of both hemispheres); ALCHORNEA (all tropics); ALEURITES (Asia and Pacific); ANDRACHNE (tropics and subtropics); ANTHOSTEMA (Madagascar; tropical Africa); ANTIDESMA (palaeotropics); APOROSA (tropical Asia); BALIOSPERMUM (Indo-Malaya); BISCHOFIA (Indo-Malaya, Pacific Islands); BREYNIA (Africa, Asia, Polynesia); BRIDELIA (Africa, Asia, Australia); BUXUS (temperate regions of the Old World); CHROZOPHORA (Mediterranean region, Asia, Africa); CICCA (Asia); CLEISTANTHUS (Africa, Indo-Malaya); CNESMONE (India, Malay Peninsula, Java, Sumatra); CROTON (tropics and subtropics); DALECHAMPIA (tropics); DAPHNIPHYLLUM (tropical Asia); DICHOSTEMMA (tropical Africa); DRYPETES (Africa, Indo-Malaya, tropical America); ELAEOPHORBIA (tropical

Africa); EREMOCARPUS (California); ERYTHROCOCCA (tropical Africa); EUPHORBIA (subtropical and warm temperate regions); EXCOECARIA (Old World tropics); FLUEGGEA (Old World tropics); GELONIUM (Asia, Africa); GLOCHIDION (tropical); HEVEA (Brazil, Guiana); HIPPOMANE (warm America, West Indies); HOMONOIA Indo-Malaya); HURA (tropical America); HYMENOCARDIA (Indo-Malaya, Africa); ICHTHYOTHERE (Brazil); JATROPHA (America, Malaya); JOHANNESIA (Brazil); JULOCROTON (Central and South America); MABEA (Central America, Brazil, Guiana); MACARANGA (tropics of the Old World); MAESOBOTRYA (tropical Africa); MALLOTUS (Asia, Africa); MANIHOT (South America to Mexico); MANNIOPHYTON (tropical Africa); MAPROUNEA (Brazil, Guiana, West Africa); MAREYA (tropical Africa); MERCURIALIS (Europe, Western Asia, Japan); MICRODESMIS (Asia, Africa); NECEPSIA (tropical Africa); OLDFIELDIA (tropical Africa); OMPHALEA (tropical Africa and America); OPHTHALMOBLAPTON (Brazil); PARIS (Europe, northern Asia); PEDILANTHUS (Central and South America, West Indies); PETALOSTIGMA (Australia); PHYLLANTHUS (tropics); PSEUDOLACHNOSTYLIS (tropical Africa); PUTRANJIVA (India); PYCNOCOMA (tropical Africa, Comoro Islands, Madagascar); RICHERIA (tropical America); RICINODENDRON (tropical Africa); RICINUS (tropical Africa); SAPIUM (all tropics); SAUROPUS (Indo-Malaya); SEBASTIANIA (America, Africa); SPONDIANTHUS (tropical Africa); STILLINGA (America, Africa, Mauritius, Madagascar, Fiji); SYNADENIUM (tropical and South Africa, La Reunion); TETRACARPIDIUM (tropical Africa); TETRORCHIDIUM (tropical America and Africa); TOXICODENDRUM (South Africa); TRAGIA (Asia, Africa); TREWIA (India); TRIGONOSTEMON (Indo-Malaya); TRITAXIS (Indo-Malaya); UAPACA (tropical Africa, Madagascar).

The medicinal and poisonous spurges of India belong to 36 genera :—ACALYPHA, ALCHORNEA, ALEURITES, ANDRACHNE, ANTIDESMA, APOROSA, BALIOSPERMUM, BISCHOFIA, BREYNIA, BRIDELIA, BUXUS, CHROZOPHORA, CICCA, CLEISTANTHUS, CROTON, EUPHORBIA, EXCOECARIA, FLUEGGEA, GELONIUM, GLOCHIDION, HIPPOMANE, HOMONOIA, HURA, JATROPHA, MACARANGA, MALLOTUS, MANIHOT, MICRODESMIS, PHYLLANTHUS, PUTRANJIVA, RICINUS, SAPIUM, SAUROPUS, SEBASTIANIA, TRAGIA, TREWIA.

A. Cells of ovary 2-ovuled.

I. Male flowers of one pedicelled stamen numerous surrounding a single-pedicelled female, all enclosed in a cup-like involucre ... ... EUPHORBIA.

II. Flowers apetalous; sepals 4 in male, imbricate; sepals 4 or 6 in female.
  a. Leaves alternate ... ... HURA.
  b. Leaves opposite ... ... BUXUS.

III. Sepals 1-2-seriate. Petals minute or absent. Stamens 1-2-seriate. Ovary 2-many-celled; cells 2-ovuled.
  a. Leaves alternate, undivided, quite entire. Flowers petaliferous. Stamens 3-6.
    1. Calyx valvate, stamens in a column.
      i. Fruit a drupe; ovary 2-celled ... BRIDELIA.
      ii. Fruit capsular; ovary 3-celled ... CLEISTANTHUS.
    2. Calyx imbricate, stamens free. Flowers small. Disc of 10 glands. Herb ... ... ANDRACHNE.

b. Leaves alternate, rarely subopposite, undivided, quite entire. Sepals imbricate. Petals absent. Stamens 3 or more. Flowers solitary or in axillary fascicles.
1. Fruit dry capsular of 3 bivalved cocci.
i. Herbs, shrubs or trees; styles free or united below; disc present, of scales or a ring ... PHYLLANTHUS.
ii. Shrubs or trees; styles long united in a column, rarely free; disc absent ... GLOCHIDION.
2. Fruit of 6 cocci; epicarp fleshy white ... FLUEGGEA.
3. Fruit baccate of 3 to 6 hard cocci in a fleshy epicarp.
i. Sepals 4; stamens 4; fruit large; tree ... CICCA.
ii. Male flowers turbinate or hemispheric, lobes minute; fruit small; shrubs or treelets ... BREYNIA.
iii. Male flowers rotate or discoid, lobes minute; fruit medium; shrublets ... ... SAUROPUS.

c. Leaves alternate, undivided, entire or serrate. Sepals imbricate. Petals absent. Stamens few or many. Styles or stigmas 2-3, dilated. Fruit a drupe. Stamens 2-3. Ovary 2-3-celled. Drupe 1-celled PUTRANJIVA.

d. Leaves alternate, trifoliolate. Sepals imbricate. Petals absent. Fruit a berry.
Sepals 5. Stamens 5 ... ... BISCHOFIA.

e. Leaves alternate quite entire. Styles or stigmas usually very minute. Fruit various.
1. Fruit drupaceous; disc circular pulvinate or conic; seeds laterally flattened reticulate; filaments long ... ... ANTIDESMA.
2. Fruit capsular dehiscent; flowers in catkins; filaments long ... ... APOROSA.

B. Cells of ovary 1-ovuled.

I. Perianth double, of calyx and corolla. Stamens 4-10; filaments free. Ovary 1-3-celled. Fruit a small drupe. Flowers in axillary panicles. Petals imbricate. Stamens 5-10 ... ... MICRODESMIS.

II. Perianth single, or of the male, or of both sexes, double. Stamens 1-2-seriate. Ovary 2-3-celled. Inflorescence terminal or axillary.
a. Flowers in terminal 2-3-chotomous cymes; cymes unisexual, or with the central flower female, petaliferous.
1. Leaves digitately nerved or lobed. Stamens many. Fruit capsular ... ... JATROPHA.
2. Leaves palmilobed. Juice usually milky. Stamens 10 in two whorls ... ... MANIHOT.
3. Leaves digitately nerved. Stamens 8-20. Fruit a drupe ... ... ALEURITES.
b. Flowers in terminal androgynous spikes or racemes. Petals usually villous. Stamens strongly incurved in bud alternate with the sepals. Capsule of 3 cocci. CROTON.
c. Flowers in axillary racemes. Stamens erect in bud. Petals present. Sepals valvate. Anther-cells connate. Styles bifid. Fruit capsular. Stellately tomentose herbs or shrubs ... ... CHROZOPHORA.
d. Flowers in axillary rarely terminal spikes racemes or panicles, apetalous. Calyx valvate in bud.
1. Filaments free; anthers erect, 2-celled, cells united by their base only. Styles very long fimbriate or lacerate. Female flowers in large bracts ... ... ACALYPHA.
2. Filaments free; anthers 2-celled or 4-locellate; cells oblong or globose, laterally attached by a narrow or broad connective.
i. Stamens 4 to 10. Anthers 2-celled. Filaments slender, anther-cells oblong parallel. ALCHORNEA.

ii. Stamens very numerous. Anthers 2-celled.
† Leaves opposite. Anther-cells parallel. Fruit fleshy or capsular ... ... TREWIA.
†† Leaves opposite or alternate. Stamens very many, central in the flower; anther-cells usually globose, adnate to the often broad connective ... ... MALLOTUS.
iii. Stamens one or more central; anthers 3-4-locellate; anther-cells subglobose. Styles entire. Fruit capsular ... ... MACARANGA.
3. Filaments variously connate in bundles.
i. Male and female flowers in axillary spikes. Staminal bundles indefinite. Capsule unarmed ... ... HOMONOIA.
ii. Flowers in terminal panicles. Leaves palmate, serrate. Staminal bundles indefinite ... RICINUS.
e. Flowers in axillary or leaf-opposed clusters, rarely panicled or racemed, apetalous. Sepals of male imbricate or calyx shortly toothed. Stamens numerous, central in the flower.
1. Male-flowers fascicled. Sepals 5. Fruit smooth, indehiscent ... ... GELONIUM.
2. Male-flowers in panicled cymes. Sepals 4-5. Capsule of three 2-valved cocci ... BALIOSPERMUM.
f. Flowers in axillary spikes or racemes, apetalous. Male calyx valvate. Styles connate. Fruit capsular.
Racemes androgynous. Male calyx 3-5-partite; female calyx of 5 sepals. Stamens 1-3. Styles spreading above ... ... TRAGIA.

III. Perianth single. Calyx of male minute and open in bud, or obsolete.
a. Herb with very short leaf opposed bisexual spikes. Annual ... ... SEBASTIANIA.
b. Trees or shrubs.
1. Racemes terminal. Male calyx terete, 2-3-lobed. SAPIUM.
2. Racemes lateral or terminal. Calyx terete, 3-partite. Stamens 3 ... ... EXCOECARIA.
3. A tree. Flowers monoecious. Male calyx 2-3-lobed ... ... HIPPOMANE.

ACALYPHA.

The genus includes 320 tropical and subtropical species.

The following species are used medicinally in the Philippine Islands—*A. indica* Linn.—; in Madagascar—*A. spiciflora* Burm. f.—; in La Reunion—*A. indica* Linn., *A. integrifolia* Willd.—; in Zululand—*A. peduncularis* Meissn.—; in Southern Rhodesia—*A. petiolaris* Krauss—; in Gold Coast and Nigeria—*A. ciliata* Forsk.—; in Oubanghi-Chari—*A. ornata* Hochst.—; in Indo-China —*A. Evrardii* Gagnep., *A. indica* Linn.—; in the Malay Peninsula —*A. siamensis* Gage—; in India—*A. fruticosa* Forsk., *A. hispida* Burm., *A. indica* Linn., *A paniculata* Miq.—.

A. Herb. Leaves long-petioled, ovate or rhombic-ovate, crenate-serrate ... ... 3. *A. indica.*
B. Shrub.
a. Leaves ovate-acute or subacute, crenate, glabrous and glandular beneath ... ... 1. *A. fruticosa.*
b. Leaves broadly rhombic-ovate, at the base shortly cuneate, at the apex cuspidate-acuminate, subacutely and coarsely serrate ... ... 2. *A. hispida.*

c. Leaves long-petioled, ovate-acuminate ... 4. *A. paniculata.*
d. Leaves sub-coriaceous rhomboid narrowed to blunt base, bluntly serrate, tip blunt ... ... 5. *A. siamensis.*

1. **Acalypha fruticosa** Forsk. occurs in the Deccan Peninsula, Ceylon, Pegu, Martaban and Ava. It extends to Arabia and tropical Africa.

The leaves are attenuant and alterative, and an agreeable stomachic in dyspepsia and other ailments. The dose of the infusion of the leaves as ordered by the Vaidyas in Southern India is half a teacupful twice in the day.

The leaves are a Chinese remedy for colic and diarrhœa.

In Arabia the leaves are macerated in water, and children with pustules washed in the liquid.

Arabic: Bortam—; *Canarese*: Chinni—; *Chinese*: Tch'a Iang—; *Deccan*: Chinni—; *French*: Ricinelle—; *Hadie*: Defran—; *Surdud*: Shohat—; *Tamil*: Sinni—; *Telugu*: Chinni—; *Uahfat*: Ansthat—; *Yemen*: Bortom, Defran—.

2. **Acalypha hispida** Burm. is cultivated in Indian gardens.

The leaves are beaten up with green tobacco leaf and an infusion of rice, and applied to inveterate ulcers.

The flowers, boiled in water or administered in the form of a conserve, are said to be specific in diarrhœa and similar disorders.

Malayalam: Vattattali—.

3. **Acalypha indica** Linn. occurs throughout the hotter parts of India and Ceylon. It extends to the Philippine Islands and tropical Africa.

The plant is used as expectorant as a substitute for senega. It has also a diuretic action. It is a useful remedy for bronchitis, asthma and pneumonia; also for rheumatism. It was formerly employed as a purgative and anthelmintic.

The root, bruised in hot water, is employed as a cathartic, and the leaves as a laxative in decoction mixed with common salt. The leaves are used in scabies and, mixed with lime, in other cutaneous diseases.

The powder of the dry leaves is given to children in worm cases, also a decoction prepared from the leaves with the addition of a little garlic. The juice of the same part of the plant, together with that of the tender shoots, is occasionally mixed with a small portion of margosa oil, and rubbed on the tongues of infants for the purpose of sickening them and clearing their stomachs of viscid phlegm.

The expressed juice of the leaves is in great repute, wherever the plant grows, as an emetic for children, and is safe, certain and speedy in its action. Like Ipecacuanha, it seems to have little tendency to act on the bowels or to depress the vital powers, and it decidedly increases the secretion of the pulmonary organs.

A decoction of the leaves is given in ear-ache; a cataplasm of the leaves is applied as a local application to syphilitic ulcers, and as a means of relieving the pain of snake-bite and the irritation caused by the bite of the centipede.

Fresh leaves ground into a paste, made into a ball to the size of a large marble, and introduced into the rectum, are very useful in relieving obstinate constipation of children.

The plant is used in congestive headaches: a piece of cotton is saturated with the expressed juice and inserted into each nostril, relieving head symptoms by causing hæmorrhage from the nose. The powder of the dry leaves is used in bed sores and wounds attacked by worms.

The leaf of this plant is said to be a parasiticide and is applied externally, ground with common salt or quicklime or lime juice. A paste of the leaves with lime juice was prescribed for cases of ringworm (different varieties of cutaneous tinea). In chronic cases it had no effect, but in recent cases it did some good (Koman).

Caius and Mhaskar have had nothing but disappointment with the plant. They found it quite ineffective as an anthelmintic; and the leaves proved useless as an external application in the treatment of snake-bite.

Arabic: Harram-ed-dhibbel—; *Bengal*: Kanda-amadu, Muktajari, Murkanta, Shwetbusunta—; *Bombay*: Khokali, Khokli, Kuppi—; *Canarese*: Chalmari, Kuppi—; *Chinese*: T'ie Han Ts'ai—; *English*: Indian Mercury—; *French*: Bois queue de rat—; *Godavari*: Murkandachettu, Murukonda—; *Gujerati*: Vanchhikanto—; *Hindi*: Khokali, Khokhla, Khokli, Kuppi—; *Indo-China*: Tai tuong xanh—; *Malay*: Rumput lislis—; *Malayalam*: Kuppamani—; *Marathi*: Khajoti, Khokli, Kupi—; *Mauritius*: Herbe chatte, Ortie de l'Inde—; *Philippines*: Bugos—; *Porebunder*: Dadro—; *Sanskrit*: Arittamunjariye—; *Sinhalese*: Kupamenya, Kuppamaniya, Waelkupamenya—; *Tamil*: Kuppaimeni, Kuppamani—; *Telugu*: Kuppaichettu, Kuppintaku, Murkandachettu—; *Uriya*: Indramaris—.

4. **Acalypha paniculata** Miq. is found in the Deccan Peninsula, from Malabar southwards, and in Ceylon; it ascends to 3,000 feet. It is distributed over to Java and tropical Africa.

It is often used as a substitute for *A. indica*.

Aguku: Odukwe—; *Ibo*: Odukwe—; *Yoruba*: Ilewu—.

5. **Acalypha siamensis** Gage is found in sandy open country on the east coast and in the north of the Malay Peninsula, whence it spreads over Siam.

The Malays use the leaves for making tea.

Malay: Tumput—.

Alchornea.

The genus numbers about 50 tropical species, rarest in Asia.

A. cordifolia Muell.-Arg. and *A. hirtella* Benth. are used medicinally in tropical West Africa.

The root of *A. floribunda* Muell.-Arg has properties similar to those of Indian hemp and is much used in the Belgian Congo as a stimulant and narcotic.

Alchornea rugosa Muell.-Arg. is found at Amherst in Burma, in the Andaman Islands and Malacca, extending eastwards to China, the Malay Archipelago and Bouton Straits.

The seeds are used as a purgative in Indo-China.

Indo-China: Bo met, Bo net, Chua mot, Dat mot, Muoi, Soi giai—; *Lao*: Khang poi—.

ALEURITES.

The genus consists of 6 species, inhabiting warm Asia.

A cordata Steud. is used medicinally in China; *A. moluccana* Willd. in India, the Philippine Islands, Madagascar, Brazil and Guiana.

Aleurites moluccana Willd. is typically a seashore plant. It is found wild and planted in the Malay Peninsula, on the sea-coasts and on limestone rocks at 1,000 to 1,500 feet altitude. It is distributed over the Malay and Polynesian islands. The tree is cultivated in India, and very much so in South India.

The oil obtained from the kernels by expression, has been found, in doses from one to two ounces, to act as a mild and sure purgative, producing in from three to six hours after ingestion free bilious evacuations. It was found to approach nearly to castor oil in the mildness and certainty of its operation, but superior to it as having neither taste nor smell, and as producing its cathartic action without any nausea.

In Madagascar and La Reunion the leaves, heated with a flat iron, are applied several times in succession to articulations in cases of acute rheumatism.

Arabic: Jouzebarri, Khasifehindi—; *Bengal*: Akola, Akrot, Jangliakrot—; *Bombay*: Akrod, Jaiphul, Jangliakrot, Janglieranda, Japhal, Jelapa—; *Brazil*: Noz de Bancoul, Noz da India—; *Burma*: Tosikyasi—; *Canarese*: Akroda, Natakrodu—; *Caroline Islands*: Raguar—; *Chinese*: Shih Leih—; *Cutch*: Akrota—; *English*: Belgaum Walnut, Bengal Walnut, Camiri Nut, Candleberry Tree, Candle Nut, Indian Walnut, Singapore Nut—; *French*: Aleurit des Molluques, Bancoulier—; *Guam*: Lumbang, Raguar—; *Gujerati*: Akhoda, Jangli-akhroda—; *Hawaii*: Eboe, Kukui—; *Hindi*: Akola, Akrot, Jangliakrot—; *Hova*: Bakoly, Savoga, Savokara—; *Ilocano*: Balucanag—; *Jamaica*: Country Walnut—; *Kemirih-Malay*: Buaktas—; *La Reunion*: Bancoul, Bancoulier—; *Madagascar*: Mofotra—; *Malay*: Buahkeras, Kanieri—; *Malayalam*: Akrottu, Akshotam, Karankolam—; *Marathi*: Akhod, Japhala, Ranakhrot—; *Mauritius*: Bancoul—; *Persian*: Chaharmaghz-e-hindi, Girdagan-e-hindi—; *Samoa*: Lama —; *Sanskrit*: Akharota, Akhota, Akshota, Asphotaka, Gudashaya, Kandarala, Karparala, Kaureshta, Madanabhaphala, Parvatiya, Phalasneha, Pritakchhada, Bekhaphala, Svadumajja, Vrittaphala—; *Shan*: Kanyin, Mak man yau, Mak yau lik—; *Sinhalese*: Kakkuna, Ratakekuna, Tel-kekuna—; *Tagalog*: Baguilumban, Balocanad, Balucanad, Calumban, Capili, Lumban, Lumbang—; *Tamil*: Nattakkar-ottu—; *Telugu*: Natakrotu, Uduga—; *Urdu*: Akharut—; *Uriya*: Akuroto—; *Visayan*: Rumbang—.

ANDRACHNE.

This genus consists of 15 species, broadly distributed over the tropical and temperate regions of both hemispheres.

A. ovalis Müll.-Arg. is used in South Africa as an anthelmintic and insecticide.

Andrachne cordifolia Müll.-Arg. is found at altitudes of 5,000-8,000 feet in the Central and Western temperate Himalaya, from Nepal westwards to Murree and Afghanistan.

The plant is poisonous, and the twigs and leaves are said to kill cattle when browsed in the early morning on an empty stomach.

Beas: Chirmutti, Mutkar, Pin—; *Chenab*: Barsu—; *Garhwal*: Bhatula—; *Jaunsar*: Bharti, Bhartoi—; *Jhelum*: Gurguli, Kurkni—; *Punjab*: Gurguli, Kurkni, Kurkuli—; *Ravi*: Barotri, Madare—; *Sutlej*: Tsatin—.

Antidesma.

This genus includes 90 palaeotropical species.

A. madagascariense Linn. is used medicinally in La Reunion; *A. membranaceum* Muell.-Arg. in Liberia; *A. venosum* E. Mey. in South and tropical West Africa; *A. zeylanicum* Lam. in Ceylon; *A. ghaesembilla* Gaertn. in Cambodia; *A. bunius* Spreng, in India.

A. Ovary tomentose or pubescent	...	2. *A. ghaesembilla.*
B. Ovary glabrous.		
a. Leaves 3-6 in. Spikes stout often 4-5 in.	...	1. *A. bunius.*
b. Leaves 1-3 in. Spikes slender 1-1½ in. ...	...	3. *A. zeylanicum.*

1. **Antidesma bunius** Spreng. is a small evergreen tree found throughout the hotter parts of India, from the Nepal and Sikkim Terai and Assam, southwards to Singapore and Penang; and from Parusnath in Behar to Ceylon. It extends to the Malay Islands and China.

The acid leaves are used in snake-bites; and, when young, they are boiled and used in syphilitic cachexia.

Mhaskar and Caius have demonstrated that the leaves are not an antidote to snake venom.

Burma: Kywepyisin—; *Canarese*: Nayikute—; *Lepcha*: Kantjer—; *Malayalam*: Cherutali, Nulittali—; *Marathi*: Amati—; *Nepal*: Himalcheri—; *Pampangan*: Bignay—; *Philippines*: Bubbugnay—; *Sinhalese*: Karawellakebella—; *Tagalog*: Bignai—; *Tamil*: Nolaidali—; *Telugu*: Anepu, Janupolari—; *Visayan*: Bugnai—.

2. **Antidesma ghaesembilla** Gaertn. is a small tree found in the tropical Himalaya, from Simla to Bhutan and southwards to Ceylon, Singapore, Perak and Penang. It extends to Siam and China, the Malay Islands, Australia and Africa.

The bark, the leaves, and the wood are used medicinally in Cambodia. The bark is considered astringent and tonic. The leaves are finely crushed in a mortar and applied to the fontanel of newly-born babes, and to the head of children suffering from dengue or from a cold with cephalalgia. The wood, or better the young stems with their bark, are used as an emmenagogue.

Cambodia: Dangkiep kdam—; *Canarese*: Pulimpurase, Pullampurasigida—; *Central Provinces*: Jhondri—; *Malay*: Balng ayam, Gunchiak—; *Malayalam*: Cheriyannatam—; *Mundari*: Koetang, Koetangnuetasura, Matasuradaru—; *Telugu*: Janupulisaru, Kondapolari, Lona, Nallaballi, Polari—; *Uriya*: Nihanahari—.

3. **Antidesma zeylanicum** Lam. occurs in the southern Deccan Peninsula, and is common in Ceylon.

A decoction of the leaves is used as a snake remedy; but Mhaskar and Caius have shown experimentally that it is useless as an antidotal as well as a symptomatic treatment.

Sinhalese: Hinembilla—; *Tamil*: Nolaidali—.

Aporosa.

The genus consists of 35 Indo-Malayan species.

Aporosa lindleyana Baill., a much-branched evergreen tree, occurs in the Deccan Peninsula from the Konkan southwards, and is abundant in Ceylon.

A decoction of the root is given in jaundice, fever, headache, insanity, and seminal loss.

Canarese: Sarali—; *Malayalam*: Kotili, Vetti, Vittil—; *Sinhalese*: Baranaembilla, Kebella—; *Tamil*: Kotili, Vittil—; *Tulu*: Sarali—.

Baliospermum.

This genus consists of 10 Indo-Malayan species.

Baliospermum montanum Müll.-Arg. (=*B. axillare* Bl.) is a stout subherbaceous leafy shrub. It is found in the tropical and subtropical Himalaya, from Kashmir to Bhutan; in Assam and the Khasia Hills down to Chittagong, Pegu, Tenasserim, Burma, and Penang; in the Deccan Peninsula, from Berar and the Konkan to Travancore. It also occurs in Siam and Java.

This plant is much used in Hindu medicine, where purgation is indicated, the root being generally prescribed. This is described as 'pungent, heating; purgative, anthelmintic, diuretic, alexiteric; useful in pains, diseases of the skin and of the abdomen, piles, wounds, enlarged spleen, itching, inflammations, anæmia, leucoderma, jaundice'.

The seeds are used as a drastic purgative, but in overdoses are an acro-narcotic poison; they are sometimes used as a substitute for *Croton Tiglium*. They are also used externally as a stimulant and rubefacient. The oil is a powerful hydragogue cathartic, and is useful for external application in rheumatism. Madden states that to the east of the Sutlej the leaves are in high repute for wounds, and the sap is believed to corrode iron. The root is considered cathartic, and is used in dropsy, anasarca, and jaundice.

A decoction of the leaves is said to be useful in asthma.

Caius and Mhaskar have found the root equally useless in the treatment of snake-bite and of scorpion-sting.

Arabic: Habbussalatinebarri, Habbussalatinesahrai—; *Bengal*: Danti, Hakum, Hakun—; *Berar*: Boa—; *Bombay*: Dantimul, Jamalgota—; *Burma*: Natcho—; *Canarese*: Danti, Kaduharalu—; *Cutch*: Dantimul, Jamalgota—; *Gujerati*: Dantimul, Jamalgota—; *Hindi*: Dante, Danti, Hakum, Hakun—; *Lepcha*: Poguntig—; *Malayalam*: Dantika, Katalavanakku, Nakadanti, Necvalam, Niratimuttu—; *Marathi*: Danti—; *Melghat*: Danti, Jangli jamalgota—; *North-Western Provinces*: Janglijamalgota—; *Persian*: Bedanjirekhatai—; *Sanskrit*: Amukheti, Anukula, Bhadra, Danti, Dantika, Erandapatri, Erandaphala, Gunapriya, Jayapala, Kumbhi, Madhupushpa, Makunaka, Nagadanti, Nagasphota, Nepala, Nikumbhi, Nishalya, Nishkumbha, Pratyakparni, Raktadanti, Rechani, Ruksha, Shighra, Shwetaghanta, Shyenaghanta, Taruni, Udumbaraparni, Upachitra, Varahangi, Vishalya, Vishodhini—; *Tamil*: Kattamanakku, Niradimuttu, Nirettimuttu, Peyamanakku—; *Telugu*: Ettadundiga, Kanakapata, Kondamudamu, Nelajidi—; *Uriya*: Donti—.

Bischofia.

The only species of this genus, **B. javanica** Bl., is a large evergreen tree occurring in the sub-Himalayan forests and outer

hills, spreading over Chota Nagpur, Assam, Burma, Chittagong, and the Western Peninsula. It is found in the Malay and the Pacific Islands.

In Assam the juice of the leaves is considered a cure for sores.

Assam: Uriam, Uriana—; *Bombay*: Bok—; *Burma*: Aukhyu, Pogaungza, Yepadauk—; *Cagayan*: Toogan—; *Canarese*: Gobranerul, Goparimgurulle, Govarnellu, Nigurulle, Nile, Nilimara—; *Dehra Dun*: Paniala—; *English*: Java Cedar, Vinegar Wood—; *Formosa*: Ka-tang—; *Garhwal*: Kaen, Kanji, Kot semla—; *Haldwani*: Pankoen—; *Hindi*: Bhillar, Irum, Kain, Kein, Kotsemba, Paniala, Pankain—; *Igorrote*: Tuel—; *Ilocano*: Quitaquita—; *Kadir*: Naunal, Nira, Tirippu—; *Kumaon*: Koen—; *Lepcha*: Sa-nong kung—; *Malayalam*: Nira, Tirippu—; *Malkot*: Billar—; *Mundari*: Daruhajam, Hajam—; *Nilgiris*: Red Cedar—; *Oudh*: Irum—; *Philippines*: Canarem, Dueg, Tua—; *Santali*: Pader—; *Saora*: Panta—; *Tagalog*: Dampol, Toa, Toob, Topc, Toog—; *Tamil*: Madagirvembu, Milachadayan, Milachittyan, Tondi—; *Telugu*: Nalupumushti—; *Tharu*: Areng—; *Uriya*: Dingiri—; *Visayan*: Tooc—.

BREYNIA.

This genus consists of 12 species, found in Africa, Asia and Polynesia.

Calyx greatly enlarged in fruit	... 1. *B. patens.*
Calyx not or scarcely enlarged in fruit ...	... 2. *B. rhamnoides.*

1. **Breynia patens** Rolfe is found in the tropical Himalaya from Nepal to Mishmi, in Assam, Chittagong, Burma, the Western Peninsula, and Ceylon.

The plant is astringent to the bowels. The juice of the stem is given in conjunctivitis.

Gujerati: Kamboi, Kedakamboi, Khedakamboi—; *Hindi*: Kalamahomad, Kambhi—; *Malayalam*: Peruniruri—; *Marathi*: Kalichikali—; *Porebunder*: Kali-kamboi, Kamboi—; *Sanskrit*: Bahupraja, Bahupushpa, Devadaru, Kamboji—; *Saora*: Kintaipude—; *Telugu*: Devadari—; *Uriya*: Deulopohora, Jajan, Medhokotahotoru—.

2. **Breynia rhamnoides** Müll.-Arg. is found throughout tropical India, Ceylon, and the Malay Peninsula; extending to the Malay and the Philippine Islands, and China.

The bark is astringent. In Behar the dried leaves are smoked like tobacco, in cases in which uvula and tonsils are swelled.

Canarese: Bamari, Gandupachcheri, Huli, Kadunugge, Karisuli, Kempehuri, Kempuhili, Suli—; *Ceylon*: Manippulanti—; *Hindi*: Surasaruni—; *Malay*: Suruyian—; *Malayalam*: Chuvannaniruri, Kattuniruri, Pavilappula—; *Oudh*: Tikkar—; *Sanskrit*: Aruin—; *Santali*: Kadrupala, Karki—; *Sinhalese*: Gaskayila—; *Tamil*: Kattuniruri, Manippulanji, Pavalappul, Pavalappula, Pamari, Sigappuppula—; *Telugu*: Ettaballi, Ettapurugudu, Nagalipachchari, Pagadapu, Pagadurugudu, Vellari, Yellari—; *Uriya*: Jajan—.

BRIDELIA.

This genus includes 60 species, spread over the tropics and subtropics of the Old World.

B. cambodiana Gagnep. is used medicinally in Cambodia, *B. schlechteri* Hutch. in South Africa; *B. atroviridis* Muell.-Arg., *B. ferruginea* Benth. and *B. micrantha* Baill. are used in Nigeria and in Gold Coast; *B. montana* Willd. and *B. retusa* Spreng, in India.

Leaves membranous	... 1. *B. montana.*
Leaves rigidly coriaceous	... 2. *B. retusa.*

1. **Bridelia montana** Willd. is found in the sub-Himalayan tract from the Jhelum eastwards; it also occurs in the Khasia Hills, the Central Provinces, Bihar, Orissa, and Upper Burma.

The root and the bark are much used as an astringent medicine in Bombay and Goa.

The plant has been credited with anthelmintic properties.

Assam: Kaisho—; *Bombay*: Asano—; *Canarese*: Kittoe, Sidigulige—; *Cutch*: Asana—; *Garhwal*: Gaya—; *Goa*: Faturfoda—; *Gujerati*: Asano—; *Hindi*: Geia, Gondni, Kargnalia, Khaja, Kusi—; *Khond*: Balli—; *Kumaon*: Kurgnulia—; *Marathi*: Asana—; *Mundari*: Karakadaru—; *Nepal*: Geio—; *Saharanpur*: Gondni—; *Tamil*: Vengaimaram—; *Telugu*: Gundubigalu, Panchavoni, Pantangi, Pantegi, Pantiga, Patunga, Sannakodari, Tellavegisa—; *Uriya*: Marda, Nuanali—.

2. **Bridelia retusa** Spreng. is found throughout India, and Ceylon, Burma and Malacca.

The root and the bark are valuable astringents.

Hindu practitioners in Western India use the bark for the removal of urinary concretions.

The bark is used as a liniment with gingelly oil in rheumatism.

Ajmere: Lamkana—; *Assam*: Kohir—; *Banswara*: Angnera—; *Bengal*: Kasai, Kosai—; *Betul*: Kasai, Sankana—; *Bhil*: Asana, Gunjan, Katiain—; *Bhumij*: Karika—; *Bombay*: Asauna, Assana, Phatarphod—; *Burma*: Seikche, Seikchi, Seikgyi, Tseichyi—; *Canarese*: Asana, Garige, Goje, Gojji, Guju, Gurige, Gworgie, Havugandha, Kogyamunji, Maguva, Muljane, Mullahonne, Mullubenga, Mulluhonne, Nasinagandha, Nasinage, Phatterphodi, Siruhonne—; *Central Provinces*: Karka, Kassei, Kassi—; *Chittagong*: Kamkui—; *Deccan*: Sun—; *Dehra Dun*: Gaya, Khaja—; *Garhwal*: Gauli, Gaya, Khaja—; *Garo*: Kashi—; *Gond*: Kassei—; *Gujerati*: Asana, Ekalakanto, Monj—; *Hindi*: Gauli, Kaj, Kajja, Kassi, Khaja—; *Ho*: Kaka—; *Kalagarh*: Goli—; *Kharwar*: Kaj, Kaji, Kanj—; *Khond*: Rugendi—; *Kolami*: Kaka, Kharaka—; *Konkani*: Kongy—; *Kurku*: Karka, Karkha—; *Lambadi*: Makhiro—; *Lepcha*: Pengji—; *Malayalam*: Chalaru, Komanji, Mullukayani, Mulluvenya, Mulluvenna—; *Mandevi*: Haklo—; *Marathi*: Asana, Asanakutgi, Gunjan, Kantakauchi, Katiain, Katiyen, Kutki, Palapasana, Patharaphoda, Phatharaphoda—; *Matheran*: Asana, Hasana, Palehasan, Phatarphod—; *Mechi*: Katakuchi—; *Monghyr*: Kuj—; *Mundari*: Karaka—; *Nepal*: Geio—; *Nimar*: Kasai, Sankana—; *Portuguese India*: Bentka—; *Punjab*: Mark, Pathor—; *Rajbanshi*: Nanda—; *Rajputana*: Angnera, Lamkana—; *Rammagar*: Goli—; *Reddi*: Annemu—; *Saharanpur*: Ekdania, Gondni—; *Sanskrit*: Asana, Ekadivi, Ekavira, Mahavira, Sakridvira, Suvarika—; *Santali*: Kadrupala—; *Saora*: Annemu—; *Sinhalese*: Kattakaala, Ketakala, Ketakele—; *Tamil*: Adamarudu, Asuvai, Kadugai, Komanji, Malaivengai, Mullumarudu, Mulluvengai, Mulvengai, Sem, Singattan, Siruvengai—; *Telugu*: Annemu, Bontavegita, Duriyamaddi, Ettapattaka, Kodaratti, Koramaddi, Koramanu, Kosengi, Peddayanemu, Poramanu, Selaka—; *Tharu*: Khooj—; *Tinnevelly*: Adamaradu—; *Tulu*: Mullugunje—; *Uriya*: Kasai, Kasi, Kosai, Kosi, Panikasi—.

Buxus.

The genus consists of 25 species, inhabiting the temperate regions of the Old World.

B. balearica Lam. is used medicinally in Majorca, *B. sempervirens* Linn. in Europe and North America.

Buxus sempervirens Linn. occurs in the temperate Himalaya, from Kumaon to Simla and Bhutan at 5,000-9,000 feet, and on the Salt Range in the Punjab. Westwards it extends to North Africa, and to western and southern Europe, where it abounds in

limestone districts. Northwards it extends to western Siberia, Turkestan, China and Japan.

Yunani practitioners use both the leaves and seeds:—'The leaves are good for headache, pain, prolapsus ani. The seeds are bitter, astringent, tonic to the heart and brain; used in stomatitis, to dry the bad humours of the liver'.

The wood in its native countries is considered diaphoretic, being given in decoction as an alterative for rheumatism and secondary syphilis. It is used as a substitute for guaiacum in the treatment of venereal disease when sudorifics are considered to be the correct specifics.

Boxwood has been found narcotic and sedative in full doses; emetico-cathartic and convulsant in overdose. The tincture was formerly used as a bitter tonic and antiperiodic, and had the reputation of curing leprosy.

A volatile oil distilled from the wood has been prescribed in cases of epilepsy. The oil has been employed for piles and also for toothache.

The leaves, which have a nauseous bitter taste, have sudorific, alterative, and cathartic properties; they are given in powder, in which form they are also an excellent vermifuge.

Various extracts and perfumes were formerly made from the leaves and bark. A decoction was recommended as an application to promote the growth of the hair.

Dried and powdered, the leaves are still given to horses for the purpose of improving their coats. The powder is regarded by carters as highly poisonous, to be given with great care. In Devonshire, farriers still employ the old remedy of powdered Box leaves for bot-worms in horses.

In some parts of Europe Box is one of the active ingredients in a cure for the bite of a mad dog.

Camels readily eat the leaves; but they are poisoned by them.

The bark of the root is officinal in Portugal.

Afghanistan: Shandalaghune—; *Arabic*: Bakas—; *Catalan*: Boix—; *Dutch*: Boxboom, Palm, Palmboom—; *English*: Box Tree, Dudgeon, Evergreen Box—; *French*: Bois bénit, Buis, Buis commun, Ozanne—; *German*: Buchsbaum—; *Greek*: Pyxos—; *Italian*: Bosso, Bossolo, Busso, Buxo, Mortella—; *Jaunsar*: Papri, Sansadu—; *Kashmir*: Chikri—; *Kumaon*: Papri—; *Mashudi*: Shamshath—; *North America*: Box-tree, Bush-tree, Common Box, Dudgeon—; *North-Western Himalayas*: Chikri, Papri, Poppar, Sansadu, Shamshad—; *Persian*: Shamshad—; *Portuguese*: Buxo—; *Punjab*: Chikri, Papar, Paprang, Papri, Papur, Shamshad, Shumaj—; *Roumanian*: Cimisu, Cimsu, Merisor tureesc—; *Russian*: Buksus, Samshit—; *Spanish*: Boj—; *Swedish*: Buxbom—; *Urdu*: Shamshad—.

Chrozophora.

This genus consists of 11 species, natives of the Mediterranean region, tropical Asia and tropical Africa.

C. plicata A. Juss. is a poison with acrid properties. *C. senegalensis* A. Juss. is used medicinally in Northern Nigeria.

A prostrate herb. Stamens 15 in two whorls. Ovary and capsule with stellate tomentum and silvery scales. 2. *C. rottleri*.

A procumbent stellately woolly herb. Ovary and capsule with stellate tomentum but without silvery scales ... 1. *C. prostrata*.

1. **Chrozophora prostrata** Dalz. is found throughout India: the Punjab, the Upper Gangetic Plain, Bihar, Gujerat, Konkan, Deccan, North Kanara, Sind, Central and South India. It extends westwards to North Africa and Spain.

The ashes of the root are given to children for cough. The leaves are considered depurative. The seeds are used as purgative.

The Santals mix the root with that of *Carissa Carandas* for blistering purposes.

Bengal: Khudiokra—; *Chinese*: Pa Teou Nan—; *French*: Bancoulier—; *Gujerati*: Betookharada, Okharada—; *Hindi*: Shadevi, Sonballi, Subali—; *Punjab*: Nilakrai, Nilkhanti, Putkhanda—; *Sanskrit*: Suryavarta—; *Santal*: Pangonari—; *Sind*: Shadevi, Sonballi, Subali—; *Tank*: Nealboti—; *Telugu*: Guruguchettu, Lingamiriyam—.

2. **Chrozophora rottleri** A. Juss. occurs through the whole of India. It extends to Afghanistan and thence to the Mediterranean region.

The plant has emetic, drastic, and corrosive properties. The seeds are used as a cathartic.

Afghanistan: Kapochist—; *English*: Turnsole—; *French*: Morelle à indigo—; *Gujerat*: Kalookharad—; *Hindi*: Shadevi, Sonballi, Subali—; *Marathi*: Suravarta—; *Punjab*: Kukronda, Nilan, Tappalbuti—; *Sanskrit*: Suryavarta—; *Sind*: Shadevi, Sonballi, Subali—; *Spanish*: Tornasol—.

Cicca.

C. disticha Linn. (=*Phyllanthus distichus* Müll.-Arg.) is cultivated in India and the Malay Peninsula. It occurs in the Malay Islands and in Madagascar.

The root and the seed are cathartic. The fruit is acid and astringent.

The juice of the root-bark is used as a poison, often for criminal purposes. It produces headache, sleepiness, and death accompanied by severe abdominal pains.

Bengal: Hariphal, Hariphul, Loda, Noari—; *Bombay*: Harparawri, Raisvala—; *Burma*: Thimbawzibyu, Thinbawniyu, Thinbozihpyu—; *Canarese*: Aranelli, Karinelli, Kirinelli, Kirunelli, Rayaranelli—; *English*: The Country Gooseberry, Star Gooseberry—; *French*: Brignolier—; *Goa*: Cherambola—; *Hindi*: Chatmeri, Harfarauri, Nuree, Nurphal—; *Konkani*: Rojanvalli, Rosanvalli—; *La Reunion*: Cherimbelier—; *Malay*: Chermela—; *Malayalam*: Arinelli, Nellipuli—; *Mauritius*: Chérimbolier—; *Pampangan*: Iba—; *Sanskrit*: Ghana, Komalavalkala, Lavali, Lavalippala, Lavani, Pandu, Skandhaphala, Srigdha, Sugandhamula—; *Sinhalese*: Ratanelli—; *Tagalog*: Bangquiling, Banquilin, Iba, Yba—; *Tamil*: Arunelli, Sadadaram, Sadagam—; *Telugu*: Rachayusirika, Ratsavusiriki—; *Tulu*: Karinelli—; *Urdu*: Harpharuri—; *Uriya*: Aurakuli, Bungarada, Narokoli—; *Visayan*: Bangquiling, Layohan, Poras—.

Cleistanthus.

The genus includes 110 African and Indo-Malayan species.

Cleistanthus collinus Benth. occurs in Bihar, Chota Nagpur, the Satpura Range, the Chanda District and the Western Peninsula. It is rare in Ceylon.

The plant is poisonous. An extract of the leaves and fruit acts as a violent gastro-intestinal irritant.

In Chota Nagpur the fruit and bark are employed to poison fish; the latter is also considered a useful application in cutaneous diseases. For severe headache, the head and upper part of the body are bathed in water in which the leaves have been steeped. The Mundas throw the leaves, dried and pounded, into pools and ponds to kill fish.

Berar: Ghara—; *Canarese*: Badedarige, Bodadaraga, Kadagargari, Kodasige—; *Central Provinces*: Ganari, Garar, Garari—; *Gond*: Garari—; *Hasada*: Parasudaru—; *Hindi*: Garari, Garrar, Karla—; *Ho*: Pasu—; *Kharwar*: Kargali, Kergali—; *Khond*: Kadise—; *Kolami*: Larshuter, Parasu, Pas, Pasu—; *Malayalam*: Nilappala—; *Marathi*: Garari—; *Mundari*: Kargelung, Parasu—; *Naguri*: Kargelodaru, Kargelungdaru—; *Sanskrit*: Indrayava, Kaudigam, Kutaja, Nandi—; *Santali*: Kargali, Kargalli—; *Tamil*: Nilaippalai, Odaichi, Odan, Odishi, Odu, Odugu, Oduppai, Oduvan—; *Telugu*: Kadise, Korshe, Korsi, Vadise—; *Uriya*: Karada, Koroda, Korora—.

CROTON.

This genus includes 600 species, inhabiting all tropical and subtropical countries.

The 'Crotons' of gardens do not belong to this genus, but to the genus *Codiaeum* of Papua and Polynesia.

The following species are used medicinally in China, Malaya, the Philippine Islands—*C. Tiglium* Linn.—; in Indo-China— *C. argyratus* Bl., *C. Cumingii* Müll.-Arg., *C. maieuticus* Gagnep., *C. oblongifolius* Roxb., *C. poilanei* Gagnep., *C. Tiglium* Linn., *C. tonkinensis* Gagnep.—; in North America— *C. californicus* Müll.-Arg.—; in Mexico — *C. dioicus* Cav., *C. draco* Cham. and Schlecht., *C. niveus* Jacq., *C. vulpinus* Sesse and Moq.—; in Venezuela and Colombia— *C. leptostachyus* H. B. and K., *C. malasubo* Karst.—; in Peru— *C. suberosus* H. B. and K.—; in Brazil— *C. antisiphiliticus* Mart., *C. campestris* St. Hil., *C. fulvus* Mart.—; in Guiana— *C. origanifolius* Lam.—; in the West Indies— *C. cascarilla* Benn., *C. eluteria* Benn., *C. flavens* Linn., *C. glabellus* Linn., *C. lucidus* Linn.—; in Gambia and Nigeria— *C. amabilis* Muell.-Arg., *C. lobatus* Linn.—; in Gold Coast— *C. lobatus* Linn., *C. penduliflorus* Hutch—; in East Africa— *C. elliotianus* Baill., *C. gubouga* S. Moore; in Southern Africa— *C. gratissimus* Burch., *C. gubouga* S. Moore, *C. sylvaticus* Hochst.—; in Madagascar— *C. macrobuxus* Baill.—.

A. Inflorescence lepidote.
  a. Leaves densely lepidote beneath
    1. A tree ... ... 1. *C. argyratus.*
    2. A shrub.
      i. Petiole ½-1½ in. Stamens 15-18. Capsule ½ in. long, broadly oblong ... ... 5. *C. reticulatus.*
      ii. Petiole ¼ in. Stamens 12-15. Capsule ¼ in. long, scaly ... ... 3. *C. Cumingii.*
  b. Leaves glabrous when old ... ... 4. *C. oblongifolius.*

B. Inflorescence stellately tomentose or glabrous.
  a. Leaves 3-5-plinerved at the base, scabrid or softly pubescent with stellate hairs beneath ... 2. *C. caudatus.*
  b. Leaves strongly triple-nerved ... ... 6. *C. Tiglium.*

1. **Croton argyratus** Bl. is a small evergreen tree, common in the forests and woods of Burma, Malaya, Sumatra, Java, and Borneo.

In Indo-China the leaves are infused for a digestive tea.

Indo-China: Bac la, Day mang—; *Malay*: Cherit badak, Mungke, Simmungke—.

2. **Croton caudatus** Geisel is found in the Eastern Himalaya, in Assam and Bengal down to the Deccan, Malacca, and Ceylon; extending to Java and the Philippine Islands.

The leaves are applied as a poultice to sprains.

In Lakhimpur the young leaf buds are powdered with the leaves of *Caesalpinia sappan* and used for liver diseases.

Bengal: Nanbhantur—; *Lakhimpur*: Latamahundi—; *Lepcha*: Tackchabrik—; *Malay*: Akar guroh periat, Akar tuku takal—; *Uriya*: Pholancokriti, Sanaushnota, Wusta—.

3. **Croton Cumingii** Müll.-Arg. is a straggling shrub found on rocks, usually limestone, throughout the Malay Peninsula, Siam, Indo-China, and the Philippine Islands.

The plant is used medicinally in Annam.

Indo-China: Co chu lon—.

4. **Croton oblongifolius** Roxb. is found in Sylhet, Bengal, Chota Nagpur, the Central Provinces, Burma, the western Peninsula, and Ceylon.

The seeds and fruits are purgative.

The Goanese and the inhabitants of Southern Konkan administer the bark in chronic enlargements of the liver and in remittent fever. In the former disease, it is both taken internally and applied locally. As an application to sprains, bruises, rheumatic swellings, etc., it is in great request.

In the Southern Konkan, it has a reputation as a remedy in snake-bites.

The Santals use the bark and root as a purgative and as an alterative in dysentery.

The roots enter into the composition of pills used by the Mundas of Chota Nagpur for chronic rheumatism. The root bark is given in small doses as a purge; a larger quantity is said to be poisonous.

The leaves are used externally in Cambodia for liver complaints and scabies. The leaves are often boiled in water, and the liquid applied hot to the itch.

The root, bark, and seeds are equally useless in the antidotal and symptomatic treatment of snake-bite; the root is useless as an external application (Mhaskar and Caius).

Assam: Burmaparokupi—; *Bengal*: Baragach, Putri—; *Bombay*: Ganasuar, Gunsur—; *Burma*: Theyin, Thityin—; *Cambodia*: Trapung—; *Goa*: Gonsur—; *Hindi*: Buragach—; *Indo-China*: Cui den, Tra poung—; *Kharwar*: Bhain swan—; *Koderma*: Maisonda—; *Kolami*: Konya, Kuli, Kurti, Kutikonyer, Poter—; *Lohardugga*: Putri—; *Malay*: Kote, Putol—; *Mal Paharia*: Putol—; *Marathi*: Ganasura, Gunsur—; *Mundari*: Kuti, Kutidaru—; *Nepal*: Ach—; *Oudh*: Arjunna—; *Patna*: Chucka—; *Sanskrit*: Bhutankusa—; *Santali*: Gote—; *Tamil*: Milgunari—; *Telugu*: Bhutalabhairi, Bhutankusamu—; *Tharu*: Mahson—; *Uran*: Poter—; *Uriya*: Masundi—.

5. **Croton reticulatus** Heyne is found in the Deccan Peninsula, from the Konkan southwards. It also occurs in the Central Province of Ceylon.

The bark is used as a bitter stomachic.

Bombay: Panduray—; *Marathi*: Pandhari, Pandharisala—; *Matheran*: Pandhri, Pandurai—.

6. **Croton Tiglium** Linn. is found naturalized and cultivated in Bengal, Assam, and southwards to Burma, Malacca, and Ceylon. It extends to the Malay Islands and Ceylon.

According to Ayurveda the fruit and the seed are purgative; and the oil from the seed is purgative, carminative, useful in diseases of the abdomen, mental troubles, convulsions, fever, insanity, inflammations, bronchitis.

According to Yunani practitioners the seeds have a bitter bad taste, causing a burning sensation; cathartic, expectorant, emetic; good in sore eyes, excessive phlegm, leucoderma.—The oil is cathartic, tonic; removes pus and bad matter from the body.

The seeds and the oil are officinal and their properties are well known: irritant, rubefacient, cathartic. The seeds are officinal in Finland and Portugal; the oil is officinal in Austria, Belgium, Beazil, Denmark, France, Germany, Great Britain, Japan, Mexico, Norway, Russia, Spain, Switzerland, the United States, and Yugoslavia.

In Lakhimpur the seeds are ground in water, and the infusion is used to kill insect pests.

The fruits are employed by Dayaks in Borneo to poison fish. The root is used in Kelantan as an abortifacient.

On account of their drastic purgative properties the seeds and oil are regarded by the Chinese as entirely poisonous. The bark is used as a tonic in Annam.

Caius and Mhaskar gave two adult males one minim of croton oil in one dose. The patients had several motions, but passed no worms though they were ultimately found to have been harbouring 356 hookworms. These same workers found that the seeds are not an antidote to snake venom, and that they are useless as a collyrium in the treatment of snake-bite or as an external application to the sting of the scorpion; they also demonstrated that the leaves have no action when applied externally to the site of the bite from a poisonous snake.

Annam: Ba dau—; *Arabic*: Batu, Dand, Datun, Habbussalatin—; *Bengal*: Jamalgota, Jaypal, Jhayal, Rechuk—; *Bombay*: Jaipa, Jaipal, Jamalgota—; *Burma*: Kanako—; *Canarese*: Danti, Japala, Jayapala, Nepala—; *Chinese*: Pa Teou, Pa Teou Seou, Pa Tou—; *Deccan*: Jamalgota—; *English*: Purging Croton—; *French*: Bois des Molluques, Bois de Pavana, Bois de Pavanna, Pois purgatif, Graine de Tilly, Graine de Moluques, Petit pignon d' Inde—; *Gujerati*: Nepal—; *Hamadan*: Habb-el-salatin—; *Hindi*: Jamalgot, Jamalgota— *Indo-China*: Ba dau, Ba tau, Bat khlot, Cong khoi—; *Italian*: Grana tiglio—; *Japan*: Hazu—; *Java*: Cheraken—; *Lakhimpur*: Kanibhi—; *Malay*: Chemkian, Chengkian—; *Malaya*: Bori, Pai Tow—; *Malayalam*: Dantibijam, Katalavanakku, Nirvalam—; *Marathi*: Jamalagota, Jepal, Jeyapal—; *Mauritius*: Croton jilly, Tilly—; *Persian*: Badanjirekhatai, Bidendjirehkhatai, Dund, Habbdilmaluk, Habbelkhatai—; *Portuguese*: Croton tiglio—; *Sanskrit*: Danti, Jayapala, Nepala—; *Sinhalese*: Jayapala, Nepalam—; *Tagalog*: Camaisa, Tuba, Tubacamaisa—; *Tamil*: Kattukkattai, Naganam, Nagangi, Nervalam, Nigumbam, Nirvalam, Sambari, Sayabalam, Sevalangottai, Siduram, Sittudu, Tendi—; *Telugu*: Nepalamu, Nepalavemu—; *Tulu*: Berada, Eyaribittu—; *Uriya*: Jaipalo Joyopalo, Konika—; *Visayam*: Camarandag, Macasla, Tubasabuquid—.

EUPHORBIA.

The genus comprises 750 species, inhabiting chiefly subtropical and warm temperate countries. It is very various in habit. Some species have a fleshy angular stem, furnished with spines, resembling that of a Cactus; these species yield by incision a resinous juice which is strongly drastic, and used externally as a vesicant. The other Euphorbias, which have a normal stem and leaves, have a purgative milky juice; some are considered efficacious in syphilitic cachexia; others are emetic, or slightly astringent and aromatic, or astringent and slightly narcotic.

The following species are used medicinally in Europe— *E. amygdaloides* Linn., *E. Chamaesyce* Linn., *E. Characias* Linn., *E. Cyparissias* Linn., *E. Esula* Linn., *E. Gerardiana* Jacq., *E. helioscopia* Linn., *E. hyberna* Linn., *E. Lathyris* Linn., *E. Myrsinites* Linn., *E. palustris* Linn., *E. Peplis* Linn., *E. Peplus* Linn., *E. resinifera* Berg., *E. serrata* Linn.—; in the Mediterranean region— *E. aleppica* Linn., *E. Apios* Linn., *E. dendroides* Linn., *E. Peplis* Linn., *E. spinosa* Linn.—; in Arabia— *E. antiquorum* Linn., *E. officinarum* Linn.—; in China— *E. adenochlora* Morr. and Dcne., *E. helioscopia* Linn., *E. humifusa* Willd., *E. Lathyris* Linn., *E. pekinensis* Rupr., *E. Sieboldiana* Morr. and Dcne.—; in Indo-China: *E. antiquorum* Linn., *E. Atoto* Forst., *E. Chamaesya* Linn., *E. edulis* Lour., *E. hirta* Linn., *E. hypericifolia* Linn., *E. neriifolia* Linn., *E. parviflora* Linn., *E. rosea* Retz, *E. thymifolia* Linn., *E. Tirucalli* Linn.—; in Malaya— *E. Lathyris* Linn., *E. pekinensis* Rupr., *E. Sieboldiana* Morr. and Dcne.—; in the Philippine Islands— *E. hirta* Linn., *E. neriifolia* Linn., *E. Tirucalli* Linn.—; in Australia— *E. Drummondii* Boiss.—; in Fiji— *E. hirta* Linn.—; in North America— *E. albomarginata* Torr. and Gray, *E. coralloides* Linn., *E. corollata* Linn., *E. hirta* Linn., *E. humistrata* Engl., *E. Ipecacuanha* Linn., *E. Lathyris* Linn., *E. maculata* Linn., *E. marginata* Pursh., *E. ocellata* Durand, *E. Preslii* Guss., *E. serpyllifolia* Pers.—; in the West Indies— *E. buxifolia* Lam., *E. linearis* Retz, *E. pulcherrima* Willd.—; in Mexico— *E. glyptosperma* Linn., *E. prostrata* Ait., *E. pulcherrima* Willd.—; in Peru— *E. laurifolia* Lam., *E. pulcherrima* Willd.—; in Chile— *E. portulacoides* Linn.—; in Brazil— *E. brasiliensis* Lam., *E. caecorum* Mart., *E. cotinifolia* Linn., *E. heterodoxa* Muell.-Arg., *E. hypericifolia* Linn., *E. papillosa* St. Hil., *E. phosphorea* Mart.—; in Guiana— *E. cotinoides* Miq., *E. hirta* Linn., *E. hypericifolia* Linn., *E. punicea* Sw.—; in the West Indies— *E. hirta* Linn., *E. pulcherrima* Willd.—; in the Canary Islands and in Guinea— *E. balsamifera* Ait., *E. canariensis* Linn.—; in West Africa— *E. aegyptiaca* Boiss., *E. balsamifera* Ait., *E. convolvuloides* Hochst., *E. hirta* Linn., *E. kamerunica* Pax, *E. lateriflora* Schum. and Thonn., *E. leonensis* N. E. Br., *E. Poissonii* Pax, *E. polycnemoides* Hochst.—; in Abyssinia— *E. cerebrina* Hochst.—; in Ethiopia— *E. officinarum* Linn.—; in Madagascar— *E. anagalloides* Bak., *E. Bojeri* Hook., *E. emirnensis* Bak., *E. erythroxyloides* Bak., *E. hirta* Linn., *E. splendens* Boj., *E. trichophylla* Bak.—; in La Reunion— *E. dissimilis* Cordem., *E. goliana* Lam., *E. heyneana* Boiss., *E. hirta* Linn.,

E. hypericifolia Linn., *E. Peplus* Linn., *E. prostrata* Ait., *E. thymifolia* Burm., *E. Tirucalli* Linn.—; in Southern Africa— *E. abyssinica* J. F. Gmel., *E. basutica* Marl., *E. bupleurifolia* Jacq., *E. clavarioides* Boiss., *E. helioscopia* Linn., *E. ingens* E. Mey., *E. mauritanica* Linn., *E. procumbens* Mill., *E. restituta* N. E. Br., *E. sanguinea* Hochst. and Steud., *E. striata* Thunb., *E. truncata* N. E. Br., *E. virosa* Willd.—.

E. Candelabrum Tremaut, *E. mauritanica* Linn., *E. striata* Thunb., and *E. virosa* Willd. are used as arrow poisons by the Bushmen of Southern Africa; *E. sapini* de Wild. is similarly used by the tribes of Oubanghi-Chari.

The latex of *E. canariensis* Linn. is officinal in Portugal and Spain; that of *E. resinifera* Berg. in Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Hungary, Italy, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, and Yugoslavia.

A. Herbs, rarely shrubby below; prostrate or ascending. Leaves all opposite. Glands 4-5, usually furnished with a membranous petaloid limb.

I. Erect or decumbent branching herbs or shrubs, with leaves $\frac{1}{8}$-$\frac{2}{3}$ in. long or thereabouts. Involucres in axillary and subterminal cymes or crowded in the uppermost leaves. Limb of gland conspicuous though small.

a. Glabrous. Stem stout swollen at the nodes ... 2. *E. Atoto.*

b. Glabrous or sparsely pubescent

1. Annual. Seeds smooth or with broad shallow transverse pits ... ... 7. *E. hypericifolia.*

2. Perennial. Seed rugose ... ... 12. *E. rosea.*

c. Hispid with copious crisped hairs ... ... 6. *E. hirta.*

II. Prostrate, rarely erect plants, with leaves $\frac{1}{8}$-$\frac{1}{3}$ in. long, rarely more. Involucres solitary, or in very short subsessile cymes, usually crowded along one side of the stem, or of short lateral branches. Limb of gland obscure or absent.

a. Stems hispidly hairy. Capsules pubescent or hirsute.

1. Leaves crenulate. Capsules pubescent. Seeds furrowed ... ... 16. *E. thymifolia.*

2. Leaves entire. Capsules hirsute. Seeds pitted ... ... 4. *E. granulata.*

b. Stems glabrous. Capsules glabrous.

1. Leaves nearly as broad as long. Seeds smooth ... ... 9. *E. microphylla.*

2. Leaves from a very unequal base, elliptic-rhomboid, very obtuse ... ... 14. *E. sanguinea.*

c. Stems glabrous or short-hairy ... ... 19. *E. turcomanica.*

B. Shrubs or trees with fleshy terete ribbed angled or flattened stems and branches. Leaves absent or alternate or the upper opposite.

I. An erect unarmed shrub or tree. Branches spreading, cylindric, scattered, whorled or clustered. Leaves absent or few small linear-oblong ... ... 17. *E. Tirucalli.*

II. Erect shrubs or trees, with stout angled ribbed or winged branches that are crenate or nodose at the angles or wings, and there provided with 2 or 3 stipular prickles.

a. Pairs of stipular spines on tubercles or swellings of the branchlets ... ... 10. *E. neriifolia.*

b. Pairs of stipular spines on flat brown or black corky areas, not on swellings of the branchlets. 11. *E. nivulia.*
c. Pairs of stipular spines in the sinuses of the thick sinuate wings .... 1. *E. antiquorum.*
d. Pairs of stipular spines on the margins of the thick obtuse undulate wings ... ... 13. *E. Royleana.*
e. Pairs of stipular spines on the lobes of the lobulate wings ... ... 18. *E. trigona.*

C. Herbs, rarely shrubby below, usually erect. Leaves alternate, upper opposite.
I. Involucral glands transversely oblong with rounded margins.
a. Perennial herbs.
1. Capsule smooth. Plant quite glabrous ... 15. *E. Thomsoniana.*
2. Capsule warted. Plant glabrous or sparsely hairy ... ... 8. *E. longifolia.*
b. Annuals. Capsule smooth. Seeds pitted ... 5. *E. helioscopia.*
II. Involucral glands truncate retuse or 2-cornate. Annuals. Seeds oblong leprous ... ... 3. *E. dracunculoides.*

1. **Euphorbia antiquorum** Linn. occurs throughout the hotter parts of India and Ceylon, in dry places, ascending to 2,000 feet. It is common all over Burma, being often cultivated for hedges. It is found on the limestone rocks of the Malay Peninsula, where the plant is also cultivated occasionally.

In the Nighantas the plant is described as purgative, pungent, digestive, bitter and heavy, and is said to be useful in constipation, flatulent distention, tumours, swellings, abdominal enlargements, rheumatism, spleen, leprosy, mania and jaundice.

A plaster, prepared from the roots and mixed with asafœtida, is applied externally to the stomachs of children suffering from worms. The bark of the root is purgative, and the stem is given in decoction in gout.

The juice, which flows from the branches, is used as a purgative to relieve pain in the loins. It is an acrid irritant in rheumatism and tooth-ache. When taken internally, it acts as a drastic purgative. It is also employed in nervine diseases, dropsy, palsy, deafness and amaurosis. It is a popular application to warts and other cutaneous affections.

The juice is prescribed as a purge and deobstruent in those visceral obstructions and dropsical affections which are consequent on long-continued intermittent fever. Externally, mixed with margosa oil, it is applied to limbs which have become contracted from rheumatism.

In Bombay the root is mixed with country liquor to make it more intoxicating, and the juice is used to kill maggots in wounds, and is dropped into the ear to cure earache, a practice common to many parts of India. In the Konkan the stem is roasted in ashes, and the expressed juice, with honey and borax, given in small doses to promote the expectoration of phlegm.

The Mundas of Chota Nagpur use the milky juice to poison and catch fish. The juice is also used as a purge: mixed in a raw egg it gives as many stools as there are drops of the juice in the mixture.

A preparation from this plant is given as a cure for cough by the Santals.

The hard woody part of the stem is used medicinally by the Malays.

In Cambodia the latex is used as an emetic; the core of the plant is administered in dysentery and in febrile conditions. Throughout Indo-China the milky juice is reputed emetic, purgative, and hydragogue.

The Hindus employ the root mixed with black pepper as a medicine for the cure of snake-bites internally and externally. Mhaskar and Caius have experimented with both the root and the milky juice, and they have found that, whether given internally or applied externally, those drugs are useless in the treatment of snake-bite.

Annam: Xuong rong—; *Arabic*: Zaqqum-e-hindi—; *Belgaum*: Tindarisend—; *Bengal*: Bajvaran, Lariyadaona, Nagri, Narasij, Tekatasij—; *Burma*: Pyathal, Shasoung-pyathal, Shazanoji, Tazaung—; *Cambodia*: Chanlat day—; *Bombay*: Bontakalli, Bontegalli, Bontekalli, Chaturagalli, Jadekalli, Mundugalli—; *Ceylon*: Chaturakkalli—; *Deccan*: Tidharisend, Tindharisend—; *English*: Spurge Cactus—; *Gujerati*: Tandharisend—; *Hasada*: Siddaru—; *Hindi*: Narashij, Sayord, Tidharasend—; *Indo-China*: Chan leat day, Thanh long, Xuong rong—; *Malayalam*: Chaturakalli, Kalli, Ratakkali—; *Marathi*: Naraseja, Narsej—; *Michi*: Shidu—; *Mundari*: Eteke, Etete, Siddaru, Marangeteke—; *Persian*: Zaqqum-e-hindi, Zaqunniya-e-hindi—; *Sadani*: Sid—; *Sanskrit*: Sihunda, Simhunda, Snuhi, Tridharaka, Vajra, Vajrakantaka, Vajri—; *Santal*: Etke, Etkec'—; *Sinhalese*: Daluk—; *Tamil*: Amudangam, Kalli, Kandiravam, Kaniravam, Kodiravam, Mavirukkam, Murittargalli, Sadurakkalli, Saduchi, Sunakkudam, Tiruvargalli, Vachiram, Vachirangam, Valangalli—; *Telugu*: Bommajemudu, Bontajemudu, Bontakalli, Peddajemudu, Simhundumu—; *Tulu*: Darekhalli—; *Urdu*: Zakum—; *Uriya*: Dokahanasiju, Dokanasij, Lohasiju—; *Yemen*: Gholak, Kelah—.

2. **Euphorbia Atoto** Forst. is found on the Malabar Coast, from Canara southwards. It is common on the sandy seashores of the Malay Peninsula, the Andaman Islands, and Ceylon. It is distributed to the Malay Archipelago, China, Australia, and the Pacific Islands.

In Indo-China women use the milky juice as an emmenagogue, and also as an abortifacient. According to Sallet, when prepared in a certain way and cooked with honey over the water bath the latex is a good remedy for tuberculosis.

In New Caledonia sea-water in which the plant has been soaked and malaxated is very much used as a purgative.

Indo-China: Thuoc doi—.

3. **Euphorbia dracunculoides** Lam. is met with throughout India in the plains and low hills. It extends westwards to Arabia and tropical Africa.

The fruit is used to remove warts.

Bengal: Chhagulpuputi, Jychee—; *Hindi*: Chagulputputi—; *Punjab*: Kangi, Richni, Sudab—; *Rajputana*: Bamburi—; *Santal*: Parwa—; *Telugu*: Tillakada—.

4. **Euphorbia granulata** Forsk. inhabits the Western Peninsula, Chota Nagpur, Malwa, the Rajputana Desert, the Punjab, Sind, Afghanistan, Arabia, Egypt, and the Canary Islands.

In Las Bela the plant is said to purify the blood.

Arabic: Lebbaejde, Lebbejn, Libbein, Melachene—; *Jhalawan*: Gwandar—; *Kharan*: Shirgonah—; *Las Bela*: Khirwal—; *Rajputana*: Dudeli—; *Santali*: Kantha arak—.

5. **Euphorbia helioscopia** Linn. is a common field-weed in spring throughout the Punjab plains and the Siwalik tract, ascending to 7,000 feet in the outer Himalaya. It has been introduced into the Nilghiris. It spreads over Afghanistan, and westwards to the Atlantic. It also occurs in Japan.

The plant is used as a hydragogue cathartic, and the juice is applied to remove warts. The juice is sometimes, though improperly, used to cure sore eyelids, causing in many instances intolerable pain and inflammation.

In the Punjab the milky juice is applied to eruptions, and the seeds are given with roasted pepper in cholera. In Waziristan the juice is used in herpes.

In Sind the juice is used in the form of a liniment in neuralgia and rheumatism, and the root is employed as an anthelmintic.

The latex is successfully used for the removal of warts in South Africa.

Afrikaans: Melkbos, Melkgras, Wolfsemelk—; *Arabic*: Rumude, Ssaade—; *Baluchistan*: Gurbagund, Sohrbulok, Zahrihk—; *Catalan*: Lletera, Lleterola, Mal d'ulls—; *Chinese*: Tse Ch'i—; *English*: Cat's milk, Churn-staff, Sun Spurge, Wartwort—; *French*: Lait de couleuvre, Omblette, Réveille matin, Tithymale—; *Hindi*: Hirruseeth, Mahabi—; *Iraq*: Khannaq-ad-dijaj, Um-al-halib—; *Italian*: Esula, Titimaglio, Titimalo, Tutumaglio—; *Kharan*: Gurbagund—; *Malta*: Cat's Milk, Spurge, Sun Spurge, Erba calenzuola, Tenghoud—; *Punjab*: Chatriwal, Dudal, Gandabute, Kulfadodakak—; *South Africa*: Milkweed, Spurge—; *Spanish*: Lechetrezna, Mirasol—; *Waziri*: Sagergotiae—.

6. **Euphorbia hirta** Linn. (=*E. pilulifera* Linn.) is a common weed in waste ground, found throughout the hotter parts of India from the Punjab eastwards, and southwards to Ceylon and Singapore. It inhabits most of the tropical and subtropical countries.

The dried herb is stimulant, expectorant, and diuretic. It has been frequently reported useful for bronchitis and asthma affections.

The juice of the plant is given in dysentery and colic, and the milk applied to destroy warts. A decoction is used in asthma and chronic bronchial affections.

The plant is chiefly used in the affections of childhood, in worms, bowel complaints, and cough. It is sometimes prescribed in gonorrhœa.

The root is given by the Santals to allay vomiting, and the plant to nursing mothers when the supply of milk is deficient or fails.

The plant is widely used in West Africa as a medicine. In Gold Coast it is ground and mixed with water for use as an enema for constipation. The white juice is used by women to increase the flow of milk. The leaves are used in curing sores; their juice is sometimes squeezed into the eyes to cure eye trouble.

Similarly in Liberia the plant is given along with lime juice as a laxative, and the latex is applied for conjunctivitis; a thorn or other foreign body is extracted with the help of the latex, which is also applied locally as an antidote to arrow poison or to assist extraction of the head.

The herb is very much used in La Reunion as an astringent in chronic diarrhœas and dysenteries. It is also applied topically to ulcers, oedemas, and phlegmons. The juice is given for aphthae. It is considered tonic, narcotic, and antiasthmatic.

A popular astringent and haemostatic in the Philippine Islands. It is used in the treatment of dysenteries in Annam.

The plant is much used in Guiana as a febrifuge. As a poultice it is applied to abscesses and inflamed glands.

The plant is known in Australia as 'Queensland asthma herb'. It is used there as a remedy for coughs, bronchial and pulmonary disorders, but more especially in paroxysmal asthma.

There is no doubt that an extract of this plant has a sedative effect on the mucous membrane of the respiratory and genito-urinary tract. It has been found by me very beneficial in cases of asthma. I have been using a tincture of it in my private practice in diseases of the genito-urinary tract and in chronic bronchitis and asthma. The result has been very satisfactory (Koman).

According to Dikshit and Kameshwar Rao experiments conducted on cats, dogs, and rabbits, with and without anaesthesia, show that the drug has got a fairly marked action on the respiratory system, depressing the respiration and producing a well marked dilatation of the bronchioles. The drug produces a local irritation of the stomach when given by mouth in larger doses and produces nausea and vomiting. If injected intravenously in animals, however, it has got a depressant action on the movements of the intestines. There is an immediate cessation of the automatic movements of the intestines and a relaxation of the tone of the muscle. The cardiovascular system is depressed, and an intravenous injection leads to a fall of blood pressure chiefly due to the depression of the heart. Perfusion experiments show a depression of the heart. Other systems of the body like the genito-urinary system are not markedly affected (18th Ind. Sc. Congress; Nagpur, 1931).

Australia: Queensland Asthma Herb—; *Awuna*: Ahinkodze, Notsigbeng—; *Bengal*: Barakerui, Burakeru, Burokeruee—; *Betsileo*: Aidinono—; *Bombay*: Nayeti—; *Canarese*: Achchegida—; *Central Provinces*: Gordon—; *Ceylon*: Madduppachcharichippillu, Palavi—; *English*: Asthma Herb, Asthma-weed, Australian Asthma Herb, Euphorbia, Pill-bearing Spurge, Snake Weed—; *Ewe*: Notsigbee—; *Fiji*: Do ni osi—; *French*: Euphorbe à globules, Euphorbe à pilules, Herbe à Jean Renaud, Herbe Jean Robert, Herbe à serpents, Madelone plat, Mal famée, Malnommée, Pilulier, Poil de chat—; *French Guiana*: Grande malnommée, Petite malnommée rouge, Malnommée—; *Guam*: Golondrina—; *Gujerati*: Dudeli, Dudh, Nagladudheli, Ratidudheli—; *Hausa*: Nonankurchiya—; *Hindi*: Bahidudhi, Dudhi, Laldudhi—; *Indo-China*: Co sua lon la, Ka ta, Phi duong thao, Vu sua—; *Kolami*: Pusitoa—; *Konkani*: Dudurly—; *Kwang Tung*: Yu Tchou Ts'ao—; *La Reunion*: Jean Robert—; *Lepcha*: Sung-gryong muk—; *Malay*: Ambin jantan, Gelang susu, Kurumak susu—; *Malayalam*: Nelapalai—; *Mano*: To a gbondo—; *Marathi*: Dudhi, Dudnali, Govardhan, Mothidudhi, Nayati—; *Mauritius*: Jean Robert—; *Mundari*: Kodasing—; *Nzima*: Akubaa—; *Oloke Meji*: Emi-ile, Emile—; *Pampangan*: Bolobotones, Magatas, Malismhalis,

Sisiohan, Sisiwhan—; *Philippines*: Batabotonis, Botobotones, Golandrina—; *Porebunder*: Mothidudheli, Motodakardumaro, Ratodakardumaro—; *Sanskrit*: Nagarjuni, Pusitoa—; *Sinhalese*: Budadakiriya, Dadakiriya, Kiritala—; *Susu*: Boxeforotai, Nyalefoxe, Nyayafoke—; *Tagalog*: Batobatonis, Gatasgatas, Sayican—; *Tamil*: Amumpatchaiyarissi, Patchaiyarissi—; *Telugu*: Bidarie, Nanabala, Nanabiyan, Reddinanabrolu—; *Timne*: Ebit, Yankara-ebit—; *Twi*: Ahinkodge—; *Visayan*: Bovi, Buyayava, Gatasgatas, Tavava—; *Wolof*: Homguelem—; *Yoruba*: Egele, Ege-ile, Emi-ile—.

7. **Euphorbia hypericifolia** Linn. is common throughout the hotter parts of India and Ceylon, and occurs up to 4,000 feet on the Himalaya. It is found in the tropics generally, with the exception of Australia and Pacific Islands.

An infusion of the dried leaves is a remedy in dysentery, diarrhœa, menorrhagia, and leucorrhoea, and it affects the system as an astringent and feeble narcotic.

It is given with milk to children in colic.

In Guiana cataplasms of the plant are applied in cephalalgia. In La Reunion the plant is considered drastic, but rarely used as such; it is better known as an astringent and styptic.

In Annam a decoction of the plant is used in measles and in gravel.

Arabic: Melachene—; *Bombay*: Nayeti—; *Brazil*: Erva de Santa Luzia—; *French Guiana*: Marie claire—; *Gujerati*: Dudheli—; *Hindi*: Dudhi, Dudhikalava, Hakshardana—; *Indo-China*: Chanleat, Co sua, Vu sua—; *La Reunion*: Herbe Saint-Jean, Jean Belan—; *Marathi*: Dhaktidudhi, Dudhi, Dudhmogra—; *Mauritius*: Herbe colique, Herbe mal lévé—; *Porebunder*: Dhakradunmaro, Dudheli—; *Punjab*: Hazardana—; *Rajputana*: Dudeli—; *Sanskrit*: Dugdhika—; *Sinhalese*: Eladadakiriya—.

8. **Euphorbia longifolia** D. Don has been reported from Thoucote in Nepal. It is also reported that the juice is applied to fistulous sores in Kashmir and the Punjab.

9. **Euphorbia microphylla** Heyne is found in Bengal, Bundelkhand, Southern India, Burma and Java.

In Chota Nagpur, a preparation of this plant, along with that of *Cryptolepis Buchanani* is given to nursing mothers when the supply of milk fails or is deficient.

Bengal: Chotokeruee—; *Gujerati*: Dudhi—; *Marathi*: Dudhi—; *Porebunder*: Ekphulidudheli—; *Santali*: Dudhiaphul—.

10. **Euphorbia neriifolia** Linn. is common in rocky places throughout the Western Peninsula. It is cultivated elsewhere in India, as also in Ceylon, Burma, Baluchistan and the Malay Islands.

The plant is a reputed Ayurveda medicine. The Nighantas describe it as 'bitter, pungent; laxative, carminative, alexipharmic; improves the appetite; useful in abdominal troubles, bronchitis, tumours, loss of consciousness, delirium, leucoderma, piles, inflammations, enlargement of the spleen, anaemia, ulcers, fevers.—The milk is pungent, laxative; good for abdominal troubles, tumours, leucoderma.—The leaves are heating, carminative; improve the appetite; good for tumours, pains, inflammations, abdominal swellings.

The Yunanists consider it a good substitute for *E. Tirucalli*.

The milky juice is used as a purgative and a rubefacient. It is prescribed as a cathartic and deobstruent in visceral obstructions and dropsical affections consequent on long continued fever. It enters into the composition of most of the drastic purgatives.

The juice is empolyed in earache; mixed with shoot it is applied to the eye in ophthalmia; mixed with margosa oil it is used as an application in rheumatic affections.

On the Western coast the bark of the root, boiled in rice water with the addition of arrack, is considered useful in dropsy.

In the Rajputana Desert the milky juice is used as a cure for coughs, and is applied to the skin as a blister.

The leaves are used as a diuretic in Indo-China.

The juice of the leaves is a popular cure for earache in the Philippine Islands.

A succus consisting of equal parts of the juice of this plant and simple syrup was prepared and administered in doses of 10 to 20 minims three times a day in cases of asthma, and was found to give relief to the fits of that disease (Koman).

The milk and the root enjoy an almost universal repute as remedies in snake-bite. Mhaskar and Caius have, however, found the two drugs useless in the antidotal and symptomatic treatment of snake-bite and scorpion-sting, and equally useless when applied topically to the bite or the sting.

Annam: Xuong rong rao—; *Arabic*: Wurzizuker—; *Bengal*: Hijdaona, Mansasij, Patashij, Shij—; *Berar*: Thuar, Thuhar—; *Bombay*: Minguta, Newarang, Thor—; *Burma*: Shasaung, Shasoung, Shazawnminna, Zizaung—; *Canarese*: Elegalli, Yalekalli—; *Deccan*: Kuttekijibhkapatta, Kuttekijibhkasend. Newrung, Putteunkesaynd, Thoor—; *Goa*: Nevulkanta—; *Gujerati*: Thor, Tuaria—; *Hindi*: Munsasej, Pattonkisend, Putteun, Sehund, Senhur, Sij, Thohar, Thor—; *Ilocano*: Carambuaya—; *Indo-China*: Giang lam, Xuong rong, Xuong rong rao, Xuong rong ta—; *Kolami*: Etke—; *Konkani*: Nivalkantem, Nivalkanti—; *Malay*: Sesudu—; *Malayalam*: Ilakalli, Kalli—; *Marathi*: Mingut, Nevagunda, Newrang, Niwarung—; *Nimar*: Thuar, Thuhar—; *Pampangan*: Bait, Sorogsorog, Sorosoro—; *Philippines*: Lengua de perro—; *Portuguese*: Cardeira—; *Punjab*: Gangichu—; *Rajputana*: Thor—; *Sanskrit*: Patrasnuhi, Pattakari, Snuhi, Svarasana—; *Santali*: Etke—; *Sind*: Minaguta, Nivadunga, Thohur, Thoor—; *Sinhalese*: Paluk, Patuk—; *Tagalog*: Bait, Sorogsorog, Sorosoro—; *Tamil*: Ilaikkalli, Kalli, Manjevi, Nadangi, Naynakki—; *Telugu*: Akujemudu—; *Tulu*: Irekalli—; *Urdu*: Zakum—; *Uriya*: Siju—.

11. **Euphorbia nivulia** Ham. is found in dry rocky places throughout Bengal, South India, and Bengal. It is often planted for hedges.

The Yunanists use the plant as a substitute for *E. Tirucalli*.

The juice of the leaves is used internally as a purgative and a diuretic; mixed with nim oil it is applied externally in rheumatism. The warm juice is a good cure for earache, and it is occasionally rubbed over the eyes to remove dimness of sight.

On the Western Coast the root bark is boiled in rice water and arrack, and given in dropsy.

The pulp of the stem, mixed with green ginger, is given to persons bitten by mad dogs.

Bengal: Sij—; *Berar*: Thuar, Thuhar—; *Burma*: Shasoung—; *Canarese*: Dubbakalli, Dundukalli, Gutagalli, Yellakalli—; *Deccan*: Patteoon—; *Dehra Dun*: Thor, Thuor—; *Gujerati*: Thorkantalo—; *Hasada*: Eteke—; *Hindi*:

Katathohar, Senhur, Sij, Thor, Thuhar, Thura—; *Jaunsar*: Suru—; *Kolami*: Etke, Etki—; *Lambadi*: Motataria—; *Malayalam*: Ilakalli—; *Marathi*: Kaudenivdung, Newrang, Nivdung, Niwarung—; *Mundari*: Burueteke—; *Nimar*: Thuar, Thuhar—; *Porebunder*: Kautalio, Thorkantalo—; *Rajputana*: Raj, Tor—; *Sanskrit*: Patrasnuhi, Sehuda, Svarasana, Vajradruksha, Vajri—; *Santali*: Etke—; *Tamil*: Ilakalli, Manjevi, Nanangalli—; *Telugu*: Akujemudu, Akukalli, Bonthajamudu—; *Urdu*: Zakum—; *Uriya*: Kolosiju, Siju—.

12. **Euphorbia rosea** Retz is found in the Deccan Peninsula, from the Carnatic to Tranquebar, on the coast. It is common near the sea in Ceylon and Indo-China. It also occurs in Afghanistan.

The plant is used as a drastic purgative in Indo-China. The leaves and seeds are considered to be a good worm remedy.

Indo-China: Co sua, Nohn la—.

13. **Euphorbia Royleana** Boiss. is common on dry rocky hillsides of the outer Himalaya from the Indus to Kumaon, ascending to 6,000 feet. It occurs also on the Salt Range.

The acrid milky juice possesses cathartic and anthelmintic properties.

Beas: Chu, Chunga, Surs—; *Chenab*: Chula—; *Dehra Dun*: Thor, Thuor—; *Garhwal*: Surai—; *Hindi*: Senhur, Shakarpitan, Thar, Thor—; *Jaunsar*: Suru—; *Jhelum*: Suli—; *Kumaon*: Sihund, Sohund—; *Punjab*: Shakarpitan, Thar, Thor—; *Rajputana*: Thor—; *Ravi*: Chun—; *Salt Range*: Tordanda—; *Sutlej*: Suro, Tsui—.

14. **Euphorbia sanguinea** Hochst. occurs in Baluchistan, spreading over to Afghanistan, tropical Arabia and Africa.

When used for medicinal purposes it is prepared like 'bhang' (Hotson).

The Sutos use it as an application to sore nipples in suckling mothers.

Brahui: Meshir—; *Pretoria*: Spurge—; *Suto*: Kxamamaswana, Selwe, Tatampoi-e-nyenyane—.

15. **Euphorbia Thomsoniana** Boiss. is found in Kashmir between 10,000 and 12,000 feet.

The crushed root-stocks are employed by the natives of Kuram as detergents for washing the hair, and, when boiled, are given as purgatives.

Kashmir: Hirtiz—.

16. **Euphorbia thymifolia** Linn. is common in paths and gravelly spots in the plains and lower hills of India, Ceylon, and the Malay Peninsula; ascending up 5,500 feet in Kashmir. It is found in all hot countries except Australia.

The dried leaves and seeds are slightly aromatic and astringent. They are given in worm cases and in certain bowel affections of children in the Tamil country. In Northern India they are considered stimulant and laxative. They are commonly used as a purgative in Sind.

The Santals use the root as a remedy for amenorrhœa.

In the Konkan the juice is used to cure ringworm. Among the Mundas of Chota Nagpur it is employed to stop diarrhœa; half a handful of the whole plant being pounded and drunk in a mixture with water and sugar-candy.

In Indo-China the plant is used as a cathartic; the seeds and leaves are considered anthelmintic.

In Arabia the juice of the plant is made into a paste with wheat flour, and administered as a purgative in the form of pills. The bruised plant is applied to wounds.

In La Reunion the herb is used as an astringent in diarrhœa and dysentery.

The expressed juice or the powdered plant is administered internally with wine as a remedy for snake-bite, and it is applied externally to the part bitten; but whether given internally or applied externally the plant is equally useless in the treatment of snake-bite (Mhaskar and Caius).

Arabic: Rummid—; *Bengal*: Dudiya, Shweetkeruee, Swetkerua, Swetkirui—; *Bombay*: Nayata, Nayeti—; *Ceylon*: Ammanpachcharichippillu, Chittirapalavi—; *Gujerati*: Nahanidudheli—; *Hindi*: Chhotidudhi, Chothaduhi—; *Indo-China*: Co sua, Nhon la—; *La Reunion*: Rougette—; *Malay*: Segan padang—; *Marathi*: Ghakdidudhi, Lahandudhi, Mothidudhi—; *Mauritius*: Petite rougette—; *Mundari*: Kdoasingjaite—; *Nasirabad*: Khiri—; *Persian*: Gazardanah—; *Porebunder*: Jhinkidudheli, Jhinkodhakardhumaro—; *Punjab*: Baradodak, Dhoduk, Hazardana—; *Sanskrit*: Laghudugdhika, Raktavindachada—; *Santali*: Nanhapusitoa, Nanhapusituar—; *Sind*: Dhoduk, Hazardhana—; *Sinhalese*: Bindadakuriya—; *Tamil*: Chinamampatchaiyarisi, Sittrapaiadi—; *Telugu*: Bidurunadabiyam, Reddivarimanubala—; *Yemen*: Rummid—.

17. **Euphorbia Tirucalli** Linn., a native of Africa, has become naturalised in the drier parts of Bengal, the Deccan, South India, and Ceylon; elsewhere it is largely cultivated for hedges, and in Berar is much grown to shelter young mango plants from direct sunlight.

According to Yunani practitioners the juice of this plant is purgative, carminative; useful in gonorrhœa, whooping cough, asthma, dropsy, leprosy, enlargement of the spleen, dyspepsia, jaundice, colic, tumours, stone in the bladder.

The fresh milky juice is applied to warts and used as a rubefacient embrocation in rheumatism. It is good alterative in syphilis, and a good application in neuralgia. In the Konkan it is given as a purge; and the charcoal, which is very light, is used in making pastilles. In Goa it is used to poison fish. The milky juice is a dangerous drug to handle, causing severe and tenacious conjunctivitis.

In Cambodia the plant is used to stupefy fish.

The root is used in La Reunion as a vesicant, more rarely as an emeto-cathartic.

The bark is used as a vesicant in Java, and is also applied to fractures.

In some parts of India a decoction of the root is given in certain cases of colic, and the milky juice mixed with melted butter is prescribed as a purge. The juice is also applied topically in neuralgia.

Katathohar, Senhur, Sij, Thor, Thuhar, Thura—; *Jaunsar*: Suru—; *Kolami*: Etke, Etki—; *Lambadi*: Motataria—; *Malayalam*: Ilakalli—; *Marathi*: Kaudenivdung, Newrang, Nivdung, Niwarung—; *Mundari*: Burueteke—; *Nimar*: Thuar, Thuhar—; *Porebunder*: Kautalio, Thorkantalo—; *Rajputana*: Raj, Tor—; *Sanskrit*: Patrasnuhi, Sehuda, Svarasana, Vajradruksha, Vajri—; *Santali*: Etke—; *Tamil*: Ilakalli, Manjevi, Nanangalli—; *Telugu*: Akujemudu, Akukalli, Bonthajamudu—; *Urdu*: Zakum—; *Uriya*: Kolosiju, Siju—.

12. **Euphorbia rosea** Retz is found in the Deccan Peninsula, from the Carnatic to Tranquebar, on the coast. It is common near the sea in Ceylon and Indo-China. It also occurs in Afghanistan.

The plant is used as a drastic purgative in Indo-China. The leaves and seeds are considered to be a good worm remedy.

Indo-China: Co sua, Nohn la—.

13. **Euphorbia Royleana** Boiss. is common on dry rocky hillsides of the outer Himalaya from the Indus to Kumaon, ascending to 6,000 feet. It occurs also on the Salt Range.

The acrid milky juice possesses cathartic and anthelmintic properties.

Beas: Chu, Chunga, Surs—; *Chenab*: Chula—; *Dehra Dun*: Thor, Thuor—; *Garhwal*: Surai—; *Hindi*: Senhur, Shakarpitan, Thar, Thor—; *Jaunsar*: Suru—; *Jhelum*: Suli—; *Kumaon*: Sihund, Sohund—; *Punjab*: Shakarpitan, Thar, Thor—; *Rajputana*: Thor—; *Ravi*: Chun—; *Salt Range*: Tordanda—; *Sutlej*: Suro, Tsui—.

14. **Euphorbia sanguinea** Hochst. occurs in Baluchistan, spreading over to Afghanistan, tropical Arabia and Africa.

When used for medicinal purposes it is prepared like 'bhang' (Hotson).

The Sutos use it as an application to sore nipples in suckling mothers.

Brahui: Meshir—; *Pretoria*: Spurge—; *Suto*: Kxamamaswana, Selwe, Tatampoi-e-nyenyane—.

15. **Euphorbia Thomsoniana** Boiss. is found in Kashmir between 10,000 and 12,000 feet.

The crushed root-stocks are employed by the natives of Kuram as detergents for washing the hair, and, when boiled, are given as purgatives.

Kashmir: Hirtiz—.

16. **Euphorbia thymifolia** Linn. is common in paths and gravelly spots in the plains and lower hills of India, Ceylon, and the Malay Peninsula; ascending up 5,500 feet in Kashmir. It is found in all hot countries except Australia.

The dried leaves and seeds are slightly aromatic and astringent. They are given in worm cases and in certain bowel affections of children in the Tamil country. In Northern India they are considered stimulant and laxative. They are commonly used as a purgative in Sind.

The Santals use the root as a remedy for amenorrhœa.

In the Konkan the juice is used to cure ringworm. Among the Mundas of Chota Nagpur it is employed to stop diarrhœa; half a handful of the whole plant being pounded and drunk in a mixture with water and sugar-candy.

In Indo-China the plant is used as a cathartic; the seeds and leaves are considered anthelmintic.

In Arabia the juice of the plant is made into a paste with wheat flour, and administered as a purgative in the form of pills. The bruised plant is applied to wounds.

In La Reunion the herb is used as an astringent in diarrhœa and dysentery.

The expressed juice or the powdered plant is administered internally with wine as a remedy for snake-bite, and it is applied externally to the part bitten; but whether given internally or applied externally the plant is equally useless in the treatment of snake-bite (Mhaskar and Caius).

Arabic: Rummid—; *Bengal*: Dudiya, Shweetkeruee, Swetkerua, Swetkirui—; *Bombay*: Nayata, Nayeti—; *Ceylon*: Ammanpachcharichippillu, Chittirapalavi—; *Gujerati*: Nahanidudheli—; *Hindi*: Chhotidudhi, Chothaduhi—; *Indo-China*: Co sua, Nhon la—; *La Reunion*: Rougette—; *Malay*: Segan padang—; *Marathi*: Ghakdidudhi, Lahandudhi, Mothidudhi—; *Mauritius*: Petite rougette—; *Mundari*: Kdoasingjaite—; *Nasirabad*: Khiri—; *Persian*: Gazardanah—; *Porebunder*: Jhinkidudheli, Jhinkodhakardhumaro—; *Punjab*: Baradodak, Dhoduk, Hazardana—; *Sanskrit*: Laghudugdhika, Raktavindachada—; *Santali*: Nanhapusitoa, Nanhapusituar—; *Sind*: Dhoduk, Hazardhana—; *Sinhalese*: Bindadakuriya—; *Tamil*: Chinamampatchaiyarisi, Sittrapaiadi—; *Telugu*: Bidurunadabiyam, Reddivarimanubala—; *Yemen*: Rummid—.

17. **Euphorbia Tirucalli** Linn., a native of Africa, has become naturalised in the drier parts of Bengal, the Deccan, South India, and Ceylon; elsewhere it is largely cultivated for hedges, and in Berar is much grown to shelter young mango plants from direct sunlight.

According to Yunani practitioners the juice of this plant is purgative, carminative; useful in gonorrhœa, whooping cough, asthma, dropsy, leprosy, enlargement of the spleen, dyspepsia, jaundice, colic, tumours, stone in the bladder.

The fresh milky juice is applied to warts and used as a rubefacient embrocation in rheumatism. It is good alterative in syphilis, and a good application in neuralgia. In the Konkan it is given as a purge; and the charcoal, which is very light, is used in making pastilles. In Goa it is used to poison fish. The milky juice is a dangerous drug to handle, causing severe and tenacious conjunctivitis.

In Cambodia the plant is used to stupefy fish.

The root is used in La Reunion as a vesicant, more rarely as an emeto-cathartic.

The bark is used as a vesicant in Java, and is also applied to fractures.

In some parts of India a decoction of the root is given in certain cases of colic, and the milky juice mixed with melted butter is prescribed as a purge. The juice is also applied topically in neuralgia.

In Malaya the latex is inserted into cuts in bullocks to form the elevated recognition marks.

Annam: Cay san ho, San ho—; *Arabic*: Azfur-zukkum, Zaqqum-e-hindi—; *Baluchi*: Dedar—; *Bengal*: Gul, Lankasij, Latadaona—; *Bombay*: Niwal, Sehund, Seyr, Shera, Tej, Thor, Thora—; *Burma*: Shashoungleknyo, Shasoungleknyo, Tazaunglekhnyo—; *Canarese*: Bontakalli, Bottugalli, Kadunevali, Kalli, Kodukalli, Kolugalli, Kolukalli, Nandugalli, Pachanegalli, Yellegulla—; *Cochin-China*: Cay san ho xanh—; *Deccan*: Barkisend, Karikisend, Send—; *English*: Milk Bush, Milk Hedge, Indian Tree Spurge—; *Goa*: Nival—; *Gujerati*: Dandalithora, Pardeshithora, Thordandalio—; *Hindi*: Konpahlsehnd, Sair, Sehud, Sehund, Sendh, Shirthohar, Sij—; *Indo-China*: Ramok, San ho xanh, Thanh san ho, Thap nhi, Xuong kho—; *Java*: Kayoo-oorb—; *Lambadi*: Taria—; *La Reunion*: Laine sans feuilles, Tirucalli—; *Malayalam*: Guda, Katerumakkali, Kolkalli, Tirukalli—; *Marathi*: Nevli, Nirval, Nivla, Niwarung, Seyr, Seyrteg, Shar, Shera, Tej, Thuvar, Vajraduhu—; *Mauritius*: Calli—; *Melghat*: Thuar, Thuhar—; *Nimar*: Thuar, Thuhar—; *Persian*: Shirtothar, Zaquniya-e-hindi—; *Porebunder*: Kharsanithora, Thora—; *Sanskrit*: Bahukshira, Dandasruha, Ganderi, Snuka, Trikuntaka, Vajradruma—; *Santali*: Siju—; *Sind*: Sair, Sij, Thora—; *Sinhalese*: Navahandi, Thovar—; *Tagalog*: Catuit—; *Tamil*: Kalli, Kiri, Kombukkalli, Pachankalli, Parchanu, Tirukkalli, Tiruvatti—; *Telugu*: Chemudu, Jemudu, Kadujemudu, Kalli, Kanjiemudu, Sannajemudu, Tirukalli—; *Tigrinia*: Qoutscheh—; *Tulu*: Kodukalli—; *Urdu*: Zakum—; *Uriya*: Lonkasiju—; *Yemen*: Dahan, Rummid—; *Zulu*: uMunde, umIululu—.

18. **Euphorbia trigona** Haworth inhabits dry rocky hills in the Deccan, and probably other parts of India. It is found in the Andaman Islands and the Moluccas.

The fresh milky juice is a direct irritant both when taken internally and applied externally. Taken in very small quantities, it is a drastic purgative.

Telugu: Kattimandu—.

19. **Euphorbia turcomanica** Boiss. is found in Baluchistan, whence it extends to Persia and Mesopotamia.

In Baluchistan the plant is boiled and used as a medicine for gripe.

Brahui: Meshir—.

EXCOECARIA.

The genus consists of 30 species, inhabiting the tropics of the Old World.

A deciduous shrub	1. *E. acerifolia.*
A small evergreen tree	2. *E. agallocha.*

1. **Excoecaria acerifolia** Fr. Didrichs. is found at 5,000-6,000 feet in the western and central Himalayas from Nepal to Kumaon. It also occurs in the Khasia Hills.

The Bhutias of East Kumaon use the leaves as a remedy for rheumatism.

Garhwal: Dudhila—; *Kumaon*: Basingh—.

2. **Excoecaria agallocha** Linn. is a common small evergreen tree of the Coast and tidal forests of India, Burma, the Malay Peninsula, the Andaman Islands, the Malay Archipelago, North Australia, New Caledonia to Tonga.

The milky juice, which exudes from the bark of this tree when green and fresh, is very acrid and injurious to the eyes, hence it is called 'the blinding tree of India'.

A decoction of the leaves is occasionally given by Hindu doctors in epilepsy, in the quantity of a quarter of a tea-cupful twice daily. This decoction is also used as an application to ulcers.

From the lower part of the trunk and roots, a soft, light, reddish suber is obtained, which is sold by the itinerant medicine men of Western India, under the name of *Tejbul*, as an aphrodisiacal tonic.

The natives of Eastern Australia, as well as those of New Guinea, use the milky juice to cure certain ulcerous chronic diseases, e.g., leprosy.

In Fiji, it is employed for the cure of leprosy, its mode of application being very singular. The body of the patient is first rubbed with green leaves; he is then placed in a small room and bound hand and foot, when a small fire is made of pieces of the wood of this tree from which rises a thick smoke; the patient is suspended over this fire, and remains for some hours in the midst of the poisonous smoke and under the most agonizing torture, often fainting. When thoroughly smoked, he is removed, and the slime is scraped from his body; he is then scarified and left to await the result. In some cases he is cured, but frequently the patient dies under the ordeal.

The milky latex obtained from the bark when it is green is used by Malays as an irritant poison; it is so acrid when fresh that it blisters the skin. In Kelantan it is given internally as a poison.

Andamans: Yekin—; *Australia*: Blind-your-eyes, River Poisonous Tree—; *Bengal*: Gangwa, Gengwa, Geogheria, Geor, Geria, Goria, Uguru—; *Bombay*: Geva—; *Burma*: Kayau, Kayaw, Tayau, Tayaw—; *Canarese*: Hara, Haro—; *English*: Blinding Tree, Milky Mangrove—; *Fiji*: Sinu-gaga—; *Formosa*: Hsiang shu—; *Hindi*: Gewa—; *Igorrote*: Ali—; *Indo-China*: Gia, Ngai, Soen gia, Tia mu, Va, Ya—; *Malay*: Aquila, Baboeta, Babooter, Bebuta, Bubuta, Butabuta, Garamataboeta, Noto—; *Malayalam*: Katappala, Karmmatti, Komatti—; *Marathi*: Geva, Phungali, Suran, Surind, Surund—; *Marinduque*: Diladila—; *Pampangan*: Butabuta, Himbabao—; *Queensland*: Balavola karping—; *Samoa*: Toto—; *Sanskrit*: Agaru, Uguru—; *Sinhalese*: Talakiriya, Telakiriya, Tellakwiya—; *Spanish*: Arbol del ciego, Buta de Filipinas—; *Tagalog*: Botabota, Buta, Butabuta—; *Tamil*: Agadil, Agi, Ambalatti, Ambalavirukkam, Tillai, Perundillai—; *Telugu*: Chilla, Tella, Tilla—; *Uriya*: Ghona, Gowan—; *Visayan*: Alipata, Himbabao, Lipata, Siac—.

Flueggea.

The genus consists of 6 species, found in the tropics of the Old World.

Branchlets stout ending in spines	...	... 1. *F. leucopyrus.*
Branchlets slender unarmed	...	... 2. *F. virosa.*

1. **Flueggea leucopyrus** Willd. occurs in Sind, the Punjab Plain, Burma, the Western Peninsula from Canara southwards. It is abundant in Ceylon.

The juice of the leaves, or the leaves made into a paste with tobacco, are used to destroy worms in sores.

The plant is said to be a fish poison.

Afghanistan: Perapastawane—; *Canarese*: Bilchuli, Gudahale, Huli—; *Central Provinces*: Challamanta, Salemanta—; *Goa*: Parpo—; *Gujerati*: Shinavi—; *Hindi*: Suffaidmahommad—; *Malayalam*: Perinklavu—; *Marathi*: Kandekuvana, Pandharphali—; *Matheran*: Pandharphali—; *Merwara*: Halepan, Salipan—; *Nepal*: Achal—; *North-Western Provinces*: Aintha, Hartho—; *Porebunder*: Tumari—; *Punjab*: Bata, Bhathi, Gargas, Girk, Girthan, Kakun, Vanuthi—; *Rajputana*: Halepan, Salepan—; *Sanskrit*: Apiyadruma, Bhuriphali, Panduphali, Svetakamboja—; *Sind*: Kiran—; *Sinhalese*: Hinkatupila—; *Tamil*: Irubulai, Mudbulanji, Mulluppulatti, Pula, Pulanji, Varadbul, Varadbula, Vedbula, Vellaippula, Vellaippulanji—; *Telugu*: Challamunta, Mekarayi, Puli, Tellapulisaru, Tellapuliyudu, Tellapurugudu—.

2. **Flueggea virosa** Baill. (=*F. microcarpa* Bl.) occurs throughout India, Ceylon, and the Malay Peninsula. It extends to the Malay Islands, China, Australia, and tropical Africa.

The juice of the leaves, or the leaves made into a paste with tobacco, are used to destroy worms in sores.

The West Ashantis use the roots to cure gonorrhœa. They boil the whole plant in water and wash themselves in the water to 'become strong'.

In Rhodesia the root is used as an aphrodisiac.

The Ewe people of Togoland use the leaves to cure constipation. For this purpose they are boiled and the water is drunk.

In Indo-China the astringent bark is used to stupefy fish.

Arabic: Dabalab, Hamrur, Hemmele, Hennet-el-bagar, Kartjikartji—; *Ashanti*: Nkangnaa—; *Bedde*: Zandanu—; *Bombay*: Kantepuwan, Pandharphali—; *Buldana*: Pittor—; *Burma*: Konchiny a—; *Canarese*: Belahuli, Bilisuli, Gudahale—; *Chindao*: Umsosoti—; *Dagomba*: Susuwuluga—; *Dehra Dun*: Rithoul—; *Ewe*: Esre, Hesre, Hlese—; *Fulani*: Chamal, Chambe, Chame—; *Ga*: Gbekebii able-tcho—; *Goa*: Papo—; *Gujerati*: Shaunavi—; *Hausa*: Gussu, Gwiwar kare, Tsa, Tsugawun kare, Tswa—; *Hindi*: Dalme, Patala—; *Indo-China*: Bong ne, Bong no, Cang pa, Mai ten, Nhat giep thu, Xeur nam—; *Kumaon*: Athaina—; *Kanuri*: Shimshim—; *Lambadi*: Jarigaro—; *Lepcha*: Hik-ti bi—; *Malayalam*: Perinklavu—; *Marathi*: Kodarai—; *Melghat*: Pithondi—; *Merwara*: Halepan, Salipan—; *Nimar*: Jhonri—; *Sanskrit*: Apiyadruma, Bhuriphala, Dhusara, Nilishila, Panduphali, Patali, Vrittabijaka—; *Saora*: Jungjang—; *Sierra Leone*: Tigwi—; *Sokoto*: Tsa, Tswa—; *Tamil*: Irubulai, Pula, Varadbula, Vedbula, Vellaippula—; *Telugu*: Mekarayi, Sulamunta, Tellapuli, Tellapurugudu—; *Uriya*: Janjingi, Kanilehya—; *Yoruba*: Iranje—.

Gelonium.

The genus includes 20 Asiatic and African species.

Gelonium multiflorum A. Juss. occurs in Bengal and the Circars, reaching northwards to the foot of the Sikkim Himalaya. It extends from Chittagong to Tenasserim and Malacca, and is found in the woods of Upper and Lower Burma, and the Malay Peninsula. It is distributed over the Malay Islands, Siam, and China.

The bark is considered a good tonic for the gums, and is prescribed for gingivitis in Cambodia; it is also used as a purgative in hepatic troubles.

Burma: Setahanbaya—; *Cambodia*: Tromung sek—; *Hindi*: Ban naringa—; *Malay*: Buah punei, Lampun hitam, Mingantok, Ruas-ruas—; *Telugu*: Sarugata—.

GLOCHIDION.

The genus includes 160 species spread over tropical Asia and Polynesia.

G. rubrum Bl. is used medicinally in Indo-China.

Leaves 2-4 in. thin. Anthers 3 ... ... 1. *G. hohenackeri.*
Leaves 4-8 in. coriaceous. Anthers 5-6 ... ... 2. *G. zeylanicum.*

1. **Glochidion hohenackeri** Bedd. is found in Chota Nagpur and Orissa, and in the Western Peninsula; it is very common in the Konkan.

The bark is given medicinally when the stomach revolts against food.

Canarese: Banavara, Nirchalli, Nirchelli, Nirjani, Sullai—; *Malayalam*: Kuluchan—; *Marathi*: Bhoma—; *Uriya*: Baniakandhum, Chikni, Kalchia—.

2. **Glochidion zeylanicum** A. Juss. occurs in the Western Peninsula.

The bark is used as a stomachic.

Canarese: Banda, Savregidda—; *Malayalam*: Nirvetti—; *Tamil*: Kumbalam—; *Telugu*: Itepulla—.

HIPPOMANE.

H. mancinella Linn. is a native of tropical America, introduced into Indian gardens.

The bark and the berries yield a highly poisonous milky acrid juice. It is a violent irritant and powerful cathartic, diuretic, and vesicant. The least drop applied to the eye will cause blindness for some days; the smoke from the wood when burnt will also seriously affect the eyes.

The juice is much used in Cuba for tetanus and in Guiana for worms in children. Indians use it to poison their arrows.

Cayenne: Figuier—; *Cuba*: Manzanillo—; *English*: Manchineal Tree—; *French*: Arbre de mort, Arbre poison, Bois de lait, Figuier vénéneux, Mancenillier, Noyer vénéneux—; *German*: Manzenillerbaum—.

HOMONOIA.

The genus consists of 4 Indo-Malayan species.

Homonoia riparia Lour. is a small rigid evergreen shrub, found on the rocky and stony river-beds of the Sikkim Himalaya at an altitude of 1,000 to 2,000 feet; also in Assam, the Khasia Hills, and southwards to Burma, Tenasserim, the Malay Peninsula, the Andaman Islands, and Bundelkhund; and in the Deccan Peninsula from the Konkan southwards. It is also common in Ceylon up to an elevation of 2,000 feet. It extends to Siam, Cochinchina, Sumatra, Java, and the Philippine Islands.

The root is given for ulcers. It is laxative and diuretic, and a decoction is given in piles, stone in the bladder, gonorrhœa and syphilis.

In Cambodia an infusion of the wood is given in paludism. The whole plant is considered depurative.

Burma: Momaca, Yactagyiben, Yactakyee—; *Cambodia*: Rey tuk—; *Gond*: Sundeh—; *Indo-China*: Bo song, Rey tuk, Ri ri—; *Konkan*: Sherana—;

Kumaon: Kandayar—; *Kurku*: Jeljambu—; *Lao*: Kai—; *Lepcha*: Mongthel, Mung-thel kung—; *Malayalam*: Katalluri—; *Mundari*: Garahuri, Garahuru—; *Nepal*: Kholaruis—; *Philippines*: Lumanaja, Mimbre—; *Sanskrit*: Kshudrapashanabheda, Pashanabedaka—; *Santali*: Gurjor, Sunukui—; *Tagalog*: Agoyoy, Agucuc, Balanti, Dumanai, Lumanai—; *Telugu*: Cheppunjerinjal, Taniki—; *Uriya*: Jamla—; *Visayan*: Mayagos, Mayoyos, Miayos.

Hura.

The genus consists of 2 tropical American species.

Hura crepitans Linn., indigenous in tropical America, has been introduced into India from Jamaica.

The juice of the bark is a Brazilian remedy for leprosy. It is considered caustic and irritant in Guiana and Mexico, and is said to cause blindness. At Guadas the latex is used as a fish poison.

In Mexico and Guiana the leaves are much used for chronic pains; the fresh seeds are emetic and purgative and in great demand; the oil from the seeds is said to be a useful though very drastic purgative.

The bark and the latex are officinal in Portugal.

Canarese: Retidani—; *English*: West India Sandbox Tree—; *French*: Arbre du diable, Sablier, Sablier élastique—; *French Guiana*: Maman cacao, Sablier, Sablier élastique—; *Indo-China*: Ba dau tay, Diep tay, Ngo dong—; *Mauritius*: Sablier—; *Portuguese*: Assacu, Oassacu—; *Suriname*: Postentree—; *Tamil*: Mullarasomam—; *Telugu*: Simaburuga—; *West Indies*: Sandbox Tree—; *Youri-Taboca*: Oassacu—.

Jatropha.

This genus includes 160 tropical and subtropical species, chiefly American.

The following species are used medicinally in Arabia— *J. glandulifera* Roxb.—; in Cambodia, Indo-China, the Philippine Islands and Guiana— *J. Curcas* Linn., *J. multifida* Linn.—; in Mexico— *J. macrorhiza* Benth.—; in South America and the West Indies— *J. Curcas* Linn., *J. gossypifolia* Linn., *J. multifida* Linn.—; in Gold Coast— *J. Curcas* Linn., *J. gossypifolia* Linn.—; in West Africa, Madagascar, La Reunion— *J. Curcas* Linn.—; in South Africa— *J. capensis* Sond., *J. hirsuta* Hoch., *J. Zeyheri* Sond.—.

A. Evergreen tree or large shrub
   1. Leaves simple and ovate or 3-5-lobed ... ... 2. *J. glandulifera.*
   2. Leaves long-petioled, orbicular-cordate or 3-5-lobed or angled ... ... 1. *J. Curcas.*

B. Shrubs
   1. Leaves entire or 3-lobed, base cuneate, lobes entire. 5. *J. nana.*
   2. Leaves 5-lobed or -partite, lobes glandular-serrulate ... 3. *J. gossypifolia.*
   3. Leaves long-petioled, orbicular, palmately cut into many narrow entire or lobulate caudate acuminate segments ... ... 4. *J. multifida.*

1. **Jatropha Curcas** Linn. is an evergreen shrub, indigenous to America, but cultivated in most parts of India, especially on the Coromandel Coast and in Travancore. It is a common hedge-plant in the Konkan, and in the Malay Peninsula.

According to Ayurvedic practitioners 'the fruit and the seed are anthelmintic; useful in chronic dysentery, thirst, urinary discharges, abdominal complaints, biliousness, anæmia, fistula, and diseases of the heart'. The oil is reckoned a valuable external application to itch, herpes, chronic rheumatism, and sores or wounds.

The leaves are applied as a rubefacient and discutient, and a decoction of them is said to excite the secretion of milk in women. The viscid juice which flows from the stem upon incision is painted over cuts and wounds to check bleeding and promote healing.

In Goa the root-bark is applied externally in rheumatism. In the Konkan it is rubbed with a little asafoetida and given with buttermilk in dyspepsia and diarrhoea; the fresh stems are used as a tooth brush to stop bleeding from the gums.

The roasted nuts are used as a purgative by the Mundas, one nut producing three or four stools.

In Cambodia the leaves are considered insecticidal, the latex styptic, the oils from the seeds abortive.

The leaves are extensively used in the Cape Verde Islands, in the form of decoction and cataplasm to the mammae, as a lactagogue. The Bakwiri of Cameroons add a decoction of the young leaves to beer as a diuretic for rheumatism.

In Nigeria a decoction of the leaves with native natron is used by women as a wash for a month before childbirth. In Gambia the leaves are used to make a mouth-wash. In Southern Nigeria they are a remedy for jaundice, applied by rectal injection.

In West Africa the sap of the plant is used to cure toothache. It is also used as a styptic, for stopping bleeding. It is said to blind the eyes. The bark of the roots is ground and used as a dressing for sores.

In Western Ashanti the leaves are burned and the ashes applied to guinea worms, which are said to come out quickly in consequence.

The seeds are used in native Hausa medicine; the oil extracted from them is used as an application for sores in domestic stock. In Gabon the seeds are ground and mixed with palm oil to kill rats.

The oil from the seeds is applied topically in Guinea in rheumatism, herpes, and pruritus. The juice of the plant and the pounded leaves are applied to wounds and refractory ulcers.

In Gold Coast the leaves are ground and used with pounded palm nuts to make a mixture which is used as an enema for weak babies to strengthen them. They are also used for smoking bedbugs out of a house. They are often crushed in water and used as an enema. The juice of the leaves is squeezed into water, lemon or lime added, and the liquid used as a bath for curing fever. When the young leaves are boiled, the liquor is drunk to cure fever also. The seeds are commonly used as a very effective purgative. Sometimes they are used in curing eye trouble.

Indians in Natal use the seeds as a purgative.

The wood is used in Madagascar and Guiana as an anti-diarrhœic; the latex is applied to decayed teeth and to wounds, and is used as a styptic; the roots are given as emetic and purgative.

The seed is a Brazilian anthelmintic; the principle is contained in the embryo.

The blacks of Rio Nunez saponify the oil with the ashes of the Papaw, and use the preparation to heal the wounds caused by circumcision.

A toxalbumin, curcin, is present in the seeds.

Ada : Kwadidicho—; *Agolo* : Ubolu, Ubwolu—; *Agona* : Kaneadua—; *Akim* : Nkrangye dua—; *Akwapim* : Aborotortor—; *Anang* : Mbubok—; *Antilles* : Fève d'enfer, Herbe du Bon Dieu, Herbe du diable, Mancenillier bénit, Médicinier bénit, Médicinier des Barbades, Noix américaine, Pignon de Barbarie, Pignon d'Inde—; *Antsianaka* : Valavenola, Voanongo—; *Arabic* : Dandebarri, Dandenahri, Habb el meluk—; *Ashanti* : Akanedua—; *Awka* : Elu—; *Awuna* : Krorti—; *Bambara* : Baga-ni, Iridingue—; *Baoule* : Propo—; *Bengal* : Baghbarinda, Bagbherenda, Bonbheranda, Erandagachh, Paharierand, Safedind—; *Benin* : Aru-ebo—; *Bete* : Badaguigui—; *Betsimisaraka* : Kizika—; *Bhil* : Ratan—; *Bobo-Dioula* : Manan-naga—; *Bobo-Fing* : Daya-naga—; *Bombay* : Irundi, Jaiphal, Jepal, Kurikarlu, Maraharalu, Mogalieranda, Yerand—; *Brazil* : Figo do inferno, Mandubiguasu, Munduyguasu, Pinhao do Paraguay, Pinhao de purga, Pinhao paraguay, Pinheiro do inferno, Pinheiro de purga—; *Burma* : Kesugi, Thinbankyekku, Thinbaukyeksu, Thinbawkyetsu—; *Cambodia* : Lohong khvang sa—; *Canarese* : Adaluharalu, Bettadaharalu, Bettaharalu, Doddaharalu, Dundiga, Kadandla, Kaduharalu, Karnochchi, Maraharalu, Maraharlu, Maraharuli, Marayavudula, Parangiharalu, Turukaharalu—; *Cape de Verde* : Pulguiera—; *Ceylon* : Kaddamanakku—; *Chinese* : Ma Fong Chou—; *Cuba* : Piñon botija—; *Deccan* : Ehanduejot, Erundi, Jangli-yarandi—; *Efik* : Eto-mkpa—; *Egypt* : Habb-el-meluk—; *English* : Barbados Nut, Physic Nut, Poison Nut, Purging Nut—; *Ewe* : Babatsi, Gbomagboti, Kpoti, Krorti—; *Fanti* : Aburokyiriaba, Adadze—; *Formosa* : T'ung yu-shu—; *French* : Grand médicinier, Grand pignon d'Inde, Gros ricin, Haricot du Pérou, Manioc bâtard, Médicinier, Oignon d'Inde, Pignon des Barbades, Pignon d'Inde, Pourghère, Pulguère, Purghère, Ricin d'Amérique—; *French Guiana* : Médicinier—; *French Guinea* : Barané—; *Fulani* : Kidi, Kola-debbe, Kolakolaje, Kwolkwolaje—; *Ga* : Kplukacho—; *Gaboon* : Ogombo—; *Gbari* : Kwotewi—; *German* : Purgirnuss, Schwarzelrechnuss—; *Golunga Alto* : Mupuluca—; *Guam* : Tubatuba—; *Gujerati* : Jamalgota, Jangliarandi, Ratan-jota—; *Hascda* : Kulaiaradaru—; *Hausa* : Binidazugu, Chinidazugu—; *Hindi* : Bagberenda, Bagbherenda, Baghrandi, Bhernda, Jangliarandi, Pharierand, Safeda-rand, Safedind—; *Hova* : Tanantanambazaha, Tanantanamposy, Tanantanankisoa—; *Ibibio* : Etomkpo—; *Ibo* : Buluolu, Okweni, Olulu-idu, Owulu-idu—; *Ilocano* : Tavatova, Tawatawa—; *Indo-China* : Ba dau me, Ba dau nam, Coc dau, Dau me, Dong thu, Kuang, Lohong, Vao, Vong dau ngo—; *Java* : Dijarak—; *Kolani* : Kulajara, Kulejera, Totkabendi—; *Konkani* : Erond, Erondd, Jemphal—; *Kontagora* : Binidazugu—; *Krepi* : Abrortorto—; *Krobo* : Kitigblaicho, Kutugblaicho—; *Lambadi* : Ranniarendero—; *La Reunion* : Pignon d'Inde—; *Madagascar* : Kinampotsy, Kinanafotsy, Kinapotsy, Kinopotsy—; *Malay* : Jarak b'landa—; *Malayalam* : Kattavanakku—; *Malinke* : Bagha, Baha—; *Mandingo* : Baga, Bagauro, Bagha—; *Marathi* : Mogalieranda, Ranayerandi—; *Mauritius* : Pignon d'Inde—; *Melghat* : Mogali yerand—; *Mende* : Katawi, Kata-wului—; *Mexico* : Avellanes purgantes, Sangregaod—; *Misahohe* : Wabati—; *Mozambique* : Sassi—; *Mundari* : Jadabindi, Totkabindi—; *Naguri* : Kulabindidaru, Totkabindidaru—; *Nepal* : Kadam—; *Nzima* : Taprika, Tapuleka—; *Ibu* : Okwata, Ubwolu—; *Orissa* : Baigab—; *Pahouin* : Ofossn tang—; *Panama* : Arbol santo, Coquillo, Jaquillo, Piñon de purga, Tapate—; *Persian* : Dandebarri, Dandenahri—; *Philippines* : Bolongcauit, Casta, Cator, Kator, Tavatava, Tuba—; *Porto Rico* : Tartago—; *Portuguese* : Grão malucco, Grão muluco, Pinhao de purga, Pulza, Purgheira, Purgueira, Ricino maior—; *Quittah* : Abrortorto—; *Sakalave* : Savoa, Valavelo, Voanongo—; *Samoa* : Puavai—; *Sanskrit* : Akhuparnika, Chitra, Dravanti, Kananeranda, Mushikaparni, Nyagrodhi, Parvateranda, Pratyakshreni, Randa, Shanbari, Sutashreni, Vrisha—; *Santali* : Bhernda—; *Saora* : Peddanepalemu—; *Serere* : Tabanani—; *Sierra Leone* : Bagauro—; *Sinhalese* : Endaru, Erandu, Rata-endaru, Velendaru—; *Soussou* : Baranè, Barhane, Baxane—; *Spanish* : Arbol de los Piñones de Indias, Piñoncillo—; *Tagalog* : Tatataba—; *Tamil* : Adalai, Kadalamanakku, Kaitta, Kattamanakku, Kattukkottai, Kuribaravuni, Naligadi, Nikkurottam, Tiravadi, Vellaiyamanakku—; *Telugu* : Adaviyamudamu, Katiyamudamu, Kondamudamu, Nepalemu,

Peddanepalemu, Pepalemu—; *Timne*: Esigororopetr—; *Tivi*: Igadam—; *Tulu*: Kadalambudu—; *Twi*: Aborotortor, Akanedua, Nkrangyedua—; *Uriya*: Baigoba, Norokokalo—; *Visayan*: Casla—; *Wolof*: Tuba—; *Yoruba*: Botije, Botuje, Botuje-ubo, Lobotuje, Olobontuje, Shenrijun, Ubo—.

2. **Jatropha glandulifera** Roxb. is common near villages in Bengal, Burma, the Northern Circars, and the Deccan, rare in Oudh and the Punjab. One of the most abundant of hedge plants in the lower provinces, but also prevalent on village waste lands.

The juice of the plant is used in various parts of the country as an escharotic to remove films from the eyes.

The root brayed with water is given to children suffering from abdominal enlargements. It purges, and is said to reduce glandular swellings.

The fixed oil from the seeds has purgative properties. It is applied to sinuses, ulcers, foul wounds, ringworm, and also in rheumatism and paralysis.

Arabic: Abab, Kharub—; *Bengal*: Lalbherenda—; *Bombay*: Janglierandi, Undarbibi—; *Canarese*: Kariturukahalugida, Totlagida—; *Hindi*: Janglierandi, Undarbibi—; *Kolami*: Verendi—; *Konkani*: Ranerandi—; *Malayalam*: Atala, Nakadanti—; *Marathi*: Jangliarandi—; *Persian*: Baide anjira—; *Sanskrit*: Nikumbha—; *Tamil*: Adalai, Eliyamenakku, Erikkaraikattamanaku, Kattamanaku, Puliyamanakku—; *Telugu*: Dundigamu, Dundigapu, Nelaamida, Nelanepalemu, Nepalemu, Nelayamudamu, Vettiyamudamu—; *Urdu*: Jangli eranda—; *Uriya*: Simanorokokalo—.

3. **Jatropha gossypifolia** Linn. is a native of Brazil naturalized in many parts of India. It is now established in Burma and Singapore.

A decoction of the bark is used as an emmenagogue.

The leaves are applied to boils and carbuncles, eczema and itches.

The seeds act as an emetic; but they are said to cause insanity.

In the pith of the old thick stems a yellowish-brown substance is found which is sold in Gold Coast medicine markets. It is put into a clean cloth and squeezed into the nostrils, causing the patient to sneeze and effectively curing headache.

In Gold Coast the leaves and the seeds are used as purgatives. The leaves are boiled and used in the bath to cure fever. Their juice is used to cure sores on the tongues of babies.

Antioquia: Tuá-tuá—; *Ashanti*: Kaagya—; *Bambara*: Baga, Bagha, Baha, Santanan—; *Bengal*: Lalbherenda—; *Benin*: Oru-ebo—; *Canarese*: Karituru-kaharalu—; *Ewe*: Babatsi, Gbomagboti, Nakrakpoti—; *Fanti*: Aburokyiraba, Akandedua—; *Ga*: Engmelbii, Kpitikpitsho—; *Hindi*: Bhernda, Verenda—; *Ibo*: Akimbogho—; *Kolami*: Bhernda, Verenda—; *Lagos*: Lobotuje pupa—; *Malayalam*: Simayavanakku—; *Malinke*: Baga, Bagha, Baha—; *Mandingo*: Baga, Bagha, Baha—; *Mende*: Katawi, Kata-wului—; *Oloke-meji*: Olobontije-pipa—; *Panama*: Frailecillo, Frailejon, Purga de fraile, Purga de Huane—; *Santali*: Bhernda, Verenda—; *Tamil*: Adalai, Kattamanakku, Simaiyamanakku—; *Telugu*: Nepalemu, Simanepalemu—; *Uriya*: Rangakalo—; *Venezuela*: Tuá-tuá—; *Yoruba*: Botuje pua, Lapalapa pupa, Lobotuje, Olobontuje—.

4. **Jatropha multifida** Linn. is a native of South America, cultivated and naturalized in various parts of India.

The seeds are regarded as a powerful purgative. In French Guiana they are used fresh as a purgative and emetic.

In Cambodia the leaves, the latex, and the oil from the seeds are used medicinally. The leaves are used in scabies; the latex is applied to wounds and ulcers; the oil is used both internally and externally as an abortifacient.

In Indo-China the dried root is given as a decoction for indigestion and colic; it is also prescribed as a tonic, in orchitis and in oedema.

Benin: Iboisa—; *Brazil*: Flor de coral, Pinhoen—; *Cambodia*: Lohong khyang krahaam—; *Canarese*: Sime auvdala, Vilayatiharalu—; *English*: Coral Plant, French Physic Nut, Purging nut, Small Physic Nut—; *French*: Arbre corail, Médicinier bâtard, Médicinier d'Espagne, Noisetier purgatif, Petit médicinier—; *French Guiana*: Bouquet corail—; *Ilocano*: Mana—; *Indo-China*: Bach phu tu—; *Lagos*: Ege—; *Mauritius*: Arbre corail—; *Sanskrit*: Bhadradanti, Brihaddanti, Dugdhagarbha, Guchhphala, Jayavaha, Jyotishka, Virechani, Vishabhadra—; *Spanish*: Avellana purgante de Santo Domingo, Piñol de Cumaña, Purgante de España—; *Tagalog*: Mana, Tuba—; *Tamil*: Kattunervalam, Malaiyamanakku—.

5. **Jatropha nana** Dalz. is found in the Deccan, in stony places near Poona, Bombay, and throughout the Konkan.

The juice is employed as a counter-irritant in ophthalmia.

Marathi: Kirkundi—.

Macaranga.

The genus includes 180 species, occurring in the tropics of the Old World.

M. huraefolia Beille is used medicinally in tropical West Africa.

Leaves deltoid-ovate, peltate, entire. Evergreen tree, 50-60 ft.	1. *M. indica.*
Leaves peltate, entire. Small resinous tree ...	2. *M. peltata.*

1. **Macaranga indica** Wight is found in Sikkim up to 3,000 feet, the Mishmi and Khasia Hills, the Deccan Peninsula, the Andaman Islands, and Ceylon.

The gum is applied to sores.

Kumaon: Ramalo—; *Malayalam*: Puthatamara—; *Malkot*: Papri—; *Sinhalese*: Kenda—; *Tamil*: Vuttuttamara—.

2. **Macaranga peltata** Muell.-Arg. is found on the hills of Orissa and the Circars, and on the Ghats from the Konkan to Travancore. It is abundant in Ceylon, up to 3,000 feet.

The gum, powdered and made into a paste, is reckoned a good external application for venereal sores.

Bombay: Chanda—; *Canarese*: Chandakanne, Chandkal, Chenthakanni, Chinthakanni, Jatiyuppalige, Kanchupranti, Kanjupparanti, Upaligi, Uppalige, Upparanti—; *Ceylon*: Vaddakkanni—; *Kadir*: Pimugam—; *Kanara*: Chandkal—; *Konkani*: Chandori—; *Malayalam*: Pattavanni, Uppila, Vatta—; *Marahi*: Chanda, Chandoda, Chandora, Chandwar—; *Matheran*: Chandara—; *Mayurbhanj*: Tabhari—; *Mysore*: Chenthakanni—; *Sinhalese*: Bukenda, Kenda, Patkenda—; *Tamil*: Vatta, Vattikanni, Vattittutti—; *Telugu*: Boddi, Kondajaphara, Kondatamara, Pulichinjalamu—; *Uriya*: Gondaguria, Pianja—.

Mallotus.

The genus includes 120 species, found in the tropics of the Old World.

M. apelta Müll.-Arg., *M. cochinchinensis* Lour., *M. furetianus* Müll.-Arg., *M. philippinensis* Müll.-Arg. are used medicinally in Indo-China; *M. japonicus* Müll.-Arg. is used in Japan; *M. philippinensis* Müll.-Arg. in the Philippine Islands; *M. oppositifolius* Müll.-Arg. in Nigeria and Gold Coast.

Capsule echinate or woolly; stamens 45 to 100 ...	1. *M. cochinchinensis.*
Capsule not spiny; stamens 40 to 50	2. *M. philippinensis.*

1. **Mallotus cochinchinensis** Lour. is very common in the secondary jungle and woods of Burma, the Malay Peninsula, the Malay Islands, Cambodia, Indo-China, and China.

The root and the fruit are applied topically to bruises in Indo-China.

Indo-China: Bai bai, Bet, Bo, Bong bet, Giay, Plan—; *Malay*: Balik angin—.

2. **Mallotus philippinensis** Müll.-Arg. is found throughout tropical India; along the foot of the Himalaya from Kashmir eastwards, ascending to 5,000 feet; all over Bengal and Burma, Singapore, and the Andaman Islands; and from Sind southwards to Ceylon. It is distributed to China, the Malay Islands, New Guinea, and Australia.

The leaves are bitter, cooling; give appetite; cause flatulence and constipation. The glands on the fruit are pungent, heating; purgative, anthelmintic, vulnerary, detergent, maturant, carminative, alexiteric; heal ulcers and wounds, tumours, stone in the bladder; useful in bronchitis, diseases of the abdomen, enlargement of the spleen (Ayurveda).

The glands and hairs on the fruit are bitter; anthelmintic, styptic; lessen intestinal pain; useful in scabies, ring-worm, and other skin diseases (Yunani).

Among the Mundas of Chota Nagpur the root, well ground, is rubbed on the painful parts in articular rheumatism. The root is used internally by the Arabs for leprosy, and in solution to remove freckles and pustules.

The leaves, fruit, and root with honey are applied to poisoned bites, bruises, ring-worm, pimples and freckles.

In Katha, Burma, the seeds are ground to a paste, and applied to wounds and dah cuts.

The powder prepared from the fruit is used as an anthelmintic, vermifuge and purgative medicine. It is also said to possess cathartic properties. This powder, which is known as 'Kamala' and consists of the small glands and hairs on the ripe fruits, is officinal in Austria, Germany, Hungary, Italy, Japan, Portugal, and Switzerland.

In most European and American works it is stated that Kamala has long been used in India in the treatment of tapeworm; but neither literature nor tradition bear this out. It would appear from results obtained recently under controlled conditions that the value of the drug as an anthelmintic has been greatly overrated. As for its antidotal properties they have been experimentally

disproved by Mhaskar and Caius in the case of cobra and daboia venoms.

Akola: Kunkumphal—; *Almora*: Roli—; *Arabic*: Kampileh, Kinbil—; *Assam*: Gangai, Jaggaru, Puddum—; *Banda*: Kamela, Reoni, Roli—; *Bengal*: Kamalagundi, Kamila, Tung—; *Berar*: Kuku, Sendri—; *Betul*: Kunkuma, Rauni, Rori—; *Bhil*: Shendrya—; *Bijnor*: Kamela, Ruinia—; *Birbhum*: Dholasinua—; *Bombay*: Kamala, Kamela, Kapela, Kapila, Ruhin, Shendri—; *Bundelkhand*: Rori—; *Burma*: Tanthieden, Tawtheeteng, Tawthidin—; *Canarese*: Chandrahittu, Ettunalige, Honne, Hullichellu, Kapila, Kesari, Kesarimavu, Kunkuma, Kunkumada, Kunkume, Munnaga, Punnaga, Purushatunga, Surahonne, Suraparni, Suvarnakesari, Vasare—; *Central Provinces*: Chamargular, Ningur, Rauni, Rori—; *Ceylon*: Kamalama, Kapila—; *Darjeeling*: Sinduri—; *Deccan*: Kambhal, Kamila, Ruin, Ruli, Wussunthagunda—; *Dehra Dun*: Raini—; *English*: Monkey Face Tree, Spoonwood—; *Garhwal*: Rohni, Roini, Ruina—; *Garo*: Chinderpang, Machugan—; *Gond*: Koku—; *Gujerati*: Kapilo—; *Haldwani*: Roli—; *Hindi*: Kamala, Kambhal, Kambila, Kamela, Kanula, Kamud, Raini, Rauni, Rohni, Roini, Roli, Rora, Ruin, Ruli, Rulu, Wassanthaganda—; *Ilocano*: Buas, Vuas—; *Indo-China*: Aloang lay sa lang, Ba bet, Bae thau, Buom, Canh kiẽn, Du ma thich, Ema da, Giay rung, Skuoi—; *Jaunsar*: Kambel—; *Kadir*: Manjanai, Maunana, Ponni—; *Kashmir*: Kaimbil—; *Kharwar*: Rori—; *Kolami*: Garasinduri—; *Kumaon*: Rauni, Reru, Riuna, Roli, Ruen—; *Lambadi*: Dholo—; *Lepcha*: Numboonghor, Puroa, Purva, Tukla—; *Lohardugga*: Rori—; *Malayalam*: Chenkolli, Kapila, Kuramatukka, Manjana, Maunana, Piponnakam, Ponnakam, Ponni, Poonagam, Punna, Tavitu—; *Mal Paharia*: Daosindra—; *Marathi*: Shendri, Shindur—; *Matheran*: Asli, Rohen—; *Melghat*: Kuku—; *Merwara*: Senduria—; *Michi*: Baraiburi, Sindurpong—; *Mundari*: Garisinduri—; *Nepal*: Safedmallata, Sinduria—; *Nimar*: Kunkuma, Rauni, Rori—; *North-Western Provinces*: Purvahung, Sinduria—; *Oudh*: Rohni—; *Persian*: Kampileh, Kanbela—; *Peshawar*: Kambalia—; *Punjab*: Kamal, Kambal, Kamela, Kumila, Reini, Reun, Rulya—; *Queensland*: Poodgee-poodgera—; *Rannagar*: Roli—; *Sanskrit*: Bahupushpa, Chandra, Kampilla, Kampillaka, Kapila, Karkatha, Kesara, Laghupatraka, Lohitanga, Madhuka, Nadivasa, Pikaksha, Punnaga, Punnagakesara, Punnama, Raktachurnaka, Raktanga, Raktaphala, Ranjaka, Rechanaka, Rechani, Rechi, Rochana—; *Santali*: Rora—; *Shan*: Tawthadin—; *Sinhalese*: Hamparandella, Hamparila, Kamala—; *Tagalog*: Banato, Sala—; *Tamil*: Avam, Kabilam, Kabilappodi, Kamala, Kambosam, Kapila, Kopilapodi, Kungumam, Kurangumanjanatti, Manjanai, Suvanagesari, Tavattai, Tiruchalai—; *Telugu*: Adavigubbatuda, Benduruppa, Chendiramu, Kunkuma, Nagarakta, Sinduragunda, Sinduri, Tunga, Vasantagandhamu, Veligarapu—; *Tulu*: Ponne—; *Urdu*: Kalileh—; *Uriya*: Bosontogundi, Kunkumo, Kopilogundi, Punango, Sinduri, Sindurogundi—; *Visayan*: Sala—; *Zambales*: Apuyot—.

Manihot.

The genus consists of 150 American species, mostly Brazilian and Mexican.

M. loureirii Pohl, a native of Cochin-China, is used medicinally in China; *M. ultilissima* is used in Brazil, Guiana, and Cambodia.

Manihot ultilissima Pohl is cultivated in various parts of India.

In Cambodia the pounded tuber is applied to ulcerated wounds. It is considered antiseptic in Brazil, and is used to preserve meat: as an ointment it is reputed useful in ulcers of the cornea.

The juice is very poisonous. In Guiana it is boiled down to a syrup and given as an aperient. The fresh rhizome is made into poultice and applied to ulcers.

The fruit is used as a fish poison in California and in Brazil.

The starch is officinal in Holland.

Ashanti: Bankye—; *Bafo*: Makwamba, Ngabo, Ngawa, Sanagal—; *Bahamas*: Bay Rush, Bitter Cassava, Cassava, Manioc, Tapioca—; *Bakundu*:

Kasara—; *Bakwiri*: Mionde—; *Balondo*: Ewa—; *Balong*: Sanagal—; *Bambara*: Bananiku—; *Banda*: Ngali—; *Basari*: Banking, Kambohando—; *Batanga*: Ewa—; *Bemoba*: Jangbwanguyuya—; *Benin*: Bobozi, Ebobozi, Igari, Igarimakole, Ikeripia—; *Betsileo*: Balahazo, Mangahazo—; *Betsimisaraka*: M' Bazaha—; *Bota*: Makwamba—; *Brazil*: Mandioca, Maniba, Manioc, Manira—; *Cambodia*: Kdouch—; *Canarese*: Kadugenasu, Maragenasu—; *Central America*: Yuca—; *Dagomba*: Bankye, Kambonjule—; *East Africa*: Mhogo—; *Ebrie*: Bede—; *Efik*: Ibo iwa, Iwa unenge, Okpo ofop iwa—; *English*: Bitter Cassava, Brazilian Arrowroot, Cassava, Tapioca Plant—; *Ewe*: Agbeli—; *Fanti*: Bankye—; *French*: Mandioc, Manioc, Manioc doux, Manioque, Pain des nègres—; *French Guiana*: Manioc, Manioc amer, Manioc petit Louis—; *Fufulde*: Mbai—; *Fulani*: Bantara, Nyambe—; *Ga*: Duade—; *Gold Coast*: Bantshi, Duaday—; *Guam*: Mandioka, Mandiuka, Mendioka, Mendiuka, Yuka—; *Hausa*: Baushin kurege, Doyar kundu, Kandirin beguwa, Karaji, Karaza, Rogo—; *Hindi*: Sakarkanda—; *Hova*: Vomangahazo—; *Ibo*: Abacha, Abaja, Akbo, Akbonkono, Akbunkolo, Akpu, Akpu-ji, Ji-akpu, Ji-gbo, Oi-akpu—; *Jamaica*: Cassada—; *Java*: Hoci dangdua—; *Kabure*: Mbaumhae—; *Kano*: Rogo—; *Kanuri*: Garisa—; *Kissi*: Yambale, Yambale fulalei—; *Konkomba*: Akombanul—; *Konno*: Tanga—; *Koranko*: Banake, Tankaso—; *Krepi*: Gbedi, Gbeli—; *Krobo*: Agbeli—; *Limba*: Kopintan—; *Loanda*: Quisaca—; *Lokko*: Bororanga—; *Losso*: Bondoronde—; *Madagascar*: Kajaha, Kazaha, Matreoka, Ropotra, Tsiveritelo, Vihazo—; *Malinke*: Bananku, Bananku gue, Bara bananku—; *Mamprussi*: Kukulajo—; *Mandingo*: Mandioca, Nyambo—; *Mano*: Bai, Bei—; *Mauritius*: Manioc—; *Mbonge*: Kasara—; *Mende*: Tangei, Rande, Nguwo—; *Mexico*: Huacamotl—; *Mundari*: Edelsangga—; *Nigeria*: Bara banankou—; *North America*: Brazilian Arrowroot, Cassava, Manioc, Tapioca Plant—; *Nupe*: Rogo, Rogo dzurugi—; *Nzima*: Bairdair—; *Portuguese*: Mandioca, Pau de farinha—; *Roumanian*: Manioc—; *Russian*: Manioc—; *Sakalave*: Ambazaha, Balafanapaka, Mohogo—; *Sherbro*: Yeke—; *Shuwa Arabic*: Baghut, Nagasha—; *Sinhalese*: Manyokka—; *Sobo*: Madaka, Medaka—; *Spanish*: Mandiiba, Maniba del Brasil, Manihot amarga, Manioc amarga, Mondioca, Yuca, Yuca amarga, Yuca brava, Yuca casave de las Antillas, Yuca casavi de las Antillas, Yuca mortifera—; *Susa*: Yoka, Yoka-fore—; *Tagalog*: Caomtingcahoy—; *Timne*: Ayoka Batsanka, Ekanda, Erogbo, Nafange, Yokaibi—; *Tivi*: Rougou, Vambeyon—; *Tschandjo*: Kungola—; *Twi*: Bankye—; *Vai*: Dumbai—; *Visayan*: Camotingcahoy—; *Uruguay*: Mandioca—; *West Africa*: Mandioca—; *West Indies*: Yuca—; *Wolof*: Gniambi, Nyambe—; *Yalunka*: Kunde, Kunde-ghrabi-na—; *Yoruba*: Ege—.

Microdesmis.

The genus consists of 2 species, one Asiatic, and one African. *M. caseariaefolia* Planch. is used medicinally in Indo-China; *M. puberula* Hook. and *M. Zenkeri* Pax. in tropical West Africa.

Microdesmis caseariaefolia Planch. ocurs in Tenasserim, and is found in woods and forests all over the Malay Peninsula. It is distributed to Borneo and South China.

The fresh sap is used in Indo-China for caries of the teeth.

Indo-China: A luan te he, Chanh oc, Dock ko bang—; *Malay*: Chateng, Chereh rambeh, Kenidei badak, Sigoniah—.

Phyllanthus.

The genus includes 500 species, temperate and tropical, absent from Europe and northern Asia.

The following species are used medicinally in Indo-China— *P. elegans* Wall., *P. Emblica* Linn., *P. Niruri* Linn., *P. reticulatus* Poir., *P. urinaria* Linn.—; in China— *P. Emblica* Linn.—; in the Philippine Islands— *P. Niruri* Linn., *P. reticulatus* Poir., *P. urinaria* Linn.;— in Colombia— *P. ichthyomethius* Rusby, *P. salviaefolius* H.B.K.—; in Brazil— *P. conami* Sw., *P. lathyroides* H.B.K., *P.*

Niruri Linn.—; in Guiana— *P. conami* Sw., *P. epiphyllanthus* Linn., *P. guyanensis* Klotsch, *P. Niruri* Linn., *P. urinaria* Linn.—; in the West Indies— *P. Niruri* Linn.—; in Lagos and Gold Coast— *P. amarus* Schum. and Thonn., *P. discoideus* Muell.-Arg., *P. floribundus* Müll.-Arg., *P. Niruri* Linn., *P. pentandrus* Schum. and Thonn., *P. reticulatus* Poir., *P. Wildemannii* Beille—; in Madagascar— *P. casticum* Soy.-Will., *P. madagascariensis* Muell.-Arg.—; in La Reunion— *P. casticum* Soy.-Will., *P. Niruri* Linn., *P. phillyreaefolius* Poir., *P. urinaria* Linn.—.

A.	A large deciduous tree; bark flaking conchoidally; branchlets slender, pubescent. Leaves equal and symmetrically set	2. *P. Emblica.*
B.	Shrubs or small trees; leaves 1 in. or more long.	
	I. Capsule small .1 in. through or less, fleshy. Pedicels slender rather long	5. *P. reticulatus.*
	II. Capsule long-pedicelled, dehiscent, .1 to .5 in. long. Leaves ovate-lanceolate glaucous beneath, 4 in. long.	1. *P. elegans.*
C.	Herbs, occasionally wiry at base; leaves distichous small.	
	I. Quite herbaceous; leaves oblong or elliptic obovate; capsule smooth	4. *P. Niruri.*
	II. Slightly woody at base; leaves linear-oblong; capsule echinate	7. *P. urinaria.*
	III. Nine inches to 2 ft. tall with long branches, leaves close set very narrow.	
	a. Leaves linear or oblong-linear; flowers pedicellate.	6. *P. simplex.*
	b. Leaves cuneate-obovate; flowers sub-sessile ...	3. *P. maderaspatensis.*

1. **Phyllanthus elegans** Wall. is found in Tenasserim, at Mulmein, Mergui, and Amherst; in the Malay Peninsula, on stream banks in Pulau Adang islands and Rawei.

In Indo-China the roots are considered antiperiodic. The juice of the pounded leaves is given to children with aphthae.

In Tongking the leaves are made into a salad and given for fatigue.

Indo-China: Bo ngot, Bu ngot, Hac rien than—.

2. **Phyllanthus Emblica** Linn. is found, wild or planted, throughout tropical and subtropical India; from the base of the Himalaya, from Jummu eastwards, and southwards to Ceylon and Malacca; whence to the Malay Islands and China.

This plant occupies an important place in Hindu Materia Medica, and the medicinal properties of its various parts are described at length in the Nighantas: 'The fruit is acrid, sour, bitter, sweetish; cooling, alexiteric, carminative, alterative, laxative, tonic, antipyretic; useful in burning sensations, vomiting, biliousness, urinary discharges, thirst, leprosy, constipation, inflammations, erysipelas, piles, anaemia, strangury; used in biliousness, thirst, sweats, anura, poisoning, ophthalmia, incipient blindness.—The leaf is used in opthalmia and incipient blindness.—The seed is acrid, sweet; aphrodisiac, antipyretic; useful in biliousness, asthma, bronchitis, leucorrhœa, vomiting.'

Mohammedan physicians esteem the plant equally with the Hindus. According to Arabic and Persian authors; 'The flowers are cooling and aperient.—The fruit is acrid, sour, cooling; astringent, tonic, expectorant, vulnerary, laxative, improves the appetite; useful in diseases of the heart, liver complaint, cold in the nose, thirst, piles, biliousness, eye troubles; stops nasal hæmorrhage; purifies the humours of the body.'

The root, the bark, and the ripe fruit are astringent. The flowers are refrigerant and aperient.

The unripe fruit is cooling, diuretic, and laxative. The exudation from the incisions on the fruit is used as an external application in inflammation of the eye.

In the Konkan the juice of the fresh bark with honey and turmeric is given in gonorrhœa.

The leaves are, in Baroda, used as an infusion with fenugreek seeds in cases of chronic dysentery, and are also considered a bitter tonic. In the same locality the milky juice is considered a good application to offensive sores.

The leaves enter into the composition of a Mundari expectorant.

In the Tamil country the calcined fruit is powdered with an equal weight of flower tops of *Mollugo nudicautis* Lam., made into a paste with milk, and given for uterine hæmorrhage during pregnancy.

In Cambodia the leaves are used in the preparation of antithermic lotions and baths, and the decoction of the roots is given in myalgia following upon some febrile condition.

Arabic: Ambliy, Amlaj—; *Assam*: Amlaki, Amluki, Sohmyrlain—; *Bengal*: Ambolati, Amla, Amlaki, Amlati, Amlika, Amulati, Aonla, Aunlah, Yeonlah—; *Betul*: Aonla—; *Bombay*: Amla, Avala, Avalkati, Avla—; *Burma*: Hziphyu, Shabju, Siphiyusi, Tasha, Zibyu, Ziphiyusi—; *Cambodia*: Ngop—; *Canarese*: Amalaka, Chattu, Dadi, Dhanya, Dhatri, Nelli, Sudhe—; *Central Provinces*: Amla, Anla—; *Canton*: Yeou Kan Tse—; *Chinese*: An Mo Le—; *Cuttack*: Alathanda—; *Deccan*: Amla, Owla, Ownla—; *English*: Emblic Myrobalan Tree—; *Garo*: Ambari—; *Gond*: Aunri, Lalla, Milli, Nalli, Nilli, Usir—; *Gujerati*: Amali, Ambala, Ambri, Amla, Bhoza, Bhoza amali—; *Hindi*: Amalachi, Amla, Amlaki, Amlika, Anola, Anuli, Anvula, Anvurah, Anwerd, Aola, Aonla, Aora, Aungra, Aunra, Aunwered, Daula—; *Indo-China*: Bong ngot, Kam lam, Kamlan ko, Yem ma lac—; *Khond*: Durga—; *Kol*: Miral—; *Kolami*: Aura, Miral—; *Konkani*: Anvallo, Dogranvalli, Dogranvallo—; *Kumaon*: Aonla—; *Kurku*: Aunre—; *Lambadi*: Ambla—; *Lao*: Ma kam paum—; *Lepcha*: Pa-om kung, Suom—; *Malayalam*: Amalakam, Nelli—; *Marathi*: Anvala, Aola, Aonli, Avala, Arola, Awla, Bhuiawalai—; *Mauritius*: Embélic—; *Mundari*: Meraldaru—; *Nepal*: Amla—; *Nimar*: Aonla—; *North-Western Provinces*: Amla, Aoula—; *Persian*: Amelah, Amuleh—; *Portuguese*: Mirabolano emblico—; *Punjab*: Ambal, Ambli, Ambul, Amla, Aonla—; *Sanskrit*: Adiphala, Akara, Amalaki, Amamalakam, Amlika, Amraphala, Amrita, Amritaphala, Bahuphali, Dhatri, Dhatrika, Dhatriphala, Jatiphala, Karshaphala, Kayastha, Pancharasa, Rochani, Shanta, Shiva, Shriphala, Shriphali, Tishya, Tishyaphala, Triphala, Vayastha, Vrishya, Vrittaphala—; *Santal*: Meral—; *Saora*: Peddavusirika—; *Sinhalese*: Awusadanelli, Nelli, Nellika—; *Tamil*: Amalagam, Andakoram, Indul, Kattunelli, Nelli, Perunelli, Sirottam, Tattiri, Toppunelli—; *Telugu*: Amalakamu, Amalaki, Nelli, Pullayusirika, Triphalamu, Usirika, Usirikaya, Usiriki—; *Tulu*: Nelli—; *Urdu*: Anwala—; *Uriya*: Aura, Khondona, Onola—.

3. **Phyllanthus maderaspatensis** Linn. is met with throughout the drier parts of India, from Banda through the Deccan Peninsula

to Ceylon. It occurs also in tropical Africa, Arabia, Java, and Australia.

In Southern India an infusion of the leaves is given for headache.

The seeds are used medicinally on account of the mucilage which they afford when soaked in water.

Arabic: Cholf, Marur—; *Gujerati*: Kanochha—; *Hindi*: Hazarmani, Kanocha, Kanochha, Niruri, Sadamanni—; *Matheran*: Kanocha—; *Persian*: Marurshatu—; *Porebunder*: Bakrado—; *Sind*: Niruri, Sadamanni—; *Telugu*: Nalausereki—; *Urdu*: Kanochha—.

4. **Phyllanthus Niruri** Linn. is found throughout the hotter parts of India, from the Punjab eastwards to Assam, and southwards to Travancore, Ceylon, and the Malay Peninsula, ascending the hills to 3,000 feet. It inhabits the tropics generally, except Australia.

Hindu physicians credit the plant with the same therapeutical properties as *P. urinaria*; they, moreover, use the leaves as a diuretic and in menorrhagia.

According to Mahommedan physicians the plant is stomachic, good for sores and in chronic dysentery; the fruit is bitter, useful for tubercular ulcers, wounds, sores, bruises, scabies, and ringworm.

The plant is much used as a diuretic in dropsical affections, gonorrhœa, and other troubles of the genito-urinary tract. It is a South Indian diuretic and antidysenteric. In Indo-China it is reputed to be diuretic, depurant and antisyphilitic. In La Reunion it is very much used in blennorrhagia, dropsy, and diarrhœa.

The fresh root is said to be an excellent remedy for jaundice. In the Konkan it is rubbed down with rice water and given as a remedy for menorrhagia. Bruised with a little water and administered internally with milk, it is a popular Tamil galactagogue. In the Rajputana Desert the root, pounded and mixed with *Commiphora mukul* Engl., is given to camels suffering from indigestion.

The leaves are stomachic. A poultice of the leaves with salt cures scabby affections, and without salt may be applied to bruises and wounds; made with rice water the poultice lessens œdematous swellings and ulcers.

In Gold Coast the leaves are pounded and used to cure gonorrhœa. Parts of the plant are used to cure constipation. The leaves are boiled and the liquor drunk to stop acute pains in the stomach. The chief use of the plant is to allay griping in cases of dysentery.

The milky juice is a good application to offensive sores.

The bark is used as a purgative and in the treatment of various diseases, and yields a bitter principle 'phyllanthin', which is a fish poison.

An infusion of the young shoots is given in dysentery.

The infusion of the root and leaves is a good tonic and diuretic, when taken cold in repeated doses.

The decoction of the root and leaves is very bitter and is a favourite remedy among the natives of Santo Domingo and Porto Rico, for the cure of intermittent fevers. I have myself many

times proved its efficacy in preventing the expected paroxysm. I was accustomed to employ a tincture made by myself with the whole plant, the dose being two drachms in the morning. Sometimes I repeated the dose, which acted upon the bowels as a slight purgative and this is very useful in inveterate intermittents with infracts of the spleen and liver. The infusion of the root and leaves is a good tonic, and a diuretic when taken cold in repeated doses (A. J. Amadeo; *Pharmaceut. Journ.*, April 28, 1888).

A decoction of the bitter root and leaves is given in Haiti for stomach-ache.

An aqueous extract or a decoction of the fresh roots, stem, and leaves is given internally in snake-bite (Roberts); but the root, stem, and leaf, are all useless as an antidotal treatment (Mhaskar and Caius).

Arabic: Mekatkata, Meneckete—; *Ashanti*: Bommaguwakyi—; *Bengal*: Bhujamla, Kiraneli, Sadahazurmani—; *Bombay*: Bhuiavala—; *Brazil*: Erva pombinha—; *Burma*: Miziphiyu—; *Canarese*: Kiranelligida, Kirinelligide—; *Ceylon*: Vellaikkilkaynelli—; *Chinese*: So Cheu—; *Deccan*: Bhuinavalah—; *Efik*: Oyomo-ke-iso-amon-ke-edem—; *French*: Herbe du chagrin—; *Ga*: Ombato-atshi—; *Guam*: Maigo-lalo, Maigu-lalo—; *Gujerati*: Bhonya anmali—; *Hindi*: Bhonya abali, Bhuinanvalah, Jangli amli, Jaramla, Niruri, Sadahazurmani—; *Ibibio*: Oyomo-ke-iso-amon-ke-edem—; *Indo-China*: Cho de—; *Java*: Aijlaun-mahaij—; *Krobo*: Ofobiokpab—; *La Reunion*: Petit tamarin blanc—; *Malayalam*: Kirganelli, Kizhanelli, Kizhkkayinelli—; *Marathi*: Bhui avali—; *Mauritius*: Curanellie blanche, Herbe au chagrin—; *Mundari*: Muikoa kantara, Pirikantara—; *Nupe*: Ebogi, Ebo zunmaggi—; *Philippines*: Hierba de San Paulo, Hierba de San Pedro—; *Porebunder*: Bhonya anmari—; *Portuguese*: Erva poubinha—; *Rajputana*: Gugerati bawal—; *Sanskrit*: Adhyanda, Ajata, Ajuta, Amala, Amlika, Amrita, Aphala, Bahupatra, Bahupatri, Bahuphala, Bahupushpi, Bhudatra, Bhudhatri, Bhumyamalaki, Bhuparva, Charati, Chorata, Dalaparshini, Dridhapadi, Hilolika, Jada, Jharika, Jhatamala, Kshetramali, Mala, Nilolika, Putrashronika, Shiva, Sukshmadala, Suksbmaphala, Uchchata, Vishaghni, Vishvaparni, Vitunnaka, Vituntika, Vrishya—; *Seychelles*: Herbe au chagrin—; *Sind*: Niruri—; *Sinhalese*: Pittawaka—; *Spanish*: Yerba de quinina, Yerba de quinono—; *Tamil*: Kilanelli, Kilkkaynelli—; *Telugu*: Nelausirika, Nelavusari—; *Twi*: Bommaguwakyi—; *Urdu*: Bhui amla—; *Uriya*: Bhui aola—; *West Indies*: Petit tamarin blanc, Quinine créole, Yerba de quinino—; *Yemen*: Mekatkata, Meneckete—; *Yoruba*: Yoloba—.

5. **Phyllanthus reticulatus** Poir. is common throughout tropical India, Burma, Malaya, and Ceylon. It extends to the Malay Islands, China, and tropical Africa.

The fruit is astringent to the bowels; useful in inflammations, and diseases of the blood (Ayurveda).

The bark is considered alterative and attenuant, and is prescribed in decoction in the quantity of four ounces or more twice daily.

The leaves are employed as a diuretic and cooling medicine in Sind.

The juice of the leaves is used medicinally in the Konkan. It is made into a pill with camphor and cubebs, which is allowed to dissolve in the mouth as a remedy for bleeding from the gums. It is also reduced to a thin extract along with the juice of other alterative plants and made into a pill with aromatics; this pill is given twice a day, rubbed down in milk, as an alterative in heat of the blood.

In Lakhimpur the juice of the leaves is used for diarrhœa in infants.

In Ashanti the leaves are mixed with palm nuts (*Elæis guineensis*) and made into a broth, which is given to newly delivered women to relieve them.

In Gold Coast the stems are used to cure sore eyes, the juice from them being blown into the eyes.

The Rongas and Europeans of East Africa use the powdered leaf as a local application to sores, burns, and suppurations, and chafing of the skin. The Rongas also apply it to venereal sores.

In Indo-China the plant is used in the treatment of smallpox and syphilis.

Akola: Pithor, Pittur—; *Assam*: Amluki—; *Bengal*: Panjuli—; *Bombay*: Pavana—; *Canarese*: Anamsula, Chippulinellu, Huli, Karesuli, Karihuli, Sannahagesoppu—; *Deccan*: Buinowla, Kalemadhkajhar—; *Fanti*: Nkokobro—; *Gorakhpur*: Sikat—; *Gujerati*: Datwan—; *Hausa*: Alambu, Alambu na tudu, Bak' in alamba, K'alambu—; *Hindi*: Buinowla, Kalemadhkaper, Makhi, Panjoli, Panjuli—; *Indo-China*: No kang pa, No phen den—; *Katagum*: Tsah—; *Konkani*: Kaili—; *Lambadi*: Kombhoiro—; *Malayalam*: Kattuniruri, Kilanelli, Nirnelli, Niruri—; *Marathi*: Pavan—; *Melghat*: Pithor, Pittur—; *Merwara*: Kabonan—; *Nimar*: Kamoi—; *Punjab*: Panjuli—; *Rajputana*: Kabonan—; *Ronga*: Tetenya—; *Sanskrit*: Bahupraja, Bahupushpa, Kamboji, Kambojini, Krishnakambhoji—; *Sind*: Kamohi, Kamohijopun, Kamu, Pikapiru—; *Sinhalese*: Welkyla—; *Tagalog*: Malaiba, Malatinta, Tinatinam, Tintatintahan—; *Tamil*: Abirangi, Karuppuppilanji, Karunelli, Kattukkilanelli, Melanelli, Nirppul, Nirppula, Nirppulanji, Pul, Pula, Pulanji—; *Telugu*: Nallapuli, Nallapurugudu, Nelapurugudu, Pandibarangi, Pulisar, Purugud—; *Timne*: Egbeli—; *Tulu*: Kakesoppu—; *Twi*: Awobe—; *Uriya*: Bonotihudi, Jojangi, Phajoli—; *Visayan*: Matangolang, Sungotolang—; *Yoruba*: Iranje—; *Zamboanga*: Nipin—.

6. **Phyllanthus simplex** Retz is found in the plains and low hills throughout India, from Kumaon to Assam and southwards to Travancore, Ceylon and Malacca, ascending to 6,000 feet. It is distributed to China, the Malay and the Pacific Islands.

The natives use the fresh leaves, flowers and fruit, with cumin seeds and sugar, of each equal parts made into an electuary, for the cure of gonorrhœa, a teaspoonful is given twice a day. The fresh leaves, bruised and mixed with buttermilk, make a wash to cure the itch in children.

The root is used in Chota Nagpur as an external application for mammary abscess.

Gujerati: Motibhonya anmali—; *Indo-China*: Vay oc—; *Marathi*: Bhuiavali, Motibhuiavali—; *Mundari*: Otemeral, Pirimeral—; *Porebunder*: Motibhonya anmari—; *Santali*: Tandimeral—; *Telugu*: Uchchiyusirika.

7. **Phyllanthus urinaria** Linn. is met with throughout India, from the Punjab to Assam, Burma, Malacca, Penang, and Ceylon; it is common in Singapore and Selangor. It inhabits the tropics generally.

The fruit and plant are acrid, sour, cooling, bitter, sweetish; alexipharmic; useful in thirst, bronchitis, leprosy, anæmia, urinary discharges, anuria, biliousness, asthma, hiccough (Ayurveda).

The plant is much used as a diuretic in dropsical affections, also in gonorrhœa and other genito-urinary troubles.

In Chota Nagpur the root is given to sleepless children.

In La Reunion the plant is considered diuretic, sudorific, depurative, and emmenagogue. It is given as a drink in dysentery and cystitis.

In Cambodia the plant is used as a bitter, tonic, astringent, and febrifuge. An infusion is given for liver complaint, diarrhœa and paludism.

Bengal: Hazarmani—; *Burma*: Miziphiyuani—; *Cambodia*: Prak phle—; *Canarese*: Kempukiranelli—; *Ceylon*: Chivappukkilkaynelli—; *Chinese*: Ko Cheu—; *Gujerati*: Kharsadabhonya anmali, Kharsadabhonya ansari—; *Hindi*: Hazarmani, Lalbhuinanvalah—; *Indo-China*: Cho de, Giap ha chau, Kho ham, Prak phle—; *La Reunion*: Petit tamarin rouge—; *Malay*: Ambin buah—; *Malayalam*: Chirukizhukanelli, Chukannakizhanelli—; *Marathi*: Lalmundajanvali—; *Matheran*: Lalbhiuawali—; *Mauritius*: Curanellie rouge, Curanellie urinaire—; *Sanskrit*: Adhyanda, Ajata, Ajuta, Amala, Aphala, Arudha, Bahupatra, Bahuphala, Bahupushpa, Charati, Chotata, Dalasparshini, Drirdhapadi, Hilkolika, Jada, Jharika, Jhatamala, Mala, Nilolika, Putrashronika, Shiva, Sukshmadala, Sukshmaphala Tali, Tamalika, Tamalini, Tamravalli, Uchchata, Vishaghni, Vishvaparni, Vitunnaka, Vituntika, Vrishya—; *Santali*: Badarzhapi—; *Sinhalese*: Binnelli, Ratpittaawka—; *Tagalag*: Ibaibaan—; *Tamil*: Shivappunelli—; *Telugu*: Ettausirika, Yerrausereki—.

Putranjiva.

The genus consists of 4 Indo-Malayan species.

Putranjiva Roxburghii Wall. is found, wild and cultivated, throughout tropical India, from the lower Himalaya in Kumaon eastwards and southwards to Pegu and Ceylon.

The leaves, the fruit, and the stones of the fruit are given in decoction in colds and fevers.

In Siam a medicine for rheumatism is made out of the leaves and fruit.

Bengal: Jiaputa, Putranjiva—; *Bombay*: Jewanputr, Jivputrak, Putajan, Putrajiva—; *Burma*: Badibyu, Egayit, Taukyat, Toukyap, Toukyat—; *Canarese*: Amani, Menasinakale, Putrajiva, Putremjiva—; *Chindwin*: Badibyu—; *Haldwani*: Juti—; *Hazaribagh*: Piten—; *Hindi*: Jiaputa, Jivputrak, Joti, Juti, Patigia, Patji, Putajan, Putijia, Putrajiva, Putranjiva—; *Kumaon*: Juti—; *Lambadi*: Kalo—; *Malayalam*: Pongalam, Ponkolam—; *Marathi*: Jewanputr, Jivputrak, Jiwanputr, Putajan, Putrajwa—; *North-Western Provinces*: Jiaputa, Joti, Juti, Putrajiva—; *Oudh*: Patji—; *Pegu*: Daukyat—; *Punjab*: Jiyaputra, Patajan—; *Ramnagar*: Juti—; *Reddi*: Veku—; *Sanskrit*: Ardhasadhaka, Apatyajiva, Garbhada, Garbhakara, Jivanaputra, Kumarajiva, Mavu, Pavitra, Putrajiva, Putranjiva, Shlipadapaha, Sidhida, Sutajivaka, Sutrajiva, Yashtipushpa—; *Santali*: Pitoj, Pitonj—; *Tamil*: Irukolli, Karupali, Karupilai—; *Telugu*: Kadrojuvi, Kudrajinik, Kudurujivi, Kudurujivir, Mahaputrajivi, Putrajivika—; *Uriya*: Bholokoli, Pohunjona, Poichandia, Poitundia—.

Ricinus.

Ricinus communis Linn. is indigenous to tropical Africa, and is found, wild or cultivated, throughout the Tropics. By cultivation it has been distributed through not only all tropical and subtropical regions, but also in many of the temperate countries of the globe. In the south of England the plant ripens its seeds in favourable situations, and it has been known to come to maturity as far north as Oslo in Norway.

The root is sweetish, heating; carminative; useful in inflammations, pains, ascites, fever, glands, asthma, eructations, bronchitis, leprosy, diseases of the rectum, and the head.—The leaves

are useful in intestinal worms, strangury, night blindness, earache; increase biliousness.—The flowers are useful in glandular tumours, anal troubles, vaginal pain.—The fruit is heating and an appetiser; useful in tumours, pains, piles, diseases of the liver and spleen.—The seed is cathartic and aphrodisiac.—The oil is sweetish; cathartic, aphrodisiac, anthelmintic, alterative, useful in tumours, diseases of the heart, slow fevers, ascites, inflammations, typhoid, pain in the back, lumbago, leprosy, elephantiasis, convulsions; causes biliousness (Ayurveda).

The root bark is purgative, alterative; good in skin diseases.—The leaves are galactagogue; good for burns.—The seeds and the oil from them have a bad taste; purgative; useful in liver troubles, pains in the body, lumbago, boils, piles, ringworm, paralysis, inflammations, ascites, asthma, rheumatism, dropsy, amenorrhœa (Yunani).

In Chota Nagpore the bark is ground and applied to burns by the Mundas. A fibre of the bark is tied round the neck to stop vomiting.

The leaf is applied to the head to relieve headache, and is commonly used as a poultice for boils. It is said to possess considerable power as a lactagogue, being applied warm to the breasts. The fresh leaves are used by nursing mothers in the Canary Islands as an external application, to increase the flow of milk. On the other hand it is generally admitted in Indo-China that the leaves act as an antilactagogue, whether applied topically on the breasts or taken internally.

In general the plant is credited with a number of peculiar properties, and is said to be useful in difficult parturition, spasmodic twitchings of the face, facial malformations, and cancer of the stomach.

The seeds and the oil from the seeds are used as a purgative wherever the plant is found growing. The Chinese use the crushed seeds more frequently than they do the oil, the paste is applied to relieve scrofulous sores. In some parts of West Africa a decoction of the leaves is taken to purge.

In Las Bela the oil is expressed and used medicinally; and a fomentation is made with the leaves to cure wounds. At Turbat in Makran it is used as an ointment for sores. At Kotra in Kachhi the leaves are used for fomentations; in Kharan they are bound over boils, and are a good cure.

In French Guinea the leaves are boiled and used as a febrifuge. In native medicine in West Africa the leaves are boiled to form a lotion for fevers, and pounded for application as a poultice to swellings. The leaf is sometimes tied on the forehead for headache. In Togo the leaves of the larger-leaved variety are crushed with cold water to form a useful eye lotion.

An infusion of the leaf is a Zulu remedy for stomach-ache. It is administered orally or as an enema. The Zulus also apply a paste of the root in toothache. In South Africa the root is the basis of several native remedies for toothache.

In Southern Rhodesia the bark is used by natives for stitching up wounds, and as a dressing for wounds and sores. The Chewas

boil the root in water which has been previously boiled with the ashes of maize stalks. The sediment from the second boiling is smeared on the teeth and gums to relieve toothache, the material not being swallowed.

The Transvaal Sutos apply the powdered roasted seeds to sores, boils, etc., in children. The foliage is considered emmenagogue, the root-bark purgative, and the leaf useful as a local application in rheumatism. The local application of the leaf to the mammae is said to produce a powerful galactagogic action. In West Africa a decoction is taken internally as a lactagogue and emmenagogue.

The bruised leaves are used for caries of the teeth and given with water for colic in Madagascar.

In La Reunion the leaves are considered lactagogue and are given in infusion or applied to the breasts.

In Guiana the leaves are applied to the breasts to help the secretion of milk. Soaked in vinegar they are applied to the forehad in cases of sunstroke. They act as a powerful sudorific.

A treatment for chancre in Northern Nigeria consists in fumigation by burning stems of *Ricinus* along with those of *Calotropis procera*.

The oil, combined with citron ointment, is used as a topical application in common leprosy.

In West Africa, castor oil is not used as a medicine internally, but externally as an unguent alone or mixed with other substances, such as groundnut or other oil. It is used as an application for parasitic skin-diseases, craw-craw, etc., and as a dressing for sores and parasitic conditions in domestic stock. In South Africa a mixture of castor oil and kerosene is known as a cheap and efficient culicide in the fight against malaria. Castor oil has been found to be almost the only agent which prevents gad-flies from attacking camels for any length of time.

Rendered soft and pulpy by heat, the leaves are applied to the Guinea-worm sore to facilitate its extraction.

Ancient Sanskrit writers prescribed the seed in the treatment of snake-bite and scorpion-sting; but Caius and Mhaskar have shown experimentally that it is not an antidote to either snake or scorpion venom.

The leaves and the seeds are officinal in Portugal; the seeds and the oil in France and Italy; the oil in Austria, Belgium, Brazil, Denmark, Finland, Great Britain, Holland, Hungary, Japan, Mexico, Norway, Russia, Spain, Sweden, Switzerland, Turkey, the United States, and Yugoslavia.

Afghanistan: Bazanjir, Buzanjir—; *Afrikaans*: Kasterolieboom—; *Almora*: In—; *Amboyana*: Camiri—; *Aowin*: Ateende—; *Arabic*: Charua, Djar, Hurua, Khirurwi, Khirwa, Tebscha, zaejt—; *Assam*: Eri—; *Awuna*: Dzonggdaleng—; *Bafo*: Bokuri—; *Balong*: Bokuri—; *Bambara*: Subarabana—; *Behar*: Anda, Amar, Lenr, Renr—; *Bengal*: Bheranda, Bherenda—; *Benin*: Era ogi—; *Berar*: Yerandi—; *Betsileo*: Kinamena—; *Bombay*: Erendi—; *Brazil*: Carapateiro, Figueira d'inferno, Mannona, Nhambuguasu—; *British Central Africa*: Mbaliki—; *Burma*: Kesu, Kyeksu—; *Cambodia*: Lohong preng—; *Canarese*: Avudala, Avudalu, Chittuharalu, Eranda, Haralu, Manda, Vardhamana—; *Catalan*: Rici, Figuera infernal, Rissino—; *Central Provinces*: Grundi—; *Chinese*: Pi Ma—; *Coimbatore*: Kotteimuttu—; *Danish*: Undertroee—; *Deccan*: Erund, Ind, Rund, Yarand—; *Dutch*: Wonderboom—;

Efik: Etighi-unenge, Eto-aran-ukebe—; *Egypt*: Kharwa, Kiki—; *English*: Castor-oil Plant, Palma Christi—; *Ewe*: Dzegbele, Dzongbati, Kasuwelti, Kasuworliti, Longo—; *Fanti*: Abronkruma, Adedenkuruma, Esusonkuruma, Sunsumnkuruma—; *French*: Avanacoë, Avanacu, Bois de carapat, Carapat, Grand ricin, Palma Christi, Paume Dieu, Pignon de Barbarie, Ricin, Ricin commun, Ricin vulgaire—; *French Guiana*: Palma Christi—; *French Guinea*: Diakoula—; *Fulah*: Diakoula—; *Fulani*: Derre, Diakoula, Kolakolaje gor'de, Zurmaje—; *Ga*: Abromkruma, Adedengkuruma—; *Genoa*: Ricin, Ricinu—; *German*: Wunderbaum—; *Gond*: Nerinda—; *Greek*: Kiki—; *Guam*: Agaliya—; *Gujerati*: Diveli, Diveligo, Tirki—; *Hamadan*: Kercheng—; *Hasada*: Ranggajara, Risajara—; *Hausa*: Chika gida, 'Dan kwasare, Kulakula, Zurma—; *Hindi*: Arand, Arandi, Arend, Arind, Erand, Erandi, Erend, Ind, Rand—; *Hova*: Tanantanankisoa—; *Hungarian*: Ricinus—; *Ibo*: Obwa, Ogba, Ogili-obwa, Ogili-ogba, Ogilisi, Ogiri-aro, Osisi-ogili—; *Ilocano*: Tangantangan, Tavatavangsina, Tawatawasinga—; *Indo-China*: Dau dau, Du du, Huong thet, Khnhe, Lohong, Miet ma, Thu du tia—; *Iraq*: Khirwa—; *Italian*: Caffee da olio, Catapuzia maggiore, Erba venaria, Fagiolo d' India, Fagiolo romano, Fava d' India, Fico d' inferno, Girasole, Mirasole, Palma Christi, Palmaperta, Ricino—; *Kabure*: Assimballo—; *Kachhi*: Harnoli—; *Kalabari*: Alamba-ngbole—; *Kharan*: Murghpad—; *Kikuyu*: Mubariki—; *Kolami*: Jarabindi—; *Konkani*: Erendi—; *Koranko*: Maraban keyo barambe—; *Kordofan*: Hurna—; *Krepi*: Atornggor, Kasuwelti, Kasuwoliti, Yevu-tongo—; *Krobo*: Kumenglo—; *Kumaon*: Andi, Arandi, Indrendi—; *La Reunion*: Ricin tantan—; *Las Bela*: Hiranr—; *Lepcha*: Hilk bu ruk-lop, Raklop—; *Loanda*: Bafureira—; *Lokko*: Tawabawa—; *Makaran*: Murpad—; *Malabar*: Tonda—; *Malaya*: Jarak, Pee mah—; *Malayalam*: Anandam, Avanaka, Chittavanaku, Erandam, Gandharvahastakam, Kotta, Panjangulam, Pantiyavanakku, Varddhamanam—; *Malta*: Castor-oil Plant, Palma Christi, Ricino, Rionu—; *Marathi*: Erandi, Yarandicha—; *Masai*: Oldule—; *Mauritius*: Palma Christi—; *Mbonge*: Boku-balondu—; *Mende*: Bonde, Ngele-bonei—; *Mentone*: Ricinu—; *Mexican*: Tlaplatl—; *Mozambique*: Ambona—; *Mundari*: Bindidaru, Ranggabindi, Ranggafara—; *Naguri*: Ranggabindidaru, Risabindi, Sutamranggabindi—; *Nandi*: Imanyet—; *Nasirabad*: Harnauli—; *Nepal*: Alha, Areta, Orer—; *Nimar*: Arand—; *North America*: Castor Bean, Castor Plant, Palma Christi—; *North-Western Provinces*: Arand, Bhatreri, Rendi, Reri—; *Nupe*: Kpamfini gulu—; *Pahouin*: N'zoum—; *Pedi*: Mokhura—; *Persian*: Bedanjir, Bedanjira, Garchak, Karchak, Tochme kerchek—; *Portuguese*: Carrapateiro, Mammona, Palma Christi, Ricino—; *Portuguese Africa*: Bafureira—; *Potenza*: Ricin—; *Punjab*: Aneru, Arand, Arind, Bedanjir, Harnauli—; *Pushtu*: Arhand—; *Rajputana*: Arend, Edia—; *Reggio*: Rizoin—; *Roumanian*: Ritina—; *Russian*: Kleshtshexika—; *Sakalave*: Kinana, Tanantanamanga—; *Samoa*: Lama-papalangi—; *San Remo*: Ricin—; *Sanskrit*: Amanda, Amangala, Bhanda, Chankuka, Chitrabija, Chitraka, Dirghadantaka, Eranda, Gandharvahasta, Gandharvahastaka, Ishta, Kanta, Panchangula, Panjangula, Ruvuka, Shukla, Shulashatru, Svehaprada, Taruna, Triputi, Triputiphala, Tuchhadru, Vardhamana, Vatari, Vranaha, Vuka, Vyadatvaka, Vyaghradala, Vyaghrapuchha—; *Santali*: Eradom—; *Sarawan*: Bedanjir—; *Sardinia*: Cacamengiu—; *Sibi*: Harnauli—; *Sicily*: Riggìnu—; *Sind*: Ayrunkukri, Heran—; *Sinhalese*: Eudaru, Telendaru—; *South Africa*: Castor Bean, Castoroil Plant, Palma Christi—; *Spanish*: Higuera del diablo, Higuera infernal, Palma Christi, Ricino—; *Sumatra*: Jarak—; *Susu*: Limbiaxule, Mbiakule—; *Suto*: Mokhura—; *Swahili*: Mbariki—; *Swedish*: Undertrarel—; *Tagalog*: Lansina, Lingasina, Tangantangan—; *Tamil*: Aimugi, Amanakku, Andagam, Asaram, Attagam, Attamanam, Attugam, Erandam, Kottai, Kottaimuttu, Muttukkottai, Peramanakku, Sanju, Sasambari, Sigandi, Sittaman, Sittamanakku, Sittiram, Tabinjam, Urppulam, Vattamam—; *Telugu*: Amudamu, Chittamudamu, Erandamu, Peramudamu—; *Tigre*: Kella—; *Tigrinia*: Vulleh—; *Timne*: An-fentoel, Lamirenda—; *Tivi*: Harev, Ihurua dzengo, Ijija, Jija, Masev, Sherai jongo, Showara jongo—; *Treviso*: Rizin, Rizino—; *Tschaudjo*: Dendelle, Sau—; *Tuareg*: Fueni—; *Turkish*: Hint—; *Tuscany*: Erba de latte, Erba lattaria, Girasole maggiore, Girasole piccolo, Manoaperta, Meo, Scatapuzia, Zecca, Zeccha—; *Twi*: Abronkruma, Adadenkuruma—; *Urdu*: Eranda—; *Uriya*: Bheronta, Chitroko, Erondo, Gobo, Joda, Kalo, Monto—; *Tindoko*—; *Uruguay*: Ricino, Tartago—; *Verona*: Rizino—; *Waziri*: Randanh—; *Xosa*: umHlavuthwa—; *Yemen*: Jar, Tebsha, Zeit—; *Yoruba*: Ilara, Ilarun, Laa, Lapalapa adengteng, Lara—; *Zulu*: umHlakuva—.

Sapium

The genus includes 100 species, inhabiting warm countries.

S. sebiferum Roxb. is used medicinally in China and Indo-China, *S. Grahamii* Prain in Gold Coast. The latex of *S. ellipticum* Pax is in Kenya an ingredient in arrow-poison.

Leaves shortly petioled, elliptic-lanceolate, obtusely acuminate, serrate or subserrate	1. *S. indicum.*
Leaves elliptic or oblong-lanceolate, acuminate, crenate-serrate	2. *S. insigne.*
Leaves long-petioled, ovate, orbicular-ovate or sub-rhombic, quite entire, finely acuminate	3. *S. sebiferum.*

1. **Sapium indicum** Willd. is found in the Sunderbund and in the tidal forests of Tenasserim and Ceylon. It occurs on the sea coasts of the Malay Peninsula, and is distributed to the Malay Islands and New Guinea.

The juice of this tree is reckoned of a very poisonous nature. The taste of the fruit is nauseous beyond description. The seeds are used for intoxicating fish.

Bengal: Batan, Batul, Huru, Hurua—; *Bombay*: Hurna—; *Borneo*: Booroo—; *Hindi*: Hurua—; *Malay*: Gurah, Guring—; *Malayalam*: Karmmatti, Venkshiri—; *Sinhalese*: Kirimakulu, Kirrimakalu—.

2. **Sapium insigne** Trim. is found in the sub-Himalayan tract, from the Beas eastwards to Assam, Chittagong, Burma, and Ceylon, ascending to 4,300 feet.

The whole tree is full of an acrid milk which, when applied to the skin, produces vesication.

Almora: Khin—; *Anamalais*: Garpathola—; *Bombay*: Dudla—; *Canarese*: Kannupade, Kurda, Nanaka—; *Dehra Dun*: Khindra, Khinna, Khinni, Khirni—; *Garhwal*: Khindra, Khinna, Khinni, Khirni, Kinna—; *Hindi*: Khina, Khindra, Khinna, Khiria, Khirni, Khirun, Lendwa, Lienda—; *Kadir*: Karuppuchchulai—; *Marathi*: Dudla, Hure, Ura, Ure—; *North-Western Himalaya*: Boddar, Khinna—; *Punjab*: Bilodar, Biloja, Dudla, Karalla, Ledra—; *Telugu*: Garbhasula—; *Tulu*: Kannupade—.

3. **Sapium sebiferum** Roxb., indigenous to China and Japan, is found as a cultivated plant in various parts of India and elsewhere in warm countries.

The acrid juice is a powerful vesicant. The oil is reputed similar to castor oil.

In China the bark is used as a tonic, and the resin as a purgative.

In Indo-China the root bark in decoction is given in dyspepsia. The fat from the seeds is used in the treatment of skin diseases.

Bengal: Momchina—; *Chinese*: Pa Teou Seou, Wu Chiu—; *Dehra Dun*: Tarcharbi—; *English*: Chinese Tallow Tree—; *Hindi*: Bilaitisissu, Vilayatishisham—; *Indo-China*: O cuu moc, Sach, Soi, Soi tia u kiu, Soi trang—; *Mauritius*: Arbre à suif—; *North America*: Chinese Tallow Tree, Tankawang Fat Tree, Vegetable Tallow Tree—; *Saharanpur*: Pahari shisham—; *Sanskrit*: Agaru, Toyapippali—; *Uriya*: Ronojita—.

Sauropus.

The genus consists of 20 Indo-Malayan species.

Sauropus quadrangularis Müll.-Arg. is found in Bihar, Chota Nagpur, and the Western Peninsula; it is common in Burma.

The dried leaves are smoked in tonsilitis.

Matheran: Chickli—; *Telugu*: Tellavusirika—.

Sebastiania.

The genus consists of 80 tropical species, mostly American.

Sebastiania chamaelea Müll.-Arg. occurs in Bihar, the Deccan Peninsula, Ceylon, Burma, and the Malay Peninsula. It is distributed to China, the Malay Islands, tropical Australia, and Africa.

The juice of the plant in wine is used as an astringent. A decoction of the plant in clarified butter is considered to be tonic, and is applied to the head in vertigo.

In Indo-China the plant is used in the treatment of syphilis and diarrhœa.

Konkan: Bhui crendi—; *Sinhalese*: Ratpitawakka—.

Tragia.

The genus includes 55 tropical and subtropical species.

T. volubilis Linn. is used medicinally in South America and in the West Indies.

T. *angustifolia* Benth. and *T. cordifolia* Benth. are considered toxic in Madagascar.

Tragia involucrata Linn., a common stinging weed, is found in dry places throughout India, from the Punjab and the lower Himalaya of Kumaon, eastwards to Assam and Burma, southwards to Travancore and Ceylon. It extends to China.

The root is considered diaphoretic and alterative; an infusion is given in ardent fever and in itching of the skin.

In the Konkan a paste of the root is used to aid the extraction of guinea-worm; mixed with the juice of *Ocimum sanctum* it is employed as a cure for itchy skin eruptions.

In Chota Nagpur the root is given when the extremities are cold during fever; also for pains in the legs and arms.

The root also forms the basis of an external application in leprosy.

The leaves enter into the preparation of an errhine which is prescribed in cases of headache.

The fruit rubbed over the head with a little water is useful in cases of baldness.

The root of this plant has diaphoretic property and is therefore given in fevers to cause perspiration. A decoction of this root 1 in 10 was found to be useful in relieving bronchitis and the attendant fever (Koman).

The fruit is not an antidote to scorpion venom (Caius and Mhaskar).

Bengal: Bichati, Bichiti—; *Bombay*: Kanchkuri, Khajkhotti—; *Canarese*: Dulagondi, Haligilu, Kiriberalu, Kiruberalu, Kirituraché, Sannaturachi, Turachi—; *Deccan*: Kanchkure—; *Hindi*: Baraanta—; *Ho*: Jipenda—; *Kolami*: Sengelsing—; *Malayalam*: Cherukodithuva, Chorinnanam, Choriyanam, Kotittuva—; *Marathi*: Kanchkuri, Khajkolti—; *Matheran*: Katavi, Kulti—; *Sanskrit*: Duralabha, Dusparcha, Dustaparisha, Grahini, Kachchura, Kasaghni,

Samudranta, Virupa, Vrishchikali, Vrishchikapatri—; *Santal*: Sengelsing—; *Tamil*: Ambu, Cherukanjuru, Erumaikkanjori, Kanjori, Kandudi, Kannichi, Karuppukkanjori, Kunasagam, Kurundotti, Punaikkanjori, Samuttirandam, Sendotti, Siruganjori, Tanavaiyadam, Turalobam, Turpparigam, Vellaikkanjori—; *Telugu*: Chinnadulagondi, Dulagondi, Dulagundi, Peddadulagondi, Regadadula, Revatidulagondi, Telumani, Tigedulagondi—; *Tulu*: Pachcherengi, Turuse—; *Uriya*: Bichati, Bichchuati—.

Trewia.

The genus consists of 2 Indo-Malayan species.

Trewia nudiflora Linn. is common in the hotter parts of India from Kumaon southwards and eastwards to Assam, Malacca, and Ceylon. It extends to Sumatra and Java.

The plant is cooling, tonic, alexiteric; improves taste; removes biliousness (Ayurveda).

The plant is used for the removal of swelling, bile, and phlegm. The root in decoction is given to relieve flatulence and is applied locally in gouty or rheumatic affections.

Bengal: Pitali, Pitoli—; *Bombay*: Bhillauri, Petari, Tumri—; *Burma*: Setkadon, Thitmyoka, Yehhmyot, Yemyot—; *Canarese*: Kadukanji, Kadukere, Kadukumbala, Kanji, Katkumbala, Katkumbla, Padye, Shillauri, Tumri—; *Dehra Dun*: Gamhar, Tumri—; *Haldwani*: Gutel—; *Hindi*: Bhillaura, Gambhar, Gamhar, Khamara, Pindara, Pitoli, Tumri—; *Kolami*: Garalohadaru—; *Kumaon*: Khamara, Tumri—; *Lepcha*: Tungplam—; *Magahi*: Hruprukban—; *Malayalam*: Kanji, Kattukumil, Malankumil, Pamarakkumil, Pambarakmubil—; *Marathi*: Petari, Pitari—; *Monghyr*: Gamhar—; *Mundari*: Garalupung—; *Nepal*: Gamari, Garum, Kurong—; *Oudh*: Bhillaur, Bhillaura—; *Saharanpur*: Dhaulpedda—; *Sanskrit*: Karahata, Karangaha, Pindara—; *Santali*: Gada lopong—; *Tamil*: Attarasu, Attupuvarasu, Kanji, Naykkumil, Sannattuvarai—; *Telugu*: Eruponaku—; *Tharu*: Bilur—; *Uriya*: Monda, Panigambhar, Pitalu, Pithaliya—.

REVIEWS.

THE BIRDS OF BRITISH SOMALILAND AND THE GULF OF ADEN. Their life-histories, breeding habits and eggs. By Sir Geoffrey Archer, K.C.M.G. and Eva M. Godman. Vols. i and ii. 63/-.

We feel that no apology is needed for bringing to the notice of the members of our Society this beautiful book on the birds of British Somaliland and the Gulf of Aden. There is a traditional connection between these areas and the Society which is evident to anyone acquainted with the back volumes of the *Journal*. No student of N.-W. India and the countries thereto contiguous can afford to disregard Somaliland and the Gulf for the light which they can throw on all problems and species connected with desert areas, for the fact that many species are common to both areas, and because many of the summer visitors and passage migrants of N.-W. India pass through or winter in the countries round the Gulf of Aden.

Sir Geoffrey Archer is well known for his thirty years' service in Africa. He is a nephew of Sir Frederick Jackson, whose book on the birds of Kenya and Uganda has just been published, and that relationship had its share in developing his interest in Natural History, and particularly in birds. In May 1914 he became Administrator of the Protectorate of Somaliland and when the status of the country was changed he became the first Governor, a post which he held until August 1922. During those years in Somaliland his leisure hours were largely given up to ornithology and by the time he left the country he had made a collection of some 3,000 bird-skins and 1,000 clutches of eggs, as well as the mass of field notes which have made this book possible. In working up this material Sir Geoffrey Archer has had the active help and collaboration of his kinswoman Miss Eva Godman who is a daughter of the late Frederick Ducane Godman, so well known to an elder generation of ornithologists.

The completed book is to consist of four volumes of which the first two have now appeared together. These show that the book will be in format an ornament to any library whether purely ornithological or more general in scope. They are handsome in appearance and the printing and paper are excellent.

The illustrations merit a few remarks. These consist of eighteen coloured plates of birds and four coloured plates of eggs as well as a number of beautiful photographs which illustrate the introduction. The plates of eggs are by Mr. H. Gronvold and are executed with the fidelity for which that name is a guarantee. The birds have been painted by the late Archibald Thorburn and will bear comparison with the best of his work. It should be remarked that this is the only book of non-British birds illustrated by Thorburn and for that reason it is bound to hold a special place in any critical study of his work. The backgrounds of the pictures, moreover, provide a good series of pictures of the scenery in Somaliland and afford an eloquent testimony to the careful collaboration between the authors and the artist which enabled the latter to paint a country that he never saw.

To turn to the text of the book it is much fuller and more readable than most faunistic works. The introductory matter is unusually interesting, occupying nearly a hundred pages. These include chapters on both the history of the country and the history of its ornithological exploration and a very full description of Somaliland and the Somali as they exist today with some very graphic pictures of the bird life typical of certain areas. These make fascinating reading, and make one long to visit a country that so far appears to have escaped the devastating march of progress. An admirable map in colours will be found at the end of the second volume.

The main text follows the system of classification which starts with the Stratheonida and ends with the Passeres. The authors admit 422 species and subspecies to their list and out of these 170 forms have been found breeding within the limits of the work. The account of each species is most ably written. Sir Geoffrey Archer is not and does not claim to be an expert systematist and his work will here and there be found lacking on the scientific

side. He has however a fluent pen and a wide knowledge of his birds in the field and using these and the work of other writers in happy combination he has produced a text which is very interesting. From it the Englishman in Somaliland will learn the points of interest about his birds and how and where to find them. At the same time the worker in other areas and the general reader will find this a book that helps him to appreciate the avifauna of a country which he may never see. We can only hope that the remaining two volumes will soon appear to join their most attractive predecessors.

H. W.

AUS DEM LEBEN DER VÖGEL. By Dr. Oskar Heinroth. x+165 pp., with 98 insets of line drawings and photos. Berlin, 1938 (Julius Springer). Price 4·8 RM.

This little volume is the thirty-fourth of the series *Verständliche Wissenschaft* or Popular Science, published by the well-known house of Julius Springer. The author, Dr. Oskar Heinroth, needs no introduction to students of ornithology. His monumental work, in four profusely illustrated volumes, on Central European birds—*Die Vögel Mitteleuropas*—is the record of practically a life-time devoted to the most thorough investigation of the life-history of almost every species found on the continent of Europe, most of which were reared, photographed and studied by him from egg upwards. As the author remarks in his Foreword, there is probably no other group of vertebrate animals about which so much has been written and yet such misconceptions prevail in the popular mind, as Birds. The object of this booklet is not to go into such purely technical matters as systematics and anatomy for which many good manuals already exist. Neither is it a purely 'popular' book on birds in general. It purports to discuss only a few aspects of bird life, but what a wide range of topics it really does cover will be readily seen from the chapter-headings in the list of contents, some of which are the following: The Chief Characteristics of Birds—How Birds Sleep—Nesting Habits—Nest-building and Breeding—The Laying of Eggs—Clutches—Does the Bird Know its Egg?—Does the Bird Recognise its Young?—Does the Incubation Period Depend upon the Size of the Egg?—Does the Size of the Egg Correspond with the Size of the Bird? Other subjects dealt with are: Cuckoo lore and Parasitism—The Egg, Development of Embryo and Growth of Young—Moult and Colouration—Food—Intelligence—Senses—Locomotion—Direction-finding, etc.

From the concise nature of the discussions backed by the authoritativeness one has a right to expect from an ornithologist of Dr. Heinroth's calibre and experience, the book is refreshing to read. In these days, when the spate of ornithological literature has become physically impossible to keep abreast of, even by a full-time ornithologist, one is otherwise liable to be left bewildered as to what is and what is not the final answer to many of the questions herein discussed.

This volume is bound to prove interesting and educative not only to the man who studies birds as a hobby, but also to the more serious student. It is our misfortune, however, that it should be in a language that will perhaps debar it to many bird-lovers in India. The illustrations are carefully selected and well reproduced and add greatly to the interest and attractiveness of the book.

S. A. A.

THE COMPLEAT INDIAN ANGLER, by John Masters, well bound and put together, covers some 115 pages of large spacious print, 34 pen and ink sketches, and 16 plates. Price 10*s.* 6*d.*

It is not a thesis on Indian fishing in the sense that Thomas' 'Rod in India' was, or even an up-to-date Anglers Hand Book or Mighty Mahseer. The author has cleverly dialogued in the shade of Isac Walton, his reminiscences of Service in India woven round his favourite sport Angling. The book makes good reading, but adds nothing new to past works. His keen

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H. W.

AUS DEM LEBEN DER VÖGEL. By Dr. Oskar Heinroth. x+165 pp., with 98 insets of line drawings and photos. Berlin, 1938 (Julius Springer). Price 4·8 RM.

This little volume is the thirty-fourth of the series *Verständliche Wissenschaft* or Popular Science, published by the well-known house of Julius Springer. The author, Dr. Oskar Heinroth, needs no introduction to students of ornithology. His monumental work, in four profusely illustrated volumes, on Central European birds—*Die Vögel Mitteleuropas*—is the record of practically a life-time devoted to the most thorough investigation of the life-history of almost every species found on the continent of Europe, most of which were reared, photographed and studied by him from egg upwards. As the author remarks in his Foreword, there is probably no other group of vertebrate animals about which so much has been written and yet such misconceptions prevail in the popular mind, as Birds. The object of this booklet is not to go into such purely technical matters as systematics and anatomy for which many good manuals already exist. Neither is it a purely 'popular' book on birds in general. It purports to discuss only a few aspects of bird life, but what a wide range of topics it really does cover will be readily seen from the chapter-headings in the list of contents, some of which are the following: The Chief Characteristics of Birds—How Birds Sleep—Nesting Habits—Nest-building and Breeding—The Laying of Eggs—Clutches—Does the Bird Know its Egg?—Does the Bird Recognise its Young?—Does the Incubation Period Depend upon the Size of the Egg?—Does the Size of the Egg Correspond with the Size of the Bird? Other subjects dealt with are: Cuckoo lore and Parasitism—The Egg, Development of Embryo and Growth of Young—Moult and Colouration—Food—Intelligence—Senses—Locomotion—Direction-finding, etc.

From the concise nature of the discussions backed by the authoritativeness one has a right to expect from an ornithologist of Dr. Heinroth's calibre and experience, the book is refreshing to read. In these days, when the spate of ornithological literature has become physically impossible to keep abreast of, even by a full-time ornithologist, one is otherwise liable to be left bewildered as to what is and what is not the final answer to many of the questions herein discussed.

This volume is bound to prove interesting and educative not only to the man who studies birds as a hobby, but also to the more serious student. It is our misfortune, however, that it should be in a language that will perhaps debar it to many bird-lovers in India. The illustrations are carefully selected and well reproduced and add greatly to the interest and attractiveness of the book.

S. A. A.

THE COMPLEAT INDIAN ANGLER, by John Masters, well bound and put together, covers some 115 pages of large spacious print, 34 pen and ink sketches, and 16 plates. Price 10*s*. 6*d*.

It is not a thesis on Indian fishing in the sense that Thomas' 'Rod in India' was, or even an up-to-date Anglers Hand Book or Mighty Mahseer. The author has cleverly dialogued in the shade of Isac Walton, his reminiscences of Service in India woven round his favourite sport Angling. The book makes good reading, but adds nothing new to past works. His keen

knowledge of the common Indian fishes, is given in a colourful story, supported by pen and ink sketches and in order not to weary the reader he gives some amusing anecdotes of every-day life that befalls the soldier or civilian during his sojourn of service in India.

The sketches of the fish, in most cases, are excellent in outline and proportion, though the finer details of Fin Rays and scales set, so important in the identification of fish, he has neglected. In the text the author has given the scientific names and partly described the fish, but has not always supported these in his sketches. This is unfortunate and defeats his own object. The Boka (*B. hexagonolepis*) is just one example on page 26, he mentions the scales in the L. Line as 28-31, but his sketch only shows 25.

On page 101 of his book the author gives an unusual setting for Butchwa (*Ea vacha*). As far as I know Butchwa (*E. vacha*) like the broken water and eddies of slow running rivers, round and about the piers of bridges, submerged trees or where smaller streams join. They often feed in shoals when the surface is considerably disturbed. I have never seen or heard of them 'sucking in air' in the manner as set down by the author, this is surely exceptional.

He mentions 121 lbs. as the record Mahseer taken on Rod and line. Revitt Carnac, so far as I know, holds the record with his fish of 119 lbs. taken in Mysore on December 28, 1919, in the Cauvery.

His experience takes him from the North-Eastern Frontier of Assam, through Hyderabad, Sind, the Punjab and Kashmere, over to the barren N.-W. Frontier to the Tochi and Kabul.

The author wisely concludes his book with a paragraph warning the reader of the names of the fish he gives as purely local to the text of his book, and not general over all India.

Mr. Masters would have done well to have resurrected, instead, the Immortal Thomas, and brought up-to-date that classic, *The Rod in India*.

A. M.

THE TRIALS OF A PLANTER, by Oscar Lindgren; printed by S. Mani Pradhan at the Mani Press, Kalimpong; and published by the author in 1933. Price Rs. 3.

This little book of 206 pages has 34 chapters. There are 7 illustrations depicting some of the more exciting incidents and these will probably afford the reader as much pleasure and amusement as the drawing of them no doubt did to the, presumably, youthful artist.

The author was at Bloxham School, and being by nature a wanderer chafed sorely at his hard lot of polishing an office stool in the city. Fortune, a benevolent uncle, and ready replies to a Board of Examiners saved him, so he came out to India in 1877 at the age of 20 bound for the career of a Tea Planter in Assam.

The voyage to Calcutta was uneventful except for frequent stoppages to repair decrepit engines; and that up the Brahmaputra river in a paddle steamer afforded plenty of mild incident. A Captain who was somewhat of a character introduced the lad to various peculiarities of life in the East, and the sight of muggers, buffaloes, wild fowl, the varied bird-life of the great river, and the teeming human life at the various stopping places gave interest to the long voyage of 33 days to Dibrugarh.

His first 'trial' was a Manager who was more fond of a whisky bottle than tea, but he was kind to the author who became an independent Manager through his recommendation.

In the early days of Tea 'leaf rolling by hand was carried on in most of the Assam Tea Gardens, it was a slow and tedious process and with a rush of leaf it was a hard task to get a cooli man to roll his maund of withered leaf'. The rolled tea was made up into balls and left to ferment, the process being hastened by wet cloths. Firing was carried out on wire sieves over brick fireplaces. It was long before these primitive devices gave way to methods in use at the present day.

After six years the author discarded Tea and entered the career of sleeper-cutter and sleeper-contractor for the Dibrugarh-Sadya Railway the construction of which began in 1883. While working in this capacity he laid the founda-

tions of the present settlement of Makum; and to this period obtain the tales of 'The Mad Mukna of Makum', 'A Romance of the Sabansiri River', 'A Night Encounter and its Sequel', 'The Dehing Saw Mills', 'A Man Eater', etc. etc.

A return to Tea planting was made and in 1887 he was opening a new tea garden in the Dibrugarh district on the Dehing river 'in a howling muddle of forests and undergrowth'; 'a white woman was as scarce as a white elephant and the less said about the way we dressed the better'. Malaria was bad and the life a hard one. About this time he saw something of elephant keddah operations and there were various fishing and shikar excursions with Miri tribesmen, of whom he speaks well.

In the chapter 'Some Snakes I have met' we read of his escape from an angry hamadryad which he afterwards shot. It measured 17 feet. A planter saves himself from another of the species by holding his coat to the furious snake. Then there was an attack on his boat by a big black snake which might have been a king cobra except that its underside was a dull red. On the wrapper of the book is a coloured picture of a large snake in typical cobra attitude which is perhaps intended to represent a hamadryad; but it is banded like a krait. The youthful artist drawing on his imagination? By the way, is there such a weapon as 'a smooth bore rifle'? And do domestic cattle eat green tea bushes? This is not known in South India.

Some chapters are devoted to voyages and incidents unconnected with life as a planter. There is 'The Wreck of the S. S. Delhi' in 1911; 'A Visit to Canada', etc. Then there is a description of the Darjiling earthquake of 1897, and of a great flood one year which did much damage along the Rangeet and Teesta rivers and in the Darjiling district.

The putting together of this small book of reminiscences has no doubt afforded much pleasure to Mr. Lindgren and been of interest to his friends. It is a great pity the proof reading was not more carefully done for every page is full of misspellings and faulty annotation.

R. W. B.

THE KANDY FLORA. By A. H. G. Alston. Pp. xvii+109. Colombo: Government Record Office, 1938. Price Rs. 3·50.

This is a sure and safe guide to the identification of the flowering plants found within easy walking distance of Kandy. Simple, reliable keys are given for families, genera, and, when needed, for species; and there are 404 good illustrations. The book opens with an excellent account of 'formations' or 'associations', and ends with a useful glossary of botanical terms.

The statement in the foreword that the book 'has been prepared for the use of the Schools' and that its 'price has been kept down as low as possible in order that purchase may be within the means of every student' invites criticism from this side of Adam's Bridge where Rs. 3·50 is an amount that few school-going boys or girls could afford to pay.

We do not know the Ceylon Government rules about the spelling of vernacular names, but the transliterations '*ch*' and '*chch*' in some of the Tamil names leave us pensive.

J. F. C.

UGANDA GAME DEPARTMENT, Annual Report for the year 1937.

What should be the functions of a Game Department? This must immediately occur to the mind of any Conservationist reading the Annual Report of the Game Department of the Uganda Protectorate for 1937. I do not think that a correct answer can be found in this report.

Section I dealing with Administration gives some illuminating details regarding the successful financial position of the department and discloses the fact that a very large profit is made from the sale of ivory, chiefly obtained by the destruction of elephants under an activity called 'elephant control'.

The small amount of the total revenue which is placed at the disposal of the Game Warden is significant.

An expenditure of £6,554 only out of a gross revenue of £21,072 seems to be a poor percentage for what should be the chief work of a Game Warden, i.e. the Conservation of Wild Life.

Detailed expenditure on such work is not given in the report, although commercial statistics are given at considerable length. At two auctions held in Mombasa during the year the average price of ivory per pound realized Shs. 7/68 and Shs. 7/10, compared with Shs. 6 and Shs. 6/55 in 1936. The price of ivory seems to be an important factor and is mentioned several times in the report, but does not appear to help the Game Warden to obtain more funds for Wild Life Conservation. Here are one or two examples showing how little of the large balances is given for the work of the Game Warden.

In 1926 the revenue of the Uganda Game Department was £12,316, expenditure £6,691, leaving a balance of revenue over expenditure of £5,625.

In 1934 the revenue was £11,676, expenditure £5,111, leaving a balance of revenue over expenditure of £6,565.

In 1937 the gross revenue was £21,072, expenditure £6,554, actually less than in 1926, leaving a balance of revenue over expenditure of £12,818, after deducting £1,700, estimated cost of internal and external transport of ivory.

Evidently in Uganda there is no relation between the money received from wild-life resources and the expenditure to conserve the same resources. The value of the yard-stick appears to be unrecognized.

It must be remembered that the revenue does not include the fees collected from registration of sporting firearms, etc. It does include the fees from Game Licences.

The magnitude of the business may be gathered from the fact that 44,577 pounds of ivory were sold during the year, as well as 31½ pounds of rhino horns and 309½ pounds of hippo teeth, realizing the sum of £16,507. We are then given in paragraph 6 under Ivory, etc., statistics showing stocks in hand at the end of the year.

A chapter headed 'Illegal Killing of Game and Breaches of Game Laws', is quickly disposed of. No details here. No information regarding numbers of prosecutions, amounts of fines, etc. But the market value of ivory comes into the picture as affecting breaches of the law.

Commencing with paragraph 11 a chapter headed 'Game Reserves', which one might imagine would be the most important and informative chapter in the book, is colourless, sketchy and disappointing in the bareness of all interesting detail.

In view of what I have written about ivory and lower down about 'elephant control' I should like to point out that in this chapter 'Game Reserves'—it only takes up about three-quarters of a page—no information is given regarding:

(1) Staff for the protection of the game reserves.
(2) Steps taken for the guarding of the reserves.
(3) Details regarding the expenditure on reserves.

But we are told that plenty of game was seen and observed. We are not told how many reserves there are or what is their acreage.

A little food for thought is given to us about the Damba Island Reserve. We are told that it is impossible to guard Damba Island effectively but we are not told why, unless the effect of the inhabited island of Kome is the excuse. With a surplus of nearly £13,000 of revenue over expenditure such an impossibility should be impossible.

A chapter headed 'Game Trophies' contains some interesting statistics regarding the elephant trophies obtained. A total of 337 elephants were shot under licence. The price of ivory seems to be an influencing factor in the sport of elephant hunting in Uganda according to paragraphs 15 and 18 in this chapter. Incidentally it is mentioned that 2,627 tusks of ivory weighing 77,118 pounds, valued at £27,046 passed through Uganda from the Belgian Congo.

In Section II, 'Elephant Control', we find the report getting down to the real thing. Here perhaps is the chief activity of the Game Department and if meticulous detail is a criterion it is the chief activity.

Paragraph 25 reads as follows:

'Owing to the absence on leave of both Game Rangers during the greater part of the year control operations in certain important localities have become somewhat disorganised and this, combined with frequent restrictions on elephant

hunting in rinderpest infected areas, has resulted in a considerable falling off in the numbers killed under organised control. In spite of these drawbacks, however, the results can be considered satisfactory. . . .'

Satisfaction appears to consist in the numbers of elephants killed. The absence of the Game Rangers appears to have saved us from accounts of wonderful feats and paeans of hearty congratulations such as have appeared in previous reports.

We are told that the reference to decreasing damage in certain District reports is most heartening. We were told much the same thing in 1926, yet the toll of increasing killings has steadily gone up until this year and this falling off in 1937 is reported to be due to shortage of staff. We have a plethora of statistics. Twenty-six African 'control' guards were employed, and in the control area 1,519 elephants were killed, mostly, I presume, by the guards. In addition to this other elephants paid the extreme penalty because 228 tusks were found in the control area which can, I think, be taken as from elephants wounded by the operations of the control.

Of the first figure of 1,519 elephants about half of the number had tusks weighing under ten pounds, which means that they were taken from immature males and females. Of the second number of 228 tusks, about half came within the same category. There are no details showing the proportion of cow ivory but it is fairly evident from the figures shown that a large number of small elephants must have been killed by the control. The African control guards came in for their share of praise.

We then have under several chapters detailed accounts of damage by and destruction of elephants in the different provinces. In these accounts it is shown that licence holders obtained some fine trophies. Details are given of incidents in connexion with the work of the control. It is to be presumed, from lack of all information on the subject, that no other methods than killing are undertaken to effect any control over elephant herds which cause depredations.

In Section III we have 'Notes on the Fauna'. Unfortunately practically nothing appears in this report about Gorilla, although there has been, I believe, considerable agitation to obtain a gorilla sanctuary in Uganda. If this sanctuary is a *fait accompli* one would have expected to hear something about it; if not one would expect to be told why nothing has been done. But there is always a good deal to be found in this report about the misdeeds of the fauna and this section is no exception. Baboons, red monkeys, leopards, lions, buffaloes, rhinoceroses, hippopotamuses, giraffes, bush pigs and zebras, as well as elephants, are all indicated.

The chapter on Birds is interesting and instructive. The list of recoveries in Uganda during 1937 of White Storks, ringed in Europe, is no doubt of great scientific interest.

Under reptiles we have a long reference to a crocodile known as Lutembe. I think the Game Warden presumes that Lutembe is as well known to the rest of the world as it is to him, but as this report may be read by many whose knowledge even of Uganda is somewhat vague, much more vague must be their knowledge of Lutembe, and a little enlightenment on the subject would have been useful. Crocodiles are not popular and efforts were made by the Game Department to deal with them by setting poison baits (phosphorus) at Katebo which were believed to have been successful.

In Section IV 'General' under a chapter headed 'Notes of General Interest' we are informed that a party of eminent South Africans had a splendid view of Lutembe. On reading this for the first time I thought it referred to a mountain! This chapter ends the references to mammals and we now turn to Section V, Fisheries.

The chapters in this section give very detailed statistics of the fishing industry in Uganda. The mass of detail collected is a great testimony to the industry of the Game Department. The economics of the business are thoroughly gone into and much information of great commercial value is to be found in this section.

The fisheries, while being of vital importance to the natives are, one would have thought, so far as a Game Department is concerned, a consideration which should take a second place after the mammal fauna, especially the larger fauna, which can, through lack of proper care and careful conservation, very easily disappear.

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The conclusion drawn from a study of this report is bound to leave the impression that the dominating factor governing the major activities of the Game Department is 'control'. One cannot help coming to such a conclusion, it may be a wrong conclusion but due to the meagre information regarding the important work of conservation and the emphasis placed on the importance of 'control' there is to my mind no alternative.

The numbers of elephants known to have been killed in Uganda during the last ten years—there must have been other deaths—amount to over 14,000, mostly killed by an organization especially formed to kill them. At least that is what the Uganda Game Department's Reports lead us to believe.

In the report for 1937 we have records of the killing of—

337 elephants by licence holders.

1,519 elephants by the Game Department.

and approximately 120 elephants found dead, based on found ivory; a total of 1,976 dead elephants.

Uganda is not a very big country, about 223,500 square miles, less than twice the area of the British Isles. The continual drain on the elephant herds is a heavy one.

Can they stand it? That is the first question.

Is it necessary? That is the second question.

Is the motive purely altruistic? That is the third question.

Is there no alternative? That is the fourth question.

No answers will be found in the report, because the information on which to base such answers are not there.

We can, however, draw certain deductions. The large revenue from the sale of ivory is not used for the conservation of wild life nor for steps to counteract the depredations of wild life except on a basis of destruction. In other words the killing of large numbers of elephants is, at present, a profitable business.

If there was no profit, if elephants had no tusks, would the official killings reach these figures?

If this question can be answered in the affirmative it means that no important significance attaches to the revenue obtained from the ivory sales? Therefore one is led to ask why this large revenue is not used to conserve wild life, utilized in research work, or expended on works to try to overcome the elephant difficulty?

If on the other hand the large revenue is appreciated as profit for general expenditure, while at the same time it is clear that little money is allocated to conservation work, then the elephant is being exploited for gain.

Many years ago an officer of a Game Department in Africa said words to this effect:

'The key note of successful conservation of wild life is the prevention of killing for profit.'

with which sentiment every conservationist will agree.

Perhaps Government profit and individual profit are two different matters? That may be so; but the principle applies to both profits.

I believe that I am correct when I write that scientists in many parts of the world view with alarm the destruction of wild life in Africa. The present policy being followed in Uganda may or may not be necessary; we cannot form a complete judgement from the accounts given to us by those responsible for the destruction.

Some of the Annual Reports of the Uganda Government Game Department have been disturbing to conservationists and distressing to many others. It seems that the time has come when an impartial inquiry should be held by persons expert in the art of practical conservation of wild life into this question of the organized destruction of elephants and other large fauna.

It would take a long time to make a thorough inquiry. It would cost a lot of money. But it would not cost as much money as the annual profit the Uganda Government are making out of the sale of government ivory.

June 19, 1938. T. H.

MISCELLANEOUS NOTES.

I.—PANTHER WITH ABNORMAL FEET.

Writing to the Society in connection with two panther skins sent to them for mounting by H. H. the Maharao of Cutch, Messrs. Van Ingen & Van Ingen state 'You might be interested to know that one of these panthers has two extra phalangeal bones and claws—twenty in all'. In vol. xxx, p. 909 of the Journal (1925) the Maharaj Kumar Shree Vijayarajji of Cutch published a photograph and a note on a panther with an extra claw-bearing toe on each hind foot, and in a recent letter H. H. the Maharao commenting on the reference to his trophy made by Messrs. Van Ingen & Van Ingen says 'This is the third one I have shot having the same character. All three have been found in more or less the same part of Cutch. Apparently the extra toe in some cases is hereditary.' The recurrence of these abnormalities within the area appears to indicate that His Highness' suggestion is possibly correct. In vol. xi, p. 734 of our *Journal*, Mr. S. Eardley-Wilmot refers to a panther shot by him in Oude, with five fully developed claws and toes on each hind foot.

BOMBAY. S. H. PRATER.

May 30, 1938.

II.—JACKALS (?) AND A CAPTIVE PANTHER.

I have just recently read Mr. F. W. Champion's book entitled *With a Camera in Tiger-land* and was very much interested in his remarks on leopards and hyaenas in the chapter entitled 'Hyaenas and others'. In July 1936 I came into possession of a young male leopard some four months old and I kept this animal which was perfectly tame until December of the same year when I gave him to the Zoo at Trivandrum, Travancore. During the time the animal remained in my possession he occupied a fairly large cage in my compound with a bare earth floor, and on many occasions on my visiting the leopard in the early morning I found that holes had been burrowed under the edge of the cage presumably so that the burrowing animal could steal scraps of food which had been left. After keeping watch several times on hearing my dog bark late one night I ran around to the cage and found the panther hiding behind a small box and a couple of animals engaged at a piece of meat which had been purposely given extra to the leopard in his evening meal. Immediately on hearing me the 'raiders' made off and as far as I could make out they were only ordinary jackals or perhaps wild dog. I thought it rather amazing that the leopard should endeavour to hide from the marauders but did not think it worth recording until I had read Mr. Champion's book. It

should be observed that, although on every occasion raids were made holes were made which were big enough to let the leopard walk out without any difficulty, he made no attempt to do so but instead appeared next day very much cowed.

QUILON, TRAVANCORE,
SOUTH INDIA. NOEL J. S. THOMPSON,
February 22, 1938. F.R.S.A., F.Z.S., A.I.A.A.

III.—PANGOLIN AND SAMBAR: A CURIOUS BELIEF.

We publish below an extract from the Chief Forest Officer's Report of 11th February 1938 to the Administrator, Bastar State.

'I may say that though I have not seen the Pangolin in this State (Bastar) but I am certain that it does exist for the reasons given below:—

(1) That it is a nocturnal animal, and moves slowly and hence the chances of locating it in forests are few and far between.

(2) That the bony scales of this animal are made into finger rings and buckles by professional men in Jagdalpur and other villages and sold to the patients suffering from rheumatic diseases. The writer of this note in his recent tour was seriously offered a set of rings and buckles made of Pangolin scales at Ulnar camp to relieve the nerve pains.

This harmless creature certainly requires protection, otherwise it would be wiped off completely. I suggest a thorough survey of this animal through S.D.O. Tahsildars, S.I. Range Officers and Revenue Inspectors.

Incidentally I heard very curious story about this animal from the aborigines. They believe that when a sambar comes across a Pangolin it rears up on his hind legs and at the same moment the Pangolin rolls itself into a ball and then Sambar comes down —with all his weight on to the back of Pangolin—delivers blow after blow until the Sambar succeeds in dislodging a couple of bony scales.

As soon as this operation is over, the Sambar picks up the loose scales and swallows them.

In support of this story, the aborigines told me that, once the Pangolin is on his defensive (i.e. rolls up), you may strike dozens of blows with either butt end or sharp end of an axe it makes no impression on the animal. On the other hand, a Sambar on many occasions succeeds in killing the animal.'

EDITORS.

IV.—AN ALBINO SAMBAR.

Records of albino wild animals always have a certain amount of interest, so the following note is submitted.

In the course of an evening stroll in the mixed *sal* and chir pine forests at 1,500 ft. near Chaukhamb in the hills of the

Kohtri valley not far from Lansdowne, my wife and I saw a very conspicuous white object standing some 35 yards away and about the same number of feet below us. For a moment we thought we must be getting near a forest camp (we did not know the country), and that we were looking at the rear view of a white hill pony with phenomenally shortly docked tail; then that it was only a barkless bleached stump of that shape. But after the first moment, there was no question but that it was a sambhar hind standing with its back to us, with head turned to watch us through some thin scrub. We watched it with and without binoculars at the short range mentioned for as long as we wished, for, despite our movements, it did not stir. The muzzle was conspicuously pink and completely pigmentless as also were the fleshy parts round the eyes; the eyes also appeared pink, but we could not be absolutely certain of this; the ears with the light showing through them appeared possibly very slightly pigmented. Over the whole body the hair was definitely white, perhaps a bit dingy as though in need of grooming, as sambhar mostly look to be at this season, but impossible to describe as merely 'pale buff' or 'pale fawn'. It seems surprising that so conspicuous an animal could survive to maturity in forests with plenty of tiger and leopard, not to mention poachers.

NAINI TAL, U.P.
April 1, 1938.

H. G. CHAMPION, I.F.S.,
Conservator of Forests,
Western Circle.

V.—THE MATING OF ELEPHANTS.

The manner in which elephants mate has long been a moot point. Owing perhaps to the position of the generative opening in the Cow it has been suggested that during congress she lies on her back—some have held that she digs a hole. The question if there yet remains any doubt as to the manner of fecundation may definitely be set at rest by the authentic photograph which I enclose.

The female was purchased on the 13th February 1936 being wild and just caught in a Khedda. Her age is about 30 years and height 7 ft. 6 in. The tusker is aged 35-36 having been in captivity for about 30 years, his height is 8 ft. 5 in. At the time the snap was taken the female had been partly broken in—she could carry a pad but did not know all the words of command. The pair had been brought in from the hills where they are let loose fettered and lead a semi-natural life often mixing with wild herds. The snap was taken from a distance of 60 yards in an open field with scores of villagers looking on. The tusker mounted about eight times, but the female did not respond as she kept crossing her hind legs. Subsequent to this the tusker mounted on several occasions, either in the compound or in the hills. The female is now in calf. The tusker has been getting musth for the last 5 years, the attack generally lasting from 10 days to a fortnight when he is unapproachable. The attack comes on usually

in April or May. When in musth he always seeks the company of a female, and mounts whether she is willing or not. A point to be emphasised is that he was not musth when the photograph was taken.

COMILLA, TIPPERA,
E. BENGAL. PAUL DE LAUNEY.
April 11, 1938.

[We have not published the photograph submitted by the writer. There are a number of photos in existence which prove that elephants copulate in the position usual to quadrupeds. In the female elephant, the peculiar position of the female external generative opening, which hangs down in much the same position as the penis in the male, led to widespread doubts as to whether the act of copulation was performed in the position normal among quadrupeds. On plaques and in ancient Indian sculpture in which elephants are sometimes represented *in coitu*, the female is shown literally standing on her head. The weight and vigor of the male may force the female to go down on her fore knees and rest her forehead on the ground. Under sexual excitement the generative opening in the female is raised from its pendant position and assumes a situation more or less normal in quadrupeds. The alteration in position has been observed by ancient anatomists. Aristotle refers to it in his *Historia Animalium*. An interesting note in the *Oriental Sporting Magazine* indicates that the animals may at times take advantage of irregularities in the confirmation of the ground and so ease the burden of weight. In the note under reference the writer saw a pair of elephants mating. The female was standing in a dry nullah which was not more than five feet wide. The male rested his forefeet on either bank and so relieved the cow of the weight of his body.—EDS.].

VI.—A LARGE INDIAN ELEPHANT.

A Game Ranger on crop protection patrol shot a large tuskless male elephant last December in the Bhamo District of Upper Burma. The elephant which was a notorious man-killer, contained 8 ball shot from 12-bore guns, along one side (it was impossible to turn the elephant over to find out what was in the other side) and measured between pegs placed at the shoulder and the fore-feet, 10 ft. 8 in. It is probable that the effect of lying on its side, slightly increased the height measurement as recorded between the pegs but it would be interesting to learn whether larger Indian elephants than this are on record.

MAYMYO, BURMA. F. J. MUSTILL,
February 11, 1938. *Game Warden.*

[The highest recorded measurement of an Indian elephant is that of an animal from Ceylon which taped 10 ft. 8 in. at the shoulder (E. L. Walker, *Rowland Wards Records of Big Game*.

8th Edition). In the same book the record measurement from Burma is given as 10 ft. 6 in. (H. Shaw Dunn). In comparison the record African elephant is 11 ft. 6½ in. Extravagant estimates of the height of elephants have been recorded from time to time. Much amusing information is given in Sanderson's classic work, *Forty Years among the Wild Beasts of India*. Madras elephants were at one time said to be 17-20 ft. high while an animal at Dacca was said to be 14 ft. Sanderson went there to measure the monster which he found did not exceed 10 ft. Sanderson, who knew as much about elephants as any man is likely to know, was of opinion that an elephant measuring 10 ft. at the shoulder does not exist in India. The largest male he ever met measured 9 ft. 10 in. and the tallest female 8 ft. 5 in. Cingalese elephants according to Emerson Tennent seldom exceed 9 ft. According to Evans, another great authority on these beasts, 300 male elephants measured in Burma averaged 7 ft. 10¼ in. at the shoulder, a group of females, 7 ft. 5¾ in. A merchant who had handled 2,000 of these animals, only had one that reached 9 ft. 4 in.—EDS.].

VII.—BEHAVIOUR OF GAUR OR INDIAN BISON.

With reference to Col. C. G. Toogood's note in the last *Journal* on the curious behaviour of Bison: Gaur are apt to behave strangely when concentrated on something which has aroused their excitement, *vide* my recent note on two bulls attacking a third fallen bull, while the cows stood around, in spite of the fact that the wounded bull had been fired at twice, and we were in full view within a few yards.

On another occasion a bull's attention was concentrated on a bear close to it. I shot the bear but the bison never moved for several minutes but stood staring at the dead bear, and finally walked slowly away.

HONNAMETTI ESTATE,
ATTIKAN, MYSORE P.O., R. C. MORRIS.
S. INDIA.

January 16, 1938.

VIII.—BEHAVIOUR OF GAUR OR INDIAN BISON (*BIBOS GAURUS*).

The note on tiger and bison on pages 852-53 of the December issue is interesting.

An incident in this connection occurred on 14th April last year, when I was walking at sunrise along a forest track in the Nilgiri-Wynaad.

I noticed a solitary bull bison (seen also on the previous day grazing in a swamp) about 50 yards up the slope above the road, standing at rest in thin tree jungle. I was in plain view but although the bull turned his head to stare at me more than once,

he was not in the least alarmed. As I watched him through my glasses, he slowly lowered his head and gave a deliberate long-drawn snort at the long grass a few paces in front—whence I heard a continuous cracking, culminating a few seconds later in a fine tiger striding slowly out on to the road side fire line, eighteen paces from me. The bison did not change his stance or seem in any way alarmed, though in the confusion consequent on my shooting the tiger, he of course, vanished.

The point is the entire absence of alarm shown by the bison regarding both myself, my tracker, and the tiger, and my own small experiences are to the effect that bison have not shown shyness at least when seeing or hearing man.

On 17th May, last year, Major E. G. Phythian-Adams and I were in the same locality after one of the local rogue elephants (which we shot the same day). Early in the morning we found a bull bison with a small head grazing in bush jungle alongside a wide open grass track. On our approach within 50 yards (there was practically no wind) the bull walked out into the middle of the path and came towards us, head up and snorting—he appeared so truculent that I turned over my safety-catch. We walked towards him and at less than 30 paces, he appeared to recognize us and the trackers as men and galloped off. Again in 1936, while staying with Mr. R. C. Morris, I found a fine bull on the Mysore-Coimbatore boundary, and although I was quite exposed in waist-high grass, the bull could not apparently make me out at 70 paces, and walked off slowly into the forest. From curiosity I followed him, and noted that he halted several times at 30 paces or so to stare at my tracker and myself.

I have had several similar experiences, notably in Coorg, many years ago. On one occasion a bull and I were face to face for many minutes in forest, so close that I could watch the flies walking on his face. Again one old grey bull (with a row of mynahs sitting on his back) did not even raise his head from grazing in a swamp as we pushed through the noisy grass close to him, only an hour after firing several shots from a ·470 cordite less than a mile away.

Mr. R. C. Morris's opinion and experiences on this question would be interesting. It almost appears as if bison on many occasions cannot fully recognize men moving in the open at over 50 yards.

51 Ross Keppel Line,
Peshawar Cantt.
February 7, 1938.

H. G. ROSSEL,
Major.

IX.—THE USE OF FIREWORK OR ROCKET CARTRIDGES IN THE PROTECTION OF CROPS.

I have read with interest the article on page 855 of your December 1937 issue, entitled 'The Use of Firework or Rocket Cartridges in the Protection of Crops'. In Burma we tried out

similar cartridges during 1935 and 1936 but with little success. This was attributed to the fact that crop raiding elephants in many parts of the country had become accustomed to villagers attempting to drive off the crop raiders by exploding green bamboos and throwing flares, etc. A further difficulty was experienced owing to the fact that a lot of paddy field raiding takes place during the rains and the damp atmosphere adversely affected the cartridges. Maroons, thrown by hand were also tried out, but as this involved approaching the elephants to within 50 yards and lighting the maroon with a match, generally at night, little success attended these efforts. Wild elephants are now being controlled under a definite scheme, which consists briefly in extermination where the forest is unsuitable for retaining the elephants and confining the remainder to large areas of forest where conditions are more suitable. Extermination is being done by a combination of kheddahs and armed Game Rangers, but it is also necessary to post armed Game Rangers round parts of the permanent blocks where crop raiding occurs. There is now some evidence that crop raiders are realising the dangers which attend their visits to cultivation and it may be possible in the near future to try out fire-work cartridges once more. For this reason I should be grateful if Mr. Morris would send me the name of the German firm which manufactured the cartridges used by him. No one regards with favour the wholesale slaughter of wild elephants but in 1935 the elephant population in Burma was conservatively placed at 10,000 animals and during that year only 45 animals were captured. Under the present scheme it is expected that the elephant population will be reduced by 3,000 animals, leaving a stock of about 7,000 animals.

MAYMYO, BURMA. F. J. MUSTILL,
February 11, 1938. *Game Warden.*

X.—THE YELLOW-BELLIED FLYCATCHER (*CHELIDORYNX HYPOXANTHUM*): AN EXTENSION OF ITS RANGE.

I shall be glad if you can kindly tell me whether you have *Chelidorynx hypoxanthum*, the Yellow-bellied Flycatcher, noted for this district (in winter only). I saw a pair of these birds in a wood about 8 miles along the Jammu road in the first week in March 1936. Last year I was at Home, so did not have any opportunity of observing them. But this month I have again seen two or three of these birds at places between here and Jammu. I see from the old *Fauna* that they do not appear to be noted west of Simla, but possibly the new edition of the *Fauna*, of which I have no copy, may give further information. As I was on two occasions able to get within a few feet of the bird (which was hawking from a small bush) and examine it very thoroughly through

my glasses, there can be no doubt about the identity of the species.

SIALKOT, PUNJAB. E. A. STORRS FOX.
February 13, 1938.

XI.—THE STATUS OF THE KOEL (*EUDYNAMIS SCOLOPACEUS* L.) IN SIND.

Since writing the article on this subject, which appeared in Vol. xxxix, No. 2, of the Society's *Journal*, dated the 15th April 1937, I had occasion to visit Shikarpur in June last after a lapse of several years.

I was in Shikarpur from the 4th to the 8th June 1937 and found that the Koel had continued its movement north and arrived there. I heard several Koel call repeatedly on the early morning of the 5th. The day following I paid a flying visit to the mango *topes* and gardens round about the town and both heard and saw several birds, both male and female, in the short time that I had at my disposal.

From the 6th to the 8th, the date of my departure, I heard birds calling daily, early mornings, and a pair daily visited some fig trees in the Rest House garden, where I often saw them at very close range.

Purbia *malis* and others in the P.W.D. garden, Shahi Bagh and other gardens told me that the Koel had made its first appearance in Shikarpur only two summers previously (1935) and that it had been there regularly every summer since.

As the Crows had not then commenced their domestic affairs I was unable to obtain first-hand knowledge of its breeding in Shikarpur, but a Purbia *mali* in Shahi Bagh told me that the year before (1936) he had seen a pair of crows feeding a young Koel which was just able to fly. I have no reason to doubt this information as the Purbia of the U.P. knows the Koel only too well.

KARACHI. K. R. EATES,
January 27, 1938. F.Z.S., M.B.O.U.

XII.—SOME INTERESTING RECORDS OF BIRDS IN THE PUNJAB. A CORRECTION.

In my note under the above heading on page 861 of vol. xxxix it was stated that ♂ ♀ *Chrysocolaptes guttacristatus sultaneus* were obtained on 24th and 26th February, 1936. I have now been informed by Mr. Hugh Whistler that, by an oversight, the ♀ was wrongly identified. It is *Dinopicum shorei* (Gould,) the

Himalayan Golden-backed Three-toed Woodpecker, which also is new to the Punjab List.

RAWALPINDI, PUNJAB.
April 3, 1938.

H. W. WAITE, M.B.O.U.,
Indian Police.

XIII.—CUCKOO PROBLEMS.

It is already April and so rather late to ask for the following observations to be carried out this year, but I am going to make a start myself and I would ask for co-operation from all those interested in the cuckoo.

It is desirable to find out what are the reactions exactly, if any, betrayed by those species of small birds that habitually foster the cuckoo, when they find a strange egg in their nest.

I suggest that a light bamboo hide be constructed which is easily portable. This can be set up near such nests and observations can be carried out from it.

A suitable egg must be chosen for the experiments. It should be either a cuckoo's egg, or some other bird's egg about the size of a cuckoo's egg, and the *greater the contrast* between it and the eggs of the nest-owner the better. I am starting with a bulbul's egg on which I have painted a startling, wide zone of white—in white enamelled paint. This is in violent contrast to the eggs of the Burmese Stone Chat and Blyth's Pipit—species of common fosterers I am experimenting on this year.

Some authorities on the cuckoo maintain that the nest-owners frequently 'eject' cuckoo's eggs which contrast too violently with their own. They do not suggest how this feat is accomplished and *have not as yet proved that it takes place.* They are however convinced that it does happen. On the face of it it would appear to be physically impossible for such small birds to remove a cuckoo's egg from their nests unless they first broke the egg in their nest and then carried off the fragments in their bill.

To try and clear up this little problem I have suggested that experiments be conducted as I have described. These experiments must be of course carefully recorded in a note-book and the data published in due course when a sufficient number of experiments have been carried out.

To avoid unnecessary bother in waiting in the hide I suggest that the hide be set up and left unoccupied for a few hours till the nest-owners are used to it. If it is then occupied the birds will return at once to their nest and the observation can then be made in the least possible time. Many hundreds of such observations are necessary before we can form an opinion, but these observations are quick and easy enough to conduct and should afford interest, if not amusement, while they are being carried out, and so I hope those interested in the cuckoo will

help and later record with full data the results of their experiments.

TAUNGGYI, S. SHAN STATES,
BURMA. T. R. LIVESEY.

April 7, 1938.

XIV.—STRANGE ACCIDENT TO A VULTURE.

(*With a photo*).

A young friend of mine took three photos of a vulture which attacked a dying calf a few miles out of Bombay but apparently



was too venturesome and was caught by the head in the calf's mouth. Both were found dead together. He wants to know if it is a common occurrence.

21, RAVELIN STREET,
BOMBAY. J. A. C. GREENWOOD.

March 16, 1938.

[Most unusual we believe.—EDS.].

XV.—OCCURRENCE OF THE LESSER ORANGE-BREASTED GREEN PIGEON (*DENDROPHASA BICINCTA BICINCTA*) AT KEAMARI, SIND.

On the 3rd January 1938 a Green Pigeon was shot at Keamari by D. Lyons, son of Lieut. G. Lyons, R.I.A.S.C.

The bird, thanks to Major W. J. Dixie, R.I.A.S.C., was brought to me by Lieut. Lyons himself the same day for identification and proved to be an adult female of the species named above. The bird was very fat and its plumage was in perfect condition.

It was obviously no 'escape'. The crop contained a number of freshly eaten pipal berries. The pigeon when shot was seated at the top of a pipal tree. The young shikari, who was using a ·22 air gun, did not think at the time of looking carefully in the tree for other birds but says that a couple of days later he saw another bird in Keamari sitting at the top of a pipal tree.

About the 4th or 5th, yet another Green Pigeon, species not known, was seen seated at the top of a leafy tree in Karachi by a lady. So far as I am aware no others came to notice.

The Society very kindly examined the skin of the bird shot by young Lyons at Keamari and informed me that it had been correctly identified as *Dendrophasa bicincta bicincta*.

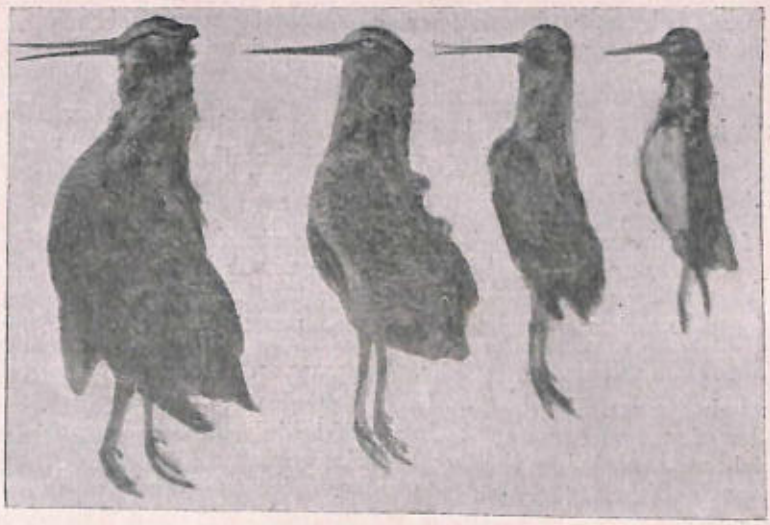
Regarding its occurrence in Sind the Society writes, 'With regard to its distribution we can find no reference to its occurring so far west as Karachi. The *Fauna* gives its north-western distribution as follows:—'Northern India from the United Provinces along the Terai through the foot hills and adjoining plains to Eastern Assam, north of the Brahmaputra; Bengal and Bihar, but replaced in the extreme east by *praetermissa*.

It is difficult to ascribe any real reason for its occurrence at Karachi, but it is quite possible that the bird may have been driven southwards by the prevalent cold wave.'

KARACHI. K. R. EATES,

February 2, 1938. F.Z.S., M.B.O.U.

XVI.—WOODCOCK, WOOD SNIPE, PINTAIL SNIPE AND JACK SNIPE IN ONE DAY!



The enclosed photograph may be of some interest, as showing the relative sizes of Woodcock, Wood Snipe, Pintail Snipe and Jack Snipe. The respective weights were $11\frac{5}{8}$, $5\frac{1}{2}$, $4\frac{3}{4}$ and 2 oz.

It is very doubtful if all four species have ever been shot on the same day on these hills, prior to this. They were shot by me on the 16th February 1938, not very far from Ootacamund.

'LANSDOWN', OOTACAMUND.
March 25, 1938. R. F. STONEY.

XVII.—THE SNIPE-BILLED GODWIT [*LIMNODROMUS TACZANOWSKIUS* (VERREAUX)] IN ORISSA.

The head and legs of a Snipe-Billed Godwit were sent to the Society by Mr. R. S. Clough. The bird was shot at the Chilka Lake, Orissa, in December 1937. There are a few previous records of the occurrence of this winter migrant within Indian limits. But as Mr. Stuart Baker indicates it doubtless occurs far more often than it is recognised and shot.

BOMBAY. S. H. PRATER.
May 31, 1938.

XVIII.—THE OCCURRENCE OF THE TURNSTONE, THE RED-NECKED PHALAROPE, THE FALCATED TEAL AND THE SHELDRAKE AT PATNA.

On 23rd September 1937 a young male Turnstone (*Arenaria interpres* L.) was brought to me by a local bird-catcher who declared it was trapped on a Jheel in the outskirts of the town. It had a wing measurement of 149 mm. The same man also brought me on 6th November 1937 a female Red-necked Phalarope in winter plumage. Its legs were black but the lobes of the web between the inner and middle toes were bright orange and the tibia was pale orange.

An adult male Falcated Teal (*Eunetta falcata* Georgi.) was also brought to me on the 30th January 1938 being trapped along with Widgeons and Shovellers. The Sheldrake (*Tadorna tadorna* L.) is a rare visitor to these parts. Thirty years ago I once noticed a solitary bird on the Ganges which would not let me get within range though it could be distinctly identified through glasses. Last year, in December, I noticed a small flock and again came across a flock of eight birds on 5th January 1938 which were probably the same birds. Two attempts were made to get within range but they were too shy and would not let me get anywhere within range.

PATNA. E. A. D'ABREU.
February 10, 1938.

XIX.—BEWICK'S SWAN (*CYGNUS BEWICKII* YARRELL) NEAR DELHI.

I enclose a snap of myself holding up a bird shot on the 26th instant by Mr. R. E. Grant Govan of Delhi at Sutana about 45 miles north of Delhi.

There seems to me to be little doubt that it is a Bewick's Swan (*C. bewickii*). The upper part of the beak upto the eye was yellowish and the beak and legs jet black. Other particulars are neck 2 ft. long, spread 6 ft. 6 in., base of neck to tip of tail 2 ft., legs 1 ft. 6 in. The bird appeared to be slightly immature for though the feathers were white, there were a few slightly greyish feathers on the neck and wings.

It was sitting in a piece of water about 2 ft. deep and 100 × 300 yds. in extent. The water or jhor was not far from a village. It was clear in the centre with the ordinary reeds and a few weeds near the edges. When shot the bird was alone and appeared on the whole to be confiding. The Manager of the Manton's, to whom this bird was given, intends to preserve the skin and send it to Bombay.

There appears to be no previous record of Swan near Delhi and perhaps some of your other readers would be interested to see this and possibly supply useful information.

DELHI. E. S. LEWIS.

December 29, 1937.

[The bird was sent to the Society's Museum. It is an example of Bewick's Swan (*Cygnus bewickii* Yarrell). There are two previous records of the occurrence of this swan within Indian limits. One is a specimen shot at Jacobabad, Sind, by Mr. B. L. McCullock on the 2nd December 1907, and the second is a female shot by Captain P. C. Elliot-Lockhart near Mandan, N.-W.F.P., on the 30th December 1910. Both these specimens are in the Society's collection.—EDS.].

XX.—OCCURRENCE OF THE LONG-TAILED DUCK (*CLANGULA HYEMALIS* LINN.) NEAR QUETTA.

Perhaps it may interest your Society to know that a female specimen of the Long-tailed Duck in full plumage was shot on Khush Dil Khan Lake, 40 miles from here on the 2nd January 1938. A flight of about 6 have been observed in the lake. I believe this variety must be very rare in India. Their home is near the Arctic Circle.

This year very many more Red-headed Pochard have been shot than formerly.

On 16th January a male and female Smew were shot. They too are uncommon up here.

STATION STAFF OFFICE,
QUETTA. M. B. P. REEVE,
January 21, 1938. *Major.*

[This is the fourth recorded instance of the occurrence of this duck within Indian limits since the publication of the record of the specimen shot by Capt. A. E. L. Dredge at Chaman, Baluchistan, in October 1933 (*J.B.N.H.S.*, vol. xxxvii, p. 549).—EDS.].

XXI.—SHELDRAKE (*TADORNA TADORNA* LINN.) IN ORISSA.

Since I wrote to you on the 17th December a friend of mine here has been down to the Chilka Lake and tells me that he saw hundreds of Sheldrake (*Tadorna tadorna* Linn.) there; one of which he shot to show to the boatmen, as they were unfamiliar with the species. This seems to be a particularly interesting record in view of the fact given recording the distribution of this duck by Stuart Baker in *Indian Ducks and Their Allies* and subsequently in the *New Fauna*, vol. vi. Chilka Lake is, as you know, 320 miles south of Calcutta.

1, CLIVE STREET,
CALCUTTA. R. J. CLOUGH.
January 1, 1938.

XXII.—A HYBRID: COMMON TEAL AND BAIKAL TEAL.

I do not know whether the following note is of any interest.

When shooting Duck on the Mirgund Reserve in the main Kashmir Valley, I shot an unusual duck. It was in general appearance rather like a drake Teal, but much larger and heavier. It had two markedly pointed tail feathers. It weighed 1 lb. 4 oz. It was flying in company with ordinary Teal. Date, 29-12-37.

It was skinned by Mr. F. Ludlow and sent to the British Museum (Natural History) for identification.

I have since heard that it is unlike any bird that they had previously received and after a number of people had looked at it, it was decided that it was a cross between a common Teal (*Nettion crecca*) and a Baikal Teal (*N. formosum*). The visits of the Baikal Teal to India are extremely rare.

THE RESIDENCY, KASHMIR,
SRINAGAR. J. W. THOMSON GLOVER.
April 1938.

XXIII.—MIGRATION OF WILD FOWL.

(*Continued from vol.* xxxviii, *p.* 833).

Place of Ringing	No.	Date of Ringing	Species	Ringed by	Place of Recovery	Date of Recovery
Bhulpinder, Sagur, Patiala State, Punjab.	3624	30- 3-1929	Shoveller ♂ (*S. clypeata*)	W. H. Hutton	Kzyl-Orda (approx. 40°45′ N, 65°30′ E.	March 1929
Gajja, Bhawalpur State, Punjab	2165	12-12-1928	Mallard ♂ (*A. platyryncha*)	G. Atkinson	Volchikhino, Slavgorod. (52°20′ N, 79°20′ E.	May 1929
Manchar Lake, Sind ...	2784	26- 1-1929	Gadwall (*C. streperus*)	B. B. Maclachlan.	Novo-Voznessenskaja near Tatarsk. (55°20′ N, 76°E	October, 8th 1930.

BOMBAY.
May 30, 1938.

EDITORS.

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XXI.—SHELDRAKE (*TADORNA TADORNA* LINN.) IN ORISSA.

Since I wrote to you on the 17th December a friend of mine here has been down to the Chilka Lake and tells me that he saw hundreds of Sheldrake (*Tadorna tadorna* Linn.) there; one of which he shot to show to the boatmen, as they were unfamiliar with the species. This seems to be a particularly interesting record in view of the fact given recording the distribution of this duck by Stuart Baker in *Indian Ducks and Their Allies* and subsequently in the *New Fauna*, vol. vi. Chilka Lake is, as you know, 320 miles south of Calcutta.

1, CLIVE STREET,
CALCUTTA. R. J. CLOUGH.
January 1, 1938.

XXII.—A HYBRID: COMMON TEAL AND BAIKAL TEAL.

I do not know whether the following note is of any interest.

When shooting Duck on the Mirgund Reserve in the main Kashmir Valley, I shot an unusual duck. It was in general appearance rather like a drake Teal, but much larger and heavier. It had two markedly pointed tail feathers. It weighed 1 lb. 4 oz. It was flying in company with ordinary Teal. Date, 29-12-37.

It was skinned by Mr. F. Ludlow and sent to the British Museum (Natural History) for identification.

I have since heard that it is unlike any bird that they had previously received and after a number of people had looked at it, it was decided that it was a cross between a common Teal (*Nettion creca*) and a Baikal Teal (*N. formosum*). The visits of the Baikal Teal to India are extremely rare.

THE RESIDENCY, KASHMIR,
SRINAGAR. J. W. THOMSON GLOVER.
April 1938.

XXIII.—MIGRATION OF WILD FOWL.

(*Continued from vol.* xxxviii, *p.* 833).

Place of Ringing	No.	Date of Ringing	Species	Ringed by	Place of Recovery	Date of Recovery
Bhulpinder, Sagur, Patiala State, Punjab.	3624	30- 3-1929	Shoveller ♂ (*S. clypeata*)	W. H. Hutton	Kzyl-Orda (approx. 40°45′ N, 65°30′ E.	March 1929
Gajja, Bhawalpur State, Punjab	2165	12-12-1928	Mallard ♂ (*A. platyryncha*)	G. Atkinson	Volchikhino, Slavgorod. (52°20′ N, 79°20′ E.	May 1929
Manchar Lake, Sind ...	2784	26- 1-1929	Gadwall (*C. streperus*)	B. B. Maclachlan.	Novo-Voznessenskaja near Tatarsk. (55°20′ N, 76°E	October, 8th 1930.

BOMBAY.
May 30, 1938.

EDITORS.

XXIV.—THE FOOD OF THE MUGGER (*CROCODILUS PALUSTRIS*).

With reference to Mr. McCann's note on the crocodiles of Powai Lake feeding on beetles (which habit I have independently confirmed), I am informed by a usually reliable local authority, that these 'degenerate' animals feed on the fallen fruit of the 'Oomber'. (*Ficus glomerata*).

ANDHERI. HUMAYUN ABDULALI.

November 25, 1937.

XXV.—THE HEAD SHIELDS OF THE HAMADRYAD [*NAIA HANNAH* (CANTOR)]: AN ABNORMAL EXAMPLE.

I append a drawing of the head of the King Cobra [*Naia hannah* (Cantor)] I shot in 1936 showing a peculiar characteristic in the form of a small scale imposed between the parietals and the two occipital shields as shown shanked in the sketch.

After a perusal of various works on Indian snakes I find that this feature is not noted or illustrated in drawings of this snake's head. I therefore conclude that it must be a variation from the normal with this particular specimen. Another feature is the divided left-hand occipital, the left lobe having the appearance of a body scale, also the unequal size of the temporals from each other on either side.

It will also be seen that the right parietal has a kink in the side. I note that Wall mentions in his 'Poisonous Terrestrial Snakes' that he has never seen a ..... scale in the Hamadryad. Two exist on either side of the lower jaw of this specimen.

NADUAR ESTATE,
VALPARAI P.O., R. N. CHAMPION-JONES.
S. INDIA.

March 1, 1938.

[The snake described by the author is an aberrant specimen. None of the Hamadryads in our collection show the characters indicated.—EDS.].

XXVI.—TWO CATERPILLARS OF ECONOMIC IMPORTANCE NOT RECORDED BEFORE FROM S. INDIA.[1]

At the previous session of the Congress the author submitted a paper on the cultivation of the *Koorkan* plant (*Coleus parviflora*), as a vegetable crop in Malabar, and in that paper a passing

[1] Paper read at the Indian Science Congress, Calcutta, 1938.

reference was made to two leaf-eating caterpillars causing some damage to the crop. Further studies were since made on these two insects and in this short paper an attempt is made to present the data collected, on the bionomics of these insects and their proper identification. There is no previous record of these insects as pests from any part of India. The insects have been identified as (1) *Pycnarmon cribrata* F. and (2) *Phostria piasusalis* W. both belonging to the family *Pyralidae*.

Pycnarmon cribrata F.

The adult insect is a medium-sized moth with the cream white wings, speckled with brownish patches. It is similar in appearance to *P. jaguaralis* G. Though nine species of the genus *Pycnarmon* (*Aripana* of Moore) are recorded by Hampson in his *Fauna* volume this species is not one of them.

The life history of the moth is passed on the *Coleus* plant itself. The eggs are laid on the tender leaves and the caterpillar feeds from inside a longitudinally folded leaf. The two lateral halves of the leaf are brought over and folded inwards and having eaten the leaf it folds another and feeds from inside of this sheath. A full-grown caterpillar reaches an inch in length. It is slender and elongated and slightly compressed dorsoventrally. General colour is olive green above and paler below. Head pale brown; prothorax dark grey, all the body segments from behind the prothorax have each a transverse row of shining black tubercular spots each giving rise to a pale white set; while on the meso- and metathoracic segments there are two such black spots on each side of the middorsal line, all the abdominal segments have only one on each side of the middorsal line. All these segments have also a lateral smaller black spot on each side. The legs are grey and the pro-legs transparent green. The pupa is reddish brown and is found inside the leaf fold itself. The pupation period occupies ten to twelve days.

Phostria piasusalis W.

This caterpillar, though a leaf feeder, exhibits a slightly different habit. Instead of folding a single leaf longitudinally like *Pycnarmon* this larva selects the top shoot leaves of the plants and webs them together and remains feeding inside this fold made of more than one leaf. In general coloration the caterpillar of *Phostria* is pale green uniformly and has no series of black spots. The moth also has sombre pale brownish wings with no conspicuous spots. No species of *Phostria* is recorded by Hampson in his fauna volume.

During the breeding of these moths, the leaf folder caterpillar *Pycnarmon* was found heavily parasitised in the fields by a small stout built braconid wasp *Microgaster psarae* W. previously recorded as parasitic on the brinjal leaf webber *Psara bipunctalis* F. in Malaya. The parasitic cocoons are pure white in colour and the parasite is a small shining red and black active insect measuring

about 1/6 in. in length. It appears possible that this parasite plays the part of a fairly efficient natural enemy of the pest.

MADRAS. T. V. RAMAKRISHNA AYYAR, B.A., PH.D.,
Government Entomologist (Retd.).

XXVII.—NOTES ON THE EARWIG (*DICRANA KALLIPYGA* DOHRN.).

Original specimen, ♀, caught in room at night, 28-11-37. When kept under observation was seen to feed on small insects, such as small grasshoppers, soft caterpillars, etc., by seizing them with the forceps, which are used for this purpose with as much dexterity as the callipers of a crab. The abdomen is then flexed and rotated to enable the object held in the forceps to be readily eaten by the earwig. Sometimes the victim is firmly held in the forceps for some time before feeding operations begin. The face of the insect is often eaten first, and the grip may be shifted from time to time to facilitate feeding; when only part of the meal remains the grip may be relaxed and the remains eaten without the help of the forceps. In the case of small and helpless insects also seizure may be effected directly by the mouth parts. When hungry, small insects may be pursued energetically and seized with the forceps with great dexterity. On one occasion when another specimen of the same species was placed in the tin it was bitten in half and the thorax and abdomen sucked empty.

On December 26th sixty-four eggs were found to have been laid on pieces of bark and moss. These have not yet hatched out and may be infertile. Oviposition was not witnessed. The eggs are oval, dull white, and are neatly stuck by one end to a flat surface.

So far this specimen has been kept alone and it feeds regularly on small grasshoppers.

Four new specimens; two ♂ and two ♀. These were found under the bark of eucalyptus trees after rain. They are of the same species as the above and this appears to be the common species up here; I have so far only found one other species living in similar places. These specimens feed in the way already described and are very aggressive, threatening each other and sparring with their forceps and when possible seizing each other; but opposite sexes treat each other in a much more friendly way. The males are readily distinguished from the females by their comparatively smaller abdomen and by the appearance of the last dorsal segment, which is very broad and produced laterally into strong crested folds; in the male also the penultimate ventral segment is broad and rounded, while in the female it is triangular and rounded at the apex. The male forceps is also distinctive, being stouter and more aggressive looking. The average length of the body appears to be about 20 mm. and the forceps 5 mm. The two female specimens are definitely larger than the males.

Reproduction.—The two couples have been seen *in coitu* on various occasions, the penultimate ventral segment of the ♂ being apposed to that of the ♀ and remaining attached in this position for several hours. The ♂ has usually to rotate its posterior half of the abdomen for this purpose, while the front part of the body usually remains unrotated. The act of copulation is preceded by the stroking and tapping of the dorsal surface of the terminal segments of the ♀, and the ♂ finally insinuates its forceps under the penultimate ventral segment of the ♀.

28-1-38. Twenty-four eggs were found stuck to the side of the bottle, and two days later fifteen additional eggs had been laid in the same place. On the 1st and 3rd of February a couple was seen 'in coitu' for several hours.

Though powerfully attracted by bright light at night, these specimens appear to have poor vision, but very acute sense of touch. They spend a good deal of time on their toilet, the antennae, the feet, the forceps and other parts of the body being severally cleansed during moments of leisure by drawing the part through the mouth organs in order to remove excessive moisture, dust, etc.

My specimens tally well with the description of *Dicrana kallipyga* given in the *Fauna*. There are certain differences. The head is not brick-red but blackish brown; the ♀ is definitely larger than the ♂ particularly as regards the abdomen.

AUCHINDOON, SIR FRANK CONNOR,

OOTACAMUND. *Major-General,*

February 3, 1938. D.S.O., F.R.C.S., I.M.S.

[A previous note on the function of the 'Forceps' in the Earwigs (*Forficulidae*) written by Sir Frank Connor was published in vol. xxvi, p. 688. It refers to a specimen taken by him at Amara in Mesopotamia in 1918 and subsequently associated by Mr. P. A. Buxton with *Labidura riparia* (*J.B.N.H.S.*, vol. xxvii, p. 963). In the introduction to the Volume on Dermaptera (Earwigs) in the *Fauna* series, Mr. Malcolm Burr refers to the use of the forceps by these insects as weapons of offence and defence. They are not used in copulation but, as the present note indicates, may be used for holding the food and conveying it to the mouth. Occasionally they are used to fold and unfold the wings and lift up the wing cases or elytra.—EDS.].

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of Members of the Bombay Natural History Society was held on Thursday the 24th March, 1938, at 6-15 p.m. in the Prince of Wales' Museum (New Wing), Rev. Fr. J. F. Caius, S.J. presiding.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.

The Honorary Secretary announced the election of the following 28 new members since the last meeting held on 25th August 1937:—

Mr. G. R. Nicolaus, F.R.G.S., F.Z.S., London; Mr. Mohamed Etzad, Rasul of Jehangirabad Raj, Colvin Taluqdars College, Lucknow; Mr. Ravendra Ramanuj Singh, I.M. Academy, Premnagar, Dehra Dun; H. E. Sir Roger Lumley, G.C.I.E., D.L., Bombay; Mr. Charles A. Osborn, Bombay; Mr. E. T. Osborne, Kirkee; Capt. P. M. McSwiney, I.M.S., Muttra; G. D. Lake Esq., England; Mrs. W. L. Clements, Bombay; Mr. A. J. E. Howey, England; H. H. Maharaja Shri Vijaysinhji of Rajpipla; Dr. H. J. Slocum, U.S.A.; The Superintendent, State Museum & Zoo, Trichur; Mr. P. G. Burder, Jubbulpore, C.P.; Capt. F. L. Roberts, Loralai; The Mess Secretary, Officers' Combined Mess, The Burma Rifles, Maymyo, Burma; Mr. C. P. J. De Haas, Java; Mr. W. E. Popple, Bombay; Mr. D. J. Emerson, Malabar; Mr. A. D. Vincent, Mundakayam, S.I.; The Director of Agriculture, Baghdad, Iraq; Mr. G. E. Turnbull, B.F.S., Rangoon; Mr. Carr A. Martin, Rangoon; The Business Manager, Marine Biological Laboratory Library, Woods Hole, Mass., U.S.A.; Mr. R. C. Jackman, Fort Sandeman; Capt. F. G. Anderson, Calcutta; Mr. J. A. C. Greenwood, F.R.En.V. Soc., Bombay; and Mr. A. de B. Adam, Jubbulpore, C.P.

BOMBAY NATURAL HISTORY SOCIETY.

Office Bearers—1938.

Patron.—H. E. The Viceroy of India.

Vice-Patrons.—H. H. The Maharaja of Travancore, G.C.I.E.; H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, G.C.I.E., K.C.S.I., K.C.V.O.; H. H. The Maharaja of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar; H. H. The Nawab of Junagadh, G.C.I.E., K.C.S.I.; Sir David Ezra, Kt., F.Z.S.; F. V. Evans, Esq.; A. S. Vernay, Esq.; Lt.-Col. K. G. Gharpurey, I.M.S. (Retd).

The following gentlemen were elected to serve on the Managing Committee for the ensuing year:—

President.—H. E. Sir Lawrence Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Father J. F. Caius, S.J., F.L.S.; and Rt. Rev. R. D. Acland, M.A.

Executive Committee.—Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, M.I.A.; Mr. M. J. Hackney; Mr. D. G. Hill; Mr. H. L. Shoveller; Lt.-Col. W. C. Spackman, I.M.S.; Lt.-Col. S. S. Sokhey, I.M.S.; Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.; Mr. F. Wadia; Mr. P. M. D. Sanderson, F.Z.S. (*Honorary Secretary*); Mr. H. M. McGusty (*Honorary Treasurer*).

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S.; Lt.-Col. R. W. Burton, I.A. (Retd.); Mr. C. H. Donald, F.Z.S.; Dr. F. H. Gravely, D.SC.; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S.; Mr. R. C. Morris, F.R.G.S., F.Z.S.; Major E. G. Phythian-Adams, F.Z.S., I.A. (Retd.); Dr. Baini Prashad, D.SC.; Mr. H. C. Smith, I.F.S.; Lt.-Col. C. G. Toogood, C.I.E., D.S.O.; Mr. J. H. Williams.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER 1937.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J., F.L.S.; Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. H. D. Ash; Mr. Farrokh E. Bharucha; Sir Alwyn Ezra, Kt., F.R.G.S., F.Z.S.; Mr. A. Forrington; Mr. C. G. Freke, C.I.E., I.C.S.; Mr. J. B. Greaves, M.L.A.; Mr. D. G. Hill; Lt.-Col. S. S. Sokhey, I.M.S.; Lt.-Col. C. G. Toogood, D.S.O.; Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.; Mr. P. M. Sanderson, F.Z.S. (*Honorary Secretary*); Mr. H. M. McGusty (*Honorary Treasurer*), Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.SC., Madras; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian-Adams, I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Maymyo; Mr. F. Wadia, Poona; Mr. J. Williams, Coimbatore.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); C. McCann, F.L.S. (*Assistant Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1937.

The Society's Journal.—Three parts of Volume XXXIX of the Journal were published during the year.

MAMMALS.

Mongooses of British India.—Mr. Pocock's paper is based mainly on the collections made by the Society's Mammal Survey and on such material as was available at the British Museum. The Survey material was previously reported on in the *Journal* by Messrs. Oldfield Thomas and Wroughton. Pocock agrees with the view accepted by both Thomas and Wroughton that the Brown Mongoose of Ceylon, hitherto recognised as a distinct species under the name *Herpestes fulvescens*, is a race of the Brown Mongoose (*H. fuscus*) of the South Indian hill ranges. The author disagrees with Wroughton's recognition of the Small Nepal Mongoose (*H. nepalensis*) and the Ceylon Mongoose (*H. lanka*) as distinct species, and regards the former as a racial form of the Small Indian Mongoose (*H. javanicus auropunctatus*), and the latter, of the Common Indian Mongoose (*H. edwardsi*). The author thus reduces the total number of species occurring in British India to six. A reduction is also made in the number of sub-species.

Wroughton, Thomas and Miss Riley, from their study of the splendid material provided by the Survey, differentiated a number of races which cannot be recognised as such. The variations indicated in many of these so-called sub-species may be attributed to changes in coat and colour due to season. The author gives reasons for his conclusions and, following the methods adopted in his previous papers on Indian Carnivora, gives detailed descriptions of the individual species examined by him.

Measurements of Tigers.—Mr. G. H. L. Marshall publishes records of tigers shot by him in the Naga Hills, Assam. Out of a total of 59 animals (27 tigers and 32 tigresses) the average length of 18 full grown males is 8 ft. 7 in. and of 25 full grown females, 7 ft. 9 in. Only one tiger exceeded 9 ft. It taped 9 ft. 6 in. and was exceptional. Mr. Marshall suggests that the tigers of the Naga Hills are definitely smaller than those recorded from other areas in India. It would be interesting to obtain similar data from other parts of India. We have Sir John Hewett's record of tigers shot by him in Garhwal and Naini Tal. Eight males ranged between 10 ft. ¼ in. and 10 ft. 5½ in., while seven females were between 9 ft. and 9 ft. 3 in. Unfortunately Sir John's records from Naini Tal and Garhwal all relate to large animals. We do not know whether smaller animals were shot by him in this area and have therefore no means of arriving at a conclusion regarding the average size of tigers in Garhwal. Average measurements, arrived at from records such as Mr. Marshall has kept, if obtained from different provinces, will help us to arrive at more definite conclusions regarding the size attained by tigers in different parts of the country.

Man-eating Hyaenas in the United Provinces.—Reports have appeared from time to time in the press of Hyaenas attacking human beings in the United Provinces. Investigations made by the Society through responsible district officers revealed two instances in which children were reported to have been killed by hyaenas and one authentic case in which the hyaena was actually seen carrying off a child which was subsequently rescued. Hunger induced by shortage of the natural food may have been the contributory cause. It is suggested that man-eating, once established in an individual, may become a tradition passed on from a mother to her offspring; hence attacks on human beings may recur within a particular area over a number of years, till the particular stock which has acquired this trait has been exterminated.

Birds.

Scientific Surveys.

Vernay Scientific Survey of the Eastern Ghats.—With the publication of parts XV and XVI dealing with the waders and ducks, Messrs. Whistler and Kinnear bring to a close their reports on the Eastern Ghats Survey which commenced in the year 1933. The survey of this area, undertaken in the year 1929-30, was made possible by the generous assistance of Mr. A. S. Vernay who

contributed a sum of Rs. 14,300 towards the expenses. 1,777 birds and 1,621 mammals were collected in the districts traversed by the Eastern Ghats. The mammal collections were reported on by Mr. Pocock and Mr. Fry, and the bird collections by Messrs. Whistler and Kinnear. Previous to this survey, little was known of the Ornithology of the Madras Presidency; while, as regards mammals, the Eastern Ghats area had not been worked by the Mammal Survey. The ornithological reports on the results of the survey have been written in the form of an account of the Birds of the Madras Presidency. The reports include all the species hitherto recorded from the Madras Presidency, whether collected by the Survey or not and thus provide an up-to-date account of the avifauna of the Province. Apart from this, the authors have dealt with each species from the standpoint of its general distribution within the boundaries of British India, supplementing and frequently correcting the data recorded in the new *Fauna*. The work thus provides us with more precise knowledge of the range and movements of various species. Further, by meticulous labour and research they have helped to unravel the existing confusion in the nomenclature of many species and, from a careful study of all published records and of the collections made available by the survey and through other sources, they have been able in many instances to revise what has hitherto been recorded regarding the geographical races of species dealt with.

Ornithologists in India owe a deep debt of gratitude to Mr. A. S. Vernay whose generosity made this survey possible and to Mr. H. Whistler and Mr. N. B. Kinnear for their labours. The painstaking thoroughness and the care that they have devoted to the preparation of the report have made the work the most important contribution to Indian Ornithology of recent years.

Surveys of Travancore and Cochin.—These surveys were undertaken on behalf of the Society by Mr. Salim A. Ali in the year 1933, to link up with surveys made in the Eastern Ghats and Hyderabad State. The expenses were met by grants made by the States for this purpose. The material obtained was reported on by Mr. Salim A. Ali, assisted by Mr. H. Whistler. Publication commenced in 1935; and with the issue of parts VII and VIII during the year the series has been concluded. What was known previously of the ornithology of Travancore was based mainly on the papers written many years ago by Hume and Fergusson. The present surveys, and Mr. Ali's reports on the collections made by him provide a consitlerable extension of our knowledge of the ornithology of this interesting area. The value of Mr. Ali's papers is enhanced by the ecological notes made by him while collecting in the field. The work reveals what can be done by a collector with an understanding of what work *in the field* implies. Systematics provide the basis of Biological Science but, if we are to advance beyond the foundations, there are other roads upon which this advance must be made, and one of them is the study of the living animal in relation to its environment. It is work, whose importance is being increasingly recognised and which offers abundant opportunity to students in this country. The thanks of

the Society are due to Mr. Ali for the very thorough manner in which he has carried out these surveys and for the valuable contributions he has made to Indian Ornithology.

North-Western India.

Sind and the Punjab.—Mr. K. R. Eates wrote on the distribution and breeding of the Koel (*Eudynamis scolopaceus*), the Greater Spotted Eagle (*Aquila clanga*), the Large Indian Paroquet (*Eupatria nepalensis*), the Northern Yellow-fronted Woodpecker (*Leiopicus mahrattensis blanfordi*) and the Rock-Horned Owl (*Bubo bubo bengalensis*) in Sind. The notes supplement the data provided in Ticehurst's work on the birds of the Province. The drying up in Sind, within the last fifty years, of many lakes and swamps has accounted for the disappearance or comparative scarcity of many species which were once abundant. The Samaro Dhand, once the breeding ground of hundreds of Cormorants, is now bone dry. Another species affected is the larger Spotted Eagle which, when Hume wrote about it 64 years ago, was the commonest species in Sind and which, as Mr. Eates shows, is now being replaced in the drier tracts by the Indian Tawny Eagle (*Aquila vindhiana*). On the other hand, the extension of cultivation and the planting of trees along natural and artificial waterways is attracting other species, among them the Koel which, unknown in the Province fifty years ago, first localised itself in Karachi and its environs, and which has now extended its permanent territory as far north as Nawabshah. The occurrence of this bird in towns and villages along the Pinyari Canal, which runs from Kotri to the southern boundary of the Province, suggests that its line of advance into Sind has been from Cutch and the Kathiawar States. The Large Indian Paroquet (*Eupatria nepalensis*) is another species which is extending its range in the Province. The great perennial canals now made possible by the Sukkur Barrage and the impetus given to cultivation and the planting of trees is radically affecting the fauna and flora of the Province whose physical features are undergoing so great a transformation under the agency of Man. Fortunately, ornithologists of the future in computing the nature, and extent of these changes, will have as the basis for comparative study Dr. Ticehurst's work on the birds of the Province. The value of such work to future students is emphasised in the paper on the *Birds of Lyallpur*, contributed by Messrs. M. Afzal Husain and Hem Raj Bhalla of the Punjab Agricultural College, Lyallpur. The area about which they write is particularly interesting as within the last forty years it has been transformed by intensive irrigation from a barren wilderness with typical desert vegetation into one of the most highly cultivated parts of the Punjab, where a rotation of crops and an increase of fruit and ornamental trees now provide food and shelter for an abundant bird life. The authors remark they had unfortunately no data as a basis for comparative study and were unable to indicate the extent to which the environmental changes had effected the bird life of the

area. Besides providing a list of the birds of Lyallpur the authors deal especially with the food of the birds listed by them. This is a question of importance to agriculturists in India where so little is known about the significance of various species of birds in the control of insect pests of crops. Such scanty notes as existed were published by Mr. Mason in his paper on the Food of Birds in India (*Agri. Dept. Memoirs Entom. Series*, Vol. III). Mr. D'Abreu has carried out parallel investigations in the Central Provinces, and the present paper on the Birds of Lyallpur is a useful addition to the literature on the subject. Three years ago the Society made a representation to the Imperial Council of Agricultural Research in support of Mr. Salim Ali's proposal to carry out a systematic investigation into the food of birds in this country. The proposal received the support of the Bombay Provincial Committee, but a final decision on this question has been relegated to the nebulous future. We take this opportunity for stressing once again the need for the survey which cannot but be beneficial to the progress of agriculture in this country, and would draw a parallel to the intensive investigation into the food of birds carried out by the Board of Agriculture in the United States where the value of such research is appreciated.

The Revd. E. A. Storrs Fox's paper on the Birds of Murree is based on observations made in the hill station between the years 1932 and 1935. As the author's notes cover the cold weather, the paper forms a useful supplement to the previous articles on the birds of this area by Rattray (1903-4, vol. xvi, pp. 421, 675) and Magrath (1908, vol. xix, p. 142).

Mr. H. W. Waite reported the occurrence of some rare and hitherto unrecorded species in the Punjab; additions to the Punjab list are the Bronze-winged Jacana (*Metopodius indicus*), the Broad-billed Roller (*Eurystomus orientalis*), and Hodgson's Golden-backed Woodpecker (*Chrysocolaptes guttacristatus sultaneus*).

Peninsular India.

Bombay and Salsette.—Parts II and III of the serial on the birds of Bombay and Salsette were published. The authors, Messrs. Salim Ali and Humayun Abdulali, aim at providing a handbook of the birds of these islands based on all the available records. Their notes on field identification, breeding habits, etc. enhance the interest and value of the work which, when completed, will be issued with the series of pamphlets on the Fauna of the Islands of Bombay and Salsette published by the Prince of Wales' Museum.

Southern India.—Mr. Edward G. Nichols contributed a paper on the Birds of Kodaikanal, a popular hill station in the Palni Hills, Madura District. The paper is confined to the birds observed in the station between April and June, and is intended especially as a guide to visitors who come there for the hot weather. Notes on field identification, haunts and song are included as a help to the recognition of the various species, 90 of which are listed in the work.

Mr. J. Williams wrote on the Game Birds of Anaimalai Hills and the South Coimbatore District. His paper deals with the game and semi-sporting birds occurring in the Valparai Planting District, the *sholah* country above it, and also in the low country around the foot hills of the Anaimalais. Deforestation in the developed areas has led to a distinct increase in the number of Fantail Snipe.

Mr. F. N. Betts contributed a well illustrated paper on the Birds of a South Indian Tank in the Province of Coorg. Ecological notes of this description covering bird life in relation to a particular environment deserve encouragement and indicate a line of study which might with advantage be followed by others in the country.

Mr. C. H. Biddulph supplements the information provided by the Vernay Scientific Survey of the Eastern Ghats in relation to the distribution and breeding of the White-bellied Sea-Eagle (*Haliaëtus leucogaster*) and the Short-toed Eagle (*Circaëtus ferox*).

Major Phythian-Adams records the occurrence of the Bittern in South Mysore marking an extension of its southernly range.

Burma.

Mr. P. F. Garthwaite, assisted by Dr. C. B. Ticehurst, contributed observations on birds collected by him in the plains and foot hills of Burma. His notes supplement or correct the information provided in the new edition of the *Fauna* regarding the status and distribution of the species listed by him.

Mr. J. K. Stanford contributed notes on some rare birds of Northern Burma. Among the species mentioned are the White-collared Ouzel (*Turdus merula albocincta*), the Hen Harrier (*Circus cyaneus*) and the Scaup (*Nyroca marila marila*) which have not been recorded previously from Burma.

Birds and Ants.—In Vol. xxxviii, No. 3 of the Society's *Journal* Mr. Salim Ali referred to previous observations on the curious habit of birds introducing ants into their plumage. Many species indulge in this behaviour; some, like the crows and starlings, not only stick ants among their feathers but literally bathe in swarms of ants. In response to Mr. Ali's note further contributions were made to this interesting question by Capt. R. S. P. Bates, who describes how he saw a Song Thrush bathing in a swarm of red ants issuing from the ground; the crushed bodies of the ants could be seen adhering to the plumage. Mr. Bainbrigge Fletcher describes similar behaviour on the part of a Drongo which picked up ants with its beak and, before swallowing them, rubbed them on the root of its tail and also under its wings. The suggested explanation is that the birds employ the ants to rid themselves of parasites. Formic acid, which is well known for its antiseptic properties, emanating as it does from the crushed bodies of ants, might well have the effect of ridding the plumage of parasites. This is theory. How far the conclusion is correct further observation and experiment can alone decide. One interesting aspect of the question is that the habit is shown to be instinctive in as much as young birds taken from the nest, which could

not have had a similar experience before, behaved exactly in the same way, though their plumage showed no trace of parasites.

Mr. Lowther's beautifully illustrated article on Nightjars deserves special mention. His camera studies of Indian Birds are delightful and their interest is enhanced by the well written narrative of his experiences with his subjects.

Reptiles.

Mr. A. G. L. Fraser completed his papers on the Snakes of Deolali. Part II dealt with the osteological characters of the snakes. Part III records the species obtained in the area. The author is to be congratulated on an extremely well written and interesting paper involving considerable original research in a fresh field of investigation.

The variation in the structure of the hemipenis in the Green Pit Viper, known as *Trimeresurus gramineus*, first indicated by Mr. and Mrs. Pope led them to recognise four distinct species: *gramineus*, *albolabris*, *stejnegeri* and *occidentalis*. *Gramineus* was restricted by them to the Indo-Chinese region, the westernly limit of its range being Darjeeling and the hill ranges of Assam; while the species occurring in the Indian Peninsula was given the name *occidentalis*. Dr. Malcolm Smith however indicates that the type locality of *gramineus* is Vizagapatam, and as such this name is more applicable to the Indian form. For the Indo-Chinese species, Dr. Malcolm Smith provides a new name *Trimeresurus popeiorum*. In the same paper, Dr. Smith gives reasons for applying Zaumenti's name *nepa* to the viper hitherto known as *Ancistrodon hypnale*.

A new species of Agamid Lizard (*Japalura kaulbacki*) is described by the author. The type is based on an immature male obtained by Mr. R. Kaulback in the Nyum Tamai Valley and Burma-Tibet Border.

Mr. C. McCann contributed an interesting article on the Common Agamid Lizard (*Calotes versicolor*) usually known as the Bloodsucker, in which he gives a detailed account of the breeding habits of the species.

Fishes

During the year we commenced publication of a serial, illustrated in colour and black and white on the *Game Fishes of India* by Dr. S. L. Hora. It is being written more or less in the lines of Stuart Baker's popular paper on Game Birds. Three parts were issued. They deal with the Indian Trout [*Barilius* (*Opsarius*) *bola*], the Bachhwa (*Eutropiichthys vacha*), and the Garua (*Clupisoma garua*). Since Thomas wrote his classic 'The Rod in India' progress has been made in our knowledge of Indian Fishes, but unfortunately, as the author points out, the scientific nomenclature of the various forms is in great confusion and it is difficult without much research to fix the precise generic and specific limits of even such common species as the Mahseer, generally

known under the name of *Barbus tor*. While Dr. Hora's researches add considerably to the scientific value of these articles, his paper also includes such data as were available regarding the habitats and habits of the fishes described. These notes will be of particular interest to anglers and an appeal is here made to all those interested in the subject to send notes on fish and fishing to the *Journal* of the Society.

Fishes of Deolali—Apart from his interest in Snakes, Mr. Fraser during his stay in Deolali carried out a systematic survey of the Fresh Water Fishes of the area. Between June 1935 and May 1936, he collected some 4,463 specimens from different localities in and around Deolali and supplemented his collection with profuse ecological notes on fish life in various types of habitat. These collections form the basis of four papers by Dr. Hora. Part I gives the list of species with the description of the localities in which they were obtained. Part II, written by Fraser, contains his notes on the ecology of the fishes of the area. Parts III and IV, which will be published in 1938, will contain descriptions of new species and will discuss the geographical relationships of the fish fauna of Deolali with special reference to its affinities with that of the Deccan. The thanks of the Society are due to Mr. Fraser for the excellent manner in which he has carried out his survey, and to Dr. Hora and Mr. K. S. Misra for their work on these collections which will form an important contribution to Indian Ichthyology.

Invertebrates.

Two articles of particular economic interest issued during the year are Mr. N. K. Panikar's article on the Prawn Industry of Travancore and Cochin, and Mr. C. McCann's paper on the Land Crabs of Bombay and Salsette. Mr. N. K. Panikar draws attention to the great possibilities of development of the Prawn fisheries in the backwaters of Travancore. He describes the history of the industry and the methods under which prawns are captured and marketed. He indicates that the marked deterioration in the industry is due in a large measure to various remediable handicaps. There is the lack of any scheme of planned production, secondly imperfect methods of preparation of the product, which limit the area of consumption and prevent successful competition, and finally the absence of any organization for marketing the produce. The author indicates methods by which the yield may be increased, and stresses the need for an investigation into the feeding, breeding and migratory habits of the prawns, and proposes improvements in methods of preservation and marketing.

Mr. McCann describes the life history and habits of the Land Crab (*Paratelphusa guerini*). Land Crabs, the genus *Paratelphusa* in particular, are generally considered as serious pests of paddy crops in certain districts. The author's conclusions regarding *P. guerini* in Salsette are that the damage done to rice crops is negligible. There is no general invasion of the fields by these crabs and such nipping of the leaf blades before transplanting as takes

place is generally done by crabs living within the field. The damage is not severe. The author holds that the only real damage the crabs are responsible for is the riddling of the *bunds* between the fields with their burrows, thereby weakening them and causing their collapse. Damage to plant life is negligible.

Insects.

Afghanistan.—Collections made in North Afghanistan by N. N. Umnov in 1930 provide the basis of a paper on the *Blattodea, Mantodea, Phasmodea* and *Orthoptera* by Leo Misthenko. Such data as were available on the fauna of this little known area have been included in the paper. Several species are recorded for the first time and five new species of *Acridodea* are described.

Chinese Turkestan.—A paper on the Butterflies and Moths of Chinese Turkestan was contributed by Lt.-Col. J. W. Thomson-Glover. It is based on collections made in the Tekkes Valley, Tian Shan Mountains and the Bashi Valley, 80 miles south of Kashgar, and from Bostan Terek. The moths were mainly collected in the Residency gardens at Kashgar. The paper also includes a list of species collected on the journey from Srinagar to Kashgar and is supplemented with a list of the *Lepidoptera* collected by Stolickza within the Province in 1873 and 1874.

Aphids of the Deccan.—Mr. V. G. Deshpande of the Agricultural College, Poona, published a preliminary account of aphids collected by him in Poona during the last four years. Though these insects occupy a place among the major pests of agricultural crops in India, we have little knowledge about them and the only literature dealing with Indian species is the Aphididae of Lahore by Das (*Mem. Ind. Mus.*, Vol. vi, No. 4, 1918). A more complete knowledge of the life and habits of these insects is a necessity both from the economic and academic standpoints.

Interesting papers on the life history and habits of a Carton-Building Ant (*Crematogaster dohrni artifex*) and the Marriage Flight and Colony Founding habits of our Common Black Ant (*Camponotus compressus*) were contributed by P. N. Krishna Ayyar.

Botany.

In his paper on the Mosses collected in the Balipara Frontier tract in Assam by Dr. N. L. Bor, Mr. H. N. Dixon makes an important contribution to the bryology of the Province. The literature on the mosses of this area was limited so far to the work of Griffith and Mitten published in the *Musci Indiae Orientalis* and to the author's previous work on the mosses collected during the Abor Expedition (*Rec. Bot. Survey Ind.*, vi, pp. 57-73). The present paper is exceptionally welcome, dealing as it does with a particularly interesting area which has never been explored botanically. 40 species new to Science are described and 1 new genus.

Rev. Fr. Caius continues his series of articles on the Medicinal and Poisonous Plants of India. The orders dealt with are the

Spiderworts (*Commelinaceae*), the Campions and Pinks (*Caryophyllaceae*) and the Crowfoots (*Ranunculaceae*). The last family is one of the most important as there is scarcely a single plant throughout the order which can be regarded as harmless while some are deadly. Fortunately most crowfoots lose their acrid qualities when cooked or dried.

Publications.

Beautiful Indian Trees, by the late Rev. E. Blatter and Mr. W. S. Millard, which appeared originally as a serial in the Society's Journal, was published during the year. The book has been very favourably reviewed both in England and in this country. Its beautiful illustrations and the attractive manner in which the subject has been handled by the authors make it a work welcome to students and laymen. It maintains, as indicated by one of its reviewers, "the broad educative outlook which is known to be the policy of all the works of the Society."

The Museum.

The Natural History Section of the Prince of Wales' Museum where the Society's collections are now shown has been closed to the public since 1936 owing to the transfer of the collections to the New Wing. Work on installing the collections has been carried out since that time and three galleries—Mammals, Birds, Reptiles and Fishes are ready and will be opened by H. E. the Governor of Bombay on the 17th of March 1938. It is proposed to issue in the *Journal* a descriptive account of these galleries which are among the finest to be seen in any country; they indicate the advance which has been made in museum methods and technique during recent years.

Revenue Account.

This shows a deficit of Rs. 2,262-5-5 as compared with Rs. 835-10-5 last year.

Membership is down by 35 and the loss under this head is accounted by the fact that 44 members have not yet paid last year's subscription.

We have been fortunate in enrolling a new Vice-Patron—H. H. The Nawab of Junagadh, whose support is greatly appreciated, and we start 1938 well with a cheque for Rs. 5,000 from the Prince of Wales' Museum in repayment of work carried out and financed by the Society.

Expenditure.

This shows a small increase of Rs. 132, compared with 1936.

Salaries and wages are up by Rs. 766, due to the restoration of the cut of 4 per cent, and it is satisfactory to note that other items of expenditure have been reduced.

Membership.

During the year 1937, 42 new members and 2 Life Members joined, 4 members died and 74 resigned.

The total number of Members on the Roll of the Society (excluding 186 Life Members) was as follows:—

31st December 1936	...	964
,, ,, 1937	...	929

Taxidermy.

The Society's Taxidermy Department will close down at the end of April.

Mr. Johnson, our Taxidermist, has secured a promising appointment with the Singapore Museum, and will be leaving us when the work which he has in hand is finished. We wish him all success in his new appointment.

Staff.

The Committee wish to record their appreciation of the good work done by the Curator and his staff during the past year.

PRINTED AND PUBLISHED BY V. M. PHILIP AT THE DIOCESAN PRESS, 18, CHURCH ROAD, VEPERY, MADRAS

EDITORS: P. M. D. SANDERSON, S. H. PRATER, C. MCCANN, 6, APOLLO STREET, FORT, BOMBAY

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BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1937.

LIABILITIES	Rs A P	Rs A P	ASSETS	Rs A P	Rs A P
Life Membership fees :		50,725 0 0	*Investments—At holding value or Market value whichever is lower :—*		
Donations for specific objects unexpended :			Rs. 35,000 3½% Loan 1947/50 at 102½% ...	35,787 8 0	
Show Cases, Models of Fish, etc. in Prince of Wales Museum—Account No. 1 ...	1,384 14 7		,, 15,000 5% do. 1945-55 at par ...	15,000 0 0	
Show Cases, etc. in New Building, in Prince of Wales Museum—Account No. 2.	2,035 9 11		,, 10,000 3% do. 1951-54 at 98% ...	9,800 0 0	
Special Journal Fund	8,773 2 4		,, 14,000 4% Bombay Port Trust Bonds at 77%	10,780 0 0	
Ornithological Survey	1,619 9 3		,, 15,000 4 % Bombay Improvement Trust Bonds at 76%... ...	11,400 0 0	
		13,873 4 1			82,767 8 0
Sundry Creditors :			Rs. 89,000		
			Cash—		
Brig. W. H. Evans, account Butterfly Books	118 6 10		With National Bank of India, Ltd., Bombay	305 3 7	
Messrs. John Bale Sons and Curnow, account Tree Book	2,042 15 1		With National Bank of India, Ltd., London, £160-4-0 at 1/6	2,136 0 0	
The Diocesan Press, Madras	1,941 13 2		Fixed Deposit with P. & O. Banking Corporation, Ltd., Bombay	5,000 0 0	
Messrs. Vandyke Printers	473 5 4		On hand	150 9 0	
For Expenses (Audit fee)	250 0 0				7,591 3 7
		4,826 8 5	*Sundry Debtors :*		513 0 0
Surplus Assets :			*Taxidermy Department :*		190 3 4
			Advances to Staff :		315 0 0
Balance as per last Balance Sheet ...	28 446 6 8		*Furniture :*		
			As per last Balance Sheet	1577 0 0	
	Rs A P		*Less* Depreciation	25 0 0	
Less—Libel Case... ...	1,918 4 0				1,552 0 0
Loss of Revenue Account.	2,262 5 5		*Publications excluding Journals :* Stock on hand as certified by the Hon. Secretary ... ,, ...		300 0 0
	4,180 9 5				
		24,265 13 3	*Game Books, Vol. III :* Stock on hand as certified by the Hon. Secretary		357 0 1
			Beautiful Indian Trees : Stock on hand as certified by the Hon. Secretary		104 10 9
Total ...		93,690 9 9	Total ...		93,690 9 9

Note.—A stock of 20,100 old Journals and the valuable research collection and Library of 2,600 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

BOMBAY, *1st March, 1938.*

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants. Auditors.

H. M. McGUSTY,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY

Dr. *REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1937.* *Cr.*

	Rs A P	Rs A P		Rs A P	Rs A P
To Salaries	18,991 0 0		By Subscriptions	19,629 13 0	
,, Society's Contribution to Staff Provident Fund	1,440 13 0		,, Entrance Fees	450 0 0	
,, General Charges	635 9 4		,, *Sales of :*		
,, Rent	2 436 0 0		Old Journals	854 0 4	
,, Stationery and Printing	288 2 5		Game Books, Vols. I & II	540 5 2	
,, Postage	713 14 6		Society's Publications	455 9 3	
,, Library	230 1 2		Bird Charts and Albums	421 6 7	
,, Audit Fee	250 0 0		,, Interest on Investments and Fixed Deposit	3,159 0 5	
,, Fire Insurance	150 0 0		,, Profit on outside works ...	925 15 7	
,, Depreciation on Furniture	25 0 0		,, (Vice-Patronship Donation)	2,500 0 0	
,, Cost of printing Journals	6,037 15 4				28,936 2 4
		31,198 7 9	,, Expenditure over Income carried to Balance Sheet		2,262 5 5
Total ...		31,198 7 9	Total ...		31,198 7 9

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1937.

	Rs A P	Rs A P		Rs A P	Rs A P
To Stock of Game Books, Vol. III	536 12 1		By Sales of Game Book, Vol. III	183 0 0	
,, Expenses during the year	3 4 0		,, Stock on hand (31st December, 1937) ...	357 0 1	
		540 0 1			540 0 1
,, Stock of Beautiful Indian Trees ...	1,550 7 7		,, Sales of Beautiful Indian Trees	5,487 14 11	
,, Expenses during the year	4,042 2 1		,, Stock on hand (31st December, 1937) ...	104 10 9	
		5,592 9 8			5,592 9 8

Dr. **Cr.**

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1937.

	Rs A P	Rs A P		Rs A P	Rs A P
Fund No. 1					
To Expenditure on Fish Gallery, etc. ...	1,277 6 0		By Unexpended Balance as per last Balance Sheet	1,362 14 7	
,, Balance carried to Balance Sheet ...	1,384 14 7	2,662 4 7	,, Donations for the Modeller's Salary, etc.	1,300 0 0	2,662 4 7
Show Cases Fund No. 2					
,, Expenditure on Show Cases in New Building	1,725 8 0		,, Unexpended Balance for Show Cases in New Building as per last Balance Sheet		3,821 1 11
,, Balance carried to Balance Sheet ...	2,095 9 11	3,821 1 11			
Special Journal Fund					
,, Expenditure on Journals	2,666 6 2		,, Unexpended balance (Special Journal Fund) as per last Balance Sheet ...	11,089 8 6	
,, Balance carried to Balance Sheet ...	8,773 2 4	11,439 8 6	,, Donation received during the year ...	350 0 0	11,439 8 6
Ornithological Survey					
,, Expenses on Ornithological Survey ...	1,380 6 9				
,, Balance carried to Balance Sheet ...	1,619 9 3	3,000 0 0	,, Donation for Ornithological Survey ...		3,000 0 0

BOMBAY, *1st March 1938*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.
Chartered Accountants, Auditors

(Sd.) H. M. McGUSTY,
Honorary Treasurer.

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Dr. *Cr.*

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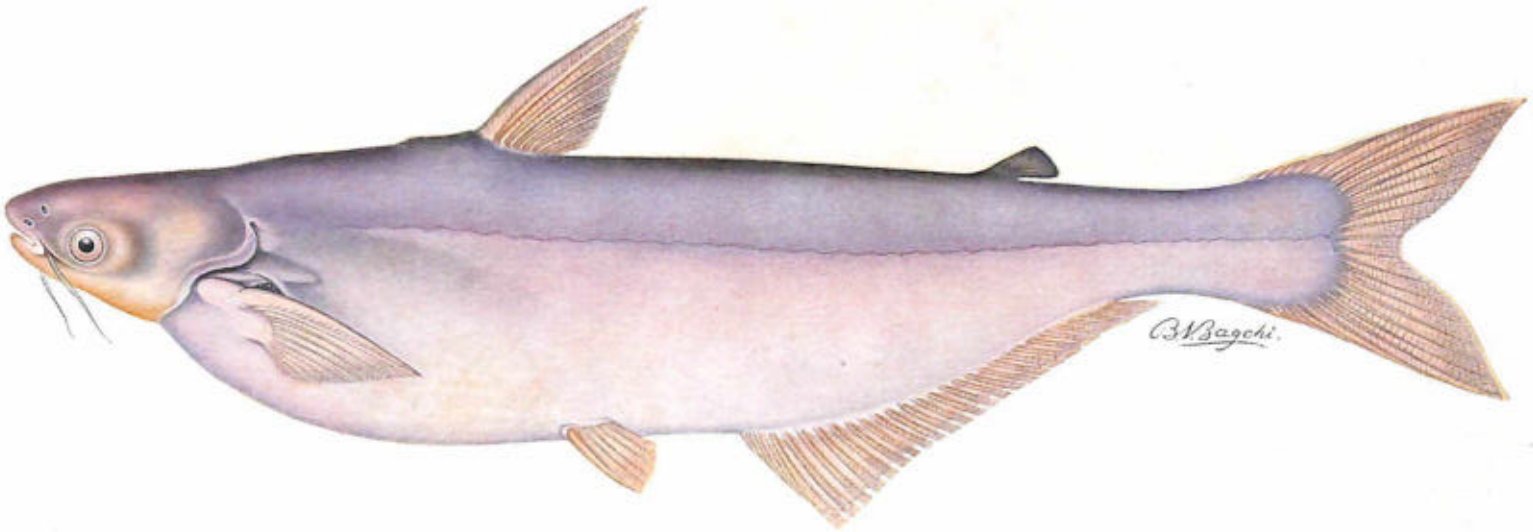
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THE PUNGAS CATFISH

Pangasius pangasius (Hamilton).

JOURNAL
OF THE
Bombay Natural History Society.

1938. VOL. XL. No. 3.

THE GAME FISHES OF INDIA.[1]

BY

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(With one plate and four text-figures).

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V.—THE PUNGAS CATFISH.

PANGASIUS PANGASIUS (Hamilton).

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INTRODUCTION.

In the preceding article (8)[2] attention was directed to certain large Catfishes which are popularly known as 'Freshwater Sharks'. Of these *Pangasius pangasius* (Ham.) is perhaps the least destructive to fisheries; it is a foul feeder and consumes considerable quantities of mud and decaying animal and vegetable matter from

[1] Published with permission of the Director, Zoological Survey of India.
[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

the bottom of estuaries and lower portions of large rivers where it lives. On account of its foul habits and estuarine habitat it is not a favoured species with the anglers, and has received very little attention from the writers of books on angling in India. Thomas (12), however, makes a passing reference to it in *Rod in India*. It is a valuable food fish and grows to a size of about 4 feet or more. During dry months large quantities of this fish are imported into Calcutta from the neighbouring estuarine creeks, especially the Matlah at Port Canning, and command a ready sale. Very little is known about the bionomics of the species and much less about suitable tackle and appliances for catching the fish with rod and line. In the present article, therefore, I shall mainly confine myself to the scientific treatment of the species and the allied forms.

Nomenclature and Systematic Position.

Hamilton (5) described the *Pungas* Catfish in his composite genus *Pimelodus* and characterised it as

'A *Pimelodus* with four tendrils; with the tail fin bifid; and with the prickles of the back fin and pectorals very little longer than the membrane.'

Cuvier and Valenciennes (3) found considerable difference between Hamilton's species and those referred to the American genus *Pimelodus*. Consequently they proposed a new genus *Pangasius* for its reception and observed that:—

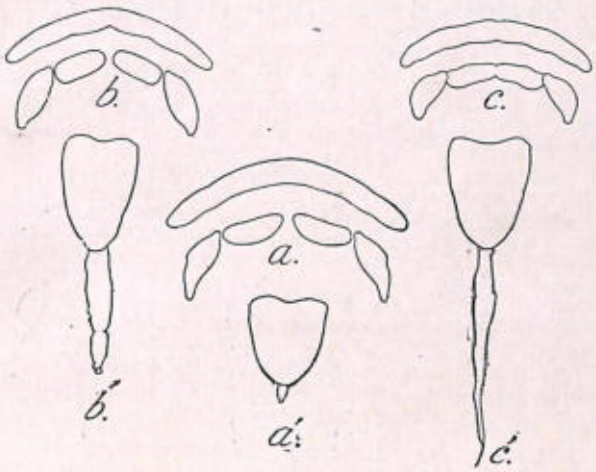
'Le Bengale a aussi des siluroïdes à casque peu chagriné, et à quatre barbillons; mais leurs barbillons sont beaucoup plus courts qu' à ceux d' Amérique. Les rayons de leurs nageoires ne se prolongent pas, et, ce qui est plus important, ils ont dix rayons aux ouïes. Cette considération me force a les séparer des précédens, et montre l' affinité que ces espèces ont avec les platystomes.'

Cuvier and Valenciennes re-christened the species *Pangasius buchanani*, but, in accordance with the International Rules of Zoological Nomenclature, the specific name cannot be changed except under very special circumstances. The correct scientific designation of the species should, therefore, be *Pangasius pangasius* (Hamilton).

Though in India proper the genus *Pangasius* is represented by a single species, *P. pangasius* (Ham.), several species have been described from the Malay Archipelago, Siam and Indo-China. The genus is thus essentially a Far Eastern genus and India forms the western limit of its distribution. Some of the Malayan species, now included in *Pangasius*, were assigned to different genera, *Pseudopangasius* 1862, and *Neopangasius* 1904, by Bleeker (1) and Popta (10) respectively. Both the genera were erected on differences in the nature of the vomerine and palatine bands of teeth, but as these structures vary considerably, even in the individuals of the same species, both *Pseudopangasius* and *Neopangasius* are now regarded as synonyms of *Pangasius*.

In separating the Indo-Australian species of *Pangasius* Weber and de Beaufort (13) have attached great importance to the bands of teeth on the palate. I have found that in young specimens of *P. pangasius* (text-fig. 1a), about 78 mm. in standard length, the

vomerine and the palatine bands are quite distinct, and, as a rule, the former are separated from each other by a considerable distance.



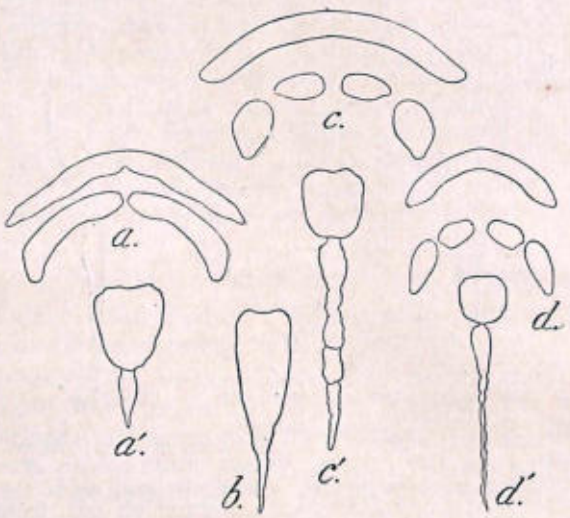
Text-fig. 1.—Upper dentition and air-bladder of 3 specimens of *Pangasius pangasius* (Hamilton), showing variation in form with growth. *a.,a'.* From a specimen 78 mm. in length without caudal; dentition ×3½, air-bladder Nat. size; *b.,b'.* From a specimen 187 mm. in length without caudal: dentition ×1½, air-bladder ×½; *c.,c'.* From a specimen 207 mm. in length without caudal: dentition ×1⅛, air-bladder ×½.

In some examples (text-fig. 1*b*), up to about 187 mm. in length, the tooth-bands are still distinct, but in older specimens the bands become united. In some cases the bands are indistinguishably mixed up, whereas in other cases the boundaries of the various bands can still be discerned. *P. pangasius* is a very specialised member of the genus, and in its development probably passes through some of the primitive stages of growth of dentition in *Pangasius*. In this connection I have studied the dentition of certain Siamese species represented in the collection of the Zoological Survey of India.

In *P. hypophthalmus* (Sauvage), the maxillary teeth are poorly developed or totally absent and those usually present on the palate are always absent. This type of dentition is generally associated with the fishes of the genus *Helicophagus*. In *P. larnaudii* Bocourt (text-fig. 2*a*), the vomerine and the palatine teeth of each side are united, but the two bands thus formed are separated in the middle. In *P. micronema* Bleeker (text-fig. 2*c*) the four patches of teeth on the palate are quite distinct; while in *P. siamensis* Steindachner (text-fig. 2*d*), the tooth-bands, though distinct, are greatly approximated.

The simplicity in the form and structure of the air-bladder in *Pangasius* seems to be correlated with the simplicity of dentition. In *P. hypophthalmus* (text-fig. 2*b'*), the air-bladder consists of a bag-like structure which tapers considerably towards the posterior end. In *P. larnaudii* (text-fig. 2*a'*), the bladder is divided into an anterior and a posterior chamber: the former being much the larger

of the two. In *P. micronema* (text-fig. 2*c'*), the anterior chamber is considerably reduced, while the posterior chamber is elongated, narrow, and subdivided into several chambers. In *P. siamensis*



Text-fig. 2.—Upper dentition and air-bladder of certain species of *Pangasius* Cuv. and Val. from Siam.

a.,*a'*. *Pangasius larnaudii* Bocourt, length of specimen without caudal 150 mm.: dentition ×1½, air-bladder ×½; *b'*. *Pangasius hypophthalmus* (Sauvage), length of specimen without caudal 143 mm.: dentition absent, air-bladder ×½; *c.*,*c'*. *Pangasius micronema* Bleeker, length of specimen without caudal 154 mm.: dentition ×3, air-bladder ×½; *d.*,*d'*. *Pangasius siamensis* Steindachner, length of specimen without caudal 126 mm.; dentition ×3, air-bladder ×½.

(text-fig. 2*d'*), the condition of the bladder is similar to that in *P. micronema*, but is accentuated still further. In the development of *P. pangasius* we find that the air-bladder is of a primitive type in young specimens (text-fig. 1*a'*), but with growth the anterior chamber becomes considerably reduced while the posterior chamber becomes narrow and elongated (text-figs. 1*b'* and 1 *c'*). I have explained elsewhere (7) the causes that are probably responsible for a change in the form and structure of the air-bladder; but it may suffice to mention here that with the compression of body and an increase in the area of the tail region the internal organs are greatly squeezed for want of space. Of the visceral organs, perhaps the air-bladder is the least important in the economy of nature and for this reason it is gradually squeezed out of the body cavity as the demand for space by organs like the liver and the kidney increases.

The air-bladder of *P. pangasius* has received considerable attention; it was described for the first time by Taylor (11) as follows:—

'The *P. pangasius* has its air-bladder composed of four or more portions, extending in a line from opposite the pectoral fins, to near the end of the

tail. The first is generally oval, the second pyramidal, and the two last, which run between the caudal portions of the lateral muscles, approach to a cylindrical shape. The numerous septa on its internal surface descend from above downwards in the first portion; in the second, they run in a transverse direction; and in the posterior ones, form a number of irregular cells.'

As will be clear from the above this type of bladder is characteristic of large specimens over a foot in length. After Taylor, Day (4) described the air-bladder of the species as follows:—

'Air-vessel large, extensive, and divided into three portions. The anterior is somewhat heart-shaped, considerably the largest, and extends from the commencement of the vertebral column to nearly opposite the posterior extremity of the pectoral fin. Its remaining portions are narrow, compressed, and continued to opposite the middle of the anal fin, amongst the muscles covering the haemal spines. It then becomes narrow and reduplicated on itself for a short distance. On removing the front wall of its first and largest portion, its interior is seen to consist of two pear-shaped cavities, the bases of which are inferior and lateral, whilst they coalesce anteriorly; the whole of the posterior half of this portion is cellular; and so is the small intermediate space between the two uncelled pyriform portions. The two posterior divisions of the air-vessel have valvular shaped folds, partially subdividing its anterior.'

Day's description is somewhat different from that of Taylor and it seems that his account is based on a smaller specimen than that examined by Taylor. Bridge and Haddon (2) also gave an account of the air-bladder of *P. pangasius*, but they were certainly dealing with a much smaller specimen than the ones examined either by Taylor or Day. They described the air-bladder as follows:—

'The air-bladder consists of an anterior portion, which is broad in front and oval behind, and corresponds to the whole of the normal bladder, and also of a contracted tubular part extending backwards in the substance of the kidney to within about half-an-inch of the anus. The anterior portion is divided internally into a short but broad anterior chamber, and two relatively large lateral compartments by the usual primary transverse and longitudinal septa. The posterior section of the bladder is a simple tubular cæcum, communicating anteriorly with both the lateral chambers but terminating blindly behind.'

Bridge and Haddon also referred to the discrepancies in the accounts of Taylor and Day, and remarked:

'As regards the subdivision of the bladder, the two accounts are neither reconcilable with each other, nor with the description given above by us, and assuming that the specimens examined by Day and Taylor were really examples of *P. buchanani*, we can suggest no explanation of the discrepancy. Our own specimen was one from Dr. Day's collection of East Indian Siluroids and had been named by him *P. buchanani*, and we may also add that its characters agreed in almost every detail with the description of this species in the *British Museum Catalogue of Fishes* (vol. v, p. 62). It will be noticed, however, that both Taylor and Day agree as to the extension of the air-bladder into the caudal muscles, which was certainly not the case in the specimen examined by us.'

The form and structure of the air-bladder in specimens of different sizes (*vide supra*, p. 357) clearly indicated to me that Taylor, Day, and Bridge and Haddon were dealing with the same species, and that the discrepancies in their accounts were presumably due to the specimens examined by them respectively being of different sizes. With a view to elucidate the problem I requested Mr. K. K. Nair (9) to make a detailed study of the changes in the internal structure of the air-bladder of *P. pangasius* during growth.

His results fully bear out the conclusions I had arrived at on a superficial examination of the air-bladder in this species.

Besides *Pangasius pangasius* (=*P. buchanani*) Bridge and Haddon have described the structure of the air-bladder in *P. djambal, P. macronema, P. micronema* and *P. juaro.* The variations noted by them are as follows :—

'The air-bladder of *P. djambal* consists of an anterior portion subdivided in the usual way into an anterior and two lateral compartments, and also of a posterior cæcal appendage. The latter is not tubular, as in *P. buchanani,* but has the shape of an elongated, flattened, oval structure, and extends nearly to the hinder extremity of the abdominal cavity, being separated from the rest of the bladder anteriorly by a deep constriction; from its posterior end a small cæcal protuberance is given off, which is less than half an inch in length, and gradually tapers to a point near the anus.'

P. djambal is now considered as a synonym of *P. pangasius,* and it is significant to note that the above description of its air-bladder corresponds with the structure of the same organ in a specimen of *P. pangasius,* 207 mm. in length without the caudal (text-fig. 1c'). Day's description of the bladder of *P. pangasius* more or less agrees with Bridge and Haddon's description of the bladder of *P. djambal.* Another point worth noticing is that Bridge and Haddon found the walls of the air-bladder of *P. djambal* much thicker than in the case of any other species of *Pangasius* examined by them.

The air-bladder of *P. macronema* 'has thin walls, and consists of an anterior and somewhat rounded portion, which includes the anterior and two lateral compartments, and in addition also, a posterior much flattened, leaf-like cæcum connected with the foregoing by a short tubular stalk.'

In *P. micronema* 'The air-bladder is broadly ovate in shape but rendered slightly bilobed in front through the existence of a deep median notch in its anterior wall. Relatively to the lateral compartments the anterior chamber is very small, and there is no posterior cæcal appendage. The walls of the bladder are extremely thin.'

Bridge and Haddon noted that this species is remarkable in being 'without a trace of the oval plate so characteristic of other species of *Pangasius.*' Thus it is not provided with the so-called 'elastic-spring mechanism', and the transverse process of the 4th vertebra, both in shape and in the support which it affords to the post-temporal and pectoral girdle, conforms to the normal condition in the great majority of the Siluroid fishes.

It is abundantly clear from the above that the air-bladder of *Pangasius* is a very variable structure and that in young individuals and less specialised forms the so-called 'elastic-spring mechanism' may be absent altogether. The last structure has been regarded by some authorities as of sufficient importance to separate *Pangasius* from the rest of the Schilbeidae into a separate family, but this is not justified on morphological grounds.

The genus *Pangasius* may now be defined as follows :—

The body is elongated and compressed. The head and body are generally covered with soft skin; the head exceptionally granulated. The head is of moderate size; the snout is more or less prominent, rounded or bluntly pointed. The mouth is sub-terminal, horizontal or slightly ascending. The lips are thickened near the angles and are continuous; the post-labial groove is widely interrupted. The

nostrils are wide apart; the anterior ones are wide, look forwards and are situated along the front border of the snout; the posterior nostrils are provided with a lip anteriorly and are situated at some distance behind the anterior nostrils. The eyes have free orbital margins, are situated behind the corner of the mouth and generally a part of the eye is below a horizontal through the corner of the mouth. There are four short barbels; one pair maxillary and one pair mandibular. The maxillary barbels originate from the anterior ends of slits which commence above or behind the angle of the mouth and are continued below the eyes. The mandibular barbels originate considerably behind the tip of the lower jaw. The teeth are villiform; those in the jaws form curved bands. The vomerine and palatine teeth are in four patches which may be separate or variously united. In certain species the dentition is poorly developed (*vide supra*, p. 357). The dorsal fin is well developed; it is provided with a strong denticulated spine, which is preceded by another short and broad spine, and 6 to 7 rays; the anterior soft rays may be filiform. The adipose fin is small. The anal fin is elongate and provided with 28 to 40 rays. There is a considerable space between the anal and the caudal fins. The pelvics are 6-rayed. The pectorals possess strong, denticulated spines. The caudal fin is deeply forked. The gill-openings are wide; the gill-membranes are deeply notched, united, and free from isthmus. The branchiostegal rays vary from 7 to 11. The air-bladder is large and lies free in the abdominal cavity; it consists of two parts, a large anterior portion, which is broad in front and oval behind, and a small tubular part which extends backwards into the kidneys (for variations in the form and structure of the air-bladder, see *supra*, pp. 357-360).

Genotype:—*Pangasius buchanani* Cuv. & Val. 1840 (=*Pimelodus pangasius* Hamilton 1822).

Distribution:—Indo-China, Siam, Malay Peninsula and Archipelago, Burma, and India.

Relationships:—*Pangasius* formed the type of Bleeker's (**1**) group *Pangasii*, but with regard to its present-day systematic position there are two current views among the leading ichthyologists. Weber and de Beaufort (**13**) follow Bleeker and assign *Pangasius, Helicophagus, Lais* and *Pseudeutropius* to the family Pangasiidae which they characterise by the possession of a pungent dorsal spine, forked caudal fin, long anal with 28-40 rays, small mouth, free orbital margin, and a small adipose fin. Thus restricted, the family cannot include forms like *Ailia, Eutropiichthys*, etc. Regan (*Ann. Mag. Nat. Hist.*, (8) viii, p. 567, 1911) and Jordan (*Classification of Fishes*, p. 149, 1923) have included a large number of genera in the Schilbeidae but have excluded *Pangasius* from it for which they propose a separate monotypic family Pangasiidae. According to Regan the following are the salient features of the family:

'The Indian genus *Pangasius* differs from the Bagridae externally in the long anal fin, with 28 to 40 rays; maxillary and one pair of mandibulary barbels are present, but no nasal barbels. The skeleton is very similar to that of generalized Bagridae, differing only in the development of an elastic

spring mechanism, the anterior rami of the parapophyses of the fourth vertebra being expanded distally to form a pair of oval plates inserted in the anterior wall of the air-bladder, but free from the supra-cleithrum. The air-bladder consists of an anterior division, corresponding to a normal bladder, and of posterior tubular cæcum. Vertebrae 15+29.'

From Bridge and Haddon's account of the air-bladder and associated skeletal elements of certain species of *Pangasius* (*vide supra*, p. 360) it is clear that the so-called 'elastic-spring mechanism' is liable to considerable variation and that in some species of the genus it may be absent altogether. My work bears this out very fully and I see no justification for separating *Pangasius* from the remaining Schilbeid genera.

In another place I (**6**) briefly discussed the relationships of *Pangasius* to the other genera of the Schilbeidae and indicated that it probably evolved from *Pangasianodon*-like ancestors and in its turn gave rise to *Platytropius* Hora in Siam and to *Proeutropiichthys* Hora in India and Burma.

Synonymy and Description.

Pangasius pangasius (Hamilton).

1822. *Pimelodus pangasius*, Hamilton, *Fish. Ganges*, pp. 163, 376, pl. xxxiii, fig. 52.
1830. *Pimelodus pangasius*, Taylor, *Gleanings in Science*, p. 171 (Air-bladder).
1840. *Pangasius buchanani*, Cuvier & Valenciennes, *Hist. Nat. Poiss.*, xv, p. 45, pl. ccccxxv.
1846. *Pangasius djambal*, Bleeker, *Nat. Geneesk. Arch. Ned. Ind.* (2), iii, p. 290.
1853. *Pangasius buchanani*, Bleeker, *Verh. Bat. Gen.*, xxv, p. 118.
1858. *Pangasius buchanani*, Blyth, *Proc. As. Soc. Bengal*, p. 286.
1862. *Pangasius djambal*, Bleeker, *Atl. Ichth.*, ii, p. 73, pl. vii.
1863. *Pangasius buchanani*, Bleeker, *Ned. Tijdschr. Dierk.*, i, p. 107.
1864. *Pangasius buchanani*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 62.
1864. *Pangasius djambal*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 62.
1871. *Pangasius buchanani*, Day, *Prov. Zool. Soc. London*, p. 709.
1873. *Pangasius buchanani*, Day, *Freshw. Fish Fisheries India and Burma*, p. 264.
1877. *Pangasius buchanani*, Day, *Fish. India*, p. 470, pl. cviii, fig. 5.
1877. *Pangasius buchanani*, Beavan, *Freshw. Fish. India*, p. 135.
1889. *Pangasius buchanani*, Day, *Faun. Brit. Ind. Fish.*, i, p. 142, fig. 61.
1890. *Pangasius buchanani*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2) ix, p. 211.
1893. *Pangasius buchanani*, Bridge and Haddon, *Phil. Trans. Roy. Soc. London* (B), clxxxiv, pp. 214-219 (Air-bladder).
1907. *Pangasius buchanani*, Lloyd, *Rec. Ind. Mus.*, i, p. 222.
1913. *Pangasius pangasius*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, ii, p. 256.
1937. *Pangasius pangasius*, Nair, *Rec. Ind. Mus.*, xxxix, pp. 117-124 (Air-bladder).

Vernacular names:—*Pangas* (Goalpara): *Pangsa* (Nathpur); *Pungas* or *Pungwas* (Bengal); *Jellum* (Orissa); *Coola Kellette* (Tamil); *Nga dam* (Burma); *Nga tan* (Akyab).

B.9-10; D.2/6-7; A.30-34; P.1/12-13; V.6[1]; C.19.

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[1] In his list of the fishes of the Purnea (Purniah) District, Buchanan remarks about the *Pangsa* of the Kusi that 'the only specimen that I was able to procure had no abdominal fins.' The absence of one or both the pelvic fins among fishes is not an unusual occurrence.

In general appearance, *Pangasius pangasius* is not unlike *Silonia silondia*, but can be readily distinguished by the absence of the caniniform teeth in the jaws, and by the presence of two pairs of fairly well-marked barbels. The length of the head is contained from 3.5 to 4.8 times and the depth of the body from 4 to 5 times in the standard length. The head is more or less granulated on the dorsal surface. The snout is slightly prominent and obtusely rounded. The head is provided with a long, narrow, median fontanel. The occipital process is more than twice as long as broad at the base, and reaches to the base of the anterior, short dorsal spine. The eyes are situated partly on the lower surface of the head and almost in the anterior half of the head. The interorbital space is flat, and is slightly less than the length of the head excluding snout. The diameter of the eye is contained from 3 to 5 times in the length of the head, from 1 to 2 times in the length of the snout and from 1.4 to 3 times in the interorbital width. The mouth is inferior, lunate, and almost as wide as the length of the postorbital part of the head. The upper jaw is partly exposed. Generally the maxillary barbels reach to the base of the pectoral spine, and the mandibular barbels are equal to about half the length of the head. The teeth are small and villiform; those on the palate form a lunate or semicircular band composed of 4 patches which may be variously joined together. In fully grown specimens vomerine teeth form an oblong, quadrangular patch more than twice as broad as long. The dorsal spine is moderately strong; it is almost as long as the head behind the angle of the mouth, is strongly serrated along the posterior border, and finely serrated anteriorly. The pectoral spine is stronger than that of the dorsal fin, and is strongly denticulated internally. The caudal fin is deeply forked.

According to Hamilton, 'The *colour* above is dusky green, and below white, with a purple gloss on the sides. The fins are whitish.' In specimens freshly taken out of water, the back is yellowish green which fades into bluish mauve above and light mauve on the sides. The lower half of the body is silvery white with a reddish tinge anteriorly. The sides of the head are golden yellow, while the fins are light reddish yellow.

Distribution and variation:—*Pangasius pangasius* grows to upwards of 4 feet in length and inhabits large rivers and estuaries. Hamilton probably became familiar with this species while stationed at Puttahaut and Baruipur in Bengal. For this reason he gives its habitat as 'estuaries of Bengal'. The species is now known from India, Burma, Siam, Malay Peninsula, and Java.

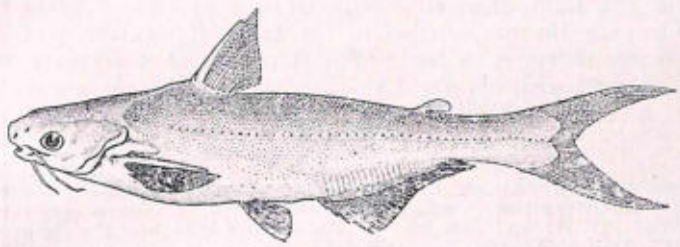
The eye is more rounded in the Burmese specimens, which also possess proportionately longer barbels. The barbels are generally longer in young individuals. In a specimen from Bangkok, the first rays of the pectoral and anal fins are filamentous. Body proportions show considerable variation with the growth of the fish.

In the collection of the Madras Museum there are two specimens from the Bhavani river in which the eyes are proportionately much larger, and correspondingly the snout and the interorbital space are shorter. The barbels are also shorter. The precise locality of these specimens is not known, but from the characters enumerated above

Measurements in millimetres

	Sunderbunds		Calcutta			Akyab	Rangoon	Bangkok		Bhavani River	
Total length excluding caudal	93·0	116·0	150·0	233·0	515·0	220·0	240·0	95·0	122·0	152·0	164·0
Length of head	21·0	27·0	34·0	53·0	100·0	49·0	51·0	25·0	35·0	33·0	37·0
Width of head	18·0	22·5	28·0	40·0	77·0	36·0	43·0	18·5	28·0	24·0	30·0
Width of body	12·5	17·0	22·0	26·0	61·0	29·0	36·0	15·0	22·0	20·0	24·0
Height of body	19·0	25·0	33·0	44·0	128·0	50·0	50·0	24·0	30·0	31·0	39·0
Diameter of eye	6·0	7·0	9·0	13·0	20·0	11·0	11·0	7·0	9·0	11·0	12·0
Length of snout	9·0	11·0	13·0	19·0	40·0	19·0	22·0	10·0	14·0	10·0	12·0
Interorbital width	11·0	15·0	17·0	30·0	60·0	28·0	32·0	12·0	20·5	15 0	19·0
Length of pectoral spine ...	18·0	23·0	28·0	40·0	85·0	43·0	40·0	16·0	22·0	28·0	31·0
Length of dorsal spine ...	18·0	23·0	25·0	38·5	77·0	42·0	39·0	16·0	21·0	24·0	25·0
Length of maxillary barbel ...	21·0	24·0	26·0	29·0	46·0	22·0	46·0	18·0	19·0	20·0	29·0
Length of mandibular barbel.	17·0	21·0	22·0	27·0	32·0	damaged	37·0	12·0	13·0	14·0	17·0

they seem to have been obtained from clear waters, where larger eyes are probably of advantage. Owing to the paucity of the



Text-fig. 3.—Lateral view of the large-eyed form of *Pangasius pangasius* (Hamilton) from the Bhavani river. × ⅔.

material from the Bhavani river it is not possible to elucidate the problem any further. The occurrence of the species so far inland is, however, of special interest.

Bionomics and Fishing Notes.

By all authorities *Pangasius pangasius* is regarded as a foul feeder. Hamilton (5) noted that 'It is eaten by all ranks of natives that use fish, but is not considered as of the best quality.' The alimentary canal is fairly long; the stomach is a large bag-shaped structure and the last portion of the canal is also wide and scale-like. It is probably one of the fishes that feed at night, and, being a bottom-feeder, can best be taken by paste baiting. Thomas (**12**) records having taken a *Pangwás* of 14 lbs. in this way.



Text-fig. 4.—Alimentary canal of a small specimen, 85 mm. in length without caudal, of *Pangasius pangasius* (Hamilton). ×2.

Young specimens, about 70 mm. to 80 mm. in length, are brought to the Calcutta Markets in November-December for sale from the Matlah river. In the collection of the Indian Museum there are young specimens of *P. pangasius* collected from the Matlah river in December, 1916. No specimens of the species were found in the Calcutta Water-works at Pulta or in the river Hooghli above Calcutta in April, 1936. Examination of the catches of fish at Nawabgunge also showed that this species does not come up the river in fresh waters. From the evidence so far available it seems that *P. pangasius* is mainly an estuarine fish that breeds in the rainy season in the lower portions of the estuaries. Strictly freshwater specimens that I have examined are those collected in the Bhavani river and now preserved in the collectioon of the Madras Museum,

Acknowledgments.

The Bombay Natural History Society very kindly made a grant towards the cost of the illustrations, and for this I offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra has helped me with the preparation of the table of measurements, and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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Explanation of Plate.

Colour sketch of the lateral view of a specimen, 550 mm. in length without the caudal, of *Pangasius pangasius* (Hamilton) from the Calcutta Market.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SÁLIM ALI AND HUMAYUN ABDULALI.

PART V.

(With one plate).

(Continued from p. 173 of this volume).

The Indian Barn Owl : *Tyto alba javanica* (Gmelin).

Field identification : Size about that of the Jungle Crow. Upper plumage pale ashy-brown, finely stippled with black and white. There is a great deal of yellowish-brown about the shoulders and on the wings. Lower parts white, sometimes tinged with buff and usually spotted with dark brown. The white facial disc with the large forwardly directed eyes and the hooked nose-like tip of the bill set in the large round head give it a ludicrously human appearance. Singly, on cornices and under gables etc. of buildings, both ruined and inhabited —commonly in the heart of the city and in the suburbs. Flying about, ghost-like, from one building to another above the glare of the street lamps.

Specimens : *B.N.H.S.* : ♀ 2-4-08 Bandra ; ♂ 10-6-12 Bandra (Mr. Windgate) ; ♀ 15-4-09 Bombay Mint (T. P. Guidera) ; *St. Xavier's College* : 173 ♂ 1-3-34 Bombay City.

Noted : *City* : Khētwādi, Girgaum, Chowpāti, Malabār Hill, Fort, Colāba, Crawford Market, Byculla, Pydhowni, Parēl etc. *Salsette* : Trombay Church, Gōdhbunder, Andhēri.

Resident. Not uncommon. The Barn or Screech Owl is purely nocturnal in its habits. It is greatly inconvenienced by sunlight and retires into dark corners and hollows during the day, seldom stirring abroad till after dusk. If disturbed during daylight it blinks distractedly and is invariably set upon and mercilessly mobbed by crows. The narrow slits under the steel water tanks placed on buildings in the city offer admirable daytime retreats and nesting sites to the urban Screech Owl population. They share these with the local pigeons and live seemingly at peace with them.

The food of the Barn Owl consists mainly—almost exclusively—of rats and mice and it is thus a highly beneficial species to have about human habitations. Some years ago we found the ground below a niche—the nesting site of a pair of these owls—in the ruined Portuguese church on the hill at Trombay to be littered with innumerable skulls, jaw- and leg-bones of rats and mice. In its haunts in the City it is not improbable that it also takes a surreptitious toll of its next-door neighbours, the pigeon squabs, which it can procure with such ease.

Breeding : We have taken no nests in Bombay or Salsette, but a pair had their family under a water tank on a building at Chowpāti (behind Wilson College) during December 1925, whence emanated a ceaseless screeching and hissing of the most raucous and eerie sort all night. It is said to breed throughout the year except in the rainiest months—July and August—laying 4 to 7 roundish-oval white eggs.

The Short-eared Owl : *Asio flammeus flammeus* (Pontop.).

Field identification : Size the same as the last. Brown above with pale edges to the feathers making a sort of game bird pattern. White underneath streaked blackish, especially on throat and breast. Facial disc buffy-white finely streaked with black and surrounded by a ruff of dark brown feathers. The two short blunt dark coloured ear-like tufts above the bright lemon-yellow eyes make its identity unmistakable. In flight rufous in wings conspicuous. Singly, in scrub and grass country such as the dry mud-flats along our creeks.

Specimens: *B.N.H.S.*: ♀ 7-2-24 Andhēri (S. H. Prater); o? November 1890 Kūrla (J. M. Mason); *St. X. C.*: 164 ♀ 10-11-33 Jūhū (H.A.).

Noted: Gōdhbunder, Bassein.

A somewhat sparse though probably regular winter visitor. Latest date 18 April (1934). Usually seen perched on the ground at the base of some cactus or other bush. It does not appear to be inconvenienced by daylight and when flushed, flies well and often for long distances.

[The Brown Fish Owl: *Ketupa zeylonensis* ssp.?

Field identification: Size and appearance not unlike the next species, but with the legs unfeathered and covered with small rough scales instead.

H.A. has observed occasional examples about the mudflats and creeks near Andhēri which he thinks may be this species.]

The Indian Great Horned Owl: *Bubo bubo bengalensis* (Frankl.).

Field identification: Size that of the Pariah Kite. A dark brown owl, streaked and mottled with buff and black, with two conspicuous black aigrettes or 'horns' above the head. Not unlike the Fish Owl in general effect, but with the legs fully covered with fulvous feathers. Singly or pairs in ancient trees about villages and cultivation.

[Specimen: *St. X. C.*: 128 ♀ 16-10-33 Kihim (H.A.).]

Not noted in Salsette, but it undoubtedly occurs and presumably is resident. The specimen was procured just across the Harbour. Its stomach contained insect remains only.

This owl has a deep hollow resounding call *Bu—bo* usually audible after sunset.

The Eastern Scops Owl: *Otus scops pulchellus* (Pall.).

Specimens: *B.N.H.S.*: o? September 1891 Bombay; ♀ 26-10-25 Colāba, Bombay (S. H. Prater. Found perched on a hat-peg inside living room!).

The Striated Scops Owl: *Otus brucei* (Hume).

Specimen: *St. X. C.*: 201 o? 11-11-34 Andhēri. (H.A. Caught in a house during daytime. When annoyed, it made a sharp noise by clicking its mandibles together.)

Status? Uncommon.

The Southern Spotted Owlet: *Athene brama indica* (Frankl.).

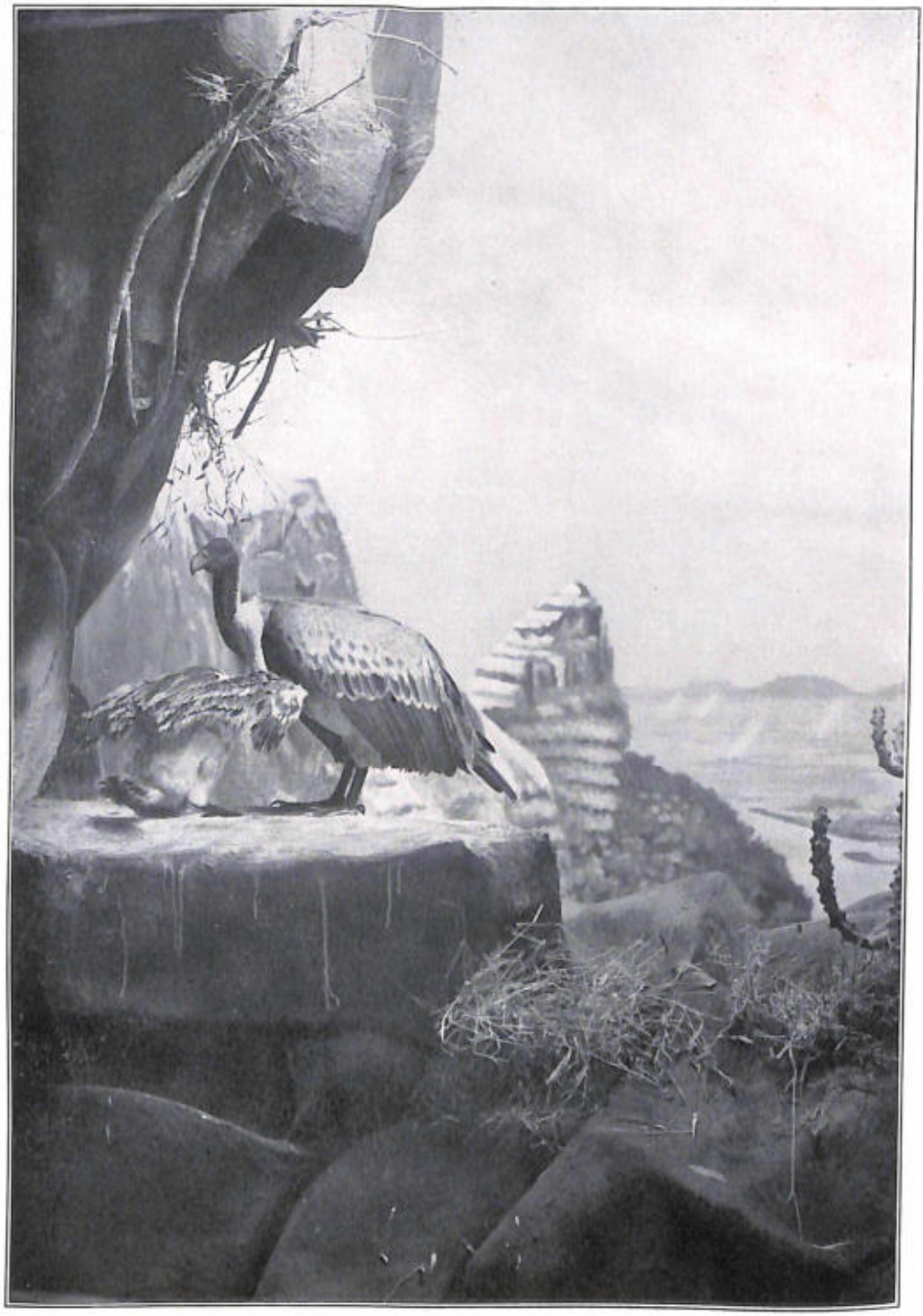
Mahrātti: *Pingla*.

Field identification: Size about that of the Myna but plumper, squatter and with a large round head seemingly fixed on without a neck. Greyish earthy-brown above with white spots and markings. Lower plumage whitish, more or less barred with brown. Typical large, round, forwardly directed eyes. Pairs, in large mango or tamarind trees near villages.

Specimens: *B.N.H.S.*: ♀ 16-1-08 Bombay (N. B. Kinnear); o? 16-3-25 Pāli Hill, Bandra (S.A.); o? 10-11-25 Bombay (Sir H. McNaughten). The above specimens seem to be somewhat intermediate between the races *brama* and *indica*, but on the whole are perhaps nearer the latter.

Noted: *City*: Government House Grounds, Wālkēshwar; Victoria Gardens, Byculla; Parēl. *Salsette*: Powāi Lake, Andhēri, Chembūr etc.

Resident. The Spotted Owlet is a familiar species in Salsette and a pair or so may commonly be found in occupation of holes and hollows in large mango, tamarind and similar trees growing in such large rambling compounds in the City as still exist, as well as about villages and homesteads in suburban areas. It is largely of crepuscular habits, not so much because daylight inconveniences it—since it is often abroad and even hunting in bright sunlight—but because of the persecution and swearing it is invariably subjected to by other birds as soon as it shows itself during the day. Pairs may be seen sitting huddled together on some shady branch. A tap on the trunk, or any noise underneath the tree, will immediately produce an enquiring little head at the entrance of a hollow. Often the bird will fly out and into a neighbouring branch, thence to bob and stare at the intruder in clownish fashion. At dusk these owlets may be seen perched upon fence posts, telegraph wires and the like, pouncing from time to time on some unwary mouse or cricket on the ground. They may sometimes be seen making ungainly sallies after winged ants and capturing them in their claws.



THE GRIFFON VULTURE [*Gyps fulvus* (Habligl.)] Nesting on the Cliffs at Mumbra, Thana Dist., Bombay. *From a Group in the Natural History Section, Prince of Wales' Museum.*

They are noisy birds and have a variety of harsh chattering and chuckles, two birds usually joining in a duet.

Breeding: We have seen eggs and young in Salsette during February, March and April. The eggs number 2 to 4 and are roundish-oval, white in colour. The nest—a pad of coir or similar fibres—is placed in holes in walls and natural hollows in tree trunks, etc. By the time the young have left it emits a ghastly stench!

The Jungle Owlet: *Glaucidium radiatum radiatum* (Tickell).

Field identification: Size and general effect as last, but dark brown above and conspicuously barred (not spotted) with pale rufous. Lower parts rufous and white, closely barred with blackish-brown. Singly, or pairs, in trees in wooded tracts.

Specimens: *B.N.H.S.*: ♂ 26-1-30 Vihār Lake environs (E. Lieberherr); *St. X. C.*: 61 ♀ 3-9-33 Jogēshwari Caves (H.A.).

Noted: Borivli, Powāi Lake environs.

Resident (presumably). Not uncommon in the jungly parts of Salsette. H.A. describes the call, which is not unpleasant, as 'a screech of 4 or 5 syllables ending with a sharp *whau-whap*'. When disturbed in daytime the bird utters an angry *qāoo*. This same note also usually precedes the call which may be uttered throughout the day, the bird not seeming to be particularly incommoded by sunlight.

Breeding: We can trace no records of nests or eggs from the immediate neighbourhood of Bombay and Salsette.

The Osprey: *Pandion haliaëtus* (Linn.).

Field identification: A typical bird of prey, slightly larger than the Pariah Kite. Dark brown above, white below streaked with dark brown. Head and neck white. A broad brown 'necklace' on upper breast conspicuous and a distinguishing feature. Usually singly, near the creeks and sea coast or our lakes, perched on fishing stakes or flying over the water with a peculiar rapid beat of its wing-tips, hovering with the poise of the Pied Kingfisher and hurling itself upon a fish near the surface with great spectacular effect.

Noted: Back Bay Reclamation, near Church Gate; Vihār and Powāi Lakes. Also down the coast at Kihim, Alibāg, Rewdānda, Salāo etc.

Winter visitor. Latest date—exceptional—17 June. EHA (*C.B.B.* 28) saw one even as late as August and suspected that a few pairs may remain behind and rear their young on our coast. We have no evidence of the Osprey breeding in this latitude, however, but it is not unlikely that some young non-breeding individuals may stay with us all the year as is the case, for instance, with the Common Sandpiper.

The Black, or Pondicherry Vulture: *Sarcogyps calvus* (Scop.).

Field identification: Size about that of the Peacock without the train. Black, with the naked head and neck, 2 bare patches on either side of the crop, and legs deep red. There are also 2 patches of downy white feathers on the thighs which, coupled with the above characters, render its identification on the wing easy. Singly, or twos and threes, in every vulture assemblage at animal carcases.

Resident. Somewhat rare and in small numbers. In our experience it is usually a cowardly bird and by no means the King described. We have never seen any deference shown it by the other vulture species, but on the other hand it may usually be seen on the outskirts of the actual press of jostling feasters at a carcase biding patiently for a favourable opportunity to slink in and snatch a morsel.

We have as yet found no nests of this vulture in Salsette. It builds large stick platforms in trees.

The Indian Griffon Vulture: *Gyps fulvus fulvescens* Hume.

Field identification: Size as the last, with a longer naked blackish head and neck more or less covered with straggly down. General colouration varying shades of cinnamon brown, the pale edges to the feathers of upper parts producing a sort of game bird pattern. Short square tail and rectangular wings with the primaries spread out like fingers at the tips, are characteristic features of a vulture in flight.

Specimens: Adult (1-2-36) and juvenile (16-2-36) from Mumbra and Funnel Hill, Karnāla, exhibited in the Bird Gallery, Prince of Wales Museum, Bombay.

Resident. Common. In the City this Vulture may be seen in small numbers about the Parsi Tower of Silence, Malabār Hill. It is common in the suburbs and Salsette at every animal carcase on the countryside.

Breeding: There are no cliffs suitable for the nesting of the Griffon Vulture in Salsette, but at Mumbra and Karnāla Fort, on the adjoining mainland, they breed in some numbers occupying ledges on the steep rock faces of Funnel Hill and similar places. The nest is a large untidy structure of twigs and straw. A single egg is laid, white in colour sometimes sparsely and faintly blotched with reddish brown. Usually not much is left of the nest by the time the young, is fairly grown, possibly due to the restricted space on the ledge and the displacement caused by the constant shuffling about of the occupant. Between 1 and 16 February (36) all the nests in the colonies at Mumbra and Karnāla contained young.

The Long-billed Vulture: *Gyps indicus* ssp.

Field identification: Size as the last. When overhead, it is distinguishable from the commoner White-backed Vulture by the uniform—not contrasting—colouration of the underside of its wings and body. As compared with the Griffon, its general colour is a dirty earth-brown.

Resident. Fairly common. To be seen among every gathering of vultures at a carcase.

Breeding: On 4 November (1933—Kaneri) a bird was observed carrying a stick for its nest. On 1-2-36 H.A. discovered a few pairs with fairly bulky stick nests on inaccessible ledges of cliffs at Mumbra (near Thāna). Griffon Vultures were also nesting on these cliffs, but it was noted that the two species occupied different portions of the hill.

The Indian White-backed, or Bengal Vulture: *Pseudogyps bengalensis* (Gmelin).

Field identification: Size as the last. Dirty blackish-brown, with practically naked head and neck. The lower back is white and a distinguishing feature. In overhead flight, a conspicuous whitish band stretches along the underside of the open wings broken in the middle by the brown body of the bird.

Resident. Our commonest vulture. Numbers always present about the Parsi Tower of Silence on Malabār Hill, the slaughter-house at Bandra and quartering the heavens everywhere. As scavengers, vultures are of the greatest utility to man. The speed and thoroughness with which a company will dispose of the carcase of a bullock or other large animal left in the precincts of a village to befoul the air and breed pestilence, is remarkable.

Breeding: This vulture always builds its nests in large trees—Peepal, Banyan, Tamarind or on Palmyra or Cocoanut palms—25 to 40 feet up. The nests may commonly be seen about Borivli, Gōdhbunder, Chembūr and elsewhere in Salsette, often situated in or near a village. Frequently several nests may be in the same tree. They are large untidy platforms of sticks lined with green leaves. There is apparently no well-defined season though from October to March the nesting is most general. We have observed a bird pulling off green Casuarina twigs from a tree for its nest in May, and a pair mating on the 7th of that month. At that time some full-fledged young were also about with their parents. Only a single egg is laid, white in colour sometimes blotched with reddish-brown.

The Smaller White Scavenger Vulture or Pharaoh's Chicken: *Neophron percnopterus ginginianus* (Lath.).

Field identification: Size that of the Pariah Kite. Young birds are brown and not unlike the Kite in colouration. Adults are dirty white with black wing quills, and a naked yellow head and bill. In flight the wedge-shaped tail distinguishes it from Kites, Eagles and Vultures. Usually seen singly or in twos and threes, on the outskirts of villages, stalking along the ground with a high-stepping, waddling gait. EHA says 'It carries its body like a duck and steps like a recruit'—a very apt description.

Resident. Rather uncommon except about the mudflats near Kūrla and Dharāvi. At Bhamanvadi H.A. once observed over 50 of these birds circling up in the air at the same time.

It is a useful scavenger and will eat any refuse or offal it can come by, not excluding human ordure.

Breeding: We have not come across any nests in Salsette, but Brother Navarro of St. Xavier's College found one with eggs on an inaccessible ledge of rock on Mumbra Hill near Thāna—29 January (1936). Normally it breeds chiefly in March and April. The nest is a shabby accumulation of sticks, rags and rubbish of every description placed on ledges of cliffs, ruined buildings or in the main fork of large trees. The eggs, usually two, vary from white to pale brick-red in colour and are blotched with reddish-brown or blackish, rather thickly round the broad end.

[**The Shahin Falcon**: *Falco peregrinus peregrinus* Sund.

Field identification: Size about that of the Jungle Crow. Dark slaty and ashy-grey, above, white below with a pale ashy tinge, and barred from lower breast downwards with blackish. Conspicuous blackish cheek-stripes. Swift powerful flight on rapidly beating pointed wings. Singly, in more or less open country.

Specimen: *St. X. C.*: ♂ 25-10-33 Kihim (Alibāg Taluka, Kolāba Dist. H.A.).

Winter visitor. It is not uncommon along the coast, across the Harbour, during the cold weather when it must visit Salsette also. The stomach of the specimen contained remains of a Pied Crested Cuckoo. Another example shot at Alibāg in March contained fragments of a downy duckling, presumably lifted from the village.

We have no specimens of *Falco p. peregrinator*, the resident Indian form which probably also occurs in Salsette. This race is said to nest on ledges of steep cliffs from the Himalayas to Travancore, and a pair of large falcons observed by H.A. nesting near the top of the Funnel at Karnāla (25-2-34) were possibly these birds.]

The Laggar Falcon: *Falco jugger* J. E. Gray.

Field identification: Size slightly larger than the Pigeon. General effect similar to the Shahin but smaller size and brownish (not slaty) upper parts diagnostic. Usually singly or pairs about open country and thin jungle.

Specimens: *B.N.H.S.*: ♂ 8-2-06 Bombay (W. S. Millard); ♀? 1899 Colāba, Bombay (Capt. Piele).

Resident? Not common. EHA (*C.B.B.*, p. 24) mentions that many years ago a pair of these falcons had their headquarters, and perhaps their nest, at the University Tower. S.A. observed a pair about this same tower for several months early in 1925. According to EHA they feed largely on the pigeons that inhabit the city.

We have no record of their nesting in Salsette, though it is quite probable that they do so.

The Hobby: *Falco subbuteo* (*subbuteo* Linn.?).

Field identification: Size that of the Pigeon. In colouration and general effect a small replica of the Peregrine Falcon but with more rufous in the lower plumage.

Specimens: *B.N.H.S.*: ♀ 5-12-04 Bombay (J. D. Inverarity); ♀ 27-10-20 Kennery Islands (V. S. LaPersonne); *St. X. C.*: ♀? imm. 24-12-34 Andhēri (H.A.).

Winter visitor. Uncommon.

[**The Red-headed Merlin**: *Æsalon chiquera chiquera* (Dauden).

Field identification: Size about that of the Pigeon. The colour scheme of its upper parts is a reversal of that of the Kestrel. Crown, nape, sides of head and cheek stripes chestnut, back and rest of upper parts bluish-ashy. Lower parts white, barred posteriorly with blackish. Usually singly or pairs in open scrub country.

Specimen: *St. X. C.*: 146 ♀ 24-10-33 Kihim, Kolāba Dist. (H.A.).

Status? Rare. We have not come across the Merlin in Salsette.]

The European Kestrel: *Falco tinnunculus tinnunculus* Linn.

Field identification: Size about that of the Pigeon, with longer tail. Back and wings brick-red, with black wing-quills and grey head and tail. Underparts

light buff spotted with brown. Singly, on grass and fallow land about cultivation. Often seen stationary in the air on hovering wings.

Specimens: *B.N.H.S.*: ♂? 8-12-25, ♂? 11-11-28 Kūrla (D. A. Baretto); *St. X. C.*: [127 ♀ 16-10-33 Chōndi, Alibāg Taluka, Kolāba Dist. (H.A.)]

Noted: Colāba Reclamation, Hindu Gymkhana Grounds, Mātūnga, Dānda, Andhēri, Chembūr, Gōdhbunder.

Winter visitor. The Kestrel is not abundant, but single birds are commonly met with during the cold weather. It frequents open grass country with light scrub and small bushes here and there, and fallow land on the outskirts of cultivation. It usually perches on a stone or small bush, or hovers in mid-air to spy out insects, lizards and mice on the ground. This hovering is the most characteristic habit of the species.

The more brightly coloured race, the Indian Kestrel (*F. t. objurgatus*) probably also occurs in our area, but it is difficult to differentiate it with certainty from the European bird in the field. We have observed it about the Lingmāla Falls near Panchgani (W. Ghats, 4,400 ft.) on 11 June. A pair about some cliffs at Mahāblēshwar (Chinaman's Falls), at the end of May 1931, certainly looked as if they had their nest on a ledge.

The Eastern Steppe-Eagle : *Aquila nipalensis nipalensis* (Hodgs.).

Specimens: P.W. Museum, Bombay: ♂ ♀ 18-12-23 Andhēri (S. H. Prater).

Winter visitor or straggler? Rare. The specimens provide the only instance of their occurring in our neighbourhood.

The Booted Eagle : *Hieraëtus pennatus* (Gmelin).

In the B.N.H.S. Collection there are two specimens, both female, obtained by Mr. N. B. Kinnear at Andhēri on 15-12-08 and 15-2-09 respectively. We have not knowledgably come across this eagle in Salsette.

The Indian Black Eagle : *Ictinaëtus malayensis perniger* Hodgs.

We have doubtfully observed this eagle on a few occasions soaring over forest at Jogēshwari, Gōdhbunder and Tūlsi Lake in Salsette, and on Kankēshwar Hill across the Harbour in Kolāba Dist.—all between October and March. Mr. C. McCann described to H.A. an eagle which attacked his poultry at Andhēri (2-2-36) that could hardly have been any but this species. Confirmation, however, is necessary.

The Short-toed Eagle : *Circaëtus ferox* (Gmelin).

Field identification: Larger than the Pariah Kite. Large greyish-brown head. General plumage earthy-brown. Lower parts from breast downwards white barred with pale brown. Bare reticulated tarsi.

Specimens: *B.N.H.S.*: [♀ 12-2-00 Kalyan (J. Brand)]; ♂? 1920 Thāna (W. R. Clarke); ♂? 30-11-25 Kūrla (D. A. Baretto). *St. X. C.*: ♂?—Trombay.

Status? Uncommon. Its food consists largely of snakes.

The Crested Serpent Eagle : *Spilornis cheela* subsp.?

Field identification: Rather larger than the Pariah Kite. A dark brown eagle with full round black crest and brownish lower parts that are spotted or finely barred with black and white. Usually singly about forest.

Status? Pairs of these eagles may sometimes be seen in the forested portions of north Salsette and in the neighbourhood of the lakes, soaring in circles high above and uttering their penetrating high-pitched call of 3 notes *Kek-kek-kee*, the final *kee* much prolonged.

The White-eyed Buzzard-Eagle : *Butastur teesa* (Frankl.).

Field identification: Somewhat smaller than the Pariah Kite, greyish-brown in colour with white throat, brown and white underparts, 2 cheek-stripes and orange-yellow cere. Eye white or pale yellow, conspicuous at short range. Whitish-grey patches on shoulder of wing prominent. Singly, in open deciduous jungle and by cultivation and grassland.

Specimens: *B.N.H.S.*: ♀ 29-12-23 (S. H. Prater); ♀ 11-109 Andhēri (N. B. Kinnear); ♂? 13-11-25 Kūrla (D. A. Baretto); ♂? 11-3-11 Bombay.

Uncommon. Resident, presumably, though strangely enough we have no record between about April and November. Its food consists principally of

lizards, mice, and large insects such as locusts and grasshoppers. It keeps a lookout for its prey from posts or dry trees and pounces upon it.

We are not aware of its nesting in Salsette or the immediate neighbourhood.

The White-bellied Sea-Eagle : *Haliaëtus leucogaster* (Gmel.).

Field identification : A large bird of prey somewhat smaller than the Vulture, slaty-grey above white below. Broad blackish edging of wings and broad white tip of darkish tail diagnostic in overhead flight. The head is also white. In sailing flight, the wings are held raised above the body in an open V. Usually pairs, along the sea-coast.

Resident. In Salsette, the White-bellied Sea-Eagle has only been observed by us at the Gōdhbunder Creek and Tūlsi Lake, but across the Harbour—Alibāg etc.—and down the Konkan Coast it is fairly common. Its call is a loud duck-like *Kak-Kak-Kak* uttered in flight as well as from a perch. From this call, as EHA has pointed out, the bird gets its local name of *Kakan*. Its food consists of fish and sea-snakes captured near the surface of the water.

Breeding : The nest is an enormous platform of sticks usually built in tall trees such as Casuarinas near the sea-shore. Old nests are repaired, added to and used year after year. We know one at Kihim that has been used successively for over 25 years to our personal knowledge and for at least 20 more according to reliable local testimony. It is said to have already been in existence long before our informant came to live in the neighbourhood. The birds remain in the vicinity of the nest throughout the year, even in the non-breeding season, and may frequently be seen carrying a freshly caught fish to the empty nest to be eaten there. It would be interesting to discover —only possible by the ringing method—whether and for how long the same owners use a nest, how possession of the nest is transferred and what becomes of the young when they grow up, since the number of these eagles in any given locality appears to remain fairly constant.

The eggs, usually two, are laid in October or November.

The Brahminy Kite : *Haliastur indus* (Bodd.).

Field identification : Size that of the Pariah Kite. Tail rounded, not forked. Head, neck and underparts white, upper parts chestnut-red. Young birds brown like the Pariah Kite but the shape of the tail is always a dependable distinguishing feature. Usually near water—Harbour, creeks and water-logged areas.

Specimens : *B.N.H.S.* : ♂ 22-7-25, 27-7-25 Colāba, Bombay (C. McCann) ; *St. X. C.* : 42 ♂ 19-7-33 Andhēri (H.A.).

Noted : Mahāluxmi, Pherozeshah Mehta Gardens (Malabār Hill), Pāli Hill, Khār, Bandra, Kūrla, Sion, Andhēri etc.

Resident. Not uncommon. Local movements are particularly in evidence during the monsoon when these kites move inland owing to the prospect of food offered by the water-logging of low-lying areas. Their diet consists of any offal or garbage that can be come by, but they prefer to pick this off the surface of water. Accordingly, the Bombay docks are admirably suited to their requirements and here they get a constant supply of food floating about in the form of rubbish of every description thrown overboard from the ships. During the monsoon, land crabs in inundated country supply a welcome change of fare and are much sought after. Lizards and frogs are also eaten.

Its call is a rather harsh wheezy squeal—like that of a Pariah Kite suffering from acute hoarse throat!

Breeding : We have observed a nest nearing completion in a Casuarina tree—*ca* 70 feet up—on the sea-shore at Kihim on 1 April (1926), both owners working. Another nest in the same neighbourhood contained a single fledgling on 25 May (1936). A nest in a large Peepal at Chembūr had 2 downy young in it at the end of May. Lt. H. E. Barnes (*J.B.N.H.S.*, iii, 217) found a nest in Bombay on 2 February.

The nest is the usual largish platform of twigs. Normally 2 eggs are laid, greyish-white in colour feebly spotted with pale dingy reddish-brown.

The Common Pariah Kite : *Milvus migrans govinda* Sykes.

Hindūstāni name : *Cheel* : Mahrātti : *Ghār*.

Field identification : A large brown bird of prey, smaller than the Vulture,

familiar to all. On the wing the forked tail distinguishes it from all similar birds. Singly or gregariously in the City and suburbs, especially about meat and fish markets and refuse dumps.

Specimen: *St. X. C.*: ♂—1932 Bombay (H.A.).

Resident. Common. EHA (*J.B.N.H.S.*, vi, 269) believed that the majority of Bombay kites retired to some drier region during the monsoon. This may be true of a few, but the greater number are certainly with us throughout the year. Living in the City is far too easy and plentiful for the birds to forsake it. The Pariah Kite is one of our most useful scavengers. Large numbers may always be seen about the fish and meat section of Crawford, and our other Municipal markets. Refuse dumps, where low lying areas are being reclaimed—such as at Mahāluxmi—never fail to attract them. The ease and grace with which a kite will swoop down on and carry off a dead rat or some similar tit-bit from a narrow, thickly congested lane with all its din and traffic, twisting and turning masterfully to avoid the overhead telephone and electric wires is entertaining to watch. Some of their favourite perches in the City are the ridges of roofs, flag-staffs or radio aerial poles, and above all the round wire cages surmounting the sewage-gas pipes which are such an eyesore on most Bombay buildings. Numbers may often be seen waddling about on our maidans and playgrounds, especially after the turf has been watered, picking out earthworms. On monsoon evenings when winged termites emerge from the ground, kites foregather in large numbers to feast on them in company with crows and other birds and the chase often continues well into the dusk. Whereas the crows snap up the insects in mid-air in their bills, the kites scoop them up in their claws. The victims are subsequently transferred to the bill in mid-air. Some of the birds post themselves on the ground near the ant-hole and 'tick off' the insects as they emerge. The Pariah Kite is an inveterate chicken thief and becomes a serious nuisance to poultry-keeping especially when it has nest-young to feed.

Breeding: We have observed a pair building as early as 22 September. The usual time for eggs is from late October to about February, but some may be found till the end of March. The nest is a large untidy platform of sticks with filthy rags, grass, bits of hairy goat-skin and other rubbish thrown in. It is placed in the fork of some large tree or cocoanut-palm in Bombay City and the suburbs, or in the vicinity of villages in Salsette. A favourite site in the City likewise is the metal 'basket' under the vane of many buildings such as the Secretariat and the High Court. The normal clutch consists of 2 or 3 eggs. These are greyish-white in colour, streaked, speckled and blotched in varying degree with reddish-brown.

[**The Black-eared** or **Large Indian Kite**: *Milvus migrans lineatus* (Gray).

According to H. E. Barnes (*Birds of the Bombay Presidency*, p. 57) Hume obtained a specimen of this kite in Bombay Harbour. On 12-3-30 S.A. observed a kite at Dharamtar (Kolāba Dist.) which was probably this species. The white in the lower wing coverts which distinguishes it from the Pariah Kite was conspicuous as patches in overhead flight. This would be a winter visitor to our area.]

The Black-winged Kite: *Elanus cæruleus vociferus* (Lath.).

Field identification: Size about that of the Jungle Crow, but somewhat lighter in build. Ashy-grey above, white below with black line over eye and black patch on closed wings—at shoulder. Singly, perched on poles, dead trees etc. in open scrub country and grassland. Flies with slow deliberate wing-beats like the Roller, and often hovers in ungainly fashion.

Specimens: *B.N.H.S.*: ♀ 9-2-24 Andhēri (S. H. Prater); ♂ 28-11-99 Hog Island, Bombay Harbour (E. Comber); ♂ 26-3-99 Trombay Island (Major H. J. Walton).

Status? Rare. It feeds principally upon lizards, grasshoppers and other insects, and mice. It hovers rather cumbrously—as compared with the Kestrel—to spy out the ground below, parachutes down with open wings—only the tips quivering—resumes hovering, then parachutes still lower to get a better view of the suspect and finally pounces upon its prey. When perched, it has a habit of cocking its tail from time to time and jerking it up and down between drooping wings. It will keep to the same locality for days together and may be seen perched on the same pole or tree day after day.

We have no record of its breeding in our area or the immediate neighbourhood.

The Pale Harrier : *Circus macrourus* (S. G. Gmelin).

Field identification : Size somewhat smaller than the Pariah Kite and much more slender-bodied. A lightly built ashy-grey hawk usually seen skimming gracefully over standing crops and grassland on long motionless black-tipped wings. The female is umber-brown with reddish markings above, paler below.

Specimens : *B.N.H.S.* : ♂ 29-2-08 Andhēri (N. B. Kinnear?); *St. X. C.* : 229 ♀? 12-3-35 Andhēri (H.A.).

Noted : Gōdhbunder, Thāna, Chembūr, Khār, Borivli etc.

Winter visitor. Not common, but frequent. Easily confused with the next species—Montagu's Harrier. Every now and again as the bird 'skims along the grass and skirts the bush, dips to the hollow and rises to the mound' as EHA so aptly describes its progress, it pounces upon some unwary lizard, mouse, grasshopper, or young lark and settles down to dispose of it before resuming its beat. It perches on the bare ground or on clods of earth in preference to a bush or tree.

Montagu's Harrier : *Circus pygargus* (Linn.).

Field identification : Differs in detail from the foregoing and difficult to tell from it with certainty except with practice. On the whole it is a somewhat darker grey with the black in the wing-tips more extensive. The female is also similar to but somewhat darker than that of the Pale Harrier. Habits etc. similar to the above.

Specimen : *B.N.H.S.* : ♂ Feb. 1913 Andhēri (N. B. Kinnear).

Winter visitor.

The Pied Harrier : *Circus melanoleucus* (Forst.).

Field identification : A typical harrier in build and habits, of conspicuous black and white plumage. The female is brown as in the two foregoing species, some white and greyish in the wings. Singly, in open grass country.

Winter visitor. Rare. We have only observed a solitary example about the mud-flats at Sion Causeway on 8 April (1924) presumably on passage. It was excessively shy.

The Marsh Harrier : *Circus aeruginosus aeruginosus* (Linn.).

Field identification : A dark umber brown hawk rather like the Pariah Kite but slimmer, with rounded tail, and usually with a creamy-buff cap. Adult males have silvery grey wings and tail. Usually seen singly about marshes and jheels beating back and forth above the reed beds etc. and pouncing on frogs, disabled birds and the like.

[Specimen : *St. X. C.* : 119 ♂ 13-10-33 Bassein, Thāna Dist. (H.A.).]

Noted at snipe marsh near Gōdhbunder Creek, Māhim, Bandra.

Winter visitor. Rare. EHA says '. . . in times now almost ancient when the Flats were inundated every monsoon and did not dry for months after, it was very fond of Bombay'.

The Indian Shikra : *Astur badius dussumieri* (Temm.).

Mahrātti name : *Cheepak.*

Field identification : Size about that of the Pigeon. Ashy-grey above white below cross-barred with rusty-brown. Young birds brown and rufous above with broad brown streaks on the lower plumage. Tail in adults as well as young with broad blackish bands. Singly or pairs, in wooded country around villages and about mango topes etc.

Specimens : *B.N.H.S.* : ♀ 1-2-24, ♂ 19-1-24, ♀? -2-25 Andhēri (S. H. Prater); ♂ 12-1-13 Santa Cruz; ♀ 9-10-06 Bombay City (Mr. Keyes); ♀ 9-1-19 Malabār Hill, Bombay (W. S. Millard); *St. X. C.* : [147 ♀? 25-10-33 Kihim], 175 ♀ 20-2-34 Andhēri (H.A.).

Resident. Fairly common. Its food consists of small birds, rats, squirrels, lizards, and also locusts and large grasshoppers. It is very destructive to young chickens and on this score is a nuisance about villages, particularly when it has nest-young to feed. The tactics usually employed by the Shikra in capturing its prey is surprise. From its perch in the concealment of some leafy tree, whence it keeps a sharp lookout, it swoops upon and bears away its victim before the latter has time to scent danger.

Breeding : We have not actually taken any nests in our area, but the Shikra must undoubtedly breed here. From the excitement of a pair noted

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Resident. Fairly common. Its food consists of small birds, rats, squirrels, lizards, and also locusts and large grasshoppers. It is very destructive to young chickens and on this score is a nuisance about villages, particularly when it has nest-young to feed. The tactics usually employed by the Shikra in capturing its prey is surprise. From its perch in the concealment of some leafy tree, whence it keeps a sharp lookout, it swoops upon and bears away its victim before the latter has time to scent danger.

Breeding : We have not actually taken any nests in our area, but the Shikra must undoubtedly breed here. From the excitement of a pair noted

near Mulund at the end of March, it was obvious that they had a nest nearby.

The Southern Besra Sparrow-Hawk : *Accipiter virgatus* (*besra* Jerdon?).

Field identification : Difficult. Size about that of the Shikra and rather similar to it in colour and markings. In the hand the conspicuously greater length of the middle toe most readily serves to differentiate the two.

Status? Rare. We have not come across the Sparrow-Hawk in Salsette, but in the B.N.H.S. Collection there is a specimen (♂ imm.) obtained by Mr. N. B. Kinnear at Tūlsi Lake, 16-12-12.

The Indian Crested Honey-Buzzard: *Pernis ptilorhynchus ruficollis* Lesson.

Field identification : Somewhat larger than the Pariah Kite. Usually greyish-brown above, pale brown below narrowly cross-barred with white. A blackish crest at back of head. In overhead flight the rounded tail—cross-barred black and white—and the more finely barred undersurface of wings conspicuous. Singly, in wooded country, often soaring in circles above the forest. The forehead, sides of head and chin covered with small scale-like feathers is a diagnostic feature of the bird in the hand.

Specimen : *B.N.H.S.* : ♀ 29-1-25 Andhēri (R. Hearn).

Resident. Not uncommon in the hilly and forested parts of Salsette. It derives its name from its habit of feeding on the honey and larvae of wild bees. The call is a high-pitched screaming whistle *whee-ee-ew*.

Breeding : Barnes (*J.B.N.H.S.*, iii, 219) writes that Davidson had eggs of the Honey-Buzzard sent to him from Thāna, taken about March. On 24 April (1935) H.A. found a stick nest about 60 feet up in a Casuarina tree 50 yards from the sea-shore at Kihim (Kolāba Dist.). On 6 May it contained two downy chicks one of which was considerably larger than the other. This suggests that the interval between the laying of the first and second egg—for normally only 2 are laid—is a long one, and that incubation commences immediately the first egg is laid. He took the larger chick (♂) and found its stomach to contain the remains of a Green Whip Snake (*Dryophis mycterizans*) and numerous larvae of hymenopterous insects. There was a large colony of several bee-hives within half a mile of the nest whence the latter presumably came. The owners made no attempt to defend the nest when climbed up to.

On 25 May of the following year H.A. found the same nest again occupied, with young in it.

The Southern Green Pigeon : *Crocopus phoenicopterus chlorogaster* (Blyth).

Field identification : Size that of the Pigeon. General colour greyish and yellowish olive-green. Head and neck ashy-grey, breast and abdomen yellow. Flocks in wooded country feeding on ripe fruits of Banyan and Peepal.

Specimen : *St. X. C.* : 251 o?—Gōdhbunder (H.A.).

Status? Not common. We have only come across occasional small parties of 3 or 4 birds about Gōdhbunder and Shendūr in north Salsette. The call is a pleasing mellow whistle of several notes.

We know of no breeding records in our area or the immediate neighbourhood.

[The Grey-fronted Green Pigeon : *Dendrophasa pompadora affinis* (Jerdon).

Field identification : Smaller than the foregoing; about the size of the Ring-Dove. General colouration as above, but with the back and wing-shoulders maroon-chestnut, and breast pinkish-orange.

H.A. obtained a specimen of this Green Pigeon at Karnāla Fort (Funnel Hill) in the Panvēl Taluka of Kolāba Dist. on 25 February (1934) and observed several birds in heavy forest at about 1,000 ft. elevation there. He also came across it at Tūngār, Bassein, *ca.* 1,300 ft. on 20 April (1934).

W. F. Sinclair (*J.B.N.H.S.*, xii, 185) records a specimen shot in the Police Lines at Alibāg out of a flock on 20 July (1890).

We have not come across it in Salsette, but it no doubt occurs here from time to time in small numbers.]

[The Imperial Green Pigeon : *Muscadivora aenea pusilla* Blyth.

Field identification : Size between the Blue Rock Pigeon and the Jungle Crow. Head, neck and lower plumage pinkish-grey, upper plumage metallic bronze green.

Not observed in Salsette, but there is a specimen in the Society's Collection shot on Tūngār Hill near Bassein Rd. Station (B.B. & C.I. Railway) 34 miles north of Bombay, on 19-1-19 by a Mr. Frei. This specimen has been recorded as *C. ae. aenea* by Mr. Kinnear (*J.B.N.H.S.*, xxvi, 846) but according to the boundary between the races recently fixed by Whistler (*J.B.N.H.S.*, xxxviii, 675) it should be *pusilla*.

H.A. has verified another example shot in the same locality on 26-5-1935.]

The Indian Emerald Dove : *Chalcophaps indica indica* (Linn.).

Field identification : Size that of the Myna or of the Little Brown Dove. Colour scheme resembling that of the Imperial Green Pigeon. Metallic bronze-green above; head, neck and underparts vinous red and pinkish-grey. Usually singly or pairs, feeding on roadsides in the wooded parts of north Salsette such as along the Gōdhbunder-Thāna road or flying across them at great speed, the metallic bronze flashing in the sun.

Specimen : *B.N.H.S.* : ♂ 25-3-29 Tūlsi Lake environs (S.A.).

Noted : Powāi and Vihār Lakes, Gōdhbunder, Borivli, Trombay, Chembūr.

Resident (presumably). Not abundant but frequent in suitable country. Feeds on the ground on seeds and vegetable matter and there is usually a quantity of grit in the stomach.

Breeding : We have not come across any nests of the Bronze-winged Dove in Salsette but from the enlarged condition of the gonads of the specimen (measuring 14×7 mm.) it was evidently preparing to breed.

The Indian Blue Rock Pigeon : *Columba livia intermedia* Strickl.

Hindūstāni name : *Kabūtar*, Mahrātti : *Pārwa*.

Too well-known to need description.

One of the commonest birds in the City where large gatherings are fed regularly at recognised places by benevolent Hindu gentlemen. There is much admixture of domestic strains in the pigeons inhabiting our area and the race is perhaps about as pure as the Aryan of Nazidom!

Breeding : Pigeons breed freely throughout the year everywhere in buildings in the noisiest and most congested parts of the town, making flimsy twig nests on rafters and cornices, under eaves, in ceilings, under the iron water reservoirs on buildings and in holes in masonary wells. The usual 2 white eggs are laid. In a small disused loft, between ceiling and roof, in St. Xavier's High School at Dhobi Talao, H.A. counted 35 nests all containing either eggs or downy chicks on 8 February (1936).

The Indian Rufous Turtle-Dove : *Streptopelia orientalis meena* (Sykes).

Field identification : Slightly smaller than the Pigeon. Head greyish-brown. Upper plumage with scale-like rufous markings; lower plumage pale pinkish-rufous. A black patch on either side of hindneck, speckled silver-grey. White tips of tail feathers conspicuous as a band when the bird is alighting. Usually singly, in wooded country about cultivation.

Specimen : *B.N.H.S.* : ♀ 26-1-24 Andhēri (S. H. Prater).

Winter visitor. Rare. H.A. has seen two specimens shot near Powāi Lake in March. We have no other records.

The Indian Spotted Dove : *Streptopelia chinensis suratensis* (Gmel.).

Mahrātti name : *Kaura*.

Field identification : Size between the Myna and the Pigeon. Similar in colour to the foregoing species, but spotted with white on upper parts. A distinctive black patch with white spots on hindneck—'chessboard'. Singly, in pairs or parties, in lightly wooded country gleaning in stubble-fields, on cross-country cart tracks, etc.

Specimen : *B.N.H.S.* : ♀ 6-4-13 Santa Cruz (N. B. Kinnear).

Resident. Fairly common. We have not observed it in City limits, but it is the commonest dove in Salsette. Its call is a pleasant though rather mournful *Kroo-kruk-kruk-kroo—kroo-kroo-kroo*. The number of *kroos* varies, but is never more than 6 times.

Breeding : We have records of nests in Salsette, in course of building or with eggs and young, in March, August, October and November and they probably breed more or less throughout the year. A flimsy twig nest is built

near Mulund at the end of March, it was obvious that they had a nest nearby.

The Southern Besra Sparrow-Hawk : *Accipiter virgatus* (*besra* Jerdon?).

Field identification : Difficult. Size about that of the Shikra and rather similar to it in colour and markings. In the hand the conspicuously greater length of the middle toe most readily serves to differentiate the two.

Status? Rare. We have not come across the Sparrow-Hawk in Salsette, but in the B.N.H.S. Collection there is a specimen (♂ imm.) obtained by Mr. N. B. Kinnear at Tūlsi Lake, 16-12-12.

The Indian Crested Honey-Buzzard: *Pernis ptilorhynchus ruficollis* Lesson.

Field identification : Somewhat larger than the Pariah Kite. Usually greyish-brown above, pale brown below narrowly cross-barred with white. A blackish crest at back of head. In overhead flight the rounded tail—cross-barred black and white—and the more finely barred undersurface of wings conspicuous. Singly, in wooded country, often soaring in circles above the forest. The forehead, sides of head and chin covered with small scale-like feathers is a diagnostic feature of the bird in the hand.

Specimen : *B.N.H.S.* : ♀ 29-1-25 Andhēri (R. Hearn).

Resident. Not uncommon in the hilly and forested parts of Salsette. It derives its name from its habit of feeding on the honey and larvae of wild bees. The call is a high-pitched screaming whistle *whee-ee-ew*.

Breeding : Barnes (*J.B.N.H.S.*, iii, 219) writes that Davidson had eggs of the Honey-Buzzard sent to him from Thāna, taken about March. On 24 April (1935) H.A. found a stick nest about 60 feet up in a Casuarina tree 50 yards from the sea-shore at Kihim (Kolāba Dist.). On 6 May it contained two downy chicks one of which was considerably larger than the other. This suggests that the interval between the laying of the first and second egg—for normally only 2 are laid—is a long one, and that incubation commences immediately the first egg is laid. He took the larger chick (♂) and found its stomach to contain the remains of a Green Whip Snake (*Dryophis mycterizans*) and numerous larvae of hymenopterous insects. There was a large colony of several bee-hives within half a mile of the nest whence the latter presumably came. The owners made no attempt to defend the nest when climbed up to.

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Noted : Powāi and Vihār Lakes, Gōdhbunder, Borivli, Trombay, Chembūr.

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Winter visitor. Rare. H.A. has seen two specimens shot near Powāi Lake in March. We have no other records.

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Breeding : We have records of nests in Salsette, in course of building or with eggs and young, in March, August, October and November and they probably breed more or less throughout the year. A flimsy twig nest is built

in a bush or tree usually low down or at moderate heights from the ground. 2 white eggs invariably comprise the full clutch.

The Little Brown Dove : *Streptopelia senegalensis cambayensis* (Gmelin).

Field identification : Size about that of the Myna. Earthy brown above with greyish on wings. Head, neck and breast pinkish-brown paling to whitish on abdomen. On each side of neck there is what EHA calls 'a miniature chess-board in red and black'.

Specimen : *B.N.H.S.* : ♂ 12-9-12 Cumballa Hill, Bombay (N. B. Kinnear).

Straggler? Rare. We have never come across this dove in Bombay and curiously enough even in Salsette have noted it only once at Gōdhbunder (1924), once near Ghātkōpār (1926), and a solitary example at Andhēri (1934). EHA (*C.B.B.*, p. 152) wrote in the eighties that all the doves he had seen about Cumballa and Malabār Hills belonged to this species. If this is true then their absence now must certainly be attributed to the transformation these localities have undergone since EHA's day, and is a good example of the effect of changing environment upon bird distribution. The Little Brown Dove loves dry stony country with prickly pear and other cactus thickets which have long since disappeared from Bombay, Cumballa and Malabār Hills, before they were built up and out of all recognition, doubtless fulfilled its ecological requirements.

In *J.B.N.H.S.*, xxiii, p. 158 (April 1914) Mr. Kinnear wrote that this species, along with the Spotted and the Ring-Doves, was 'very common' on the southern end of Salsette. This is definitely not the case at present as our meagre records will show. Across the Harbour—Kolāba Dist.—however, it is fairly common. A nest with 2 chicks—about 2 days old, in clotted yellowish down—was seen near Kihim on 19-2-31. It was the typical flimsy pad of small twigs 3 ft. up in an Euphorbia bush close to the village.

The Indian Ring-Dove : *Streptopelia decaocto decaocto* (Frivalszky).

Field identification : Somewhat smaller than the Pigeon. More or less uniform pale brownish lilac-grey with a black collar on hindneck. In Babul jungle and about cultivation.

Specimen : *B.N.H.S.* : (destroyed) ♀ 30-1-21 Santa Cruz (B. C. Ellison); o? 1-12-25 Kūrla, Bombay Suburban Dist. (D. A. Baretto).

Noted : Gōdhbunder (December 1925).

Mainly a local winter visitor. In December we have observed flocks flying high up in the air, once near Kūrla and on another occasion at Gōdhbunder (several successive flocks), distinctly suggestive of migratory movement. Kinnear (*J.B.N.H.S.*, xxiii, 158) appears to have found it common on the southern end of Salsette. No season is specified. Its call is a pleasant deep *Kuk-koo-kook, kuk-koo-kook* etc.

The Indian Red Turtle-Dove : *Œnopopelia tranquebarica tranquebarica* (Herm.).

Field identification : Size about that of the Myna. A pinkish brick-red dove with ashy-grey head and black collar on hindneck. The female is pale brownish-grey; rather like a small replica of the Ring-Dove. Singly or pairs, gleaning in stubble-fields often in company with other doves.

Specimens : *B.N.H.S.* : o? 10-2-24 Pāli Hill (S.A.); ♂ 27-12-23 Andhēri (S. H. Prater); ♂ 5-12-25 Kūrla (D. A. Baretto).

Local winter visitor. Uncommon. The call is a somewhat harsh rolling *Groo-gurr-goo, groo-gurr-goo* etc.

[The Common Indian Sand-Grouse : *Pterocles exustus ellioti* Bogdanow.

There is a specimen of this sand-grouse in the B. N. H. S. Collection from Bassein, Thāna Dist. (without date) collected by P. Lyons. We have not come across it in Salsette.]

The Common Peafowl : *Pavo cristatus* Linn.

This gorgeous bird was evidently fairly plentiful in Salsette in olden days, but at the present time it has all but disappeared. John Fryer, in an account of his travels in India in the year 1673, writes that outside 'Bandora' he used his fowling-piece 'being presented with rich game as peacocks, doves and pigeons.'

Up till about the year 1910 or thereabouts S. A. remembers that small parties of peafowl were occasionally to be met with on the eastern wooded slopes of Trombay Hill, but we have not seen or heard of them there within recent years. A local shikari informed H. A. in 1936 that a few may still be occasionally driven out in beats in north Salsette. According to this informant it was met wih there oftener than the Junglefowl.

H. A. picked up a peacock feather on Karnāla Fort Hill (Panvēl, Kolāba Dist.) in February 1934.

The Grey Jungle-Fowl : *Gallus sonneratii* Temm.

Field identification : Very like the domestic fowl in appearance. General effect streaked grey with a black sickle-shaped tail. Hen brown above white below with black streaks. In hilly forest country with scrub undergrowth.

We have seen a specimen shot by a Mr. C. King in the hills round Powāi Lake in 1924. H. A. observed a single bird at Gōdhbunder in April 1934. The Grey Jungle Fowl is now rare in Salsette and becoming increasingly so under ceaseless persecution from bands of local shikaries. It is not uncommon in parts of Kolāba District. We have shot several at Parōl Pāra in Alibāg Taluka (1931). An adult cock in good condition and quite uninjured, when suddenly come upon by the beaters, was so terrified that he could not take to wing. He hopped and fluttered a few yards and began running through the bushes till overtaken by the men and done to death with sticks! The stomachs of specimens contained the green fruits and seeds of *Streblus asper* predominatingly. A bird shot in January was a cockerel about three months old indicating the breeding season to be somewhere about September-October.

The Common Red Jungle-Fowl : *Gallus gallus murghi* Robinson and Kloss.

Mr. C. McCann of the Bombay Natural History Society, a keen and reliable observer, informs us that on 24 February 1929 when accompanied by Rev. Fr. Palacios S. J., they saw a Red Jungle cock on the hills behind Kaneri Caves, Borivli, at about 1300 ft. elevation. It was within shooting distance and stood for a few seconds before scuttling away, giving them a perfect view. This record has not been confirmed by a specimen or another sight record since. Salsette and the neighbouring country is far out of the known range of the Red Jungle-Fowl.

The Red Spur-Fowl : *Galloperdix spadicea spadicea* (Gmelin).

Mahrātti name : *Chikōkri.*

Field identification : Size and general effect that of a three-quarter grown domestic hen, the cock mainly chestnut brown, the hen paler brown with black streaks and markings. Usually in pairs, but seasonally in family parties, in stony, broken country—nullahs, etc. overgrown with thickets and brushwood.

Specimens : *B.N.H.S.* : o? 16-3-24 Vihār Lake (S.A.) ; ♀ 8-12-18 Thāna (Major M. L. Ferrar) ; *St. X. C.* : 243 ♂ 24-11-35 Borivli (H.A.).

Noted : Kandivli, Gōdhbunder, Powāi and Tūlsi Lake environs. Also Karnāla and Parōl Pāra on the mainland.

Resident. Not uncommon in northern Salsette and on the adjoining mainland. The birds are usually shy and great skulkers, scuttling away through the undergrowth on the least suspicion and flying for short distances only when hard pressed, often seeking concealment in the branches of a tree. Their food consists of seeds and insects which are rummaged for among the fallen leaves. They have a habit of running uphill when alarmed.

Breeding : H.A. has seen a clutch of 3 eggs taken from a scrape in the ground near Tūlsi Lake on 15-4-36. He was informed that young had been captured in this locality at the same time. On 31-5-36 (Vihār) he observed 4 newly hatched chicks. The Red Spur-Fowl is said (*Fauna*, v, 360) to breed throughout the year except perhaps in the three months October to December.

The Common or **Grey Quail :** *Coturnix coturnix coturnix* (Linn.).

Field identification : Size about that of a ten-day old domestic chicken. Squat, plump appearance. A seemingly tailless, buff-coloured game bird with black streaks and markings. Usually singly or pairs, flushed in cultivation and grassland with a whirr of wings.

Specimens : *B.N.H.S.* : o -1-96 'Bombay' (J. M. Mason) ; ♀ 18-1-07, ♂ 19-1-07, ♂ ♂ ♀ 7-12-07, ♀ 18-1-08 Thāna (W S. Millard and N. B. Kinnear) ; *St. X. C.* : 240 o?, 241 o? (Salsette) November-December 1935 (Nunes).

Winter visitor. Found in small numbers in grassland and about harvested paddy fields. By December or January they are well in; by about the beginning or middle of March most birds have departed.

The Black-breasted or **Rain Quail:** *Coturnix coromandelica* (Gmelin).

Field identification: Somewhat smaller than the Grey Quail. Like it in general effect and habits, except that in this the male has a jet black breast. Singly or pairs in grassland.

Specimens: *B.N.H.S.*: ♀ 18-1-07, ♂ 8-1-10 Thāna (N. B. Kinnear); ♂ 2-12-08 Thāna (W. S. Millard).

Not common. We are not aware if the Black-breasted Quail is at all resident in our area or moves in locally during the cold weather only, as the majority certainly appear to do. We have no record for Salsette at any other season of the year.

The Jungle Bush Quail: *Perdicula asiatica asiatica* (Lath.).

Field identification: Size about that of the Common Quail. Male above fulvous-brown with blackish and buff streaks, below white cross-barred with black. The female has the lower parts pinkish-rufous. In coveys of 5 to 15 birds, in scrub jungle.

Specimens: *B.N.H.S.*: ♂♀ 24-11-12 Borivli (N. B. Kinnear); ♂ juv. 7-2-08, o? juv. 24-2-08 Andhēri (N. B. Kinnear); o? downy chick -12-23 Andhēri (S. H. Prater).

Resident. Common in scrub jungle in Salsette. Bush Quails have a habit of forming themselves into 'squares'—crouching huddled together under a bush, or even in the open, all facing outwards—and of suddenly 'exploding' or rising with a whirr and dispersing in all directions often when almost trod upon. The covey soon reunites by means of soft whistling calls uttered by the members. They roost at night in the same manner and are easily captured by throwing a net over the bush into which a covey has been observed to retire. Rival males occasionally challenge rivals by harsh grating calls as of the Black Drongos 'arguing' at the onset of their breeding season. What emotion these calls really signify is not certain, but they are clearly associated with breeding.

Breeding: There seems to be no well-defined nesting season, but in our area the majority seem to lay from about October to March or April. We have seen a c/4 (hard-set) taken at Jogēshwari on 30 January, and chicks in down in December, February and April. EHA (*C.B.B.*, p. 159) says it lays about the end of the rains. The nest is a slight depression in the ground lined with grass, under shelter of a bush or grass-tussock in scrub country. 4 to 8 eggs of a creamy-white colour are laid. The chicks, as with all game birds, are able to run about as soon as hatched, and to fly when incredibly tiny. Their colour and pattern render them completely invisible in their surroundings of dry grass and leaves.

The Rock Bush-Quail: *Perdicula argoondah* ssp.

Specimen: *B.N.H.S.*: ♂ juv. 24-2-08 Andhēri (N. B. Kinnear).

We have not knowledgably come across this species in Salsette. Its differentiation in the field from the Jungle Bush Quail is almost impossible.

The Southern Painted Partridge: *Francolinus pictus pictus* (Jard. and Selby).

Field identification: A plump, stub-tailed game bird, larger than the Quail, about the size of a half-grown pullet of the domestic fowl. Black, profusely spotted and barred with white and with some rufous-red in the wings. Singly, about cultivation and grassland, usually not far from water.

Specimen: *B.N.H.S.*: ♂ 24-2-08 Andhēri (N. B. Kinnear).

Noted: Kandivli, Mulund, Thāna. One shot at Chembūr (Trombay Hill) on 27 May 1914, but none met with there since.

Resident? Not common and becoming scarcer day by day. There is evidently an influx of local visitors during the rainy season and more birds may be heard calling from about August to October in Salsette (as well as across the Harbour e.g. in Alibāg Taluka) than at any other time of year. This may, however, be partly accountable by the fact that the birds are breeding then. In the rains they keep to the vicinity of paddy-fields and have a habit of mounting stones, etc. on grassy bunds separating the fields—or an isolated

tree standing in the midst of cultivation whence a good view of the surrounding country can be obtained—and uttering their familiar call *Chik . . . cheek-cheek-keray*. They call mostly in the mornings upto about 11 o'clock and then from 3 p.m. onwards.

Mr. N. S. Symons addressing a meeting of our Society on 14 January 1891 on the subject of a proposal for the protection and introduction of game into the Bombay neighbourhood (*Jour.*, vi, 120) mentioned that he had heard of as many as ten brace of Painted Partridge having been killed by one gun within 18 miles of Bombay that season in a short day's sport. He complained that for want of protection the birds were already then dwindling considerably in numbers.

Breeding: The Painted Partridge undoubtedly breeds in parts of Salsette and on the adjoining mainland during the monsoon—July to September—but we have no specific records of eggs or young having been taken here. A favourite site for nests is on the grassy bunds that separate fields. The normal clutch comprises of 4 to 8 eggs, pale olive grey in colour.

The Common Bustard Quail: *Turnix suscitator taijoor* (Sykes).

Field identification: Size somewhat smaller than the Rain Quail. General effect reddish brown above with a greyish tinge, rusty-buff below with black cross-bars on breast. The female has the chin, throat and breast black. In flight the pale buff shoulder patches are conspicuous on upper surface of wings. Distinguished in the hand from true quails by absence of hind-toe. Pairs or small parties of 3 or 4 in scrub undergrowth about grassland and cultivation.

Specimens: *B.N.H.S.*: ♂? 9-2-07, ♂? 7-12-07 Thāna (W. S. Millard).

Noted: *Salsette*: Chembūr, Andhēri, Powāi Lake environs; *Mainland*: Kihim, Alibāg, Rōha.

Resident. Not uncommon, in small numbers. Contrary to the normal condition in birds, the female of the Bustard Quail is more brightly coloured than the male. This is because the usual role of the sexes is reversed in this species. The hen does all the courting and fighting with rival hens; the cock incubates the eggs and rears the young while she is busy making fresh conquests. The call uttered by the hen is a loud drumming *Drr-r-r-r-r-r* etc. often continued for 10 to 15 seconds at a stretch. We have also heard a more subdued *Hoon-hoon-hoon-hoon* for over 5 seconds at a time, probably uttered by the cock. They are birds of sedentary habits and a pair or party may be found frequenting the same spot day after day.

Breeding: We have found eggs and chicks from March to September. It lays on the ground in a grassy patch, bending over the grasses neatly into a sort of dome. The normal clutch is of 3 or 4 eggs, usually greyish-buff with reddish-brown spots and speckles.

The Little Button Quail: *Turnix sylvatica dussumieri* (Temm.).

Field identification: Considerably smaller than the Quail. In general appearance like the Bustard Quail but differentiated chiefly by not having the breast barred, by its white or greyish legs (as compared with leaden grey or slate in that bird) and by its stub-tail being pointed. Singly or pairs, in grassy country.

No specimens, but H.A. has observed the Button Quail at Borivli (Salsette) and across the Harbour at Kihim (Kolāba Dist.).

Resident, presumably, but uncommon.

(To be continued).

THE BIRDS OF THE LACCADIVE ISLANDS.

BY

F. N. BETTS.

(*With a plate*).

Although the Laccadive Archipelago lies but 150 miles or so off the West coast of India, the islands are seldom visited by strangers except for the biennial Government inspection, and the only account of their avifauna in any way complete is that of Hume who made a fortnight's tour of the group in February 1875, in the survey ship *Clyde*, and published his results in *Stray Feathers*. In his *Short Account of the Laccadive Islands*, R. C. Ellis, I.C.S., who made four official inspection tours thither, gives a list of birds; but I am unable to say from what source this was obtained and several of the records seem open to doubt.

With the hope of being able to add to this scanty store of knowledge, I spent a fortnight among the Northern islands of the group in February of this year. The only means of getting there was to travel in one of the small island sailing craft which trade with Mangalore, and, as the various islands lie at distances of twenty to forty miles apart and communication is entirely dependent on favourable wind and weather, I was only able in the time at my disposal to explore four of the inhabited islands, and failed to reach the outlying reefs which would have yielded the most results ornithologically. My visit cannot be said to have been fruitful as I only encountered two hitherto unrecorded species both of which are regular winter migrants on the mainland.

Changes are few and slow in action in this out-of-the-way corner, and every word of Hume's interesting and entertaining account, although written over sixty years ago, applies today. As however *Stray Feathers* is long out of print and no longer accessible to everyone, it may not, I hope, be considered out of place to collate the available information on the scanty Avifauna of the Laccadives with such little original observations as I was able to make myself.

The Laccadives lie between the parallels of 14 and 10 North, and consist of a number of coral atolls and reefs, some submerged and others appearing as isolated islands or sandbanks. There are nine main inhabited islands and several small islets which, though covered with vegetation, are unoccupied owing to lack of fresh water. Most of the islands lie well out of sight of each other with the exception of Amini and Kadmat which are only six miles apart. They are all very similar, low and sandy, nowhere rising more than ten feet above sea level, lying on the Eastern edge of a circular coral reef exposed at low tide, whose Western portion encloses a shallow lagoon of varying size. They range in area from 10 acres to 1,000 and those that are inhabited are mostly thickly populated. These latter are densely planted from end to end with



Coral Reef at Kadmat.



Banyan grove at Kiltan.

coconuts, and there is very little other vegetation. A few breadfruit, drumstick trees and limes are grown, and on one or two of the islands one sees small patches of yams and other vegetables, while everywhere a sparse growth of grass springs up in the monsoon though there was little left, except on Kiltan, at the time of my visit.

Apart from this cultivated flora, a certain amount of scrub grows above the tide line and in the more infertile areas, chiefly a laurel-shrub (*Scaevola koenigii*), wild heliotrope (*Tournefolia argentea*), and a bushy shrub (*Pemphis acidula*), which is used for firewood. The uninhabited islands are covered with a dense jungle of screwpine (*Pandanus* sp.). One or two tamarinds and banyans occur, particularly on Kiltan where there is quite a grove at the Southern end of the island. The shores along the highwater mark carry a growth of Spinifex and creeping purple convolvulus (*Ipomoea biloba*).

Invertebrate life is very scarce, grasshoppers occur in small numbers, sandflies on one or two of the islands, and ants, mostly of house-haunting varieties, but there appear to be no spiders or termites, and the few butterflies one sees are doubtless windblown from the mainland. There is little therefore to support land birds, and there are only two resident species, the House Crow, no doubt introduced by human agency and almost entirely parasitic on mankind, and the White-Eye, which seems to live very largely on honey from the flowers of the coconut trees.

I noticed a remarkable absence of seafowl in the neighbourhood of the main islands. It was not until one got well off shore that one came on flocks of Terns pursuing the shoals of small fish which were chased to the surface by porpoises or sharks. This is the more remarkable as the sandbanks of Cherbaniani and Pitti are the breeding grounds of myriads of various pelagic Terns. I imagined this scarcity might be due to the fact that the birds were away at their nesting stations but was told that it was always the case.

Until about 1830 the seafowl used to breed in enormous numbers at Bitra, the most northerly of the islands on which vegetation grows, but for some reason this was suddenly deserted and they are now found only on the outlying sandbanks. Hume found *Anous stolidus* and *Sterna fuliginosa* breeding at Cherbaniani in February whilst *Sterna bergii* and *Sterna anætheta* were still in winter plumage.

These probably go to Pitti where I was informed there was an enormous colony of seafowl which lay in May, and the islanders make trips there regularly to collect eggs. Strange to say, Major Alcock in his *Naturalist in the Indian Seas* writes that when he went to Pitti at the end of November in the R.I.M.S. *Investigator* in 1891 he found the whole sandbank literally covered with the young of two species of Terns which he failed to identify, so that it looks as if there must be two breeding seasons.

If the avifauna of the islands is poor in numbers, the sea between them and the mainland is a desert. During the passage which took 30 hours outward bound and three days on the return journey the only birds we saw were two Tropic Birds, a few Shearwaters and one flock of Sooty Terns chasing a shoal of fish. Three or four miles off the South Canara coast we passed three Great Black-headed

Gulls, *Larus ichthyaëtus*, resting on the water. Approaching Mangalore at midday, soon after the daily sea breeze had settled down to blow, very large numbers of *Sterna bergii*, all in winter plumage, began to cross our bows in small flocks heading straight out to sea. The tide was just on the flood at the time, and presumably the fish were beginning to move and the birds which had been resting on the shore were going out to feed.

1. **The House Crow.** *Corvus splendens splendens* Vieill.

Only occurs on Androth, Kalpeni, and Amini. They were numerous on the latter island and fed chiefly on garbage. I saw one on February 22nd collecting dead twigs under a casuarina tree near the Kachcheri and carrying them to a nest in a neighbouring coconut palm. Strangely enough though Kadmat is only six miles away and plainly visible, they have not penetrated there. I was told that one was taken over on one occasion by an islander a few years ago and lived there for some time till it took to attacking the kids of the milch goats, after which the inhabitants persuaded the Monegar to shoot it.

2. **Brown Shrike.** *Lanius cristatus cristatus* Linn.

I saw a solitary specimen in the scrub at the uninhabited Southern end of Kiltan. This, I believe, is the first record from the group.

3. **House Martin.** *Delichon urbica urbica* Linn.

This species is recorded by Ellis, but I should think it is extremely doubtful whether it has occurred.

4. **Small Ceylon White-Eye.** *Zosterops palpebrosa egregia* Madarasz.

The *Fauna* records this subspecies as occurring in the Laccadives. I unfortunately did not obtain specimens in confirmation. Hume found them on all the islands visited. I found them numerous at Kadmat and Kiltan, rare on the barren Chetlat, and strangely enough did not see one at Amini. Perhaps the Crows have something to do with that. The birds seemed to be paired but I did not find any nest.

5. **The Koel.** *Eudynamis scolopaceus scolopaceus* Linn.

Obtained by Hume on all the islands he visited. Ellis says that it breeds on Kavarathi, but since there are no crows there this seems on the face of it impossible. I saw none though I was told that cuckoos of sorts were common at times, particularly among the banyans and scrub at the southern end of Kiltan. I searched this area and failed to find any but thought I heard one.

6. **The Brown Wood Owl.** *Strix indranee indranee* Sykes.

In Hume's day a pair of these existed on Bitra, the survivors of several which the Government had sent over to control the rat plague. They were not popular with the Islanders, and none remain as far as I know.

7. **The Osprey.** *Pandion haliaëtus haliaëtus* Linn.

I saw one at Kadmat sitting on a rock on the reef, and another at Kiltan eating a fish on top of a post on the shore which used at one time to carry a light. Hume and Ellis do not record it. It is no doubt a casual migrant.

8. **The Peregrine.** *Falco peregrinus* subsp.

Hume records this bird as a fairly regular migrant appearing at all times of the year but not breeding. He saw it at Amini, Bangaram and Kavarathi and heard of it at Kiltan. I did not see it.

9. **The Kestrel.** *Cerchneis tinnunculus tinnunculus.*

Hume found it on all the islands visited. I saw a party of three at Amini and a solitary bird on Kadmat but did not shoot any. Those Hume obtained he assigned to this subspecies.

10. **White-headed Sea-Eagle.** *Haliaëtus leucogaster* Gmelin.
Hume saw one soaring over Amini. I did not come across it.

11. **Pariah Kite.** *Milvus migrans govinda* Sykes.
Hume did not actually see this bird but reports it on hearsay. I also did not meet any but was told that Kites turn up no infrequently and steal chickens.

12. **Black-winged Kite.** *Elanus caeruleus vociferus* Lath.
Hume obtained this species at Amini and Kadmat. I did not see it, nor does Ellis record it.

13. **Pale Harrier.** *Circus macrourus* Gmel.
Recorded by Ellis. I saw two at Kiltan myself. Presumably these and the other birds of prey must subsist largely on rats and domestic chickens when they can be got as there is very little else for them to prey on.

14. **Montague's Harrier.** *Circus pygargus* Linn.
Reported by Ellis.

15. **White-breasted Waterhen.** *Amaurornis phoenicurus phoenicurus* Penn.
Ellis recorded this bird as a resident. I did not see it nor does Hume record it, and it seems unlikely that a bird of such weak wing-power should have wandered so far unless assisted.

16. **Crab Plover.** *Dromas ardeola* Payk.
Hume saw a flock on Peremal Par. Ellis records it as resident. I did not see it.

17. **White-cheeked Tern.** *Sterna repressa* Hartert.
Hume obtained two immature specimens at Cherbaniani.

18. **Little Tern.** *Sterna albifrons* subsp.
Hume obtained several at Cherbaniani.

19. **Large Crested Tern.** *Thalasseus bergii edwardsi* Mathews.
Hume saw a large flock at Peremal Par and a few at Cherbaniani and one at Bangaram. I saw none among the islands though they were numerous on the mainland coast.

20. **Lesser Crested Tern.** *Thalasseus bengalensis bengalensis* Lesson.
Hume saw a large flock at Peremal Par, as well as some at Cherbaniani and thinks they breed there.

21. **Panayan Tern.** *Sterna anaetheta antarctica* Lesson.
Hume found them in enormous numbers at Cherbaniani in February in winter plumage.

22. **Sooty Tern.** *Sterna fuscata infuscata* Licht.
Hume found it breeding in vast numbers at Cherbaniani in February. I saw flocks well out to sea between the islands feeding on shoals of fish driven to the surface by sharks and porpoises but never within seven or eight miles of land. We passed quite close to one resting on the back of a sleeping turtle.

23. **Philippine Noddy.** *Anous stolidus pileatus* Scopoli.
Hume found this species beginning to breed at Cherbaniani in the second week of February.

24. **Turnstone.** *Arenaria interpres interpres* Linn.
Hume calls this the commonest bird on the Laccadives. This is strange as Ellis does not mention it, and I failed to come across a single one on any of the islands I visited.

25. **Kentish Plover.** *Leucopolius alexandrinus* subsp.
Hume saw one at Kadmat and one at Bangaram. I did not encounter any and Ellis does not record it.

26. **Central Asian Small Sandplover.** *Cirrepidesmus mongolus artifrons.*
Hume obtained three at Kadmat. I shot one out of a flock of half a dozen at Kiltan, the only ones I saw.

27. **Large Sandplover.** *Cirrepidesmus leschenaultii* Lesson.
Hume obtained specimens at Kadmat and Kiltan. I did not see any.

28. **Eastern Golden Plover.** *Pluvialis dominicus fulvus* Gmelin.
Recorded by Hume and Ellis though I did not find it. Hume saw it on all the islands and says it was particularly numerous at Amini where there were at least fifty feeding on the shore or resting among the Spinifex above the beach.

29. **Curlew.** *Numenius arquata orientalis* Brehm.
Hume obtained two, one at Kadmat and one at Agathi, the only records.

30. **Whimbrel.** *Numenius phaeopus* Linn.
Hume found it at Amini, Kiltan and Bitra and it is recorded by Ellis. I met it on each island visited singly or in small flocks of three or four. They were very shy and would not allow approach within shot.

31. **Common Sandpiper.** *Tringa hypoleucos* Linn.
Hume records it as fairly common and Ellis includes it in his list. I found it the most numerous of any shore bird on all islands, particularly on Kiltan where they found the piled rocks of the storm beach on the Eastern shore particularly to their liking.

32. **Greenshank.** *Glottis nebularia* Gunnerus.
Hume shot one at Kadmat, the only record.

33. **Sanderling.** *Crocethia alba* Vroeg.
Hume shot a pair at Bitra. Ellis does not record it nor did I see one.

34. **Knot.** *Calidris tenuirostris.*
Hume saw a pair at Bitra, the only record.

35. **Australian Red-legged Gannet.** *Sula sula rubripes* Gould.
Hume identified a flock of Gannets seen near Peremal Par as this species. I saw none.

36. **Booby.** *Sula fiber.*
Hume saw single specimen of this Booby at Cherbaniani and Peremal Par. I am unable to trace the current correct name for this bird as it does not appear in the Synonymy of the *Fauna*. From the descriptions of the Islanders it seems highly likely that Boobies of some kind breed at Pitti in May.

37. **Short-tailed Tropic Bird.** *Phaethon indicus* Hume.
Hume obtained one not far from the Cherbaniani Reef. I saw two solitary specimens during the passage from the mainland both at least 50 miles from the nearest shore.

38. **Persian Shearwater.** *Puffinus persicus* Hume.
Ellis records this as resident, but neither Hume nor I ever noticed any Shearwaters anywhere near the Islands.

39. **Wedge-tailed Shearwater.** *Puffinus pacificus hamiltoni* Mathews?
During the passage from the Malabar coast I encountered several Shearwaters, all solitary and a great distance from land. All these had dark underparts and so could not have been *P. persicus.*

40. **Common Heron.** *Ardea cinerea rectirostris* Gould.

Hume saw several at Bangaram and says he saw stick nests in the trees which probably belonged to them though they were not breeding at the time of his visit. Ellis says there is a breeding colony on Viringilli, a small islet in the Minicoy lagoon. I saw two on the reef at Kadmat and one at Kiltan.

41. **Indian Reef Heron.** *Demiegretta asha* Sykes.

Hume saw one at Bitra, the only record.

42. **Little Greem Heron.** *Butorides striatus javanicus.*

Hume shot one at Kadmat. I saw one on the reef at Amini.

43. **Common Teal.** *Nettion crecca crecca* Linn.

Hume does not mention this but it is recorded by Ellis. I picked up a dried head on the beach at Amini and was told that they were regular winter visitors though in varying numbers, coming in very tired and tame and resting in the Mosque tanks and on the lagoons.

44. **Indian Pond Heron.** *Ardeola grayii.*

Hume saw one or two on Amini and Kadmat. The only one I saw I flushed out of the Mosque tank at Amini.

THE TAXONOMIC DESCRIPTION OF *RHINOPHIS TRAVANCORICUS* BOUL.

BY

BENI CHARAN MAHENDRA, F.Z.S.,

St. John's College, Agra.

(*With* 1 *plate*).

A recent examination of four specimens of the rare Uropeltid snake *Rhinophis travancoricus* Boul. makes it necessary to institute certain changes in its taxonomic description. Two of these specimens, which constitute the entire collection of this species in the Indian Museum, were borrowed by me from Dr. Baini Prashad; one came as a present from Prof. Padmanabha Aiyar, Maharajah's College of Science, Trivandrum; and the fourth from Prof. C. John, St. Berchmann's College, Chenganacherry.

The species *Rhinophis travancoricus* was instituted by Boulenger[1] in 1892 on the basis of a single specimen obtained by Mr. H. S. Ferguson[2] 'near Trivandrum, at the 6th mile-stone towards Vambayam, in June, 1892', and its first description, published in the *Journal of the Bombay Natural History Society* (January 1893),[3] was almost at the same time adopted, with slight modifications, in the *Catalogue of the Snakes in the British Museum.*[4] Sarasin[5] (1910) listed this species as endemic to South India, and Wall (1923),[6,7] made observations on its lepidosis. Quite recently, Smith[8] has revised Boulenger's description for his forthcoming volume on Indian *Serpentes*, and I am grateful to him for the following copy of his manuscript:

Rhinophis travancoricus Boul.

'Rostral not ridged above, separating the prefrontals for half their length, or a little more or less, the portion visible as long as

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[1] Boulenger, G. A., 'Description of a new earth-snake from Travancore.' *Jour. Bomb. Nat. Hist. Soc.*, 1892-93, vol. vii, p. 318.

[2] Ferguson, H. S., 'List of Snakes taken in Travancore from 1888 to 1895.' *Jour. Bomb. Nat. Hist. Soc.*, 1895, vol. x, p. 70.

[3] Vide footnote 1 above.

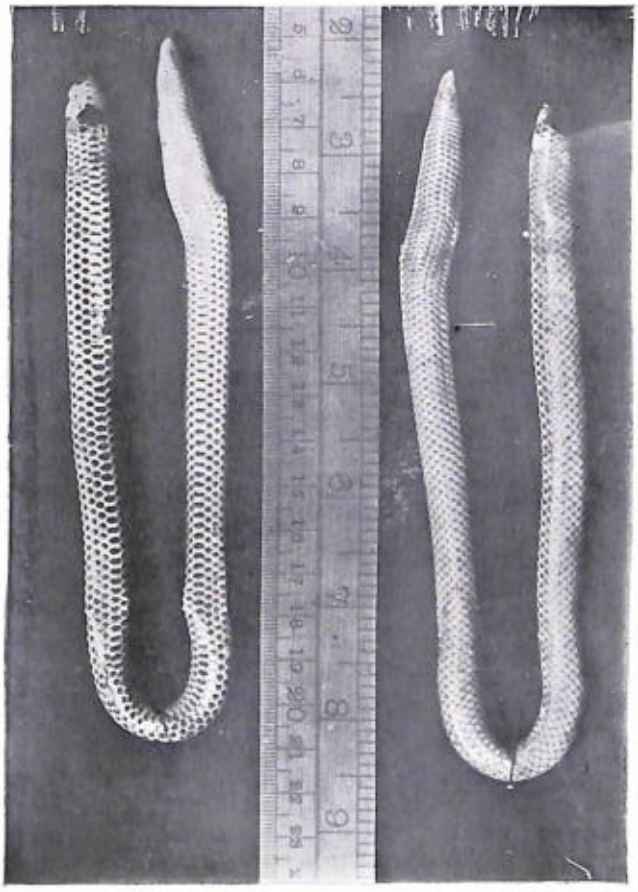
[4] Boulenger, G. A., *Cat. Sn. Brit. Mus.*, London, vol. i, 1893, p. 143.

[5] Sarasin, Fritz, 'Über die Geschichte der Tierwelt von Ceylon', *Zool. Jahrb.*, 1910, Suppl. 12, p. 137.

[6] Wall, F., 'A Hand-list of the Snakes of the Indian Empire,' *Jour. Bomb. Nat. Hist. Soc.*, 1923, vol. xxix, no. 2, p. 355.

[7] Wall, F., 'How to Identify the Snakes of India (including Burma and Ceylon', 1923, p. 17.

[8] Smith, Malcolm A., 'The Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia, vol. iii, Serpentes.' (*In course of preparation.*)



Rhinophis travancoricus Boul.
Photograph of a record example presented to the author by Prof. C. John.

the distance between it and the hinder part of the frontal; frontal as long as the parietals; eye one-third the length of the ocular shield; scales in 17 rows; V. 132-146, one and a half times as broad as the adjacent scales; C. 5-7; caudal disc as long as the shielded part of the head; almost flat, covered with spicules.

'Dark purplish brown, the scales on the sides and belly edged with whitish; on the throat and fore part of the belly almost completely whitish; anal region black; lower surface of tail yellow.

'Total length 180, diameter 7 mms.

'*Range*. Travancore (Trivandrum, Pirmed, Ernakulum). Found at sea-level and in the hills to about 4,000 ft.'

With regard to the *rostral*, Smith (unpublished MS.) says, 'the portion visible as long as the distance between it and the hinder part of the frontal.' In all the four specimens examined by me, the portion visible is distinctly less than this distance, being nearly two-thirds of the latter. The diameter of the *eye* varies from one-third to two-fifths the length of the ocular shield. The number of *ventrals* in one specimen (viz., Prof. John's) is 151, and that exceeds the limit mentioned by previous authors by 5. *Scale rows* behind the head are 17, not 19 as recorded by Boulenger (1893).

The type specimen described by Boulenger measured 170 mm. Smith (unpubl. MS.) gives 180 mm. as the total length, and 7 mm. as the diameter of the body. Of the specimens examined by me, two, viz., no. 16482 of Ind. Mus., and Prof. Aiyar's specimen, measure 220 mm. in length, and that considerably exceeds the previous record. However, Prof. John's specimen is a veritable giant in this respect, being 320 mm. long. That beats the old records by 140 mm. !

Boulenger (1893), in the synopsis of the genus *Rhinophis* given by him, lays stress on the ratio between the diameter of the body and the total length, and says in connection with *R. travancoricus*, 'the diameter of body 34 times in the total length.' The present examination does not bear him out in this respect, as the following measurements show:

Specimen	*Total Length*	*Diameter*	*Ratio*
16481 (Ind. Mus.) ...	160 mm.	6½ mm.	$24\frac{8}{13}$
Aiyar's	220 ,,	7½ ,,	$29\frac{1}{3}$
16482 (Ind. Mus.) ...	220 ,,	7 ,,	$31\frac{3}{7}$
John's	320 ,,	9 ,,	$35\frac{5}{9}$

Prof. Aiyar's specimen differs in colouration both from the other specimens and from the published description. It is markedly *melanistic*, being dark slate-coloured. The throat and the anterior part of the belly are also dark, and the white edgings on the scales on the sides and the belly are inconspicuous. The anal region is black, but as the region of the belly anterior to it (as a matter of fact, the whole ventral region) is darkish, it does not stand out as a definite patch as in other specimens. The lower surface of the

tail is pinkish, and there is a dark patch just behind the subcaudal scute.

As a result of the present study, the following description for the species may be proposed :

Snout acutely pointed; *rostral* smooth above, not keeled, about $\frac{1}{3}$ the length of the shielded part of the head, separating the prefrontals for half their length, the portion visible less than the distance between it and the hinder part of the frontal; *frontal* longer than broad, as long as the parietals; diameter of the *eye* $\frac{1}{3}$ to $\frac{2}{5}$ the length of the ocular shield; *scales* in 17 rows; *ventrals* 132-151, about $1\frac{1}{2}$ times as broad as the adjacent scales; *caudals* 5-7; *caudal disc* as long as the shielded part of the head, almost flat, covered with spicules.

Yellowish-brown to shining dark slate-coloured, the scales on the sides and belly edged with whitish (edgings less conspicuous in melanistic specimens); on the throat and fore part of the belly almost completely whitish (even this region dark in melanistic specimens); anal region marked out by a dark patch in specimens in which the ground colour is not dark slate; lower surfaces of the tail yellow or pinkish.

Maximum length 320 mm., diameter varying from $6\frac{1}{2}$ to 9 mm.

Range. Travancore (Trivandrum, Mahendragiri, Pirmed, Ernakulum, Chenganacherry). Found at sea-level and in the hills to about 4,000 ft.

In the end, it is my pleasant duty to thank Dr. Baini Prashad, Prof. Padmanabha Aiyar and Prof. C. John for the specimens examined; Dr. Baini Prashad for the loan of two volumes from the Indian Museum library; and Dr. Malcolm Smith not only for sending me his unpublished description of the species, but also for many acts of friendship and kindness during the past years.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

SUPPLEMENTARY INTRODUCTION.

These descriptions were originally prepared for the *Entomologist's Record*, but lack of space entailed considerable delays in publication, and it was eventually decided that the series could be handled more advantageously in India. The following had, however, already appeared:—

Introduction—1933, xlv, p. 136.
Byasa aristolochiae F., *aristolochiae*—1933, xlv, p. 137.
Chilasa clytia L., *clytia*—1933, xlv, p. 137.
Huphina nerissa F., *evagete* Cr.—1933, xlv, p. 138.
Catopsilia crocale Cr.—1933, xlv, p. 148.
Terias hecabe L., *hecabe*—1933, xlv, p. 148.
Pareronia valeria Cr., *hippia* F.—1933, xlv, p. 149.
Danais chrysippus L.—1933, xlv, p. 149.
Euploea core Cr., *core*—1935, xlvii, p. 18.
Elymnias hypermnestra L., *undularis* Drury—1935, xlvii, p. 18.
Euthalia garuda Moore, *suddhodana* Fruhs.—1935, xlvii, p. 49.
Rathinda amor F.—1935, xlvii, p. 49.
Suastus gremius F., *gremius*—1936, xlviii, p. 19.
Udaspes folus Cr.—1936, xlviii, p. 19.
Dasychira mendosa Hbn.—1936, xlviii, p. 58.
Orgyia postica Wlk.—1936, xlviii, p. 59.
Porthesia (Euproctis) scintillans Wlk.—1936, xlviii, p. 99.
Rhyncholaba acteus Cr.—1937, xlix, p. 80.
Natada suffusa Moore—1937, xlix, p. 81.
Polytela gloriosae F.—1937, xlix, p. 124.
Ophiusa coronata F.—1937, xlix, p. 125.
Buzura suppressaria Guen.—1938, l, p. 76.
Agathia laetata F.—1938, l, p. 77.
Sylepta derogata F.—1938, l, p. 77.

and I am much obliged to the Editors of the *Entomologist's Record* for permission to republish them here.

In some of these I have added further references and also names of food-plants; such additions are enclosed in brackets.

Since writing the original introduction, a considerable advance in our knowledge of the early stages has been made by the publication of Vol. v in the *Fauna of British India*, Moths—Sphingidae by Bell and Scott; this contains descriptions and, in many cases coloured figures or photographs, of all the then known Indian Sphingid larvae.

Calcutta, 4-vii-38.

Introduction.

The more easily obtained books on Indian Lepidoptera are, I have found, of very little help in the identification of the early stages; a large number of the few descriptions appearing in Sir George Hampson's Moths in the *Fauna of British India* and in the Indo-Australian section of Seitz's *Macrolepidoptera of the World* are vague, incomplete and even inaccurate, whilst Evans, in his *Identification of Indian Butterflies*, ignores the early stages altogether.

I have, therefore, made a point of recording brief descriptions of the various larvae that have passed through my hands in the hope that they may prove of use to other entomologists working in India.

When numbering the somites I have in all cases ignored the head, the 1st somite is, therefore, the one immediately behind the head, i.e. the first thoracic somite. Further, in spite of the fact that most of the descriptions are noted as being made from single larvae, they have all been checked with other examples so that there is no danger of an aberration masquerading as the usual form. There is, however, always the possibility of some of these descriptions applying to local forms only.

In cases where the description given in the four volumes of Moths by Sir George Hampson in the *Fauna of British India* or in the English Edition of the Indo-Australian section of Seitz's *Macrolepidoptera of the World* is particularly incomplete or misleading, I have added it to mine with the reference 'Hampson' or 'Seitz' as the case may be.

London, 7-vii-33.

RHOPALOCERA.

Papilionidæ.

Byasa aristolochiae F., *aristolochiae*.

Moore, *Lep. Ind.*, v, 178, pl. 442, figs. 1, 1a-1c. 1901-03.
(Moore, *Lep. Ceyl.*, i, 151, pl. 57, figs. 2a, 2b. 1880-81.)

Head and legs black. Body velvety black, the 6th somite with a white transverse band. The skin between the somites dark purplish crimson. 1st to 3rd somites each with eight coral red fleshy tubercles, the dorsal four on the 1st somite being very much smaller than the others. 4th to 10th somites each bearing six of these tubercles, those on the 6th being white, except the lowest one which is red. 11th and 12th somites with four tubercles. Osmeterium yellow.

Pupa fawn, very like a curled dead leaf. Thorax keeled with five white lines anteriorly and two posteriorly diverging from the keel. Wing cases darker brown and developing into a lobe anteriorly. The first three abdominal somites each with a white lateral U-shaped line. 4th to 7th abdominal somites each bearing a pair of conspicuous rounded lobes. Suspended by a girdle and tail pad of dark brown silk.

Food-plant—*Aristolochia* sp.

Described from a full fed larva found in Calcutta 8-x-31, pupated 12-x-31 and a female emerged 26-x-31.

Seitz does not mention the number of the tubercles nor the intersegmental colour of the larva and omits the colour of the pupa.

Chilasa clytia L., *clytia*.

(Moore, *Lep. Ceyl.*, i, 153, pl. 57, fig. 1b. 1880-81.)

(Moore, *Lep. Ceyl.*, i, 154, pl. 56, fig. 2b. 1880-81.)

(Moore, *Lep. Ind.*, vi, 84, pl. 502, figs. 1, 1a-1b. 1903.)

Moore, *Lep. Ind.*, vi, 89, pl. 506, figs. 1, 1a-1d. 1903.

Head and legs black. Ground colour black. A wide cream dorsal stripe from the 1st to the 9th somite, a cream lateral stripe from the 1st somite joining the dorsal stripe on the 7th and forming a trident, and a cream lateral stripe extending backwards from the 10th somite. A subdorsal series of fleshy black tubercles with a rose pink spot at the base of each. A double lateral series of rose pink spots, the upper complete and the lower with spots on the 3rd, 4th, 5th, 7th, 8th and 9th somites only. The osmeterium blue.

Pupa like a broken piece of stick, mottled with various shades of brown. Cylindrical, the last four abdominal somites hollowed out below. Thorax not keeled but projecting forward over the head which is truncate. Supported by a girdle and tail pad of dark brown silk.

There is no difference between the type and v. *dissimilis* in the early stages.

(Food-plant—*Alseodaphne semicarpifolia* Nees (Laurineae).)

Described from a full fed larva found in Calcutta 20-iv-31, pupated 23-iv-31 and a female emerged 4-v-31.

Seitz does not mention the cream-coloured markings and states that the 'fork on the neck' (osmeterium?) is pale-coloured.

(In my original description I omitted to mention that the first three tubercles of the subdorsal series are double, the additional ones being slightly smaller.)

Zetides agamemnon L., *agamemnon*.

Moore, *Cat. Lep. Mus. E.I.C.*, i, 114, pl. 3, figs. 9, 9a. 1857.

Moore, *Lep. Ceyl.*, i, 145, pl. 63, fig. 2a. 1880-81.

Davidson and Aitken, *Journ. Bom. Nat. Hist. Soc.*, v, 363. 1890.

Moore, *Lep. Ind.*, vi, 7, pl. 470, figs. 1, 1a-1c. 1903.

Jordan Seitz, *Indo-Austr. Rhop.*, 101.

Head green. Body green with darker indistinct oblique stripes. Spiracles black. Shape thickened from head to 3rd somite then tapering. The 1st and 2nd somites each with a small black subdorsal spine, the 3rd with a similar but slightly larger spine with an orange ring round the base. Anal plate with a pair of spines. Osmeterium pale green and, when once protruded, not withdrawn for some time. It is directed forward in a horizontal plane rather than above the head as in most Papilionid larvae. When at rest the larva bears a strong resemblance to a large green Pentatomid bug and this is increased when it is alarmed as the protruded osmeterium then mimics the bug's antennae.

Pupa pale green. Thorax with a white dorsal line, which divides on the first abdominal somite and joins again at the base of the cremaster. Thorax produced in front into a blunt horn tipped with brown and this colour continues as a margin along the outer edge of the wing cases. Head obtuse.

Moore, in *Lep. Ceyl.*, gives *Magnoliaceae* and *Anonaceae* as food-plants.

Described from a full fed larva found at Peshoke (2,500 ft. Darjeeling District) 30-xii-36, pupated 4-i-37 and a male emerged 2-ii-37.

Bingham, quoting Davidson and Aitken, describes the larva as having four pairs of spines. This is a little misleading as the spines on the anal somite are green and quite different to the black spines on the thoracic somites.

Pieridæ.

Huphina nerissa F., *evagete* Cr.

Moore, *Lep. Ceyl.*, i, 136, pl. 53, fig. 1b. 1880-81.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 574. 1897.

Typical Pierid larva of a dark velvety green. Very like *Pieris rapae*.

Pupa very like that of *Pieris rapae* in shape. Two colour forms, one green with head, thoracic keel and a triangular patch on each side of the metathorax pale brown. The other with the ground colour darker and similar markings in paler brown.

Food-plant—*Capparis* sp.

Described from a full fed larva found in Calcutta 22-xi-30, pupated 24-xi-30 and a male emerged 5-xii-30.

Catopsilia crocale Cr.

Moore, *Lep. Ceyl.* i, 122, pl. 48, fig. 1b. 1880-81.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 570. 1897.

(De Nicéville and Kuhn, *J.A.S.B.*, p. 271, pl. 1, figs. 5a, 5b. 1898.)

Typical Pierid larva. Head green with minute black dots. Skin of the body very rough, green with minute black dots. A white spiracular line above which is a black dotted one and below an olive green stripe. Ventral surface whitish green.

Pupa boat-shaped with the thorax slightly keeled and the head produced to a point. Two colour forms. The one apple green with a yellow line on the thoracic keel and another lateral one running from the head along the dorsal edge of the wing case to the tail. The other form grey green, a dark brown dorsal line and a pale lateral line. The wing cases and the sides of the abdomen suffused with dark brown striae. Suspended by a girdle and tail pad.

Food-plant—*Cassia* sp.

Described from two full fed larvae found in Calcutta 7-ix-31, pupated 9-ix-31 and two females emerged 14-ix-31.

Seitz describes the pupa as having black tubercles,

Terias hecabe L., *hecabe*.

Moore, *Lep. Ceyl.*, i, 118, pl. 45, fig. 1c. 1880-81.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 570, pl. 6, figs. 5, 5a. 1897.

Typical Pierid larva, green with a white spiracular line. The skin rough.

Pupa with thorax slightly keeled. Very variable in colour. Some grass green with a dark dorsal line and a black spot at the base of the wing cases, others have in addition a square black subdorsal spot on the 2nd abdominal somite and others again have the wing cases more or less suffused with black and black lateral suffusion.

Food-plant—*Cassia* spp.

Described from a batch of nine full fed larvae found in Calcutta 17-x-31, pupated 19-x-31 and five males and four females emerged 24-x-31.

Seitz states that the larva has a large black head, this was not the case with my specimens.

Terias blanda Bsd., *silhetana* Wall.

Bell, *Journ. Bom. Nat. Hist. Soc.*, x, 571, pl. 6, figs. 6, 6a. 1897.

Fruhstorfer Seitz, *Indo-Austr. Rhop.*, ix, 169.

Head large and black. Body yellow green, the anterior portion usually rather darker owing to the contents of the crop. A barely distinguishable pale lateral stripe. The appearance is very different to that of *T. hecabe*, whose larva is of a far bluer green with a distinct white lateral line and a green head. Gregarious.

Pupa with the thorax compressed and the wing cases forming a deep keel. Ground colour yellowish, almost obscured by black suffusion, and a black dorsal line. Suspended by the tail and a longish girdle. A point of interest is that while all my *T. hecabe* larvae have suspended themselves for pupation from the lid of their tin, the great majority of the *blanda* larvae pupated on the stems of their food-plant.

Food-plant—*Cassia* spp.

Described from a batch of full fed larvae found at Peshoke (2,500 ft. Darjeeling District) 1-i-37, one of which pupated 13-i-37 and a female emerged 26-i-37.

Pareronia valeria Cr., *hippia* F.

Bell, *Journ. Bomb. Nat. Hist. Soc.*, x, 573. 1897.

Typical Pierid larva, bright green with a pale dorsal line. Legs pinkish. A lateral fawn coloured blotch of granular appearance on the 4th and 11th somites. A series of oblique dark lateral lines from the 5th to the 10th somite. Anal plate projecting and slightly forked.

Pupa compressed laterally. Wing cases very large. The head produced into a beak forming an almost unbroken curve with the dorsum. Colour whitish green with a dark dorsal and a pale lateral line. 2nd abdominal somite with a pair of small black dots. Wing cases with a red central and a series of white submarginal spots.

Food-plant—*Capparis* sp.

Described from a full fed larva found in Calcutta 10-i-31, pupated 12-i-31 and a female emerged 22-i-31.

Seitz describes the larva as being green but mentions no markings. He compares the shape of the dorsal distal margin of the pupa to that of an enormous sun helmet.

DANAIDÆ.

Danais limniace Cr., *mutina* Fruh.

Moore, *Lep. Ceyl.*, i, 4. 1880-81.

Moore, *Lep. Ind.*, i, 30, pl. 6, fig. 1. 1890-92.

Head very pale green with two black rings. Ground colour very pale green, each somite with four transverse black lines, the second being considerably broader than the others and dividing into two laterally. A yellow sublateral band edged above with black. A pair of long fleshy filaments on the 2nd and a pair of short on the 12th somite, coloured pale green with black tips and with a black line along the anterior and posterior edges. Legs and prolegs pale green ringed with black. Ventral surface with indistinct transverse black lines.

Pupa green with the following brilliant golden markings. A beaded dorsal band along the posterior edge of the 4th abdominal somite. A dorsal and a lateral spot on the 3rd and a dorsal spot on the 2nd abdominal somite. A subdorsal and a lateral spot on the metathorax and a dorsal and lateral spot on the mesothorax. A double spot on the eye. A spot at the base of the wing case, a subbasal spot and a post median series of two to four spots placed in a curve. A spot on the edge of the wing case in continuation of the dorsal band. A very short line at each end of the transverse dorsal stripe, the cremaster and a U-shaped mark on the ventrum black. Suspended by the cremaster under a leaf.

Bingham gives *Asclepias* and *Calotropis* as food-plants.

Described from a full fed larva and pupa found in Calcutta 25-viii-35, from which a male emerged 26-viii-35.

Danais chrysippus L.

(Moore, *Lep. Ceyl.*, i, 7, pl. 3, fig. 1b. 1880-81.)

Moore, *Lep. Ind.*, i, 36, pl. 8, fig. 1, 1890-92.

(Bingham, *Fauna Brit. Ind.*, Butterflies, i, 11. 1905.)

Head grey with two black rings. Ground colour grey, 1st to 11th somites each with a black transverse central stripe and a black line on each side. The 2nd to 11th somites each with a pair of subdorsal elongate yellow spots. 12th somite with a transverse yellow stripe edged with black. 2nd, 5th and 11th somites with a pair of subdorsal black filaments, those on the 2nd longest and pointing forward, the base of the pair on the 5th somite reddish. A yellow lateral stripe. Legs black. Claspers black banded with grey. Anal plate black. Ventral surface blackish with a few grey dots.

Two pupal forms, the one blue green, the other pinkish buff. Both with a golden spot on the eye, one in the middle of the wing

case, one at its origin and two near the lateral edge of the metathorax. The abdomen with a dentate ridge on the 4th somite, black anteriorly and gold posteriorly. Cremaster black. Suspended by the tail from any suitable support. The green form is usually found among leaves, the buff form in other situations.

Food-plant—'Ak' (*Calotropis procera* R. Br.).

Described from a full fed larva found in Calcutta 27-x-31, pupated 29-x-31 and a male emerged 6-xi-31.

Seitz mentions a wax yellow pupal form but I have never seen it.

Euploea core Cr., *core*.

(Moore, *Lep. Ind.*, i, 81, pl. 23, figs. 1, 1a. 1890-92.)

Head shining black edged with white, a white mark above the jaws and a white line running from the side of the mandibles to the median suture forming a triangle. Body chocolate brown ringed with white, a brick red line edged below with white along the spiracles, which are black. Paired black subdorsal fleshy filaments on the 2nd, 3rd, 5th and 11th somites, those on the 2nd being longest. A transverse black line on the 2nd and 3rd somites joining the bases of the filaments. Ventral surface dark brown. Anal plate black. There is another form of the larva in which the chocolate and white markings are replaced by a dark and light shade of purplish grey.

Pupa brilliantly gilded with fawn coloured markings. Cremaster and last abdominal somite black. Suspended from the underside of a leaf and somewhat resembling a drop of water shining in the sun. The fawn markings are more pronounced in those pupae that develop in shady places.

Food-plant—Oleander and Peepul (*Ficus religiosa* Linn.), vide *Entomologist*, lxvi, p. 118.

Described from a full fed larva found in Calcutta 30-ix-30, pupated 5-x-30 and a male emerged 12-x-30.

Seitz mentions an emerald green form of pupa with a brilliant metallic gloss on the head, but I have never come across it.

Satyridæ.

Elymnias hypermnestra L., *undularis* Drury.

(Bingham, *Fauna Brit. Ind.*, Butterflies, i, 171. 1905.)

Head square, pinkish brown outlined with yellow, and divided above into a pair of horns. Skin rough and pubescent. Body bright apple green with a fine double yellow dorsal line, a subdorsal yellow line bearing a red spot on the 8th, 9th and 10th somites and a blue dot on the 8th and 9th. A thin yellow line running along just above the spiracles with another below it. The last somite produced into a pair of processes about $\frac{1}{4}$ inch long, yellow at the base and shading into reddish at the apex. In some examples the red dorsal spots are obsolete.

Pupa apple green. The head divided into two short horns marked at the base with pink. The upper edge of the wing cases marked with pink and with a pink spot in the cell. Thorax keeled,

the keel yellow outlined in pink, with two subdorsal pink spots. The abdomen with a subdorsal line broken up into yellow and pink spots. Trace of a similar lateral line. The last abdominal somites strongly curved so that the pupa, instead of hanging, lies parallel to the leaf to which it is attached. Fixed to the underside of a leaf of the food-plant by the cremaster.

Food-plant—Palms of various species.

Described from a full fed larva found in Calcutta 14-x-30, pupated 18-x-30 and a female emerged 26-x-30.

Seitz does not mention the long anal processes.

NYMPHALIDÆ.

Euthalia garuda Moore, *suddhodana* Fruhs.

(Moore, *Cat. Lep. Mus. E.I.C.*, i, 186, pl. 6, figs. 2, 2a. 1857.)

(Moore, *Lep. Ind.*, iii, 115, pl. 234, figs. 1, 1a-1d. 1896-99.)

Head green, body green with a pale dorsal stripe and a pale mauve transverse line on each somite. A series of eleven feathery scoli, about $\frac{3}{8}$ths of an inch long, arising subdorsally, the first pair pointing forwards, the 2nd to 10th pairs sideways and the 11th pair backwards.

Pupa green. The head lobed with a brown spot on each projection. A lateral and a dorsal brown spot on the thorax, a gilt and brown line between the 3rd and 4th abdominal somites dorsally. Shape, ventral surface flattish; thorax and first three abdominal somites flat with a median keel and rising to a point, the posterior somites with a slight median keel.

Food-plant—Mango (*Mangifera indica* Linn.).

Described from a full fed larva found in Calcutta 16-i-32, pupated 19-i-32 and a female emerged ?-ii-32.

Seitz describes a form of the larva in which the transverse lines are yellow.

Aglais cashmirensis Koll., *aesis* Fruhs.

Head black with rufous bristly pubescence. Ground colour black sprinkled with yellow specks, which are thickest on each side of the dorsal line. 1st somite spineless, 2nd and 3rd each with four (subdorsal and lateral) and 4th to 11th somite each with seven (sublateral, lateral, subdorsal and dorsal) branched spines. 12th and 13th somites with the subdorsal spines only. Legs black. Prolegs tinged with green. When young lives gregariously in a web.

Pupa with head bilobed, thorax rising to a point and with six short subdorsal paired spines along the abdomen. Colour pinkish stone colour, some being darker and greyer. Slight gilding on the posterior portion of the thorax and on the first pair of abdominal spines. In some specimens the gilding extends over the whole body.

All stages are very like the European *A. urticae* L.

Food-plant—Nettle.

Described from one of a batch of full fed larvae found in Darjeeling 10-v-35, pupated 12-v-35 and a male emerged 28-v-35.

LYCAENIDÆ.

Cosmolyce (*Lampides*) *boeticus* L.

Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 432. 1907.

Head retractile, brown. About half an inch long of typical Lycaenid woodlouse shape. Varies in colour from pale to dark green, some specimens being suffused with purplish. A dark dorsal and a pale lateral line. Each somite with a dark subdorsal oblique line directed backwards. The divisions between the somites shallow. The gland and tubercles not very noticeable.

Pupa bone colour, the head and thorax slightly darker and shaded with black. A dark dorsal line. Each abdominal somite with four subdorsal black spots, a pair on each side of the dorsal line. Anal end rounded. Supported by a girdle of silk in a spun together leaf.

Food-plant—Lupins and Peas, preferring the flowers and seeds. De Nicéville records it feeding on the flowers and pods of *Crotalaria striata* DC. and there are probably few leguminous plants on whose flowers and seeds it would not feed.

Has the common Lycaenid habit of devouring its pupating fellow larvae. Imagines emerge about 9 a.m.

Described from a number of full fed larvae found in Calcutta 1-ii-35, one of which pupated 8-ii-35 and a female emerged 17-ii-35.

Bingham, quoting De Nicéville, describes the larva as being pale, dull green without markings except for the dark dorsal line. He also describes the pupa as being pale yellowish green.

Pratapa deva Moore, *lila* Moore.

Seitz Seitz, *Indo-Austr. Rhop.*, ix, 971.

Pupa darker or paler olive brown. The following chalky white marks, a short streak on each side of the head, a trident-shaped mark on the metathorax with the handle pointing forwards, the whole of the abdomen with the exception of the dorsum of the 1st somite and a lateral stripe. Resembles a bird dropping. Suspended by the tail without any girdle.

Described from a number of pupae found on the trunk of an orange tree at Peshoke (2,500 ft. Darjeeling District) 30-xii-36, from one of which a male emerged 13-i-37.

A pupating larva found at the same time was pale pinkish ivory in colour with the thoracic somites humped. It is said to feed on *Loranthus*.

Rathinda amor F.

Head retractile. Ground colour bright green, olive green or dull purple. The green forms with a brown transverse band on the 4th and a brown dorsal patch on the 6th to 8th somites, the purple forms with the same markings a little darker than the ground colour. A white lateral line from the 5th to 10th somite. The 2nd and 3rd somites with a pair of subdorsal horn-like projections, the pair on the third somite being the longer. A single dorsal projection on the 4th somite. The 5th somite bearing a long dorsal and a long lateral projection. The 6th to 9th somites each bearing

a dorsal projection, that on the 6th very short, the 7th and 8th slightly longer and that on the 9th long. The 10th somite with a short dorsal projection and a long lateral one.

Pupa shaped like that of a Syrphid, green with a brown dorsal patch.

Food-plant—A cultivated garden shrub with bright scarlet flowers (*Ixora* sp.). The larvae prefer the flowers and the young berries to the leaves.

Described from full fed larvae found in Calcutta 10-vii-32, pupated 12-vii-32 and males and females emerged 20-vii-32.

Seitz described the larva as being 'Green with purplish red cones of different lengths'.

GRYPOCERA.

Suastus gremius F. *gremius*.

Kershaw, *Butt. Hong Kong*, 125, pl. 14.

De Nice., *Ind. Mus. Notes*, i, 9.

Head brown with pale central and lateral stripes. Body glaucous green with a dark dorsal line. Spiracles black. Anal plate large and broad, the body flattened posteriorly.

Food-plant—Palms of various species on which the larva lives in a turned over leaf.

Pupa very moth-like, enclosed in a cell made from a spun together leaf and covered with a waxy powder. Yellow green with the last somite and cremaster reddish brown. Thorax darker green with a lateral reddish spot anteriorly.

Described from a full fed larva found in Calcutta 11-xii-31, pupated 16-xii-31 and a male emerged 10-i-32.

Udaspes folus Cr.

Kershaw, *Butt. Hong Kong*, 136-37, pl. 14.

Larva slug-like. Head dull black, heart-shaped and small for the size of the larva. Thoracic somites very slender giving the appearance of a neck. Colour bluish green due to the contents of the intestines and the blood, the skin itself being unpigmented. Anal plate very broad and flat. A white mealy blotch ventrally between each pair of claspers.

The larva lives in a turned over leaf on various sorts of Monocotyledons.

Pupa very pale green, torpedo-shaped with the head produced to a long snout. Attached by a girdle and the cremaster in a waxy cell. During the pigmentation of the developing imago, the eyes become red but later darken to black.

Described from a full fed larva found in Calcutta 17-x-30, pupated 20-x-30 and a male emerged 11-ii-31.

HETEROCERA.

ZYGAENIDÆ.

Trypanophora semihyalina Koll.

Moore, *Lep. Mus. E.I.C.*, ii, pl. xiv, fig. 6.

Hamps., *Fauna Brit. Ind.*, Moths, i, 249. 1892.

Jordan Seitz, *Indo-Austr. Bombyces*, x, 14.

Head brown and retractile. Ground colour dark brown, a lateral yellow patch extending back from the 9th somite. A series of small subdorsal tubercles, those on the 2nd somite red and double, on the 3rd black and double, on the 4th to 9th black and single and on the 10th yellow. A sublateral series of tubercles, those on the 2nd and 3rd somites red and double, on the 4th to 6th red and single, on the 7th and 8th black and on the 9th to 11th yellow. Spiracles black. Ventral surface and claspers orange red.

Pupa yellow with the thorax a little darker. Enclosed in a thin cocoon of papery white silk.

Food-plant—*Lagerstroemia indica* Linn. and *L. Flos-reginae* Retz.

Described from a full fed larva found in Calcutta 26-x-31, pupated 29-x-31 and a female emerged 12-xi-31.

ARCTIIDÆ.

Roeselia fola Swinh.

Head yellowish. The body thickly clothed with dark hair. A remarkable feature is that the head capsules are not got rid of at each ecdysis but adhere one to the other, a full grown larva often carrying a chain of five or six. Before fully mature the larva is covered with pale pink fluff, this is shed during the last instar revealing the dark hair.

Pupa reddish brown, rather long. Enclosed in a cocoon spun along a twig and composed of silk, hair and woody fragments.

Food-plant—*Quisqualis indica* Linn.

Described from a full fed larva found in Calcutta 23-x-31, pupated 27-x-31 and a female emerged 3-xi-31.

Aganais ficus F.

Hamps., *Fauna Brit. Ind.*, Moths, i, 504. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 225.

Penultimate instar. Head and legs brownish black. 1st somite orange with a black median patch. The rest of the body with a black median line, a white dorsal stripe, a black subdorsal stripe with transverse white lines and an orange lateral stripe. A pair of dorsal black spots on each somite. The 9th somite entirely black. Ventral surface orange red.

Final instar. Head and legs brownish black. Ground colour blackish, the ventral surface and claspers orange red. A lateral yellow patch on the 5th and 9th somites. 1st to 3rd somites each with eight red papillae bearing white hairs. 4th to 11th somites each with ten similar papillae. Some specimens have fine white transverse lines on the dorsum and a broken pale yellow spiracular line.

Pupa reddish brown, very noctuid in shape and enclosed in an earthen cocoon on the surface of the ground.

Food-plant—Peepul (*Ficus religiosa* Linn.).

Described from a batch of larvae found in Calcutta 6-v-32, pupated 13-v-32 and males and females emerged 24-v-32.

Asota caricae Bsd. (*alciphron* Cr.).
Moore, *Lep. Ceyl.*, ii, 52, pl. 102, fig. 1b. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 502. 1892.
Seitz Seitz, *Indo-Austr. Bombyces*, x, 227.

Head black marked behind with red. 1st somite with a red transverse band and a black median patch. A black median line, a white subdorsal stripe with a black dot on each somite, a black lateral stripe and an interrupted white spiracular line. Last somite reddish. Ventral surface dark brown. Claspers pinkish. Clad with sparse white hairs. The larvae are gregarious and very active falling to the ground at the slightest touch.

Pupa reddish brown, very noctuid in appearance. Enclosed in an earthen cocoon on the surface of the ground.

Food-plant—*Ficus hispida* Linn.

Described from a full fed larva found in Calcutta 16-i-32, pupated 19-i-32 and a male emerged 5-ii-32.

Hampson describes the larva as being 'black above, brown below; two dorsal white bands, a subdorsal black speck on each somite; a series of lateral black specks; sparse black hairs; the head red'.

Spilarctia obliqua Wlk.
Roths. Seitz, *Indo-Austr. Bombyces*, x, 243 (ab. *dahlbergiae* Moore).

Ova spherical, pale green. Laid in large batches.

Young larva with the head black. Ground colour yellowish, the first three and last three somites marked with black. A subdorsal blackish stripe. Hair pale on the pale somites and mixed with black on the black ones. Legs and claspers black. After the 3rd moult there is a series of indistinct pale oblique lateral stripes and the posterior portion of the pale somites is dark grey.

Full grown larva with the head black. Ground colour dark grey, the 1st to 3rd and 11th to 13th somites black with the intersegmental areas whitish. 4th to 10th somites with anterior half rufous orange. A pale dorsal stripe. A sublateral series of pale oblique stripes. The hair pale except on the 1st to 3rd and 11th to 13th somites, where it is mixed with black. Legs and claspers black.

Pupa of the usual Arctiid shape and dark red in colour, in a cocoon of brownish silk mixed with larval hair.

Food-plant—Sunflower, *Antirrhinum* and probably many other low plants.

Described from a number of larvae bred from ova in Calcutta, one of which pupated 26-iii-38 and a male emerged 2-iv-38.

Seitz describes the larva of ab. *dahlbergiae*, Moore as 'black, very long haired'. My larvae gave both ab. *dahlbergiae* and typical imagines and there was no apparent difference in the larvae.

Utetheisa pulchella L.
Hamps., *Fauna Brit. Ind.*, Moths, ii, 55. 1894.

Ova pale yellow, spherical with the base flattened slightly. Laid in lines with a space between each ovum. Hatch on the fourth day.

Larva—Head rufous. Body blackish with a white dorsal stripe interrupted in the middle of each somite by a transverse black edged reddish bar. A pale lateral stripe and a white sublateral line, each with a series of black centred orange tubercles giving rise to a white hair. Each somite with two black tubercles on each side of the dorsal stripe, the anterior pair being rather closer together, these each give rise to a black hair except those on the 1st to 3rd and 10th to 12th somites, which have a white and somewhat longer hair. Ventral surface greenish with a blackish lateral stripe. Legs and prolegs marked with blackish. The ground colour fades to a greyish tint prior to each moult and the markings are then more noticeable.

Pupa in a thin cocoon of white silk. Chestnut brown, the thorax blackish except for a central stripe, a blackish transverse stripe on each of the abdominal somites. Wing cases striped with black along the veins. Leg and antenna sheaths black striped. In some pupae the black markings on the thorax and wing cases are less pronounced.

Food-plant—Dahlia, but this may not be a natural one. South in *Moths of the British Isles* gives *Myosotis* and records that the larva is said not to feed in the absence of sunshine. Mine did not do this.

Described from a full fed larva from a number bred from ova in Calcutta, pupated 30-iii-38 and a female emerged 5-iv-38.

Hampson gives the following rather incomplete description:—'Larva dark grey, with a dorsal white band and subdorsal series of red spots; head yellow.'

Argina argus Koll.

Moore, *Lep. Ceyl.*, ii, 69, pl. 105, figs. 1b, 1c. 1882-83.
Hamps., *Fauna Brit. Ind.* Moths, ii, 51. 1894.
Seitz, *Pal. Bombyces*, ii, 74.

Head reddish brown, black at the sides. Body blackish with a broad white dorsal stripe. An interrupted red sublateral line from the 4th to the 10th somite. A few hairs.

Pupa in a slight web. Yellowish brown with the following black markings. On the abdomen a large dorsal and subdorsal spot on each somite and a double median and broad lateral stripe ventrally. On the thorax a U-shaped mark. On the wing cases a costal stripe, a broad median streak dividing at the outer margin into four and a broad stripe along the inner margin. Leg sheaths streaked with black.

Food-plant—A leguminous plant with large yellow flowers. The larva bores into the pods, which are pubescent, thick and about an inch and a half long, eating the unripe seeds and leaving a conspicuous hole.

Described from a number of larvae found at Peshoke (2,500 ft. Darjeeling District) 26-xii-36, one of which pupated 10-i-37 and a male emerged 29-i-37.

Hampson's description is 'Larva purple black, with a few dorsal hairs; head and a lateral line from 4th to 10th somites reddish; a dorsal series of transverse white streaks.'

LYMANTRIIDÆ.

Dasychira mendosa Hbn.

Moore, *Lep. Ceyl.*, ii, 96, pl. 115, fig. 4b. 1882-83.

(Hamps., *Fauna Brit. Ind.*, Moths, i, 452. 1892.)

(Strand Seitz, *Indo-Austr. Bombyces*, x, 292.)

Head, legs and claspers crimson. 1st somite white with four longitudinal crimson stripes and bearing subdorsal pencils of dark grey hair pointing forward. 4th to 7th somites with short dorsal tufts of greyish white hair, the skin between these somites velvety black. A lateral tuft of white hair on the 4th and another of plumose black and white hair on the 5th somite. A dorsal pencil of dark grey hair pointing backward on the 11th somite. Ground colour grey, a lateral series of crimson spots on a white line. 4th to 11th somites with a subdorsal series, the 8th to 10th bearing in addition a dorsal pair, of red spots. An interrupted white median line bearing a red spot on the 8th and 9th somites.

Pupa dark brown dorsally, the first three abdominal somites with patches of golden brown pubescence. Wing cases and ventral surface greenish. Enclosed in a cocoon of white silk mixed with larval hairs.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 9-xii-31, pupated 15-xii-31 and a female emerged 23-xii-31.

Hampson describes another form of the larva with the ground colour blackish and the dorsal tufts bright yellow. All my specimens, however, have been of the grey form with greyish white tufts.

Varmina indica Wlk.

Hamps., *Fauna Brit. Ind.*, Moths, i, 435. 1892.

Head and legs brown. Ground colour rufous with a paler dorsal line and a black subdorsal and lateral stripe. The skin on the dorsum between the 1st, 2nd and 3rd somites also black. 1st somite with a dorsal fringe of pale hair projecting forward over the head and a pencil of long grey hair arising subdorsally. 2nd to 10th somites each with a subdorsal tuft of pale yellowish hair and a slighter lateral tuft springing from a reddish tubercle. Each tuft with one or two hairs very much longer than the others. 11th somite with a dorsal pencil of dark grey hair, 12th somite with a few scattered long grey hairs. Spiracles white ringed with black. A black stripe running from each spiracle to the anterior edge of the somite, where it joins the lateral stripe. Ventrum with an interrupted black stripe.

Another larva was completely black with white spiracles.

Pupa dark reddish brown in a cocoon of thin yellowish silk mixed with larval hairs.

Food-plant—A shrub rather like the English Dogwood.

Described from a full fed larva found in Darjeeling 15-v-35, pupated 21-v-35 and a female emerged 7-vi-35.

Hampson describes the larva as 'black, speckled with white and with dorsal and lateral tufts of hair arising from fulvous

tubercles; the thoracic and anal somites with reddish tufts, the medial with grey, 4th and 11th somites with long dorsal black tufts.'

Orgyia postica Wlk.
Moore, *Lep. Ceyl.*, ii, 78, pl. 109, fig. 1b. 1882-83.
(Hamps., *Fauna Brit. Ind.*, Moths, i, 436. 1892.)
(Strand Seitz, *Indo-Austr. Bombyces*, x, 301.)

Head reddish brown. 1st somite with subdorsal pencils of long dark plumose hair projecting forward. Short dorsal tufts of yellow hair from the 4th to 7th somite. Lateral tufts of white hair on the 4th and 5th somites. A dorsal pencil of long brown hair on the 11th somite directed backwards. Ground colour blackish with a pale subdorsal line. A series of small lateral pinkish spots tufted with hair.

Pupa whitish, the thorax and first four abdominal somites dark brown. Enclosed in a cocoon of whitish silk mixed with larval hair.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 15-i-32, pupated 18-i-32 and a male emerged 24-i-32.

Hampson describes the larva as 'yellowish, sparsely clothed with brown hair; one dorsal and two lateral brown bands; paired tufts of long brown hair on the 1st and 11th somites projecting forward and backward; lateral tufts of grey hair from 4th and 5th somites; dorsal tufts of yellow hair on 4th to 7th somites; the head red,' and this description is copied almost word for word by Seitz.

Perina nuda **F.**
Moore, *Lep. Ceyl.*, ii, 94, pl. 114, fig. 1b. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 486. 1892.

Head grey and pubescent. Ground colour pinkish grey. 1st somite with a red lateral tubercle tufted with grey hair and a dorsal pair of black or red spots. 2nd and 3rd somites with an olive green lateral band, bearing two pink spots on each somite. 4th and 5th somites each with a dorsal hump covered with short hair. A broad olive green dorsal band from the 4th somite backward. 4th to 11th somites each with a subdorsal blue spot ringed with black and bearing a few black bristles. A white dorsal papilla on the 9th and a red on the 10th somite. A series of lateral tubercles tufted with grey hair. Legs, prolegs and ventral surface whitish.

Pupa under a very slight web spun over the fold of a leaf. Head, wing cases and ventral surface whitish. Thorax yellow green with a chestnut coloured transverse band anteriorly, a dorsal chestnut stripe and a lateral series of five black spots. Abdominal somites bright green, all but the 3rd and 4th with a chestnut dorsal patch, which is edged laterally on the posterior somites with black. Tufted with golden yellow hair.

Food-plant—*Ficus* of various species. Moore gives Acanthads, but this seems unlikely.

Described from a full fed larva found in Calcutta 25-viii-35 pupated 27-viii-35 and a female emerged 31-viii-35.

Porthesia (*Euproctis*) *scintillans* Wlk.
(Moore, *Lep. Ceyl.*, ii, 86, 87, pl. 111, figs. 1b, 3a. 1882-83.)
(Btlr., *Ill. Het.*, vii, 123, pl. 138, fig. 10. 1889.)
(Hamps., *Ill. Het.*, ix, 77, pl. 175, fig. 12. 1893.)
Hamps., *Fauna Brit. Ind.*, Moths, i, 483. 1892.
Strand Seitz, *Indo-Austr. Bombyces*, x, 333.

Head yellow brown. Ground colour blackish. A pair of red tubercles tufted with hair on the 1st somite. A pale dorsal stripe from the 1st to the 3rd somite, the portion on the 3rd being yellow with a red central line. A black dorsal swelling on the 4th and another on the 5th somite, that on the 4th edged anteriorly and laterally and that on the 5th posteriorly with yellow. A yellow dorsal stripe from the 6th to the 10th somite with a red central line. A black dorsal swelling on the 11th somite. 4th to 10th somites with raised black lateral patches dotted with white.

Pupa. Yellowish brown, thorax and wing cases greenish. Abdominal somites with a subdorsal and lateral dark line. Enclosed in a thin cocoon of brown silk mixed with larval hairs.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 18-x-31, pupated 22-x-31 and a male emerged 31-x-31.

Hampson describes three other forms of larva, but omits this, the only form I have seen. Seitz's description is as follows:—'Head and legs brown, head with two hair tufts on red tubercles. Dorsum white with a red streak, the third joint with a red tubercle, 4th and 5th joints with black hair tufts, penultimate joint with a black torus, last joint brown. On the sides greyish brown and red longitudinal stripes.' He does not give the food-plant.

LASIOCAMPIDÆ.

Metanastria hyrtaca Cr.
Moore, *Lep. Ceyl.*, ii, 148, pl. 141, fig. 1b. 1882-83.
Forsayeth, *Trans. Ent. Soc.*, pl. xv, figs. 3, 3a, b. 1884.
Hamps., *Fauna Brit. Ind.*, Moths, i, 410. 1892.

Head purplish grey brown, minutely speckled with darker. A dark brown median stripe divided into two above the mouthparts. Body purplish grey brown streaked and speckled with darker. 1st and 2nd somites with a dark brown dorsal stripe, narrow anteriorly and broadening posteriorly. 3rd to 11th somites each with a dorsal hexagonal dark brown blotch, the whole forming a chain, the blotch on the 8th somite rather paler in colour. A short lateral oblique dark streak on each somite. Except the 1st, each somite with four blue warts with dark hairs. The 2nd somite with a dorsal tuft, the anterior portion of short buff spatulate hairs, the posterior portion with longer black simple hairs, the skin between black. 3rd somite with a transverse fold, the skin of which is deep scarlet but which only shews when the larva is alarmed. Each somite with a lateral tubercle with a fan-shaped tuft of pale hair, immediately

above which is a smaller tuft of buff coloured spatulate hair. Ventral surface black with yellow streaks and specks, which are more pronounced laterally. Prolegs marked with orange. True legs blackish ringed with paler. Some larvae are without the dark dorsal blotches, which are replaced by a zig-zag subdorsal line.

Pupa in a cocoon of brown silk mixed with larval hairs and spun in a leaf. Colour purplish brown. Thorax thickly covered with short pale hair, parted centrally and directed sideways. The abdominal somites ringed with dark rufous hair. Head, wing, leg and antenna cases smooth.

Food-plant—*Mimusops Elengi* Linn. (Sapotaceae). The larvae feed at night and rest gregariously on the trunk during the daytime.

Described from a full fed larva found in Calcutta 20-iv-38, pupated 1-v-38 and a male emerged 15-v-38.

There seems to have been some confusion over the situation of the scarlet transverse fold. Hampson places it on the 2nd somite and Moore between the 4th and 5th.

Bombycidæ.

Ocinara varians Wlk.

Moore, *Lep. Ceyl.*, ii, 136, pl. 133, fig. 1b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 35. 1892.

Ova flattened discs. Yellow with a slightly varnished appearance. Laid in rows of eight to twelve. They become dark leaden grey the day before hatching. Hatch on the fourth day.

Young larva with the head greyish. Body with 2nd somite somewhat swollen. Dorsum whitish grey, a darker grey lateral stripe with a tooth projecting onto the dorsum on the 5th and 8th somites. A short fleshy grey horn on the 11th somite.

Full grown larva. Head brownish with a darker inverted V. Dorsum brownish, a dark greyish lateral stripe marked with orange brown on the 5th to 10th somites. Horn brown tipped with white, fleshy, not chitinised as in the Sphingidae. The larva is very variable, the dorsum may be any shade of yellow brown, grey brown or red brown, sometimes mottled and speckled with blackish, and the lateral stripe may be greyish or the same colour as the dorsum. Ventral surface greenish grey. Legs pale brown.

Pupa yellowish white, very slightly chitinised. In a boat-shaped cocoon of pale yellow silk, very closely woven and hard. Usually spun in a slight depression in a leaf.

Food-plant—Peepul (*Ficus religiosa* Linn.).

Described from a number of larvae bred from ova in Calcutta, one of which pupated 23-vi-38 and a male emerged 27-vi-38.

Both Moore and Hampson describe the horn as being on the anal somite.

Sphingidæ.

Deilephila nerii L.

Moore, *Lep. Ceyl.*, ii, 14, pl. 82, fig. 1a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 94. 1892.

Bell and Scott, *Fauna Brit. Ind.*, Moths, v, 268, pl. 3, figs. 10, 11. 1937.

Ovum—Usual Sphingid type but rather small for the size of the insect. Deposited night 23-vii-36. Hatched morning 30-vii-36.

1st instar—Head round, pale green. Body yellowish green. Horn black. Moulted 1-viii-36.

2nd instar—Head round, pale green. Body pale green, at first without markings but later two blue ringed white spots appear on the subdorsal part of the 3rd somite and a bluish lateral line dotted with white along the abdomen. Horn black, the base yellow. Moulted 3-viii-36.

3rd instar—Very similar to the previous one. The bluish lateral stripe edged above with yellow. A transverse line of white dots along the anterior edge of the 5th, 6th and 7th somites with the beginnings of a second line at the sides. 8th somite with similar spotting but the line broken on the dorsum. Moulted 5-viii-36.

4th instar—Similar to the preceding. The legs pink. The spots on the 3rd somite joined together into a kidney-shaped blotch only visible when the thoracic somites are extended. Spiracles black. Horn with the basal half stout and yellow green, the apical half very thin and hyaline, the two parts divided by a black ring. Moulted 7-viii-36.

Final instar—Similar to the preceding. Legs purplish. The spot on the 3rd somite with a dark indigo ring shading into the white centre. The lateral stripe almost obsolete on the 4th somite and the white lateral dots not present on the anterior part of the 4th, the posterior part of the 9th nor on the 10th somite. Horn yellow, very short and thick and curved downwards. Before pupation the ground colour changes; the head, the dorsal portion of the 1st somite and the area from the base of the horn to the 4th somite above the lateral line turning brown, this colour extending as a wedge along the dorsum of the 3rd somite. The rest of the body pinkish orange. Ceased feeding 10-viii-36. Pupated 12-viii-36.

Pupa—In a loose cocoon among litter on the surface of the soil. Pinkish tinged with orange, the abdominal somites sprinkled with black specks. Spiracles broadly ringed with black. A black median line on the thorax and ventrally from the head to the end of the wing cases. A male emerged 23-viii-36.

Food-plant—Oleander (*Nerium odorum* Soland).

Described from one of a number of larvae bred from ova in Calcutta.

Hampson describes the larva as 'Green, with a bluish lateral band from 4th somite to horn, with white oval spots on it, and others above and below it; 3rd somite with a blue ocellus; horn yellow.'

(*To be continued*).

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

(*With* 6 *plates*).

III.—BIRDS IN MY GARDEN.

(*Continued from page* 560 *of Volume* XXXIX).

By 'my garden' I mean the gardens of the different bungalows I have occupied during a service of over a quarter of a century spent with the East Indian Railway, in the exigencies of which I have from time to time been posted in different parts of Bengal, Bihar and the United Provinces.

Looking through my notes I find myself confronted with such an *embarras de richesse* that I hardly know where to start. I see that I have come across the nests of forty-five different species in the gardens of bungalows in which I have lived. Twenty-two of the number were found in one garden alone, in the Agra district. Over and above this, I have discovered the nests of nine additional species in my friends' gardens, including that of a Grey Hornbill, which found a nesting tree in Hume's old compound at Etawah.

SUNBIRDS.

Much has been written lately concerning the manner in which the Purple Sunbird builds its nest—I ought perhaps to have said *her* nest because the male takes no part in this task. Nevertheless what I have observed may not be without interest. On 5 April 1922, while seated in a 'long-sleever' enjoying my *palan que char*, I noticed a female Sunbird flying from one bush to another, obviously prospecting for a nesting site. The choice eventually fell upon a slender twig of a small lime tree. As soon as this important question had been decided, the little bird busied herself with fetching materials for the home that was to hold her eggs. She had not far to go. Cobwebs, small pieces of bark or decayed wood, carpenters' shavings, bits of torn-up paper, cotton, cocoons, miscellaneous rubbish—are they not all to be found somewhere in every compound? However, even allowing for the fact that the materials were close at hand, I was surprised, the following morning, when I timed her in her building operations. Forty visits in forty and a half minutes, and fifty in sixty and a half minutes! Consider what this means—searching for the material, flying with it to the nest, incorporating it in the structure and then flying away to bring more, and it will be realised she allowed herself no respite. At 8-15, the Sunbird showed signs of feeling the effects of her labours and the visits to the nest then slowed down

appreciably. Possibly this was due to a shortage of materials; more probably it was because of the heat; at all events, from mid-day till 2-30 she did not go near the nest. I imagine, like every other sensible person, up-country, she felt she needed a rest in the afternoon. Nevertheless, when I returned from office that evening, the pendent home was roughly fashioned, even down to the entrance hole. This nest held the first egg on 11 April, so that only six days were spent in its construction. Altogether three eggs were laid—a somewhat unusual clutch, two being the normal number. The eggs are a dirty-white in ground colour, with greyish-brown spots. A peculiarity about this species is that it frequently rears two broods in the same nest. I have a note also of it laying three lots of eggs in a nest I had under observation in my garden at Allahabad. Each clutch was destroyed, possibly by a Crow-Pheasant or blood-sucker lizard, though the nest was not damaged in any way until the third clutch was ravished.

Only once did I see the husband of the busy female, whose industry I have just related,—at least I presume he was her lawfully wedded spouse—go anywhere near the nest while it was being built. He perched on a neighbouring lime tree, rattled off a few canary-like notes, gave his wife the 'once over' and then, when she flew off to fetch more materials, pursued another of the opposite sex! Not only does the male Purple Sunbird not assist in building the nest but I have never seen him incubate. When, however, the eggs have hatched, he takes a more active interest in family affairs and is to be seen frequently feeding the young although even in this respect he is never so assiduous as the female.

Wood-Shrikes.

I have never been able to understand how it was that Hume succeeded only once in finding the nest of the Common Indian Wood-Shrike. In those parts of the United Provinces with which I am familiar, which were its happy huting grounds too, it is a common species, frequenting *mango* and *seesum* groves as well as orchards and gardens. Perhaps it is because of its dull grey plumage that the bird so commonly escapes notice; nevertheless its note is a peculiar whistle which never fails to attract attention. The nest, if searched for in the ordinary way, is difficult to locate, though the reverse is the case if, in March and April, the birds are patiently watched. Like the White-browed Fantail Flycatcher and the Small Minivet, they are indefatigable workers, and during these months it is a simple matter with a good pair of field-glasses to watch either sex carrying materials to the nest under construction. Moreover the species is intolerant of the presence of other birds or small animals too close to its home. It was due to this little failing that I found my first Wood-Shrike's nest, built high up in a *seesum* tree. Since then I have on several occasions found the nest of this species in my garden, usually wedged into the horizontal fork of a *nim* tree, only, however, in the western districts of the United Provinces.

I know of no prettier sight than a Wood-Shrike building its nest. Both sexes engage in the task, and frequently, while one



A COMMON WOOD SHRIKE FEEDING ITS YOUNG.

bird is at the nest the other arrives with more material. The latter will not, however, 'do anything about it' until the first arrival has taken its departure. About the third or fourth day, the future nursery assumes something approaching its final shape. Then it is that the Wood-Shrike is frequently seen *in* the nest, applying cobwebs to the exterior, smoothing things down with its beak, which is used like a trowel, first working to the right and then to the left, and finally giving strength to the whole structure by pressing the sides inwards with its chin, all the while turning round and round in the nest. Ordinarily, three eggs are laid. Out of about 40 nests that I have examined, only once have I known this number exceeded, and then the nest contained a newly-hatched chick and three eggs. In the case of a nest built in my garden, incubation lasted fourteen days from the laying of the last egg. Both sexes take part in this task and sit closely. When the eggs are hatching, Wood-Shrikes seem to have no thought for matters mundane; their whole attention is concentrated on the little bodies that are coming into the world. On such an occasion, I once photographed at close range, and without using the hiding tent, a pair of these birds at their nest. So extraordinarily confiding was the female that, incredible though it may sound, she not only twice allowed me to lift her off her nest and put her back again, but even permitted me to place a finger between her open mandibles. While all this took place the male remained perched on the nest-bough only a few inches beyond the nest.

Nuthatches.

The Chestnut-bellied Nuthatch is a common visitor to those gardens where old *mango* and *siris* trees occur, and the sight of the bird, as it runs up or down or even sideways along the trunk of some gnarled giant, almost invariably leads the novice to believe he has spotted a really uncommon species. With the Tree Creeper he is usually familiar, but the slaty-blue upper plumage of the Nuthatch is to him an unknown quantity and therefore the bird is at once put down as 'rare'. Although it is so generally distributed, I confess to having found a Nuthatch's nest only once in a friend's garden and to having seen but three nests of *Sitta c. castanea* during twenty-seven years. I attribute my failure to the fact that the bird is a very early nester—nesting operations commence in February or the beginning of March at the latest—and my attention at this time of the year is usually directed to the different birds of prey. The nest may be low down, or high up, in a tree. A natural hole serves for the nursery but the hole is plastered up with mud and clay till the entrance is only about 1¼ inches in diameter—just large enough to admit the owners. The ease with which a Nuthatch enters and leaves the nest-hole is amazing. To me the bird always appears to be unusually broad-shouldered but it literally 'packs' itself up, and lo! we have *multum in parvo*!

The 30th of March 1938 opened in a most disappointing manner for me. I had gone to Etawah hoping to photograph a Common Quail on its nest. On arrival there, I found that my *zamindar* friend had been wrong in his identification. The bird whose nest

he had found was the Jungle Bush-Quail, which I had previously photographed, and with the cutting of the *arhar* crop (in which the nest was situated) the eggs had been deserted. It was while breakfasting in my saloon, musing over my bad luck that I noticed a Chestnut-bellied Nuthatch working a *nim* tree and even descending to the ground in search of food. When the bird flew away and shortly returned, my curiosity was really roused. Following the Nuthatch on its departure again, with the glasses, I quickly found the nest-hole, which unfortunately, though quite invisible from the ground, was high up in a *nim* and overlooked the local gaol. However, thanks to the influence of friends, the municipal authorities allowed a *machan* to be erected in the road and on 7th April I was able to photograph the Nuthatch at home. The male is by far the handsomer of the two, and in addition was much bolder in facing the camera—in fact it did not worry him at all, even though not concealed in any way, a remark which also applies to myself, seated comfortably just behind the tripod. In spite, however, of being so fearless of camera and man, the obtaining of a successful photograph of the Nuthatch is no easy matter owing to its very rapid movements. Its industry is such as to give one the impression that the bird has awakened an hour late and is now doing its utmost to make up the time lost.

When first I found it, a pair of Common Mynahs paid repeated visits to the Chestnut-bellied Nuthatch's nest, frequently dropping a *nim* leaf into the hole, and on 7th April, when I was on the *machan,* the nest was from time to time visited by a Yellow-throated Sparrow, whose portrait I also secured. Such visits by other species to nests in holes of trees are not uncommon; the visitors often subsequently take possession of the hole for their own nesting purposes.

Mynahs.

Three species of Mynah have honoured me by nesting in my garden, two of them, the Common and Pied Mynahs, frequently, and the third, the Brahminy Mynah, occasionally. In Northern India the last named nests only in holes in trees. The Common Mynah nests as often in a hole in a tree as in one in a building. More than once, however, I have come across a nest resting on the top of a pillar in the verandah. The nest of the Pied Mynah is constructed quite differently. It is a large, domed, irregular mass of long straws, roots, rags and twigs placed in the outer branches of some tree,—pieces of straw and grass frequently hanging down in the most untidy manner. Sometimes, several such nests may be found in the same tree. The interior is heavily lined with feathers, but the entrance to the egg cavity is by no means easy to find. Both Common and Pied Mynahs' nests seem to be particularly susceptible to raids by snakes. I well remember watching a cobra try to climb a *simal* tree in a hole of which a pair of Common Mynahs had a nest containing young ones. I think the snake would have succeeded in attaining its object had not the parent birds, and others of their kind, flung themselves repeatedly at the cobra as it tried again and again to negotiate



THE CHESTNUT-BELLIED NUTHATCH.

A natural hole in a tree served for her nursery. The bird plasters the entrance with mud and clay leaving a narrow opening.



The Nuthatch's nest was visited from time to time by a Yellow-throated Sparrow.

the *simal's* ample girth. On another occasion, my lunch was interrupted by the chattering calls of innumerable Pied and Common Mynahs; a number of House Crows were also making use of unpleasant language: again it was a cobra; but this time it had disposed of two baby Pied Mynahs, and as it rested by the nest, it was in turn disposed of by me.

I am reminded of three incidents as I write of the Brahminy Mynah. The first two relate to a time when I was photographing this species at the same nest. The nest in question was built in a hole of a *seesum* tree growing on the bank of a canal close to the railway line. Running parallel with and immediately adjacent to the track was a path much used by the local residents. A goods train passed, and as it did so, I noticed the second fireman take a large piece of coal and throw it deliberately at a woman who was walking along the path with an infant in her arms, missing her narrowly. Even now, twenty years later, my blood boils as I think of the dastardly act and of the approving smiles this beast won as he turned to his mates on the footplate. Fortunately I had seen everything clearly and noted the time, so that in due course the Locomotive Superintendent was able to deal faithfully with the entire engine crew who, it is almost unnecessary to add, resolutely denied the charge brought against them.

The other incident relating to the nest mentioned in the preceding paragraph was as amusing as the last was disgusting. I was not using a hiding tent, but had positioned the camera near the nest and decided I would conceal myself behind a bush and operate the shutter with a piece of string attached to it. I therefore passed the string through a hole bored in a stake placed immediately under the shutter, and led it along to the spot from where I was going to pull it when the occasion arose. The top of the stake was only two inches above the ground and, while not in use, the string lay loose. A squirrel noticed this string and thinking it would make her nest cosy started collecting it in its mouth, invariably pulling the loose end in until I gave this a jerk and frightened it away. On one occasion, however, she reversed the usual order of things before I realised what was happening and so released the shutter, thereby obtaining what I imagine must be the first photograph taken by an animal of a bird's nesting site.

The third incident led me to think seriously of how young birds first leave their nests when these are built in holes in trees, etc. At the back of my mind existed an impression that the parents *drove them from the nest*. Where I got this idea from I cannot think. At the particular nest I am thinking of, the young were well feathered and it was clearly a question of hours only before they made their first public appearance. I had not long to wait. After I had photographed one of the adults at the nest neither parent would venture to feed the young again; instead, they remained on the branch of an opposite *nim* tree, with food in their beaks, uttering different notes and obviously cajoling the young to make the initial flight. When this had continued for half an hour or more, one young one, more venturesome than the rest—possibly it was the eldest too—appeared at the entrance of the hole and

then popped back into the nest. After repeating this performance three or four times, it eventually decided to take the plunge and succeeded in reaching its parents although not without effort and not without anxiety on the latter's part, as was clear from the manner in which by their excited calls they encouraged the bold spirit to do its utmost. The young bird was then given double rations and was subsequently led away to a more leafy part of the tree with a view probably to escaping the notice of such enemies as the Shikra. I have since come to the conclusion that birds that lay their eggs in holes of trees regularly resort to such an expedient when the time has come for the young to leave the home. I have watched the same thing happen with a Northern Grey Hornbill and Crested Black Tits.

Barbets and Woodpeckers.

Barbets and Woodpeckers are closely related; it will, therefore, not be inopportune to class them together for our present purpose. In many parts of the United Provinces one may confidently expect to come across the nests of the Green Barbet and the smaller Crimson-breasted Barbet in the same garden especially if *mango, gold mohur*, or cork trees are to be found therein. The prevailing colour in both species is green. The Crimson-breasted Barbet has some yellow, red and black about the head, near the eyes, about the chin and breast, yet so closely do these birds assimilate with the foliage of the trees in which they spend their lives that it is most difficult to see them, even though, from the *direction* of the calls, one obtains a fairly good idea of their whereabouts. I say *fairly good* advisedly, because their notes are somewhat ventriloquial in character owing to the manner in which these birds turn from side to side when calling. Their notes are amongst the best known bird sounds in India. '*Tonk-tonk-tonk*', says the Crimson-breasted Barbet, while the Green Barbet cries '*Kurr-r-r-r*, '*kooturuck-kooturuck-kooturuck*', till one is tired of hearing their notes.

As one would expect from their close relationship to the Woodpeckers, Barbets cut out a hole in a tree, either in the trunk, or more usually in one of the branches, wherein to deposit their eggs, the Crimson-breasted Barbet or Coppersmith frequently on the under-side of a more or less horizontal bough. Like woodpeckers' eggs, those of barbets are pure white in colour, but are very fragile and easily damaged, if one attempts to cut out a hole to obtain them. Barbets live principally on different fruits and are specially partial to the small berries of the *pipal* tree. They vary the diet somewhat when feeding the young. I have observed both species take the white- and black-winged flying ants into the nest-hole; and although one would never suspect the Green Barbet of being particularly active I have watched one catch a small dragon fly.

Very little has, I think, been recorded of the manner in which such birds as barbets and woodpeckers retire for the night. A pair of Coppersmiths I had under observation for some time in Cawnpore interested me greatly. Both parents fed the young until it was almost too dark to see, and then one of the birds always



A GREEN BARBET LOOKS OUT FROM ITS NEST HOLE.

retired to the nest-hole, while the other found shelter for the night in a neighbouring tree, in an old digging. Although I have not watched a Green Barbet retire for the night, it would seem that this species follows a somewhat similar procedure. I have noticed one come out of a hole before feeding operations could possibly have commenced for the day.

The only woodpecker, which I am *certain* had gone to rest for the night, clung to the under surface of a branch standing about 40° out of the horizontal. I watched this particular bird—a Golden-backed Woodpecker—take up this position on a *nim* tree just as it was growing dark, and it was still in this position when I investigated matters again shortly before 11 p.m. Another Golden-backed Woodpecker, which I *thought* had retired for the night, rested on the perpendicular surface of a palm tree. The bird remained in this position for about fifteen minutes, and it was then almost impossible to see, but something alarmed it and away it flew.

Two or three writers have stated that the food which woodpeckers take to their young is not visible in their beaks. This is contrary to my experience. I have photographed three different species of woodpeckers in India, the Kashmir Pied Woodpecker, the Mahratta Pied Woodpecker—at two nests—and the Black-backed Woodpecker, and in each instance the food for the young was often plainly visible as the parents arrived at the tree. Several of my photographs show this, though few are worthy of publication as owing to their rapid, jerky movements the genus has almost invariably defeated the shutter for speed.

Kites.

As a child I bore the Common Kite bitter hatred. I still have vivid recollections of how more than once, while seated out in the open in the early morning, breakfasting on buttered toast, one of these birds bore down on me from behind and snatched from my fingers the morsel I was on the point of eating. Occasionally I received scratches sufficient to draw blood; then it was that I retired, worsted, to receive poor consolation when I arrived indoors, my parents telling me I deserved all that had come my way. That, however, was more than forty years ago. Today I do not object to the Kite taking up its abode on my premises, the small chickens that it carries off being not mine but the cook's property. Often has that worthy asked me to shoot the *shaitans*, but I decline to interfere as it always gives me pleasure to see the birds about. Besides, if I did shoot the Kites, the price I would be charged for the chickens would be no less than I am asked today, so *cui bono?*

Like every other onlooker, I cannot help smiling when I see a Kite swoop down on some vendor's tray at a railway station, or snatch from some fat hand the tasty-looking sweets, freshly purchased, which are being conveyed back to a compartment in the open palm held on a level with the shoulders, that all may know how well-to-do is the purchaser. Which indicates (I am told) that I have a distorted sense of humour, while I argue—'from him that hath it shall be taken away.'

Almost invariably the Kite builds its nest near Man's habitation. It has a foundation of substantial twigs placed in the fork of some tree; wool, dirty old rags, cotton waste and similar material being used as a lining. I have seen stones and pieces of *kanker* worked in between the twigs and once came across a child's bow and arrow incorporated in a nest. On another occasion the three eggs in a nest in my compound rested on a hare's skin which the cook had carelessly thrown out near the kitchen. Usually two eggs are laid although three are not uncommon. These are greyish white in ground colour, sparingly blotched with brown and red. The long-drawn-out call of the Kite, *chee-eel,* from which the bird derives its common Indian name, is one of the familiar if unpleasant sounds of bazaar or cantonment.

Doves.

It seems strange at first sight that the behaviour of the same species should vary greatly in different parts of the country. Throughout the United Provinces, and elsewhere as well, I have found the Little Brown Dove and the Indian Ring Dove very tame, so much so that I neglected to photograph them when the opportunities were legion. In the Manbhum district in Bihar, however, both species are extremely shy. There is a good reason for this, everybody, both young and old, being bent on their destruction. Many a time in this and the neighbouring districts have I come across the most ingeniously constructed snares at the nest, added to which numbers are killed by means of bows and arrows. Elsewhere both species nest in gardens—the Little Brown Dove either in some bush, or on some ledge in the verandah itself. On one occasion I came across a nest of this species containing the usual two eggs at the foot of a bush, on the ground, on a high railway embankment. I do not remember having seen a Ring Dove's nest within the precincts of a bungalow. The bird instead builds its sketchy home regularly in some bush. I have found the nest of only one other species of dove in a garden: this belonged to a pair of Spotted Doves and was built on a verandah ledge.

The Little Brown Dove, whose photograph is shown herewith, had its nest in a thick prickly bush on a hill side covered with scrub-jungle. The nest was situated about three feet from the ground and, when I first attempted photography, contained two young ones about ten days old. The *hide* had been in position for two days and, although the parent birds were reported to be accustomed to it, hours passed before they returned to the platform of twigs. In the meanwhile much of interest was taking place at the nest itself and *in* the *hide,* to keep me occupied and even amused. At first both young ones indulged in a great deal of 'shut-eye'; after half an hour the younger squab preened itself, following this up by stretching first one wing and then the other. The elder youngster followed suit and finally both indulged themselves in this manner at the same time. They—especially the elder—also shifted their positions now and again. It was after I had been in the *hide* about an hour that a good deal of rustling began to take place amongst the dead leaves outside the tent. Thoughts of a snake or scorpion



THE LITTLE BROWN DOVE

Both young indulged in much wing flapping, one trying to oust the other to be fed first.

flashed through my mind, and great was my relief when a tiny muskshrew appeared on the scene instead and commenced to turn over the leaves between my legs, quite unconscious of the presence of Man. Two or three times I moved purposely, to frighten the little creature, when it disappeared at once only to re-appear soon afterwards.

When I had been in the *hide* about an hour and a half, both doves flew towards the nest, but settled on separate bushes a little below me. After some minutes the male flew away, followed a few minutes later by the female. After an hour both returned but again flew away, this time together, having in the meanwhile gone all round the tent. Shortly, the male returned to settle on a boulder, calling *croo* sharply, and later *cru-coo-coo-coo.* This brought the female and eventually both parents went to the nest together; the squabs in the meanwhile were most excited. The photo taken of the female at this session feeding the larger young one was spoilt by movement. Thereafter a gale sprang up shaking the hiding tent in an alarming manner so that I was not surprised when one of the parents alighted on a bush behind me and would not visit the nest.

The second photograph I took some two hours later was also not a success. I therefore moved the *hide* back a couple of feet, changed the direction slightly and leaving everything in position, with a man to keep watch, tried my luck again two days later, on 3 December. The young had grown greatly during the forty-eight hours and now appeared to be almost ready to leave the nest.

On this occasion again, I succeeded in taking only two photographs, both of which, however, were successful as the shutter was working at a higher speed. The small shrew, which during my first vigil had alarmed and then afforded me such amusement, now frightened the Little Brown Dove considerably as, out of sight, it rummaged about amongst the leaves at the foot of the bush holding the nest. When re-assured as to the author of the rustling noises, the male uttered his usual call but in a low key. Thereafter the note employed was a *ker-r,* this being used three times and approaching very near to a hiss.

Feeding the young is a most vigorous proceeding, the parent pushing its head down into the favoured squab's beak and then retreating, only to repeat the performance with its other child, both young indulging in much wing-flapping, one trying to oust the other with a view to being fed first, last and all the time. Photography under such conditions, with the principal actors in the drama in the heart of a bush, is by no means easy.

By way of contrast to the difficulties experienced in photographing the Little Brown Dove at home in a district where the genus is much persecuted, let me tell briefly of my only camera experiences with the Ring Dove, in the Sholapur district in the Bombay Presidency. There the cultivator and herd boy leave the birds alone so that all I had to do was to stick up the camera near a nest, cut away some offending twigs and proceed to take all the photos I could without even using the hiding tent. While I stood from four to five feet distant from the nest the incubating bird actually fell asleep but

awakened at once if the shadow of a kite or crow passed over. On one occasion another Ring Dove cooed in the middle distance whereupon my particular bird stood up, and then bowing with the break right down in the nest, called in return.

House Crows.

No chapter dealing with garden-nesting birds would be complete without reference to the House Crow because, as soon as the monsoon breaks in Northern India, every tree in every compound seems to have one or more pairs nesting on it. It is remarkable how very few people are aware that this species is victimized in its nesting arrangements by the Koel, a member of the Cuckoo family. Although the Koel's egg is not unlike the Crow's in general colouring, the former is noticeably the smaller. In spite of this, and inspite also of *Corvus splendens* being the wariest and cutest of birds, no difference does it notice between its own eggs and those of the Koel. I say *those* not without good reason, because I once found a House Crow incubating one of its own eggs along with *three* laid by a Koel, and at another time found a Crow's nest containing three young Koels and one young Crow. I have seen it asserted, more than once, that the young Koel, like the young Cuckoo at Home and the Pied Crested Cuckoo out here, throws out the rightful progeny or eggs from the nest. Such, however, has not been my experience. I would not go so far as to state that this does not sometimes happen, but the fact remains, that I have again and again seen young Koels and baby House Crows grow up together.

As every resident in India well knows, the House Crow knows 'who's who and what's what'. Let me illustrate this. The experience I tell of deals with one of the earliest and most vivid recollections of my childhood. I had visited a House Crow's nest and purloined one of the young it contained. The parent birds had flown round and at me, saying terrible things while I was at the nest; but having reached the ground I imagined all was now well. Alas! As I made my way to the house, bare-footed and bare-headed, I was attacked in the most insolent manner from behind. First a terrifying peck on the head and, as I ran up the verandah steps frightened out of my life, an even more vicious one above the left heel, the wound inflicted still giving trouble some months later when I was in England. Not satisfied with the way in which they had already harassed me, that particular pair of crows saw to it that I did not venture out into the compound—at least I was not able to go out alone; which was very hard lines really. It was the height of the mango season, and as the succulent fruit fell to the ground it had been my wont to rush out and recover it, a form of amusement I was no longer in a position to pursue, my brother and our host's two daughters having to do the needful instead, the crows making no attempt to demonstrate against or attack them.

I recall a derelict young House Crow which had either fallen out of the nest by accident or had attempted a premature flight. My attention to it was drawn by the terrific noise

that apparently all the crows in Hindustan were making at the back of the house. As I perched the youngster on a fencing stake, commotion became even more rife till I was reduced to wondering what I would have done in a similar predicament; it seemed clear that some were telling *junior* what he ought to do and others what he should not do so that in exasperation he seemed to cry out 'what *am* I to do?'

Crow Pheasants.

Mention of the Koel reminds me of the Crow-Pheasant, another member of the Cuckoo family which is seen commonly in the garden and not infrequently elects to nest therein—either in a thick clump of bamboos, a dense creeper or on some pollarded tree. The nest is a large, globular, domed structure of twigs with the entrance at one side and the egg cavity lined with green leaves. The internal dimensions must sometimes be insufficient to permit of the owners turning round, as I have occasionally noticed the bird incubating with the tail sticking out. This fact probably accounts for the species being so loth to leave the nest. Usually three eggs are laid, pure white in colour. The Crow-Pheasant is black, shot with green and dark blue, and has chestnut coloured wings. It trails a long tail which, as it struts along the ground, gives the novice the impression that he is gazing on a pheasant of sorts. The call is a deep, booming *whoop-whoop-whoop*, pleasant to listen to, and sometimes mistaken for the cry of the black-faced langur monkey. This is by no means the only member of the Cuckoo family found in India which builds its own nest, other not uncommon representatives being the Sirkeer and (locally) the two Malkohas. Of these I shall have more to say elsewhere. The Crow-Pheasant feeds on caterpillars, grasshoppers, small lizards *et hoc genus omne*, and is also, I fear, given to ravishing the contents of the nests of the smaller birds which make their homes in bushes and creepers. A bird I photographed had its nest, which was made of rushes only, in a clump of rushes. It will be long years before I forget the tortures I suffered from the massed attacks of a particularly objectionable variety of ant, half black, half red, as I sat inside the tent on a layer of rushes, waiting for the Crow-Pheasant to return to its nest.

Bulbuls.

The Red-vented Bulbul is to be met with everywhere; the same, however, cannot be said of the Red-whiskered species, a far more showy bird. It is extraordinary how capricious the latter is in its choice of habitat. Though common in both Cawnpore and Lucknow, commoner perhaps even than the Red-vented species, it is not to be seen in or around Allahabad, near Agra or many other districts of the United Provinces. Talking of the Red-whiskered Bulbul reminds me of when I was showing Major R. S. P. Bates, the well known contributor to the pages of the Bombay Natural History Society's *Journal* and author of *Bird Life in India*, round the Topchanchi reservoir in the Manbhum district. On his enquiring of me whether this species occurred in those parts I had to reply

in the negative. However, I spoke too soon, for less than five minutes later we saw three or four in different places! They were to be met with commonly during the next two months, but I never saw the species again in the district during the winters of 1934-35 and 1935-36, neither did I come across the Red-whiskered Bulbul in the Manbhum district nor elsewhere in the Chota Nagpur division during the hot weather or monsoon months. Both are cheerful and vivacious souls, with calls which are very similar, and are popular bazaar pets. They feed, I think, entirely on caterpillars and fruit, and seldom settle on the ground. I once took a photograph of a Red-whiskered Bulbul under somewhat unnatural conditions. The bird in question had its nest in an *Antigonon* creeper; here a successful portrait was out of the question. I therefore removed the three young ones which the nest contained and placed them in a cage on my lawn with a twig hard by, on which I hoped the parents would alight. This they very obligingly did.

Warblers.

This is the correct place to write of two representatives of the family *Sylviidae*, the Tailor Bird and the Ashy-Wren-Warbler. Both are about five inches in length; both are 'loud squeakers' and both build their nests by stitching leaves together. In this respect the Ashy-Wren-Warbler is really the more skilled architect, as it can also build two other types of nest. Although so familiar by name it is remarkable how few people knew the Tailor Bird by sight. Above it is buff-green-brown in colour and below a dirty white. The forehead is rufous, the tail long and tapered and carried a great deal over the back, and the legs reddish. The Ashy-Wren-Warbler on the other hand is ashy-blue above with reddish-brown wings and the under parts a yellowy-buff, and the tail is what is termed cross-rayed. Both species have long and somewhat curved beaks; both call until one wonders when they are going to stop to take breath, the Tailor Bird shouting *towee-towee-towee*, and the Ashy-Wren-Warbler *jimmy-jimmy-jimmy*, rather faster than the former.

The Tailor Bird may construct its nest by puncturing a number of holes on either edge of a single large leaf, as for example, a *dhak* sapling or a *canna* plant, and make the two sides meet below by stitching them together; or may enclose the nest in a number of leaves sewn together. Usually the nest is situated only two or three feet from the ground, but I have found it about fifteen feet up in a *mango* tree and knew of another in a *guava* tree. Normally, four eggs are laid, pinky-white in ground colour, with red or reddish-brown spots and speckles, mostly round the broad end. Very occasionally, the ground-colour is bluish-green. A pair which built their nest in my garden at Allahabad during three consecutive years laid such coloured eggs each season, sufficient indication, I think, that the Tailor Bird is either a very stationary resident, or returns regularly to a favourite spot for nesting purposes. I incline to the former theory, as a pair were to be seen every day throughout the year in the precincts of the compound.



THE ASHY WREN-WARBLER,
a skilled architect, builds three types of nests

There is one matter I must not forget; I know of no species, with the possible exceptions of the Jungle Wren-Warbler and Crimson-breasted Barbet, which deserts its nest more readily than does the Tailor Bird. One has not even to touch the nest: it will quite likely forsake it if it thinks this has been seen.

The other two types of nest which the Ashy-Wren-Warbler constructs are a substantial oval-domed affair with the entrance on one side, the type most commonly found prior to the rains breaking, and 'a rudely built and flimsy ball of grass, supported by grass and weeds, sometimes fairly well attached to the supports, sometimes hardly fastened to them at all', a departure from the normal which I have never come across personally.[1] Uusually four eggs are laid, rather globular in shape and a rich bick-red in colour.

The Magpie Robin and Some Others.

The Magpie-Robin is a great lover of shade and for that reason is often a regular resident in large compounds well stocked with old trees. As everyone probably knows, the male when in full song is a really beautiful songster, being at his best in the early morning and again in the evening. How miserable though does his piping squeak sound in January, when first he begins to practise his notes! Most nests are built in holes in trees although I have occasionally come across one in a hole in a wall or building. It is my belief that only the female constructs the nest or incubates the eggs. This was certainly the case with a pair which had their nest in my garden and it was amusing to watch the manner in which the male pursued his wife with a view to driving her back to the nest if she left this for more than a minute or so.[2] Five eggs are usually laid, of a greenish ground colour with brownish-red spots and blotches scattered liberally all over the surface.

I remember finding a nest of this species on 15 June one year and removing one of the eggs for a friend who had started collecting. Carelessly leaving this on the ink-stand in my office with a view to blowing it one evening, judge of my surprise when on my return to lunch on the 22nd I found it had hatched!

Other beautiful and not unusual garden-nesting species are the Blue Jay, Hoopoe, Golden Oriole and the diminutive White Eye. The first two lay their eggs in a hole of either a tree or building, while the Oriole and White Eye construct hammock-like nests suspended between two horizontal twigs. In the case of the White Eye the nest is often attached to the stems of two adjoining leaves. Up country, the Hoopoe is familiar to everybody owing both to its note, *ook-ook-ook*, repeated quickly, and because of the way in which the bird works every lawn thoroughly in the search for ants. Not many may, however, have noticed that the Hoopoe is seldom, if ever, accompanied by more than one young one; which is surprising as it commonly lays seven or eight eggs. The

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[1] *The New Fauna*, vol. ii, p. 530.

[2] The same was observed to be the case at Asansol in 1937.

inference is that mortality among the young birds is heavy although what this is attributable to is not so apparent.

It is a matter for congratulation that two such lovely birds as the Golden Oriole and the Blue Jay (in flight) should be so common. If only the latter could also be congratulated on its call! Alas! the Blue Jay croaks harshly and screams gratingly. Much can, however, be forgiven it for the wonderful aerial acrobatics which the bird performs as soon as the weather begins to warm up and its thoughts turn lightly to love making. Fortunately the Golden Oriole utters a liquid whistle, *pee-ooh,* rich in melody. It is surprising how few people know that the female of this species is differently coloured from the male, there being much green in her plumage.

The White Eye deserves a paragraph to itself. About four inches in length, the upper plumage is greenish-yellow; the chin, throat and vent are a bright yellow and the remainder of the lower plumage a light ashy shade. Round the eye is a conspicuous white ring. In the breeding season, which lasts right through the hot weather and extends well into the rains, the winter family parties break up. Then it is that the male sings his beautiful little song, so low that the average mortal does not hear it even though this soon becomes louder. As befits so tiny a species, the nest is small. Normally only two eggs are laid, I have found three, and as many as four have been reported. These are a pale greenish-blue in colour without any markings. Because of its size, necessitating the camera being very close indeed to the nest, the White Eye is a most difficult species to photograph successfully. What it lacks in inches the bird makes up for in pluck. I have known a pair not only hold their own with a pair of Little Minivets, but so out-manœuvre them that, disgusted by the manner in which they were harassed, the latter deserted the nest they were building so that the White Eyes were saved much trouble in searching for materials for the home which they also were constructing.

I have omitted all mention of such a common species as the Brown-backed Robin. Here again the sexes are differently coloured. One would like to write of the strange places this bird sometimes chooses for a nesting site, and how not uncommonly a piece of snake's slough is incorporated in its nest; or of the King Crow with the conspicuously forked tail, that delights in chasing crows and kites; and of Jungle Babblers, more commonly known as the Seven Sisters but which an American acquaintance equally aptly termed 'Hop-along', from the manner in which this species progresses by hopping; or of how I once watched *six* different adult Jungle Babblers feed the three young ones in a nest. The truth is I feel that this article has assumed such lengths I must now deal only with the Rose-ringed or Green Parrakeet, the common 'parrot' of India. My compound at Tundla, in the Agra district, where I was stationed for three years, was notorious for miles around for the myriads of these birds, along with numbers of Common Mynahs, that used to flight there every evening to take up their night's lodging. They came from all points of the compass, either in twos or threes, or as frequently,



THE BROWN-BACKED ROBIN
is versatile in the choice of a nesting site.

by the dozen, high up, flying straight, like arrows shot from bows, uttering their harsh calls and never seeming to deviate in their course. Only when almost on top of the *nim*, or cork trees on which they intended to roost did they wheel prior to alighting. Often they did not consider even this necessary but dived down at break-neck speed, invariably coming to a safe anchorage in the branches, from which they promptly proceeded to strip the foliage, the while uttering incessant squeals and squeaks. How they escaped disaster as they settled thus will always remain a mystery to me. Only very occasionally did one come to grief, not by alighting awkwardly, but by striking the telephone wires. Even so they escaped unharmed as a rule, only the wires vibrating for some seconds as a result of the impact.

For an hour before it was too dark to see my compound seemed to be the *rendezvous* of all the Green Parrakeets in India. They assembled literally in thousands; nor do I exaggerate when I say that as darkness was stealing o'er the land it was impossible to tell at a range of only ten yards what tune a gramophone outside was playing, so overwhelming was the noise the parrots and mynahs made. Then, as the light failed, the birds would quieten down until the silence could almost be *heard*.

Evensong was over.

At intervals throughout the night there would be a regular fluttering, this beginning at one tree, going to the next, and so on in sequence right through the compound, very much like the *totem* scene in *Rose Marie*. Always this was followed by the patter of the birds droppings striking the ground below. I could never make out what caused the parrots to flutter in this manner. Sometimes it seemed that a human being passing by was the reason; at others a gentle breeze springing up appeared to have something to do with this 'shivering' movement.

Ordinarily the parrots lot was a happy one, but at times life was made miserable for them. In the gathering dusk, when the trees were full of birds, a Laggar Falcon would dive straight in amongst them—never amongst the mynahs—and carry off a screaming victim. Sometimes the stoop was unsuccessful. When such was the case, the falcon, after circling round once or twice at no great distance, returned to the fray a second and even third time. Always it left finally with a parrot held firmly in both feet, protesting vigorously but to no purpose. Then pandemonium reigned supreme amongst the birds resting in the tree; in a body they would fly away shrieking, only to alight again in some other tree hard by, there to continue awhile their grotesque movements and the stripping of more foliage.

Wonderfully provided though a falcon is for capturing and killing its prey, it seems incredible that any small raptorial should attack, much less kill, such a formidably armed bird as the Green Parrakeet, possessed, as it is, of a beak that can inflict severe injury. Nevertheless, I witnessed such an assault on at least half a dozen occasions, and once, with the aid of the field-glasses, saw how the falcon carried off its victim: one foot seized the parrot above the neck, close to the head, and the other was fixed firmly into the

middle of the back, so that the bird could use neither its beak nor claws. The Lugger was not the parrots only avian enemy. A pair of Rock-Horned Owls that lived in the ravines near by also took constant toll of them. One bright moonlight night I saw one of these fine birds make its way into a tree, from which the parrots at once flew helter-skelter, shrieking at the top of their voices. Presently the great owl re-appeared and settling on the tennis court within a few yards of where I was seated proceeded to tear to pieces, and then to eat, the parrot it had caught.

Poor parrots ! the *sahib* and the *ryot* have no love for you owing to the damage you do in the garden and to the crops in the fields. And yet, in spite of the awful noise you made every evening, and every morning long before it was dawn—except in your nesting season when you scarcely visited me; in spite too of the havoc you wrought amongst my fruit trees, I have a very tender spot in my heart for you and wish you a long and happy innings in the dear old compound. I was always delighted when towards the end of February or early in March I found you had appreciated my hospitality and that you and your wife had decided to bring up your family in a hole of one of my trees. Nowhere were your three or four white eggs, or your young, safer. Our sex has often been accused of paying too little attention to the nursery, but you were ever a model husband, taking turns with your Better Half in incubating the eggs, and later working like a slave to feed your young. Farewell, and Good Luck to you !



Low Hills on the border of the Great Rann at Nir Wand, Pachum Island, Cutch.



The condition of the Great Rann, 15 miles north of Nir Wand, in September 1935.

Photos by Author.

THE REPTILES AND AMPHIBIA OF CUTCH STATE.

BY

CHARLES MCCANN, F.L.S.

(*With two plates*).

Cutch State is at certain times of the year isolated from the mainland. The periodical isolation takes place in the years of good rains, when the Great Rann and the Little Rann are flooded. During the dry season the Ranns are dry and perfectly hard, but quite uninhabitable as not a blade of grass is to be found in any part of them. The ground, in fact, is in many places covered with thick incrustations of salt. The fauna of the State is chiefly composed of desert and semi-desert species met with on the neighbouring mainland.

The records and specimens at my disposal indicate that little is known of the amphibian and reptilian faunas of Cutch State. This paper is an attempt at putting together such data as are available. The records are drawn from the collections of the Bombay Natural History Society, the *Fauna of British India* (Reptilia, 2nd Ed), and from specimens and observations made by the author during a three-weeks' tour to the Great Rann during the latter portion of September and the early part of October 1935. Most of the material in the Society's collection is from Mr. C. A. Crump, who surveyed the mammals of the State on behalf of the Society in 1912.

ORDER: LORICATA: Alligators and Crocodiles.

FAMILY: CROCODILIDÆ: Crocodiles.

Crocodilus palustris Lesson. The Mugger, Marsh Crocodile or Broad-snouted Crocodile.

This crocodile is found in some of the inland lakes. I have seen specimens in the artificial lake at Chawa. The Benas River enters the Eastern or Little Rann and, as crocodiles are fairly numerous in this river, their presence in the lakes is easily understood. They also occur in Kathiawar.

ORDER: TESTUDINES: Turtles, Tortoises and Terrapins.

FAMILY: CHELONIDÆ: Marine Turtles.

Caretta caretta. The Logger-head Turtle.

According to Captain V. C. Steer-Webster this species comes ashore at Mandvi to breed.

FAMILY: TRIONYCHIDÆ: Freshwater Turtles.

Lissemys punctata granosa (Schoepff.) Soft-shelled Turtle.

'The Bombay Presidency, including Cutch' (*F.B.I.*, 2nd Ed.).

ORDER : SQUAMATA : Lizards and Snakes.

SUB-ORDER : SAURIA : Lizards.

FAMILY : GECKONIDÆ : Geckoes.

Gymnodactylus kachhensis kachhensis Stoliczka.

'Common throughout Cutch, mostly in crevices of rocks, and very rarely seen in houses (Stoliczka).' *F.B.I.*

Hemidactylus flaviviridis Rüppel. Common House Gecko.

Locality : Bhuj (McC. !), common in houses in Cutch.

FAMILY : AGAMIDÆ.

Sitana ponticeriana Cuv.

The *F.B.I.*, 1st. Ed. mentions this species as occurring in Cutch but the 2nd Ed. does not.

Calotes versicolor (Daudin). The Bloodsucker.

This species is quite common throughout Cutch. I have seen them at Nir Wand, Pachum Island, on the very edge of the Great Rann.

Uromastrix hardwickii Gray. The Spiny-tailed Lizard.

Common in many parts of Cutch, Kawra, Pachum Islands (McC. !).

Note.—A few of these lizards were dug out of their burrows and one was swamped out by filling the burrow with water. The burrow goes down almost vertically for a foot or so and then down at an angle of about 45°. At the end of the burrow, which is about six to eight feet long, there is a chamber sufficiently large to allow the animal to turn round. The mouth of the chamber is usually closed by the spiny tail.

FAMILY : SCINCIDÆ.

Mabuya macularia (Blyth).

Locality : Cutch (*F.B.I.*, 1st. Ed.). In the second edition this species is omitted.

Ablepharus grayanus (Stoliczka).

Locality : Cutch (*F.B.I.*, 2nd Ed.).

Eumeces tæniolatus (Blyth).

Locality : Cutch (*F.B.I.*, 2nd Ed.).

Ophiomorus tridactylus (Blyth).

Locality : Cutch (*F.B.I.*, 2nd Ed.).

FAMILY : LACERTIDÆ.

Acanthodactylus cantoris cantoris Gunther.

Locality : Bhuj (B.N.H.S. collection !).

Ophiops jerdoni Blyth.

Locality : Cutch (*F.B.I.*, 2nd. Ed.).

Ophiops microlepis Blanford.

Locality : Cutch (*F.B.I.*, 2nd Ed.).

FAMILY : VARANIDÆ.

Varanus monitor (Linn.). The Common Monitor.

Locality : Bhuj, among old tombs (McC. !).

SUB-ORDER : OPHIDIA : Snakes.

FAMILY : BOIDÆ.

Eryx johnii (Russ.). Sand Boa.

Locality : Cutch (*F.B.I.*, 1st Ed.) ; Nir Wand to Kakra (McC. !).



The Saw-scaled Viper or ' Phoorsa ' [*Echis carinata* (Schneider)] basking in a bush of *Capparis aphylla* Roth in the Bunny, Cutch.



Leith's Sand Snake (*Psamophis leithii* Gunth), at Nir Wand, Pachum Island.

Photos by Author.

FAMILY : COLUBRIDÆ.

Lycodon striatus Günth.
Locality : Bluj (Crump. Nov. 1912 !).

Zamenis ventrimaculatus Gunther.
Locality : Cutch (*F.B.I.*, 1st Ed.).

Zamenis diadema Günth. The Royal Rat Snake.
Locality : Nir Wand, Pachum Island (McC. !).

Coluber helena Daud. The Trinket Snake.
Locality : Cutch (*F.B.I.*, 1st Ed.).

Dipsas trigonata Boie. The Brown Tree Snake.
Locality : Bhuj (S. D. Smith, 28-10-13 !).

Psammophis leithii Günth.
Locality : Cutch (*F.B.I.*, 1st Ed.); Nir Wand, Pachum Island (McC. !).
Note.—A very active snake frequently lying in wait among branches for its prey even during the hottest time of the day.

Psammophis condanarus Blyth.
Locality : Cutch (*F.B.I.*, 1st Ed.).

Bungarus cæruleus Daud. The Common Krait.
Locality : Bhuj (Crump, 2 specimens 1912 !).

Naia tripudians Merr. The Cobra.
Locality : Bhuj (Crump, 4 specimens 1913 !). Both the black and the pale variety occur.

Hydrophis spiralis Gray.
Locality : Cutch Coast (*F.B.I.*, 1st Ed.).

FAMILY : VIPERIDÆ.

Echis carinata Merr. The Saw-scaled Viper.
Locality : Cutch (*F.B.I.*, 1st Ed.); Nir Wand, Pachum Island (McC.); The Bunny (McC. !).
Note.—A large specimen taken in the Bunny was amid the branches of *Capparis aphylla* quite four feet from the ground. This is the first instance I know of this species climbing trees (see photo). This snake is very common in Cutch.

ORDER : BATRACHIA.

FAMILY : RANIDÆ.

Rana cyanophlyctis Schneid.
Locality : Bhuj, in tanks (McC. !).

Rana tigrina Daud.
Locality : Bhuj, Farm Bagh (McC. !).

FAMILY : BUFONIDÆ.

Bufo andersonii Bouleng.
Locality : Bhuj (McC. !); Kawra, Pachum Island (McC. !); Nir Wand, Pachum Island (McC. !).
Note.—This toad came out at night in fair numbers at Nir Wand and most of them would collect in a small patch of freshwater where they would sit for a considerable time. During the day they retreated into old rat holes.

THE FOOD OF BROWN TROUT (*SALMO FARIO* L.).

BY

DR. HAMID KHAN, Ph.D. (Cantab.),

Fisheries Research Officer, Punjab, Lyallpur.

(*With a plate*).

It is almost thirty years ago when brown trout was first introduced into the streams of the Kulu Valley in the Punjab, and since then it has been the main attraction for visitors to the Valley. It has provided good sport and good food. Yet, strange as it may appear, no attention has so far been paid to the problems the solution of which is necessary for the proper foundation of trout fisheries. For example, no precise information is available concerning the food and the feeding habits of brown trout during the various months of the year. It is evident that this subject is of paramount importance not only to the anglers for the immediate purpose of discovering the fly upon which the fish would come, but more so to those charged with the care and maintenance of trout waters. There is a general cry that trout fishing is degenerating. Is it so? If the answer is in affirmative, then we have to ask why?

Again, trout—an exotic species—has been introduced into Himalayan waters with consequent reaction on indigenous fauna and disturbance of balance of nature. What has been the influence of this on the composition of trout food and the cycle of events in the streams?

According to Southern (1935), for any intelligent conservation and improvement of trout fisheries it is necessary to know for each river and lake the following:

1. the age and rate of growth of the stock;
2. the kind and amount of food consumed;
3. the kind and amount of food available;
4. the effects on the food supply and on the number and rate of growth of the trout under various environmental conditions;
5. the extent of the natural spawning facilities and their relation to normal stock;
6. the capacity of the river to nourish fry of trout and to bring them to maturity.

A proper study of these problems will mean years of hard intelligent research and it is undoubtedly essential. Of the problems set out above, the present paper is concerned with the kind and amount of food consumed by brown trout in the Beas River in the Kulu Valley in the Punjab, as studied by the examination of its stomach contents.

The study of the food of trout has received much attention in Europe, America, Australia and New Zealand. The diet of trout has been found to consist of 'shrimps, water snails, insects, worms, etc., and small fish such as minnows and young of their own species.' (Regan 1911, Mottram 1928, 1931, Rushton 1931). Pentelow, (1932) in England, Metzellar (1929) in Michigan, Phillips (1929) in New Zealand and McKeown (1934 a, b) in Australia, investigated the food and feeding habits of trout by the examination of stomach contents and classified the contents as land insects, water insects, fish, crustacea, molluscs and such trash as gravel, wood and other debris.

Material and Methods.

The material, consisting of 102 stomachs of brown trout, was obtained mostly from anglers during the fishing season which lasts from the 1st March to the 30th October. No data on the food during winter months are available yet. The maximum weight of the fish examined was 3 lbs. 4 oz., and the minimum 3 oz. The lengths of these fish, up to the tip of the caudal fin, measured 190 mm. to 500 mm. Most of the fish were caught on[1] wet fly, i.e. artificial fly submerged just below the surface of water and imitating the nymphal stages of May flies and caddis flies. Some fish were caught on grasshoppers and worms. The bait in such cases was weighted and thus hooked mostly the bottom feeders.

The stomach contents consisted almost entirely of animal matter. The food in the front limb of the *U*-shaped stomach was, in most cases, almost undigested and was, comparatively speaking, easier to identify than that in the hind limb where its digestion had advanced. In the intestine, identification of the semi-digested food was impracticable.

In a preliminary study as this, no attempt has been made to make specific identification. Surveys of most of the aquatic insects and their immature stages in the Kulu Valley have not yet been carried out, and in the absence of such knowledge it was difficult to refer the collected material to species. The insect contents have, therefore, been classified into larger groups.

Results have been tabulated to show the distribution of various types of food taken by the fish for each month of the season. Under 'Unidentified' Coleoptera, Diptera and Hymenoptera, are included parts of insects and their larvae, and under 'Miscellaneous Insects' are shown such larvae and insects as were in a semi-digested condition and as such unidentifiable.

I am grateful to those anglers who supplied the stomachs of their catches, and I also owe my thanks to the Sub-Inspector of

[1] Fishing with a 'dry fly', i.e. by an artificial fly floating on the surface of water and imitating the winged insects, is only possible on slow running streams and has never been, and cannot be, practised on Himalayan streams.

Fisheries, Kulu, for assisting me in the collection work. I am grateful to my colleagues in the Entomological Section of the Punjab Agricultural College, Lyallpur, for the assistance which they gave in the identification of various insects.

Results of Stomach Examination.

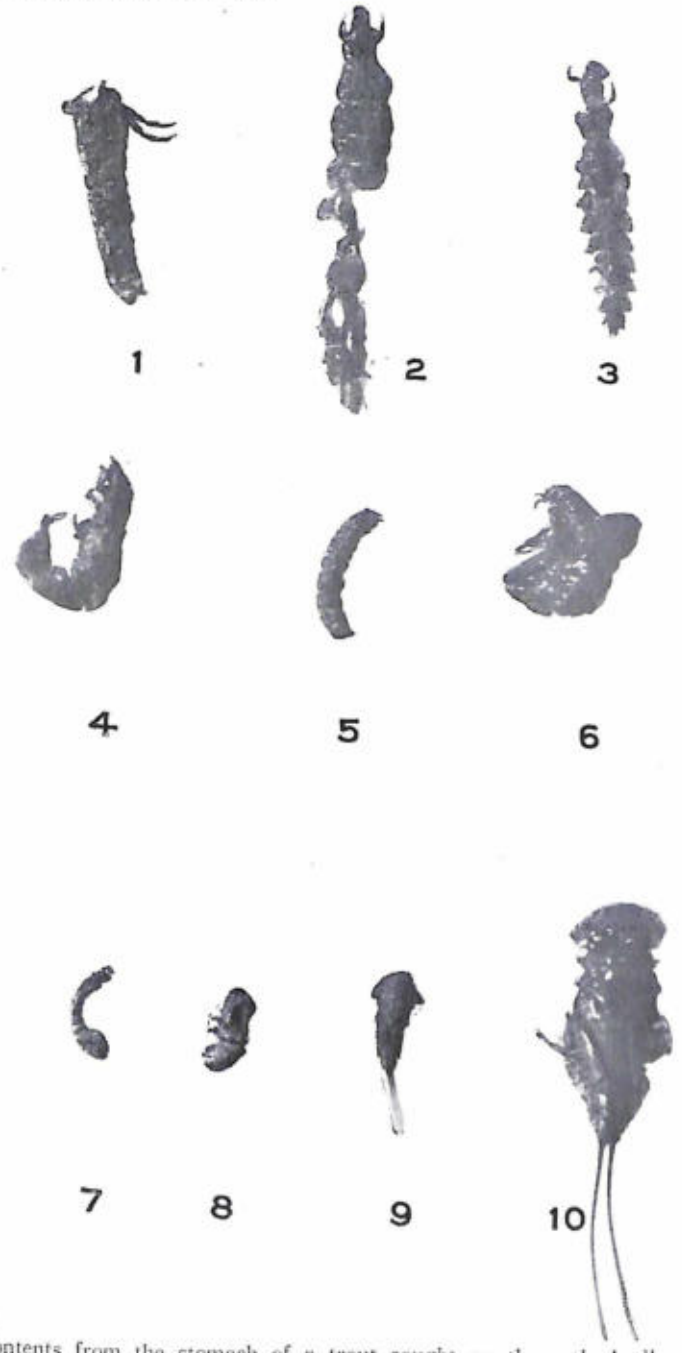
The trout is entirely carnivorous. The only indications of vegetable matter were small sticks found inside the stomachs in five cases. These had been swallowed along with caddis cases. In one specimen collected on the 20th May, 1937, 36 sticks were picked out. In two others, small grass seeds were found. No remains of water plants were found inside any stomach. The stomachs and intestines invariably contained sand and gravel-remnants of the caddis cases.

The contents of stomachs arranged in order of importance as food of trout, consisted of the following :—

(1) Insects : Caddis flies (Trichoptera), May flies (Ephemeroptera), Beetles (Coleoptera), True flies (Diptera), Ants and Wasps (Hymenoptera), Butterflies and Moths (Lepidoptera), Grasshoppers (Orthoptera), Dragon flies (Odonata), Earwigs (Dermaptera), Bugs (Hemiptera), Alder flies and Ant Lions (Neuroptera), and Stone flies (Plecoptera). (2) Pisces. (3) Arachnida. (4) Myriapoda. (5) Mollusca. (6) Crustacea. (7) Oligochaeta and (8) Amphibia.

Adult caddis flies were not found, and the larvae (Fig. 1-6), belonged to Sub-families Sericostomatidae, Hydropsychidae and Rhyacophilidae. No adult May flies were recorded and the larvae found (Figs. 9-10) belonged to *Baetis, Ecdyurus, Ephemerella* and *Iron*. Of the Coleoptera, adult forms of both the terrestrial and aquatic beetles were present, the former represented by Chrysomelidae, Carabidae and Scarabaeidae, had in all likelihood fallen from overhanging trees, or had been washed down by the floods and swallowed by the fish. Larvae of Curculionidae were fairly well represented in the stomachs of fish caught during September and October. Of the aquatic forms one adult Gyrinid was the only representative. The Diptera included the larvae of Simuliidae and Blepharoceridae (Figs. 7, 8), Cyclorrhapha and Syrphidae. Hymenoptera consisted of adult ants (Formicidae), Bees (Apidae), and wasps (Vespidae and Scolidae). The Lepidoptera consisted of caterpillars which could not be specifically identified. The Orthoptera included grasshoppers, which in two stomachs, collected in June, formed natural constituents of trout's diet, and in other cases were used as bait. The Odonata consisted of three Dragon fly larvae, and the Dermaptera, of three Earwig nymphs. Of the Neuroptera, two larvae (Sialioidea) were found in one stomach. Of the Plecoptera, only one larva was present in one specimen.

Out of the thirteen fish (Pisces) found in thirteen stomachs, one was definitely trout fingerling. It was found in the stomach of a fish, weighing 11 oz., collected on the 6th August, and measured 90 mm. in length. It filled the whole of the stomach, which had no other organism in it. In three cases, the stomachs



Contents from the stomach of a trout caught on the 11th April, 1937.
(*Photograph from actual specimens*).

Figs. 1-6. Caddis larvae (TRICHOPTERA).
Fig. 7. Simuliidae larva.
Fig. 8. Bleppharoceridae larva.
Figs. 9-10. May fly larvae (EPHEMEROPTERA).

contained barbel fry (*Oreinus sinuatus*), and in the remaining eight stomachs the fish fry was unidentifiable on account of its semi-digested condition.

The Arachnida consisted of two spiders, and the Myriapoda of one immature and one adult Scolopendra.

The Mollusca included one slug; and Crustacea were represented by one terrestrial Isopod; the Earthworms (Oligochaeta) had been used as bait. The Amphibia consisted of one tadpole found in a stomach collected in June.

Discussion.

Trout's diet: Practically any organism that is found in the water or on its surface is a possible food for the trout (Table I). The number of organisms found in a stomach varies according to the size of the organism swallowed. If the organisms are large in size, such as fish, frog or slug, their number is naturally small. But where small animals, such as caddis or May fly larvae are eaten, their number may be large. The largest number of caddis larvae taken from one specimen was 153 and there was nothing else inside the stomach. The stomach contents of a trout (Figs. 1-10), caught on the 11th April, 1937, consisted of 24 caddis larvae, 9 May fly larvae, one Blepharocerid larva, one Simuliium larva and two unidentifiable larvae. The various components of fish diet ennumerated above illustrate the variety and nature of trout's diet.

The influence of floods on the food of trout: In Tables II and III, stomach contents of fish, caught during the months of May and August, are given for comparing the food consumed by fish before and after the rains. In May, Trichoptera were found to the extent of about 60 per fish, while in August, the number had diminished to about 10. In May, one stomach out of 24, and in August 7 out of 14, contained fish fry. Out of 102 stomachs examined, 56 were collected after the rains, and out of these (Table IV), two in July, two in August, four in September and one in October, were found to be empty. That is to say, 16 per cent of the stomachs collected after the rains had practically no food in them. No empty stomach was found before the rains. Moreover the stomachs collected after the rains contained less food than those collected in the beginning of the season. The rains which commence in July, flood the river heavily and evidently cause great disturbance in the supply of available insect food.

Cannibalism: Out of 102 stomachs examined, only one case of cannibalism was recorded. It cannot, therefore, be said with any certainty that brown trout is cannibalistic in its habits. Mitchell (1914), working in Kashmir, also pointed out that in brown trout 'cannibalism is not natural and is only resorted to in special cases where other food is not available.' The question of cannibalism in trout requires thorough investigation, because if at any time food becomes scarce the life of little trout fry, with which the River Beas in the Kulu Valley is stocked annually, will be endangered.

Surface and submerged food: According to Pentelow (1932) a broad classification of the food can be made 'according to its origin, whether it is found on the surface of water or whether it is found in the water'. The former he calls 'surface' and the latter 'sub-surface' food. The greater part of the surface food, he remarks, 'consists of aquatic Diptera, Trichoptera, Ephemeroptera and Plecoptera. These insects after leaving the water have to return to it to lay their eggs and it is, therefore, natural they will make up the greater part of the surface food.' Sub-surface food is not defined by Pentelow (1932), but the term is meant to include all kinds of submerged food, whether free in the water or at the bottom of the stream.

Seasonal occurrence of surface and submerged food in the stomach of brown trout, (Table IV), indicates that the fish seem to feed on surface as well as submerged food during the whole of the season.

The abundance of submerged food and scarcity of adult flies in trout stomachs seem to show that the trout in the River Beas in the Kulu Valley is mostly a bottom feeder. For instance, while the larvae of caddis flies, commonly known to the anglers as *Grannom, Welshman's Button, Red Sedge, Cinnamon,* and of May flies called *March Brown, Olive Dun,* etc., form the principal constituents of trout food, adults of these insects are absent from stomach contents.[1]

Comparative study of trout's diet in various countries: A comparative statement of the average food per fish in the Kulu Valley, New Zealand (Phillips 1929) and New South Wales, Australia (McKeown 1934) is given in Table V. Comparison cannot be taken too far as the fish in the Kulu Valley, New Zealand and Australia live under entirely different environmental conditions, and the quantity of food varies not only according to the size of the fish but also according to the nature and density of the local fauna. Size of trout under study in the Kulu Valley varied from 3 oz. to 3 lbs. 3 oz. and of trout in Australia from 1 lb. to 4 lbs. Average weight of Kulu fish was, therefore, less than that of the Australian trout. Trout in the Kulu Valley, however, has practically the same variety of food as it has in other countries. A noticeable feature, however, is the negligible number of Crustacea and Mollusca in the stomachs of the Kulu trout.

It may be of interest to quote in this connection Mosely (1926), who commenting on Tillyard's Report (1921) on the effect of introduction of trout on the native insect fauna in New Zealand, adds that 'Nowadays trout are being introduced everywhere and perhaps we are deluded by the immediate success of our efforts. The history of New Zealand waters warns us that we must look beyond the immediate future and that stocking should be carried out on a very moderate scale, while sanctuaries for trout insect

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[1] On most parts of the River Beas it may, therefore, be said, that, as has also been pointed out by Howell (1914), 'the spoon and phantom and creeper will kill fish more readily than fly.'

food should be established in all areas where trout is being introduced. Crustaceans and Molluscs should be imported if not already present, to offer an alternative diet to the fish. Otherwise, the trout may thrive lustily in the virgin waters, increase abundantly, and by reason of their well doing, doom themselves to inevitable destruction.'

The effect of introduction of trout on the native insect fauna of the Kulu Valley is not known. The present investigations, however, indicate that though there is no immediate danger to the depletion of aquatic fauna, yet the food of trout in the Kulu Valley requires immediate attention. The present investigations, it is believed, will give sufficient impetus to further research on the subject and steps will be taken to improve the food of trout by establishing sanctuaries for insects, as advised by Mosely (1926), in side streams where trout should not be allowed to penetrate and also efforts will be made to introduce some suitable Crustacea and Mollusca to offer an alternative diet to the fish.

Summary.

1. The food of the brown trout (*Salmo fario* L.) living in the Beas River in the Kulu Valley in the Punjab has been investigated by the examination of stomach contents of 102 fish.

2. The food consists of aquatic and terrestrial insects and their larvae such as Caddis flies (*Trichoptera*), May flies (*Ephemeroptera*), Beetles (*Coleoptera*), True flies (*Diptera*), Ants, Bees and Wasps (*Hymenoptera*), Butterflies and Moths (*Lepidoptera*), Grasshoppers (*Orthoptera*), Bugs (*Hemiptera*), Alder flies and Ant Lions (*Neuroptera*) and Stone flies (*Plecoptera*). Besides insects, the trout feeds also on young fish (*Pisces*), Spiders (*Arachnida*), Scolopendra (*Myriapoda*), Snails and Slugs (*Mollusca*), Crustacea, Worms (*Oligochaeta*), Frogs and Tadpoles (*Amphibia*). Crustacea and Mollusca are present in negligible quantities in the stomachs, and the worms present were in all cases used as bait.

3. The stomachs collected after the rains contain smaller quantities of food than those collected early in the season. No empty stomach was found before the rains, but 16 per cent of the stomachs collected after the rains, were empty. The rains cause heavy floods and disturb the supply of available food in the river.

4. Disturbance in the supply of available food after the floods probably drives the trout to feed on fish fry.

5. The abundance of submerged food and scarcity of winged flies in the stomachs seem to indicate that the trout in the Beas River is mostly a bottom feeder.

6. The trout in its Indian habitats is consuming practically the same variety of food as in England, New Zealand, Australia and America.

TABLE I.

Monthly comparison of stomach contents of Brown Trout (*Salmo fario* L.) from the River Beas in the Kulu Valley.

	April 1937	May 1937	June 1937	July 1937	Aug. 1937	Sept. 1937	Oct. 1937	Total
Number of stomachs examined ...	13	24	9	11	14	27	4	102
TRICHOPTERA ...	397	1439	67	135	138	103	10	2289
EPHEMEROPTERA ...	43	38	2	2	7	30	4	126
COLEOPTERA								
Gyrinidæ ...	...	...	...	...	1	...	...	1
Curculionidæ ...	...	...	...	...	...	39	10	49
Chrysomelidæ ...	...	2	...	...	...	2	...	4
Carabidæ ...	1	2	1	...	...	2	...	6
Scarabæidæ ...	...	...	3	...	...	4	...	7
Unidentified ...	...	8	26	2	2	7	1	46
DIPTERA								
Blepharoceridæ ...	2	2	1	...	...	4	5	14
Simuliidæ ...	1	1	...	...	...	2	..	4
Cyclorrhapha ...	...	38	...	...	...	...	...	38
Syrphidæ ...	...	...	...	...	1	...	1	2
Unidentified ...	1	4	...	3	1	...	2	11
HYMENOPTERA								
Formicidæ ...	...	17	3	8	2	34	...	66
Apidæ ...	...	...	1	...	...	2	...	3
Vespidæ ...	...	...	...	...	...	1	...	1
Scoliidæ ...	...	1	...	...	...	...	...	1
Unidentified ...	...	1	...	1	...	1	...	3
LEPIDOPTERA ...	...	4	7	..	...	1	1	13
ORTHOPTERA								
Acridiidæ ...	...	1	10	1	1	4	...	17
Mantidæ ...	...	...	...	...	...	1	...	1
ODONATA ...	1	1	...	1	...	...	...	3
DERMAPTERA ...	...	3	...	...	...	...	...	3
HEMIPTERA								
Capsidæ ...	...	...	...	...	...	...	1	1
Jassidæ ...	...	1	...	...	...	...	...	1
NEUROPTERA								
Sialioidea ...	...	..	2	...	...	...	...	2
PLECOPTERA ...	...	1	...	...	...	...	...	1
MISCELLANEOUS INSECTS ...	5	19	8	1	4	2	...	39
PISCES ...	3	1	2	...	7	...	...	13
ARACHNIDA ...	1	...	...	...	1	...	...	2
MYRIAPODA ...	...	...	...	1	...	...	1	2
MOLLUSCA ...	...	...	...	1	...	...	...	1
CRUSTACEA								
Isopoda ...	...	...	...	1	...	...	...	1
OLIGOCHAETA ...	...	...	...	2	...	...	...	2
AMPHIBIA ...	...	...	1	...	...	...	...	1
MISCELLANEOUS								
Sand-gravel ...	o	o	...	...	o	...	...	
Twigs-seeds ...	o	o	...	...	o	o	...	

o Indicates presence.

TABLE II.

Summary of stomach contents of each Brown Trout (*Salmo fario* L.) caught from the River Beas in the Kulu Valley

during the Month of May 1937.

Serial number of stomachs.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Length in mm.	...	287	275	337	287	275	256	256	300	275	269	275	300	275	275	250	250	350	287	350	300	300	275	262	300	
Weight in oz.	...	10	9	16	10	8	7	6	10	8	7	9	11	10	10	7	7	14	10	17	11	10	9	8	10	
Sex	...	F	F	M	M	M	M	M	F	M	M	F	M	M	F	M	M	F	F	F	F	M	F	F	M	
TRICHOPTERA	...	125	3	24	42	83	82	119	42	107	12	12	2	127	49	26	23	17	4	78	153	101	106	49	53	1439
EPHEMEROPTERA	...	1	...	...	...	8	1	...	1	...	..	...	1	2	1	2	10	3	2	2	...	...	2	1	1	38
COLEOPTERA																										
Chrysomelidæ	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Carabidæ	...	...	...	...	..	...	...	...	...	...	...	2	...	...	...	..	...	...	...	...	...	...	...	...	...	2
Unidentified	...	...	...	...	1	...	...	...	1	1	...	...	...	...	...	...	...	1	4	...	...	...	...	...	...	8
DIPTERA																										
Blepharoceridæ	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	2
Simuliidæ	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
Cyclorrhapha	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	36	...	38
Unidentified	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	4
HYMENOPTERA																										
Formicidæ	...	...	...	...	...	...	...	1	...	1	...	1	...	3	...	...	1	3	4	...	...	...	...	2	1	17
Scoliidæ	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Unidentified	...	...	...	...	..	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
LEPIDOPTERA	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	4
ORTHOPTERA																										
Acridiidæ	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
ODONATA	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
DERMAPTERA	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	3
HEMIPTERA																										
Jassidæ	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	1	...	...	...	...	...	...	...	...	...	1
PLECOPTERA	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
MISC. INSECTS		...	...	...	...	...	...	...	...	...	...	...	1	4	...	...	5	8	...	...	...	...	1	...	...	19
PISCES	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
MISCELLANEOUS																										
Sand-gravel	...	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	o	o	o	o	o	o	
Twigs-seeds	...	...	...	...	...	...	...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	o	o	o	o	
Digested remains	...	...	...	...	...	...	...	...	...	...	o	o	...	o	...	...	o	o	o	...	o	...	o	o	o	

F = Female. M = Male. o indicates presence.

TABLE I.

Monthly comparison of stomach contents of Brown Trout (*Salmo fario* L.) from the River Beas in the Kulu Valley.

	April 1937	May 1937	June 1937	July 1937	Aug. 1937	Sept. 1937	Oct. 1937	Total
Number of stomachs examined ...	13	24	9	11	14	27	4	102
TRICHOPTERA ...	397	1439	67	135	138	103	10	2289
EPHEMEROPTERA ...	43	38	2	2	7	30	4	126
COLEOPTERA								
Gyrinidæ ...	...	...	...	...	1	...	...	1
Curculionidæ ...	...	...	...	...	...	39	10	49
Chrysomelidæ ...	...	2	...	...	...	2	...	4
Carabidæ ...	1	2	1	...	...	2	...	6
Scarabæidæ ...	...	...	3	...	...	4	...	7
Unidentified ...	...	8	26	2	2	7	1	46
DIPTERA								
Blepharoceridæ ...	2	2	1	...	...	4	5	14
Simuliidæ ...	1	1	...	...	...	2	...	4
Cyclorrhapha ...	...	38	...	...	...	...	...	38
Syrphidæ ...	...	...	...	...	1	...	1	2
Unidentified ...	1	4	...	3	1	...	2	11
HYMENOPTERA								
Formicidæ ...	...	17	3	8	2	34	...	66
Apidæ ...	...	...	1	...	...	2	...	3
Vespidæ ...	...	...	...	...	...	1	...	1
Scoliidæ ...	...	1	...	...	...	...	...	1
Unidentified ...	...	1	...	1	...	1	...	3
LEPIDOPTERA ...	...	4	7	..	...	1	1	13
ORTHOPTERA								
Acridiidæ ...	...	1	10	1	1	4	...	17
Mantidæ ...	...	...	...	...	...	1	...	1
ODONATA ...	1	1	...	1	...	...	...	3
DERMAPTERA ...	...	3	...	...	...	...	...	3
HEMIPTERA								
Capsidæ ...	...	...	...	...	...	...	1	1
Jassidæ ...	...	1	...	...	...	...	...	1
NEUROPTERA								
Sialioidea ...	...	..	2	...	...	...	...	2
PLECOPTERA ...	...	1	...	...	...	...	...	1
MISCELLANEOUS INSECTS ...	5	19	8	1	4	2	...	39
PISCES ...	3	1	2	...	7	...	...	13
ARACHNIDA ...	1	...	...	...	1	...	...	2
MYRIAPODA ...	...	...	...	1	...	...	1	2
MOLLUSCA ...	...	...	...	1	...	...	...	1
CRUSTACEA								
Isopoda ...	...	...	...	1	...	...	...	1
OLIGOCHAETA ...	...	...	...	2	...	...	...	2
AMPHIBIA ...	...	...	1	...	...	...	...	1
MISCELLANEOUS								
Sand-gravel ...	o	o	...	...	o	...	...	
Twigs-seeds ...	o	o	...	...	o	o	...	

o Indicates presence.

TABLE II.

Summary of stomach contents of each Brown Trout (*Salmo fario* L.) caught from the River Beas in the Kulu Valey during the Month of May 1937.

Serial number of stomachs.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Length in mm. ...	287	275	237	287	275	256	256	300	275	269	275	300	275	275	250	250	350	287	350	300	300	275	262	300	1439
Weight in oz. ...	10	9	16	10	8	7	6	10	8	7	9	11	10	10	7	7	14	10	17	11	10	9	8	10	38
Sex ...	F	F	M	M	M	M	M	F	M	M	F	M	M	F	M	M	F	F	F	F	M	F	F	M	
TRICHOPTERA ...	125	3	24	42	83	82	119	42	107	12	12	12	127	49	26	23	17	4	78	153	101	106	49	53	1439
EPHEMEROPTERA ...	1	...	..	...	8	1	...	1	...	..	...	...	2	1	2	10	3	2	2	...	...	2	1	1	38
COLEOPTERA																									
Chrysomelidæ ...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Carabidæ ...	...	...	...	...	...	...	...	...	1	...	2	...	...	...	...	...	1	4	...	...	...	...	...	...	2
Unidentified ...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
DIPTERA																									
Blepharoceridæ ...	...	...	...	...	...	...	1	1	...	...	...	1	...	...	...	...	3	4	...	...	...	...	36	...	38
Simuliidæ ...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	3	...	...	...	...	2	...	...	...	4
Cyclorrhapha ...	...	...	...	...	...	...	...	3	...	...	...	...	...	1	...	2	...	1	...	...	...	...	...	2	17
Unidentified ...	...	...	...	...	...	1	...	...	1	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	1
HYMENOPTERA																									
Formicidæ ...	...	...	...	...	...	1	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Scoliidæ ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Unidentified ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
LEPIDOPTERA ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
ORTHOPTERA																									
Acridiidæ ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
ODONATA ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
DERMAPTERA ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
HEMIPTERA																									
Jassidæ ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
PLECOPTERA ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
MISC. INSECTS ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
PISCES ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
MISCELLANEOUS																									
Sand-gravel ...	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	o	...	...	...	...	o	
Twigs-seeds ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	o	
Digested remains ...	...	...	...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	o	

o indicates presence.

F = Female. M = Male.

TABLE I.

Monthly comparison of stomach contents of Brown Trout (*Salmo fario* L.) from the River Beas in the Kulu Valley.

	April 1937	May 1937	June 1937	July 1937	Aug. 1937	Sept. 1937	Oct. 1937	Total
Number of stomachs examined ...	13	24	9	11	14	27	4	102
TRICHOPTERA ...	397	1439	67	135	138	103	10	2289
EPHEMEROPTERA ...	43	38	2	2	7	30	4	126
COLEOPTERA								
Gyrinidæ ...	...	...	...	...	1	...	...	1
Curculionidæ ...	...	...	...	...	...	39	10	49
Chrysomelidæ ...	...	2	...	...	...	2	...	4
Carabidæ ...	1	2	1	...	...	2	...	6
Scarabæidæ ...	...	...	3	...	...	4	...	7
Unidentified ...	...	8	26	2	2	7	1	46
DIPTERA								
Blepharoceridæ ...	2	2	1	...	...	4	5	14
Simuliidæ ...	1	1	...	...	...	2	...	4
Cyclorrhapha ...	...	38	...	...	...	...	...	38
Syrphidæ ...	...	...	...	...	1	...	1	2
Unidentified ...	1	4	...	3	1	...	2	11
HYMENOPTERA								
Formicidæ ...	...	17	3	8	2	34	...	66
Apidæ ...	...	...	1	...	...	2	...	3
Vespidæ ...	...	...	...	...	...	1	...	1
Scoliidæ ...	...	1	...	...	...	...	...	1
Unidentified ...	...	1	...	1	...	1	...	3
LEPIDOPTERA ...	...	4	7	...	...	1	1	13
ORTHOPTERA								
Acridiidæ ...	...	1	10	1	1	4	...	17
Mantidæ ...	...	...	...	...	...	1	...	1
ODONATA ...	1	1	...	1	...	...	...	3
DERMAPTERA ...	...	3	...	...	...	...	...	3
HEMIPTERA								
Capsidæ ...	...	...	...	...	...	...	1	1
Jassidæ ...	...	1	...	...	...	...	...	1
NEUROPTERA								
Sialioidea ...	...	..	2	...	...	...	...	2
PLECOPTERA ...	...	1	...	...	...	...	...	1
MISCELLANEOUS INSECTS ...	5	19	8	1	4	2	...	39
PISCES ...	3	1	2	...	7	...	...	13
ARACHNIDA ...	1	...	...	...	1	...	...	2
MYRIAPODA ...	...	...	...	1	..	...	1	2
MOLLUSCA ...	...	...	...	1	...	...	...	1
CRUSTACEA								
Isopoda ...	...	...	...	1	...	...	...	1
OLIGOCHAETA ...	...	...	...	2	...	...	...	2
AMPHIBIA ...	...	...	1	...	...	...	...	1
MISCELLANEOUS								
Sand-gravel ...	o	o	...	...	o	...	...	
Twigs-seeds ...	o	o	...	...	o	o	...	

o Indicates presence.

TABLE II.

Summary of stomach contents of each Brown Trout (*Salmo fario* L.) caught from the River Beas in the Kulu Valey during the Month of May 1937.

Serial number of stomachs.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Length in mm. ...	287	275	237	287	275	256	256	300	275	269	275	300	275	275	250	250	350	287	350	300	300	275	262	300	1439
Weight in oz. ...	10	9	16	10	8	7	6	10	8	7	9	11	10	10	7	7	14	10	17	11	10	9	8	10	38
Sex ...	F	F	M	M	M	M	M	F	M	M	F	M	M	F	M	M	F	F	F	F	M	F	F	M	
TRICHOPTERA ...	125	3	24	42	83	82	119	42	107	12	12	2	127	49	26	23	17	4	78	153	101	106	49	53	1439
EPHEMEROPTERA	1	...	...	...	8	1	...	1	...	..	...	1	2	1	2	10	3	2	2	...	...	2	1	1	38
COLEOPTERA																									
Chrysomelidæ	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Carabidæ	...	...	...	...	...	...	...	...	...	...	2	...	...	...	3	...	...	...	...	...	...	...	...	...	2
Unidentified	...	...	...	1	...	...	...	1	1	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	8
DIPTERA																									
Blepharoceridæ	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	36	...	38
Simuliidæ	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
Cyclorrhapha	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	1	3	4	...	...	...	...	2	1	17
Unidentified	...	...	...	...	...	...	...	3	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	1
HYMENOPTERA																									
Formicidæ	...	...	...	...	...	...	1	...	1	1	1	...	...	1	...	1	...	1	...	...	...	...	...	...	1
Scoliidæ	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Unidentified	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	4
LEPIDOPTERA ...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	1	3	...	...	...	2	...	...	...	13
ORTHOPTERA																									
Acridiidæ	...	...	...	...	...	...	...	1	...	...	...	...	...	...	3	...	...	...	...	...	...	1	...	...	4
Mantidæ	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
ODONATA ...	...	...	...	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	1	...	...	...	...	...	4
DERMAPTERA ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
HEMIPTERA																									
Jassidæ	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
PLECOPTERA ...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	5	8	...	1	...	...	...	...	...	19
MISC. INSECTS ...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
PISCES ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
MISCELLANEOUS																									
Sand-gravel ...	...	...	...	o	...	...	...	...	...	o	...	...	...	...	...	...	...	...	o	...	...	...	...	...	
Twigs-seeds ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	o	o	...	o	...	o	...	...	
Digested remains ...	...	...	...	...	...	...	...	...	...	o	o	...	o	...	...	...	...	...	...	...	...	...	...	...	

o indicates presence.

F = Female. M = Male.

TABLE III.

Summary of stomach contents of each Brown Trout (*Salmo fario* L.), caught from the River Beas in the Kulu Valley during the Month of August, 1937.

															Total
Serial number of stomachs ...	1	2	3	4	5	6	7	8	9	10	11	12	13	14	14
Length in mm. ...	325	312	287	300	225	325	250	250	300	312	300	250	325	362	
Weight in oz. ...	13	12½	11	11	5	12	8	8	10	14	12	6	16	20	
Sex ...	M	F	M	F	M	F	M	M	F	M	M	F	M	M	
TRICHOPTERA ...	..	...	...	...	...	28	87	5	18	...	...	...	...	...	138
EPHEMEROPTERA.	...	...	...	...	...	3	1	1	...	...	2	...	...	...	7
COLEOPTERA															
Gyrinidæ ...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Unidentified ...	...	2	...	...	...	...	...	...	...	..	...	...	...	...	2
DIPTERA															
Cyclorrhapha ...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Syrphidæ ...	..	...	...	...	...	...	...	...	...	...	1	...	...	...	1
HYMENOPTERA															
Formicidæ ..	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2
ORTHOPTERA															
Acridiidæ ...	...	...	...	...	...	1	...	..	...	...	...	...	...	...	1
MISC. INSECTS ...	1	...	...	...	...	2	...	1	...	...	...	...	...	...	4
PISCES ...	1	1	1	1	...	1	...	...	...	...	...	...	1	1	7
ARACHNIDA ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
MISCELLANEOUS.															
Sand-gravel ...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	
Twigs-seeds ...	...	...	...	...	...	o	...	...	...	...	...	...	...	...	
Digested remains ...	..	...	...	...	...	...	o	o	...	...	...	...	...	...	

F = Female. M = Male. o indicates presence.

TABLE IV.

Seasonal occurrence of surface and submerged food in the stomachs of Brown Trout (*Salmo fario* L.) in the River Beas in the Kulu Valley.

	April	May	June	July	August	September	October	Total
Number of stomachs examined ...	13	24	9	11	14	27	4	102
Empty stomachs ...	...	...	...	2	2	4	1	9
Stomachs with surface food ...	...	...	...	...	...	9	...	9
Stomachs with mixed surface and submerged food ...	2	2	5	4	2	10	2	27
Stomachs with submerged food ...	11	22	4	5	10	4	1	57

TABLE V.

Study of the average per fish for each kind of food for trout (*Salmo fario* L.) in the Kulu Valley, New Zealand and Australia.

	Kulu (India) 1936–37	New Zealand 1927–28	New Zealand 1928–29	New South Wales and Australia 1933–34
Number of stomachs on which averages are based ...	102	48	42	27
TRICHOPTERA ...	22·40	129·72	163·02	29·70
EPHEMEROPTERA ...	1·23	13·77	19·88	·27
COLEOPTERA ...	1·09	1 12	·54	5·06
DIPTERA ...	·67	1·31	2·64	·90
HYMENOPTERA ...	·70	·08	·07	4·00
LEPIDOPTERA ...	·12	·02	...	·45
ORTHOPTERA ...	·176	·047	...	·85
ODONATA ...	·029	...	...	4·30
DERMAPTERA ..	·029	...	...	...
HEMIPTERA ...	·019	·33	·26	1·73
NEUROPTERA ...	·019	1·20	1·64	...
PLECOPTERA ...	·009	·43	·64	...
MISC. INSECTS ...	·38	...	...	...
PISCES ...	·127	...	...	...
ARACHNIDA ...	·019	·02	·16	·30
MYRIAPODA ...	·019	...	...	...
MOLLUSCA ...	·009	15·41	21·94	·72
CRUSTACEA ...	·009	·083	1·02	·42
OLIGOCHAETA ...	·019	·04	·35	...
AMPHIBIA ...	·009	...	...	...

The figures denote the averages of the various orders of animals eaten per fish.

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THE MIGRATION OF BUTTERFLIES IN INDIA.

BY

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(*With one coloured plate and 4 diagrams*).

INTRODUCTORY.

The migrations of birds and mammals have been known for many centuries, and similar movements of fishes are now being studied with results of great practical importance. Among the insects great swarms of locusts have always attracted attention, but the fact that extensive movements take place in other groups is still but little known to the general public, and even in some cases to the naturalist himself.

It is now however a well established fact that many species of butterflies and moths make regular movements in the adult stage, over distances which frequently exceed a thousand miles. Thus in North America, the Monarch Butterfly (*Danaus plexippus*) flies in great numbers each Autumn from Southern Canada to Florida, the Gulf States or Mexico, and then returns to repopulate the northern area in the Spring.

In Western Europe and North Africa the Painted Lady (*Vanessa cardui*) flies regularly in large numbers from the borders of the North African desert, across the Mediterranean, northwards through Europe, and may in extreme cases reach Iceland and almost to the Arctic Circle in Russia.

That the phenomenon is not a rare and unusual occurrence may be seen from the fact that of the sixty-eight species of butterflies known to occur in the British Isles, fourteen are partially or completely dependent on immigration from the Continent for their continued existence in Britain.

The known movements of the migrant butterflies have been slowly established by the collection of individual records of directional flights, and also by discovery (often very difficult to verify) that certain insects are only to be found over large areas at one particular time of the year.

MIGRATIONS IN INDIA.

In India the latter form of evidence is not generally available, owing to insufficient study, but it has been used in support of the supposed migrations of the moth *Agrotis ypsilon* from the 'tal' lands of Mokamek in Bihar.

Directional flights of butterflies have however been known to occur here for many years.

The first record that I have been able to trace is in an English newspaper *The Liverpool Mercury and Lancashire General*

Advertiser of just a hundred years ago. In the issue for 21st December 1838 there is a paragraph which states 'Mr. Moore records a flight in India of butterflies which extended 500 miles, and Mr. Barrie describes one in Africa which occupied an area of 2,000 miles'. In a later issue of the same newspaper (4th January 1839) the Editor comments that stories about locusts can apparently be believed, but he considers stories of great flights of butterflies as merely 'flights of fancy'!

Several records and discussions of butterfly flights in Ceylon appeared about the middle of last century, but interest in India did not seem to be aroused till about the end of the century, when several short papers and notes appeared in the *Journal* of the Bombay Natural History Society and elsewhere.

Since then observers of strikingly large flights have occasionally sent in their records for publication, but no one has made any continuous study of the subject except Mr. J. Evershed, F.R.S. who was for many years Director of the Observatory at Kodaikanal, in the Pulni Hills, South India at an altitude of about 7,700 feet. Mr. Evershed observed directional movements of butterflies at Kodaikanal on numerous occasions between 1907 and 1914, and also in 1921. In 1926 he kindly placed the whole of his notes at my disposal and a full report on them has already been published (Williams 1927). Summaries of his observations will be given below.

Directional flights of butterflies are also known to occur in most of the countries bordering on India. In Ceylon they are particularly frequent and the available evidence was summarised by the present writer in 1927.

In Burma and Malaya movements seem to have been less frequently observed, but they are not uncommon in Siam and the East Indies, and probably only need a close watch to be found almost everywhere.

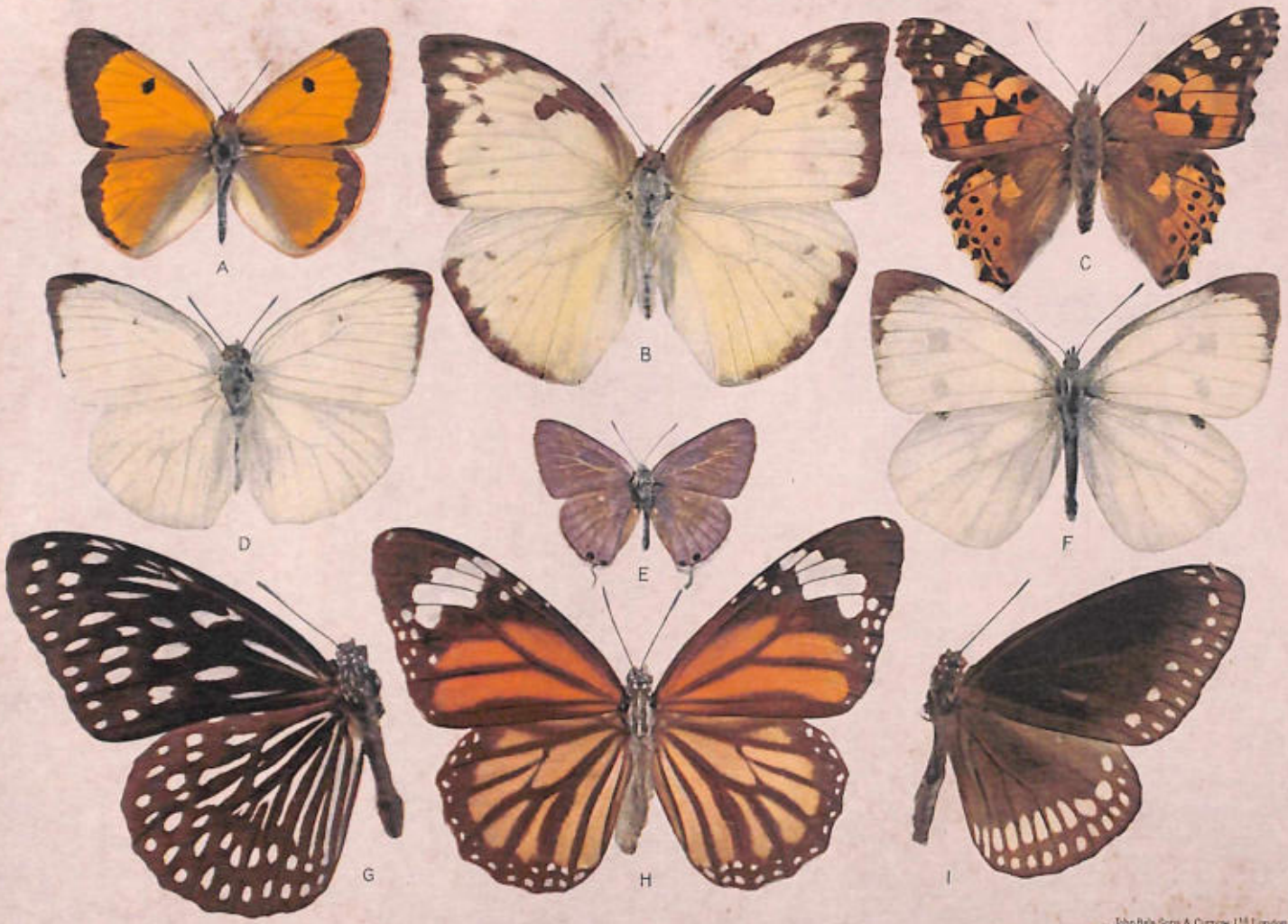
For the area to the North of India no information is forthcoming.

Information at present available in India.

In 1930 (Williams 1930) I made a general survey of the problem of migration of butterflies throughout the world, and included in it notes on the Indian butterflies that had been known to migrate. It appeared from the evidence then available that the species concerned in the migrations in the foothills of the Himalayas were very different from those of Central and South India. In this present review therefore the records along the mountains in the north will be kept distinct from those of the rest of India.

In order to summarise as briefly as possible the records that I have so far traced, they are condensed into three tables. Table I shows the records for North India and the Himalayas; Table II Evershed's records for Kodaikanal; and Table III shows the records for the rest of the country. Finally Table IV gives a list of all the species which have been recorded as migrating anywhere in India with the names of the observers of their movements.

All the flights in Tables I-III are shown in diagrammatic form in Fig. 1.



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INDIAN MIGRANT BUTTERFLIES.

A. *Colias fieldi*, Menetr. ♂
B. *Catopsilia crocale*, Cram. ♀
C. *Vanessa cardui*, Linn. ♂
D. *Catopsilia pyranthe*, Linn. ♂
E. *Lampides bœticus*, Linn. ♂
F. *Pieris brassicæ*, Linn. ♂
G. *Danaus hamata septentrionis*, Butl. ♀
H. *Danaus genutiæ*, Cram ♂
I. *Euplœa core*, Cram ♂

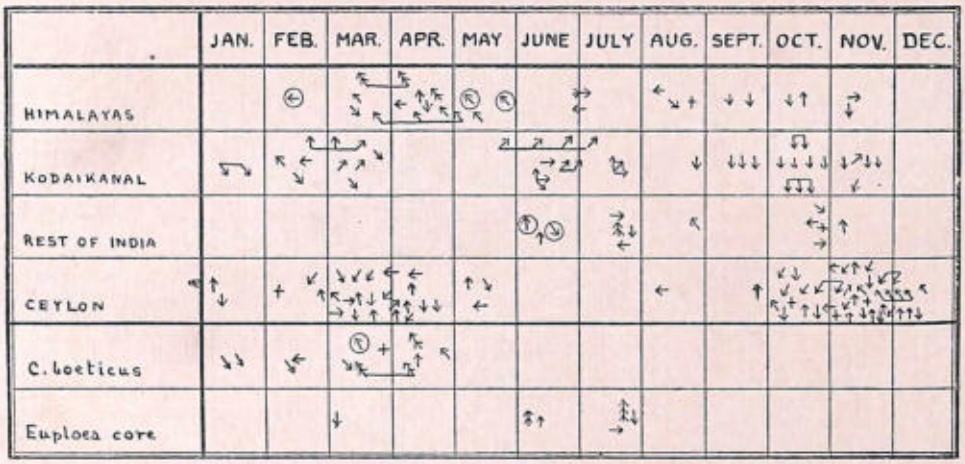


Fig. 1.—Diagram showing the date and direction of recorded flights in different parts of India and Ceylon, and also the recorded flights of *C. boeticus* and *E. core* in India.

An examination of Table I and the corresponding portion of Fig. 1 shows that the flights in the foothills of the Himalayas are chiefly in two seasons; the first in March, April and May; the second mid-August to early November; corresponding more or less to the Spring and Autumn. The flights in the Spring season are most frequently to the N.-W. and in the Autumn to the South, as shown in Fig. 2.

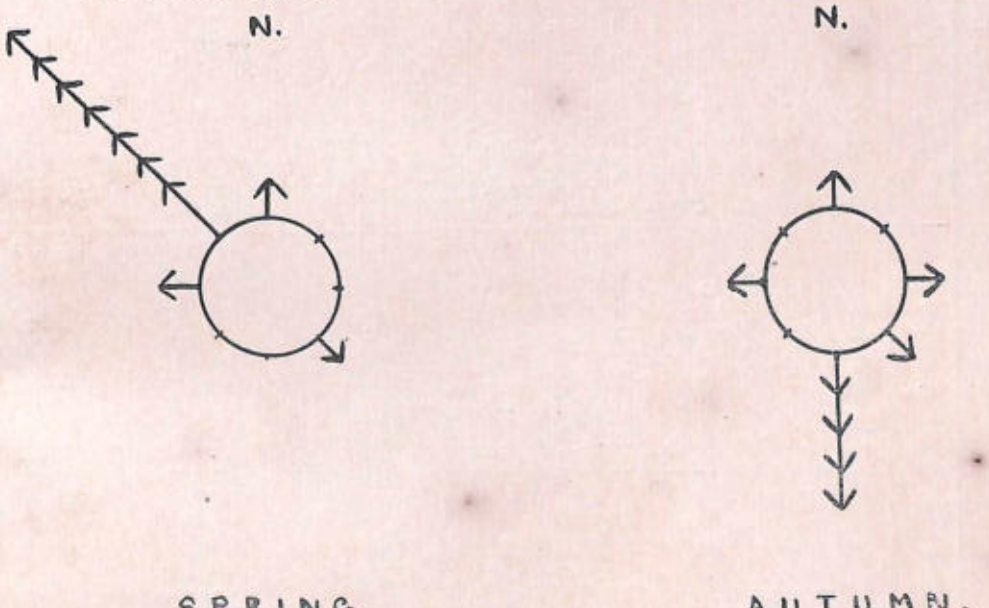


Fig. 2.—Diagram showing the directions of the recorded flights of butterflies in the Himalaya region of India separated into Spring and Autumn seasons.

TABLE I.—N. INDIA AND HIMALAYAS.

Date	Locality	Species concerned	Direction	Observer and Reference
April ...	Naini Tal, U.P. ...	*Lampides boeticus*	To North ...	Lang (de Niceville 1890).
Spring ...	Mussoorie ...	do.	...	Mackinnon (de Niceville 1890).
Annually End June to beg. July ...	Dehra Dun, U.P. ...	*Catopsilia crocale* and *C. pyranthe* ...	Most to West Sometimes to East	Ollenbach (Williams 1930b).
1900 Aug. 12 ...	Palampur, Kangra ...	*C. crocale* and a few *C. pyranthe* ...	To East ...	Dudgeon (1902).
1901 March, April, and Annual ...	Lucknow Dist., U.P....	*L. boeticus*	To North-West ...	de Rhé-Philipe (1902).
1901 April 7 ...	Palampur, Kangra ...	*A. mesentina* and a few *Danaus genutia*	To West ...	Dudgeon (1902).
1900 August ...	Shandur Pass, Chitral.	*Vanessa cardui*	To South-East ...	Evans (Williams 1935).
1908 Mid October.	Naini Tal, U.P. ...	*Precis iphita*	To South ...	Peile [See Appendix].
1909 April 16 ...	Mussoorie ...	*Colias fieldi edusina*	,, ...	,, ,,
1909 October ...	Valley of Doone ...	Unknown	To North ...	Crothers (Williams 1935).
1912 August 20 ...	Mussoorie ...	*Catopsilia*	...	Peile (Williams 1928).
1913 April 30 ...	,, ...	*L. boeticus*	To North-West ...	Peile [See Appendix].
1913 May ...	,, ...	*Spindasis nipalicus*	'Down the nullah.'	,, ,,
1915 November ...	Kampilong, Darjiling.	*Appias lalage*	To East ...	Roberts (Williams 1928).
1916 March ...	Khyber Pass ...	*Euchloe lucilla*	To South-East ...	Evans (Williams 1935).
1916 May ...	Mussoorie ...	*Papilio agestor, Delias sanaca, Neptis hylas, Parathyma opalina, Arhopalas* spp.	To North-West ...	Peile [See Appendix].
1916 End May ...	,, ...	*Delias sanaca* and others	'Down the nullah.'	,, ,,
1916 September ...	Mussoorie, U.P. ...	*D. genutia, Precis iphita, Neptis hylas, Lethe vaivarta, Papilio polytes, Terias hzta, T. libythea T. hecabe, Celastrina puspa Syntaruches plenius, Everes argiades, Vanessa canace* and others...	To South ...	,, ,,
1918 2nd half of September ...	Mussoorie ...	*Achlarus bifasciatus casyapa* ...	To South ...	Ollenbach (Williams 1930b).
1919 End March—May ...	Dharmsala, Kangra...	*Pieris brassicae*, with *Colias fieldi* and a few *D. chrysippus, V. cashmirensis* and *Polyommatus boeticus*	To North-West ...	Hingston 1928.
1920 ? Feb. ...	Rawalpindi ...	*L. boeticus*	To West ...	Evans 1927 and (Williams 1935).
1924 November ...	Dehra Dun, U.P. ...	*Kallima inachus huegelii*	To South ...	Ollenbach (Williams 1930b).
1928 March 17-25.	Naini Tal, U.P. ...	*L. boeticus*, and a few *Colias fieldi*...	To North-West ...	Broughton (Williams 1930b).
1928 Mid April ...	Dehra Dun, U.P. ...	*L. boeticus*, (annual event but very great this year)	,,	Ollenbach (Williams 1930b).

The species concerned in these flights are given in the following list. An I. after the name denotes that it has also been recorded as migrating in other parts of India, and a C. after the name denotes that it has also been recorded as migrating in Ceylon.

PAPILIONIDÆ.

Papilio agestor.
Papilio polytes. C.
Papilio machaon.

PIERIDÆ.

Euchloë lucilla.
Pieris brassicae.
Delias sanaca.
Glycestha aurota. I.C.
Appias lalage.
Catopsilia crocale. I.C.
Catopsilia pyranthe. I.C.
Terias libythea.
Terias laeta.
Terias hecabe. I.C.
Colias fieldi.

DANAIDÆ.

Danaus tytia.
Danaus genutia. I.C.
Danaus chrysippus.

NYMPHALIDÆ.

Lethe sidonis.
Parathyma opalina.
Neptis hylas.
Kallima inachus.
Precis iphita.
Vanessa cardui.
Vanessa canace.
Aglais cashmirensis.
Phalanta phalantha. I.C.

LYCAENIDÆ.

Syntaruchus telecanus.
Everes argiades.
Lycaenopsis puspa. C.
Lycaenopsis huegelii.
Cosmolyce boeticus. I.C.
Spindasis nipalicus.

HESPERIDÆ.

Lobocla bifasciatus.

It will be seen that of the thirty-three species recorded, only ten have been seen migrating further south in India or Ceylon.

The most regular migrant of all in this area is undoubtedly *L. boeticus*, the long-tailed Blue (Plate, Fig. E) which has been recorded as migrating by no fewer than nine different observers in India, and by Ormiston in Ceylon (Williams 1927, p. 24). The same species is also known as a migrant in Europe and North Africa and is found in many of the oceanic Islands of the Pacific. The records in the Himalayas are all to the North or N.-W. in February, March and April. At Kodaikanal, Evershed observed four flights in January, February and March, but all to the south or south-east. In Ceylon no exact dates are available.

Another most interesting migrant is *Pieris brassicae*, the Large Cabbage White Butterfly (Plate, Fig. F), which migrates not only in India, but also on a large scale in Europe (see Williams 1930, pp. 112-21). Lefroy (1909) says that in India this butterfly migrates from the hills in the cold weather and early hot weather. It spends this period in the submontane districts of the Himalayas, breeding on cultivated *Crucifers*, and returns to the hills for the summer. Fletcher (1925) says that it first appears at Pusa about the first week in February, and two or three generations are passed through rapidly before the end of April. At the beginning of May all disappear, and do not reappear till the following February. The only observed case of actual migration is that of Hingston (1928) referred to in Table I.

SPECIES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
PAPILIONIDÆ												
Papilio demoleus												
" *hector*												
PIERIDÆ												
Catopsilia pyranthe												
" *crocale*												
" *catilla*												
" *(florella?)*												
" *spp.*												
Appias (usually albina)												
Hebomoia (glaucippe)												
DANAIDÆ												
Danais agliæ												
" *plexippus*												
" *limniacæ*												
" *septentrionalis*												
Euploea core												
NYMPHALIDÆ												
Hypolimnas bolina												
" *misippus*												
Junonia hierta												
" *orythya*												
" *lemonias*												
" *sp*												
Atella phalanta												
" *ariadne*												
" *spp.*												
LYCÆNIDÆ												
Polyommatus boeticus												
HESPERIDÆ												
Parnasa mathias												
DRAGON FLIES												

Fig. 3.—Diagram showing the directions and months of all flights of butterflies recorded at Kodaikanal, S. India by Mr. J. Evershed, F.R.S.

(Reproduced from the *Trans. Ent. Soc. London* 1927, p. 8 by kind permission of the Society.)

Vanessa cardui, the Painted Lady (Plate, Fig. C), is one of the most widespread of all butterflies and is a regular migrant in both Europe and North America. It occurs throughout India and Ceylon and has been found far out at sea in the Indian Ocean. In Ceylon, Ormiston (1924) says that on occasions it appears suddenly in great numbers but he has no other evidence of migration. Aitken (1897) states that 'At different times of the year, but most often I think in June, large numbers of this species appear about the rocks on the seashore and in other barren situations and I am inclined to think that they are new arrivals from some other country. . . . A certain number remain permanently with us and breed on a common species of *Blumea*.' The only record of an actual flight is the one recorded by Evans in the Shandur Pass, Chitral. (See Table I.)

At Kodaikanal (Table II and Fig. 3) Mr. Evershed observed numerous migrations between 1907 and 1914, and one flight in 1921. About twenty-three species were noted, and the flight seasons fell definitely into three periods. The main flights were towards the south in October and November and included nearly all the observed species (but not *P. boeticus*). In February and March a return flight to the north occurred, but consisted only of *Catopsilia* spp. and *Appias* spp. Then after a blank period in April there was renewed activity in May and June in the same two genera, with some *Papilio polytes*, but the direction of flight was less definite. Of about 22 species observed by Evershed only 5 have been recorded as migrating in the Himalayan area; but all but two species (*Precis orithya* and *Pelopidas mathias*) are known migrants in Ceylon.

TABLE II

Obeservations made by J. Evershed at Kodaikanal, S. India.

Date	Species	Direction
1907		
February—March ...	*Catopsilia pyranthe* ...	North.
1908		
May 16 to begin. July.	*Catopsilia crocale*	North and N. by E.
October 7–21 ...	Dragonflies, *Papilio demoleus* (enormous numbers), *P. bolina*, *P. hector*, *Catopsilia crocale*, *C.? catilla*, *D. plexippus*, *limniace* and *septentrionis*, *Junonia hierta*, *J orithya*, *J. lemonias*, *Atella phalantha*	South.
1909		
March 28 ...	*Euploea core*, *C. crocale*, *C. pyranthe*	To South-East.
June 13–15 ...	*C. crocale*, *C.pyranthe*, *P. demoleus* and others	East, East by South and North-East.

Observations made by J. Evershed at Kodaikanal, S. India—(*Contd.*)

Date	Species	Direction
October 3–25 ...	*P. demoleus, E. ariadne, A. phalantha, J. orithya, J. hierta, J. lemonias, H. bolina, C. pyranthe*, a few *P. hector* and *Parnara mathias* (great many)	South, South by W., S.S.-W and S.W.
1910 ...	No records	
1911		
Jan. 4–28 and Feb. 19...	*Polyommatus boeticus* ...	South-East.
January 28–30 ...	*Appias albina*	South-East by South.
February 12 and 19 ...	Catopsilias	West and N.-West.
March 12 ...	*Appias* sp.	North-East.
March 19 ...	*P. boeticus* (many) ...	To South-East.
	Appias, males (several) ...	North-East.
	Catopsilias (a few) ...	North.
1912		
Mar. 23, 24, 25, and 28.	*Catopsilia pyranthe* only, in numbers	North by East.
May 19 (about) ...	*Catopsilia catilla* ... ... *Appias* and a few Catopsilias	E., E.S.E. and S.-E. N. and N. by E.
May 20–29 ...	*Catopsilia catilla* (pale form); on 28th all *crocale* ...	Mostly E. to S.-E., also some North to North-East.
July 31 ...	Large Catopsilias	Various, but mostly North to East.
September 11 ...	*C. pyranthe* (several), *P. hector* (only one)	South.
September 21 ...	*D. limniace* (5 or 6) ...	South or South by E.
September 15–29 ...	*H. bolina* (several each day) ...	Towards S.-W. to S.-East.
October 6 ...	*H. bolina* (large numbers of both sexes)	South and S.S-W.
October 9 ...	*C. pyranthe* (large numbers) ...	South and S.-W.
October 13 ...	Do do. ...	More or less S.
October 16 ...	*C. pyranthe* (snow-storm)	
,, ...	*P. demoleus* (large numbers), *A. phalantha*, *H. missipus* (considerable number of females, a few males), *H. bolina*, *D. plexippus* (1), *D. limniace* (1), *J. hierta* (a few), *J. lemonias* (1), *C. florella*? (a few)	S. (more or less).
October 30 ...	*P. demoleus* (large numbers), *C. pyranthe* (snow-storm), *H. bolina* (a few)	S. (more or less).
October 31 ...	*C. pyranthe*, *P. demoleus*, *Atella* (great many of all) ...	S. (more or less).
November 3–4 ...	*C. pyranthe* (small number) ...	North-East.
November 5–6 ...	*C. catilla* (considerable numbers)	S.-W. and W.S.-W.
	P. demoleus (a few), *H. bolina* (a few), *Junonia* sp. (several)	S.-W. (more or less).
November 10 ...	Hebomoias (many), Catopsilias (*catilla* chiefly) ...	South.
November 14–22 ...	*P. demoleus* and Catopsilias ...	South.

Observations made by J. Evershed at Kodaikanal, S. India—(*Contd.*)

Date	Species	Direction
1913		
March 2–9 ...	Catopsilias and *Appias* (a few only)	North.
May 18–31 and June 1.	*Catopsilia crocale, catilla* or *florella* (not *pyranthe*) ...	N.-E. and E.N.-E.
1914		
November 11 ...	*Catopsilia catilla* (considerable numbers), also *E. ariadne*, Junonias, *Atella phalantha* ...	West and W. by S.
1915–20	No records	
1921		
August 21 ...	*C. pyranthe* (many), also *C. crocale, P. demoleus* (many), *A. phalantha* (many), *D. aglea* (a few), *J. hierta* (a few)	South.

The October-November season at Kodaikanal corresponds to the change of the S.-W. to the N.-E. monsoon and is the period of maximum rainfall.

In the remainder of India (Table III, p. 449) there are only nineteen recorded flights, of which at least 12 refer to butterflies of the family *Danaidae*, and chiefly to *Euploea core*. The flights of this species seem to occur fairly regularly in the Bombay area in June and July and are chiefly towards the north. It has never been recorded in the Himalayan area, and only once at Kodaikanal, but it regularly joins in the flights in Ceylon in November and December, and again to a smaller extent in March and April.

All the localities at which butterfly migrations have been recorded in India are shown in Fig. 4 together with the direction of flight. They are well scattered over the country, but there are still very large areas from which no information is available.

A general survey of the evidence available for India thus shows that we have about eighty records of unidirectional flights over the whole country, of which about half are due to Mr. Evershed at Kodaikanal.

These records include 52 species (see table IV, p. 450) of which 27 are also known to migrate in Ceylon.

When it is realised that for the Cabbage White Butterfly, *Pieris brassicae*, we have a hundred records of flights for England alone, and another hundred for the Continent of Europe, and that for the Painted Lady (*Vanessa cardui*) we have about 400 records in different parts of its range, it will be seen that the problem in India is in a very early stage of investigation.

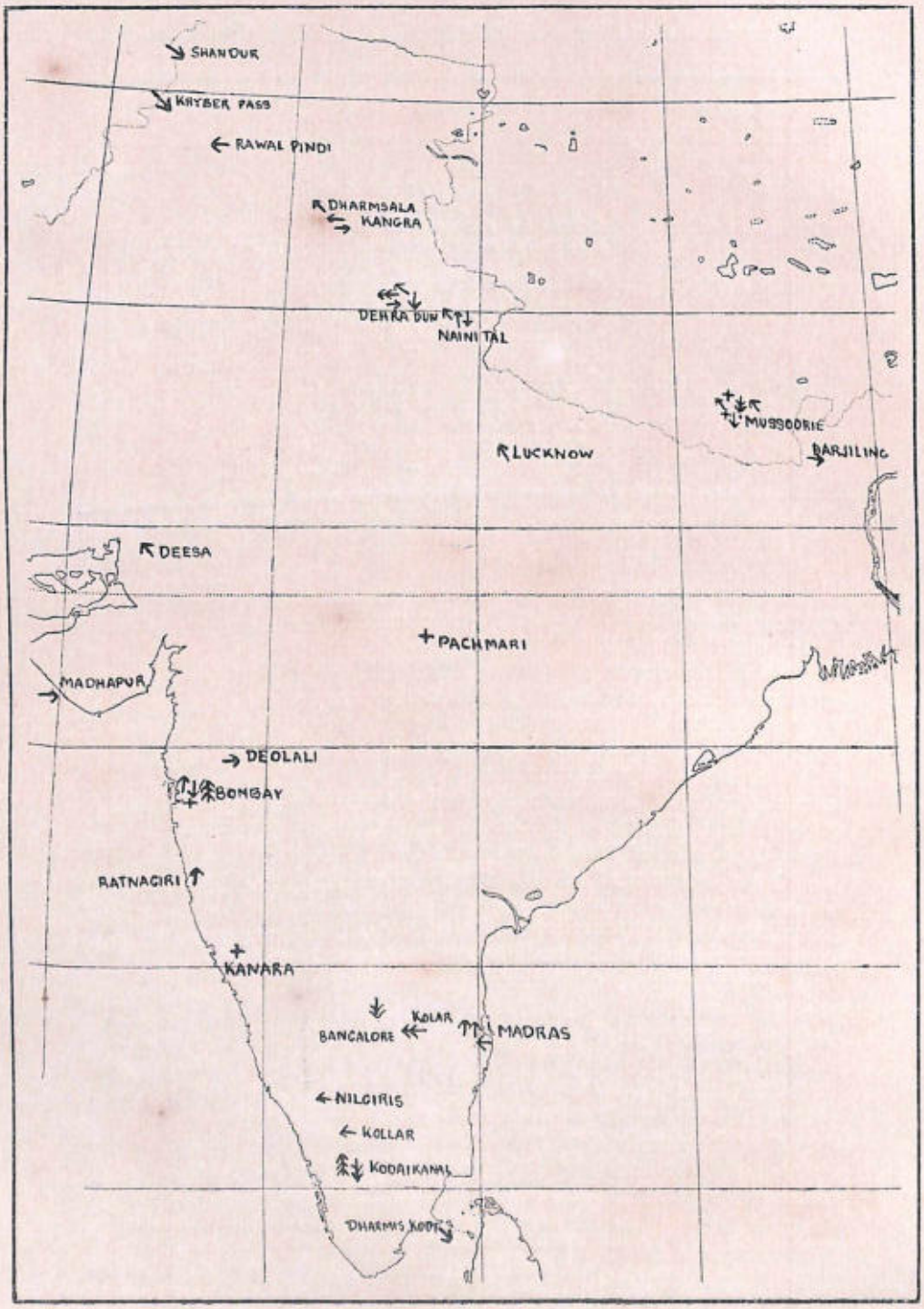


Fig. 4.—Map of India showing localities and directions of the recorded flights of butterflies.

TABLE III.—REST OF INDIA.

Date	Locality	Species	Direction	Observer and Reference
..	Siddapur, N. Kanara.	Danains	...	Prall 1898.
Several years ...	Bangalore ...	Danains, Euplœas, Catopsilias ...	To South ...	Kuhni Kannan (Williams 1929b).
,, ...	Kolar Gold Fields, Mysore ...	Danains	To West ...	Rowntree [See Appendix].
Many years, about begining June ...	Bombay ...	*Euploea core*	To North ...	Aitken 1898.
1897 ...	Ratnagiri, Bombay ...	do.	do. ...	Aitken 1897.
1897 October 21 ...	Mody Bunder, Bombay	do.	...	Prall 1898.
1898 July 26–27 ...	Bombay ..	do.	To S (only time seen in this direction) ...	Aitken 1898.
1900 July 22 ...	,, ...	do.	To North ...	Aitken 1900.
1901 Aug. 25–27 ...	Deesa, Bombay ...	*Catopsilia pyranthe*	To North-West ..	Nurse 1902.
1908 October 18 ...	Nilgiris ...	Euploœas	To West ...	Andrewes 1910.
1909 July 26 ...	Madras ...	*Danaus septentrionis*	do. ...	Punnett (Williams 1935).
1912 November 3...	,, ...	Mostly Catopsilias	To North ...	Patton (Williams 1927b).
1918 ...	,, ...	Catopsilias and Danains	do. ..	Hopkins (Williams 1923).
1920 about June ...	Kollar, Nilgiris ...	Danains	To South-East ...	Parlett [See Appendix].
1921 October 28	At sea five miles off Madhapur ...	*A. mesentina, Teria hecabe* ... *P. demoleus, E. core, D. genutia,* ... *Precis hierta, H misippus,* ... *P. aristolochiæ, Teracolus, amatus* ...	To East ...	Wall 1921.
1922 July ...	Deolali, Bombay ...	*E. core*	do. ...	Tulloch (Williams 1930b).
1922 September ...	Pachmari, Cent. Prov.	*C. crocale, C. pyranthe, T. hecabe,* etc.	...	
1932 October 30	Dhamiskodi ...	Dark butterflies	To South-East ...	Hinchey (Williams 1935).
1937 June 13 ...	Bombay ...	*Euploea core*	To North ...	Ghose [See Appendix].

TABLE IV.—INDIAN BUTTERFLIES RECORDED AS MIGRANTS.

PAPILIONIDÆ.

Papilio hector L. :—Eversbed.
**Papilio aristolochiæ* Fabr. :—Wall.
Papilio agestor Gray :—Peile.
**Papilio polytes* Linn. :—Peile.
**Papilio demoleus* Linn. :—Wall, Eversbed.
Papilio machaon Linn. :—Peile.

PIERIDÆ.

Euchloe lucilla Butler :—Evans.
Pieris brassicæ Linn. :—Hingston, Lefroy, Fletcher (Plate, fig. F).
Delias sanaca Moore :—Peile.
**Glycestha aurota* Fab. (*mesentina* Cr.) :—Dudgeon, Wall.
Appias lalage Dbdy. :—Roberts.
**Appias albina* Bdv. :—Eversbed.
**Catopsilia crocale* Cr. :—Dudgeon, Ollenbach, Eversbed (Plate, fig. B).
**Catopsilia pomona* f. *catilla* Cr. :—Eversbed.
**Catopsilia pyranthe* Linn. :—Dudgeon, Ollenbach, Nurse, Eversbed. (Plate, fig. D).
**Catopsilia florella* Fabr. :—Eversbed.
Terias libythea Fab. :—Peile.
Terias læta Bdv. :—Peile.
**Terias hecabe* Linn. :—Peile, Wall.
Colias fieldi Men. :—Hingston, Broughton, Peile (Plate, fig. A).
Colotis amata Fabr. :—Wall.
Hebomoia glaucippe Linn. :—Eversbed.

DANAIDÆ.

**Danaïs aglea* Cram. :—Eversbed.
Danaus tytia Gray. :—Peile.
**Danaus limniace* Cram. :—Eversbed.
**Danaus hamata septentrionis* But. :—Punnett, Eversbed (Plate, fig. G).
Danaus genutia Cram. :—Dudgeon, Peile, Wall, Eversbed. (Plate, fig. H).
Danaus chrysippus Linn. :—Hingston.
**Euploæa core* Cram. :—Aitken, Prall, Wall, Tulloch, Ghose, Eversbed. (Plate, fig. I).

NYMPHALIDÆ.

SATYRINÆ.

Lethe sidonis vaivarta Doherty :—Peile.

NYMPHALINÆ.

Parathyma opalina Koll. :—Peile.
Neptis hylas Linn. :—Peile.
**Hypolimnas misippus* Linn. :—Wall. Eversbed.
**Hypolimnas bolina* Linn. :—Eversbed.
Kallima inachus Bdv. :—Ollenbach.
**Precis hierta* Fabr. :—Wall, Eversbed.
Precis orithya Linn. :—Eversbed.
**Precis lemonias* Linn. :—Eversbed.
**Precis iphita* Cram. :—Peile.
**Vanessa cardui* Linn. :—Evans. (Plate, fig. C).
Vanessa canace Johann. :—Peile.
Aglais cashmirensis Kollar. :—Hingston.
**Phalanta phalantha* Drury. :—Peile, Eversbed.
**Ergolis ariadne* Moore. :—Eversbed.

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* Also recorded as migrating in Ceylon.

LYCAENIDÆ.

Syntaruchus telecanus plinius Fabr. :—Peile.
Everes argiades Ever. :—Peile.
Lycænopsis huegelii Moore. :—Peile.
**Lycænopsis puspa* Hors. :—Peile.
**Cosmolyce bæticus* Linn. :—Lang, McKinnon, Hingston, Peile, Evans. de 'Rhe-Philipe, Broughton, Ollenbach, Evershed. (Plate, fig. E).
Spindasis nipalicus Moore. :—Peile.

HESPERIDÆ.

Lobocla bifasciatus casyapa Moore. :—Ollenbach.
Pelopidas mathias Fabr. :—Evershed.

OBSERVATIONS REQUIRED.

What is needed at the moment is a very great increase in the number of observers who will watch out carefully for any directional flights of butterflies, whether in large or small numbers; and who will send in their observations and specimens to the writer of this article or to the Curator of the Bombay Natural History Society.

The information required is first of all the locality, date and direction of flight, and secondly a number of specimens of the insects concerned, taken actually from the flight. Such specimens add very greatly to the value of the record, as from them identifications of species and variety can be obtained and dissections made to see the state of development of the eggs or ovaries. One or two specimens are much better than none; and, if opportunity occurs to catch them, up to fifty is not too many. The condition of the specimens is not of major importance, and for our immediate purpose a single broken specimen, or even a wing, enclosed in a letter is better than a perfect one which has escaped.

The best way to kill such specimens is to give the insect a sharp pinch at that part of the body where the wings and legs join it (technically the *thorax*). The wings can then be folded back and the butterfly placed in a small paper envelope, or between two sheets of paper in a flat cigarette tin.

If it is not possible to obtain specimens,—if for example the flight is seen from a railway train—, then as full as possible a description of the butterfly should be sent, giving approximate size and colour, whether with or without tails on the wings, etc. Records without specimens are always of interest, as are records of flights seen in the past if locality or date can be fairly well recollected.

Over and above the records of place, direction and date, the observer may send in almost any other details that occur to him. It is not desirable to have information too stereotyped and confined to certain channels, but it is always interesting to know such facts as the direction of the wind; the height of the insects above the ground; the approximate speed of flight; the time of the day; the weather conditions preceding and during the flight; how long the flight lasts and how many insects are estimated to be passing (e.g. dozens, hundreds, thousands, millions). Special watch should

* Also recorded as migrating in Ceylon.

also be made to see if more than one species is present and, if this is so, specimens of all species should be captured, if possible, with an estimate of their relative abundance.

Flights occur also in other groups of insects as well as butterflies. Fraser in 1916 described a large flight of Hawk moths (*Sphingidae*); and the serious pest *Agotis ypsilon* has already been mentioned as a migrant. The latter species is more fully discussed in my previous review (Williams 1930 b).

Dragonflies are also known to migrate in large numbers in many parts of the world but I have no record at present of any migration in India except the record by Evershed in October 1908 (Table II).

Since the above was written I have found another old record of butterfly migration in India. E. L. Arnold (1893) describes a flight of butterflies passing 'on a soft N.-E. breeze' in the Anamalai Hills, south of Palgat, Madras. The flight was apparently about mid-November but the year is not stated. The butterflies concerned were said to include *Papilio erithonius, Papilio pammon* (a male from *Papilio polytes*) and many Pieridae.

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APPENDIX

SOME UNPUBLISHED RECORDS OF BUTTERFLY MIGRATION IN INDIA.

(1) Danain butterflies in East Mysore.

Dr. W. B. Rowntree writes to me that large migrations of butterflies occur regularly in the district of Champion Reef, Kolar Gold Fields, East Mysore, all flying to the West. Writing on the 9th September 1936 he says that the flights are expected 'in about two months time'. He also adds that he is told that they cross the Western Ghats and may be seen in clouds flying out to sea.

The species were said to resemble illustrations of *Danaus septentrionis* and *D. genutia*, but no specimens were sent from an actual flight.

(2) Danain butterflies at Kollar, South India.

Mr. L. M. Parlett informs me that in 1920 about June he saw a large flight of Danain butterflies at Kollar in the Nilgiri Hills, South India, flying to the south-east. The flight appeared to consist almost entirely of *Euploea core* and *Euploea coreta,* and was so thick that the sky looked as if full of drifting brown leaves.

Kollar is said to be about 1,200 feet altitude at the foot of the Nilgiri Hills and about 4 miles from Mettupalayam.

(3) Euploea asela at Bombay.

Miss A. Ghose informs me that on 13th June 1937 a great swarm of butterflies passed over 'Black Bay' Reclamation, Bombay, flying towards the north. The flight lasted from 10 a.m. to noon and the number of insects was estimated at 30,000. Their speed was about 4 miles per hour and they flew at a height of from 4-60 feet above the ground. The wind was from the S.W. (Monsoon) and the sky fairly clear with bright sunshine.

Miss Ghose sent me two specimens, both of which were *Euploea asela*.

(4) Various butterflies at Mussoorie in September 1916.

Lt.-Col. H. D. Peile kindly sends me the following information.

On the 20th September 1916 at Mussoorie—United Provinces, India, on the southern slopes of the Himalayas at a height of

also be made to see if more than one species is present and, if this is so, specimens of all species should be captured, if possible, with an estimate of their relative abundance.

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(4) Various butterflies at Mussoorie in September 1916.

Lt.-Col. H. D. Peile kindly sends me the following information.

On the 20th September 1916 at Mussoorie—United Provinces, India, on the southern slopes of the Himalayas at a height of

about 7,000 feet. Misty, with sunny intervals during which the following species were seen migrating from north to south against the wind.

DANAIDÆ.

Danaus genutia, common.

NYMPHALINÆ.

Precis iphita, very common.
Neptis hylas astola, wet season form. Eight taken evidently recently emerged, all the usual rather small size.

SATYRINÆ.

Lethe vaivarta, several.
**Callerebia scanda*, female captured, other worn ones seen.
**Callerebia hyagriva*, very worn female.

PAPILIONIDÆ.

Papilio polytes, seen.

PIERIDÆ.

Terias laeta, several.
Terias libythea, several.
Terias hecabe,

LYCAENIDÆ.

Celeastrina puspa, two females taken.
Syntarucus plinius, female.
Everes 'argiades' females. (May have included *E. dipora* and *E. diporides*).

On 21st September at same spot. Sunny with occasionally mist. Migration as yesterday including the following.

DANAIDÆ.

Danaus tytia, one seen near thistles.
Danaus genutia, two.

NYMPHALIDÆ.

Argynnis hyperbuis, female.
Neptis astola, nine of wet season form.
Precis iphita, very common.

SATYRINÆ.

Lethe vaivarta, three.
**Callerebia scanda*, two.

PIERIDÆ.

Terias hecabe, several.
Terias libythea, three.
Terias laeta, thirteen.

PAPILIONIDÆ.

Papilio polytes, ♀ form *cyrus* 1. ♀ form *polytes* 1.
Papilio machaon, several.

LYCAENIDÆ.

Celestrina puspa, two females.

Heavy rain followed on 24th, 25th and 26th September.

On October the 6th and 7th, 1916, at Fox's Hill, about 3 miles west of the previous locality, the stream of migration from north to south was continuing and included the following species.

DANAIDÆ.

Danaus tytia, one seen.
Danaus genutia, taken.

NYMPHALINÆ.

Phalanta phalantha, two.
Neptis astola, wet season form very common, several passing every few seconds.
Kallima inachus, one of the dry season form.
Vanessa canace, very common.

SATYRINÆ.

**Aulocera saraswata*,

LIBYTHEINÆ.

Libythea myrrha,

PIERIDÆ.

Terias libythea, both wet and dry season form.
Terias laeta, abundant.
Terias hecabe, common, many small.

On October 9th the migration continued as before including *Neptis hylas astola* and *Terias* spp.

With regard to the species marked with an asterisk, Lt.-Col. Peile states that these Satyrids have probably merely got mingled locally with the crowd of migrants.

(5) PRECIS IPHITA NAINI TAL, U.P. IN 1908.

Lt.-Col. H. D. Peile informs me that at Naini Tal, in mid-October 1908 *Precis iphita* was very common migrating from north to south over the crest of the mountain at about 8,000 feet.

(6) POLYOMMATUS BOETICUS AT MUSSOORIE IN APRIL 1913.

Lt.-Col. H. D. Peile informs me that large numbers of *P. boeticus* were passing from south-east to north-west at Mussoorie, on 30th April 1913 on the ridge about 5,500 to 6,000 feet above sea level.

(7) VARIOUS BUTTERFLIES AT MUSSOORIE, IN MAY 1916.

Lt.-Col. H. D. Peile kindly gives me the following notes:—

Mussoorie, North-West Himalayas, 3rd May 1916.

In Pumping Station Nullah, above the Pumping Station i.e. above 5,000 feet. Sunny day. Stream of butterflies passing down the nullah, i.e. towards the north-west. The following species were noted.

LYCAENIDÆ.

Arhopalas (*A. dodonsea*, *A. rama* and *A. ganesa*) in worn condition. *Celastrina* (*Cyaniris*) *huegelii*, both sexes common though males more so than females.

NYMPHALIDÆ.

Parathyma opalina, both sexes very common.

Neptis hylas astola, sporting with the above. Wet season form common; the dry season form with yellow underside less so.

Argynnis lathonia issaea, one unexpectedly taken as it flew down the nullah.

PAPILIONIDÆ.

Papilia gestor ssp. *govindra*, two seen.

PIERIDÆ.

Delias sanaca (one captured).

Lt.-Col. Peile adds 'I was catching specimens so often and others going past so numerously that I could not even pin them in a box, but had to drop them on a rock.'

(8) SPINDASIS NIPALICUS (LYCAENIDAE) AT MUSSOORIE IN MAY 1913.

Lt.-Col. H. D. Peile informs me that *Spindasis nipalicus* (=*zaffra*) was very numerous at the Pumping Station nullah at an altitude of 5,500 feet, at Mussoorie, N.-W. Himalayas, in May 1913. On 24th May, a clear sunny day, over 30 were captured by three collectors and many more seen; on 25th May 25 captured by Lt.-Col. Peile alone. These were among a stream of butterflies moving down the nullah and presumably migrating. They were usually not plentiful in this district and Seitz says 'I do not recall any excursion on which I have obtained more than one specimen'.

(9) DELIAS SANACA (PIERIDAE) AND OTHER SPECIES AT MUSSOORIE IN MAY 1916.

Lt.-Col. H. D. Peile informs me that there was a definite movement of various species of butterflies at Mussoorie at the end of May 1916, at the Pumping Station nullah.

On the 23rd May. Hot sunny day. 'A wonderful stream of butterflies from about 9-45 a.m. (or earlier), slackening about 11-30 a.m.'

24th May. Bright hot day. Less variety about than yesterday.

29th May. Same locality, violent wind and dust storms all night. Wind and some cloud and rain threatening today. Fair number

of butterflies, but the wind sometimes drove them up the nullah and out of reach of the net.

These hot days preceded the break of the rains. Included in the flight were a number of *Delias sanaca* which came steadily down the nullah in ones and twos in a leisurely way.

10. Lt.-Col. H. D. Peile informs me that on 16th April 1909 at Mussoorie, *Colias fieldi edusina* was abundant and apparently migrating from north to south.

WHERE DID THE SANDALWOOD TREE (*SANTALUM ALBUM* LINN.) EVOLVE?

BY

C. E. C. FISCHER.

As far back as written records go, sandalwood has been known and used in India and China. The heartwood of the sandal tree contains a highly scented oil with medicinal properties which is extracted by distillation. Both the wood itself and the extracted oil have been used for many purposes. Thus:

The Chinese use the wood for making the 'joss sticks' that give forth an aromatic incense and are burnt in temples. In some Polynesian islands the oil (from other species of *Santalum*) is mixed with coconut oil to render it more pleasing. The Malays mix it with other substances to scent their steam baths. They also use it in ceremonial fumigation before prayers and in the ceremonial purification of a corpse. Mixed with *Aquilaria*, the extract is poured out as a libation at the grave-side. In Burma the oil is in demand for use in cosmetics. Hindus make use of a paste made from the wood in making 'caste marks', and the oil in perfumery. The wood is burnt in funeral pyres; every such pyre should include at least one stick of sandalwood, whereas a wealthy family may make the whole pyre of nothing but this wood. Devout Parsis daily add chips or billets of the wood, according to their means, to the everlasting ceremonial fire. The oil has been employed for embalming and in Europe its chief importance is for perfumery and in the manufacture of scented soaps.

Medicinally, sandalwood and its oil have a wide application, and in the East have been considered as a universal panacea. The oil is reputed to have bitter, cooling, astringent, cardiac and tonic properties. It is said to be useful against biliousness, vomiting, fever, thirst and heat of the body. An emulsion made of the wood is applied to the skin as a cooling agent in erysipelas, prurigo and sudamina. The wood ground up with water into a paste is applied to local inflammation and to the temples for the cure of headaches and fever, to skin diseases and to allay heat and pruritus. It is also a diaphoretic, alexipharmic and aphrodisiac and is used in cases of gonorrhœa.

The wood is used for carving, for idols and for boxes prized for their scent.

As far as I am aware, the first published suggestion (with the exception of an inferential one to be mentioned later) that *Santalum album* Linn. may be an exotic in India was that made by myself in the *Kew Bulletin of Miscellaneous Information* for 1927 (page 200). It has always been taken for granted that this tree is truly indigenous in South India. Bias in favour of the universally accepted is natural; therefore, I appeal to all who wish

to consider the subject scientifically to set aside prejudice and endeavour to form an opinion in the light of the arguments set out below.

I may, perhaps, be allowed a few words of personal explanation. A few months after being placed in charge of the North Coimbatore Forest Division of the Madras Presidency in 1905, when for the first time I came into contact with the Sandal tree as a component of the forest, the conclusion that it was not an indigenous tree forced itself upon me; an idea based on local observation. I had then, however, no facilities for proving or disproving the theory. It was not till 1927 that the opportunity came. By then I had joined the botanical staff at the Herbarium at Kew and my colleagues Messrs. T. A. Sprague and V. Summerhayes, who were preparing a note on the habitat of certain genera of the *Santalaceae*, pointed out to me the irregular distribution of *S. album*. I then wrote a brief appendix to their paper (quoted above) setting out my conviction and giving a few points in support, but time did not permit of a full enquiry. At the instance of Mr. W. S. Millard, I took the matter up again and during the past year or so I have examined every source that promised information and have also consulted by correspondence a number of workers in various fields with gratifying results.

To clear the ground, it will be as well to enumerate the localities in which Sandal grows at the present time, excluding those where it is obviously cultivated. In India we can accept Mysore as the focus with the adjacent parts of the Madras and Bombay Presidencies and of Coorg. In the Malay Archipelago it occurs in the central and eastern parts of Java and in the islands of Madura, Bali, Sumba, Sau, Watar, Rota, Kisar, Timor and some of the small islands adjoining these, and also at one place in West Central Celebes.

In some of these places it is fairly certain that it has been introduced, especially around ancient Hindu temples, but it is undoubtedly indigenous in Timor and Sumba, whence it was reported by the very earliest botanists in these regions.

Evidence in favour of an Indian origin.

In the first place, it must be observed that any reference of a later date than about 1750 is of little value, since there is no dispute about the existence of sandal in quantity subsequent to this period and we know through Buchanan and others that it was well established in Mysore before the beginning of the 19th Century.

Chandana—the Sanskrit name ascribed to *Santalum album* Linn. —was known and used in India from the earliest historic times; it is frequently mentioned in the ancient Sanskritic writings. Some of these writings date probably from before the Christian era and from them it appears that the wood was the product of the Malaya Mountains of Southern India. To quote all the apposite extracts that I have obtained would swell this essay to undue proportions, but it will be useful to cite some of them.

The *Ramayana*, referring to the river Tambrapani (Tāmraparni) says: 'That river with its islands covered with fair forests of sandal goes down to the sea as a beloved maid to her lover.'

In his epic poem, *Chilappatikaram*, Ilanko-Atikal, the Tamil poet who wrote sometime between the 2nd and 5th Centuries of our era, speaks of 'Sandal born in the Southern Mountain' (Malaya *Tenmalai piranta chantanam*).

Kalidasa, not later than the 5th Century A.D., refers in several passages to sandal being derived from South India, notably in his epic poem *Raghuvamsa*, where he states: 'The neck-halter of elephants that break their foot-chains did not slip, being fixed in the marks made by the coiling serpents round the sandal trees' (iv, 48) '. . . the two mountains Malaya and Dardura which have sandal forests on their peaks . . .' (iv, 51); '. . . dally ever on the uplands of Malaya, strewn with Tamāla leaves, where the sandal-trees have cardamon-creepers clinging to them and the betel-trees (Pūga) are girt about with Betel-creeper (Tāmbūla).

In the *Panchatantra* (not later than the 5th Century A.D.) we find: '. . . the sandal does not flourish anywhere else except on Malaya.' (i, 42.)

Rājaśēkhara (880-920 A.D.) in his *Kāvya-mīmāmsā*, speaking of the Malaya Mountain, says: 'It is the home-land of the delightful true sandal . . . sandal trees encircled as far as the root-system by hooded snakes, Jāti-trees (*Ficus*?), together with *kakkolaka* (nutmeg) and cardamoms and pepper-trees.'

Monier-Williams cites *Hitopadesa* II verse 163 in reference to the sandal-tree: 'The root is infested by serpents; the blossoms by bees; the branches by monkeys; the summit by bears. In short there is no part of the sandal-tree which is not occupied by the vilest impurities.'

In the *Periplus of the Erythrean Sea*, written in the 2nd Century, we read that '. . . sandalwood, teak, ebony and blackwood were imported from Baragaza (Broach) in Western India to Apologus, an important harbour at the mouth of the Euphrates.'

Chapter XI of Kautilya's *Artha-śāstra* (attributed variously to dates between 320 B.C. and 300 A.D.) includes sandal among the 'objects that are entered into the treasury'.

Sandal is mentioned as an article of toilet in the Buddhist *Jatake* stories of the 7th Century B.C.

Finally, we know that sandalwood was one of the articles of commerce brought from India to the Roman Empire.

I have, however, found no reference of a clear and unmistakable nature to sandal growing in India, except as an admittedly planted tree, up to about the year 1780 when Francis Buchanan (later Buchanan-Hamilton) visited the State of Mysore and the adjoining territories in about 1800 and wrote an account of his travels (*A journey from Madras through the countries of Mysore, Canara and Malabar* by Dr. Francis Buchanan published in 1807). He made numerous references to the sandal tree, which at that time was to be found in quantities in many places visited by him. It is clear that sandal had been abundant there for some years before, since he states (vol. ii, 536) that: 'The quantity [of sandalwood] brought

from Coorg during the years 1792 to 1798 amounted to about 12,000 candies.'

Such is the evidence for the existence of the living sandal tree in India; and now what is its value?

In the first place it is to be noted that there is no certainty that what is now termed *Chandana* is the same plant or material that was recognised by the same name a thousand years ago. Everyone who has had to deal with vernacular plant-names is well aware of the vagueness of their application: often the same name is used for different plants in different, though adjacent, localities; or more than one name may be attached to the same plant. Even at the present time there is confusion in the commercial names of timbers. Thus, according to Meyer (*Buch der Holznamen*), the woods of the following four species are termed 'sandalwood': *Santalum album* Linn.; *Lepidaglaia Bailloni* Pierre; *Mansonia Gagei* J. R. Drumm.; *Adenanthera pavonina* Linn.—besides that of other species of *Santalum* and of allied genera. The woods of *Pterocarpus santalinus* Linn.f., *Caesalpinia Sappan* Linn. and *Ximenia americana* Linn. are known as 'False sandal'. Substitutes for and adulterants of sandalwood are frequently used. These include: *Erythroxylon monogynum* Roxb., *Aquilaria Agallocha* Roxb. (the Eagle- or Aloe-wood which has been an article of trade in and with India from a very early historical date), *Excaecaria Agallocha* Linn., *Euphorbia antiquorum* Linn., *Cordia fragrantissima* Kurz (vernacular *Sandawa*) and *Mansonia Gagei* J. R. Drumm. (see Kew Bulletin 1933, page 3).

At an early period a number of differing kinds of *Chandana* were recognised besides the 'yellow' and 'white' (*Santalum album*) and the 'red' (*Pterocarpus santalinus*). In some cases the different names were an indication of localities from which they came, e.g.: Malayaja or born in the Malaya Mountain; Srikhanda; Ghandaraja; Ghandasara; Vavara; Tailaparna; Gosirsa; Batal and Sukhad. But often the names evidently referred to differing qualities. Thus Kautilya in *Artha-śāstra* chapter xi, which is concerned with the objects that are to be entered in the treasury, gives the following interesting passage: '(as to) *Chandana* (sandal):

Santana is red and smells like rain-moistened earth; Gōśīrshaka is dark-red and smells like fish; Harichandana is of the colour of the feathers of a parrot and smells like tamarind or mango fruit; likewise Tarnapasa; Grāmeruka is red or dark-red and smells like the urine of a goat; Daivasabheya is red and smells like a lotus flower; likewise Aupaka (Jāpaka); Jongaka and Taurupā (these are the products of the country of Kāmarūpa, Assam) are red or dark-red and soft; Māleyaka is reddish-white; Kuchandana is as black as Agaru (resin of the aloe) or red or dark-red and very rough; Kālaparvataka is of pleasant appearance; Kośākāraparvataka (that which is the product of that mountain which is the shape of a bud) is black or variegated black; Sītōdakīya is black and soft, and smells like a lotus flower; Nāgaparvataka (that which is the product of Naga Mountain) is rough and is possessed of the colour of Saivala (*Vallisneria*); and Śākala is brown.'

Now it can hardly be contended that all these articles are one

and the same and are all referable to *Santalum album* Linn. Nor is it in the least likely that this latter tree will be found in association with the *Areca* palm, cardamoms and pepper, nor has it ever been known in Assam.

Reference must also be made at this point to the work of Garcia da Orta (*Colloquies on the simples and drugs of India*, published in 1562; Markham's translation, page 399) states: 'The Malayalims also say that they have a scented wood which is like white sandal, and they anoint themselves with it for fevers. They call it Sambarane.'

Then Christoval Acosta (*Tractao de las drogas y medicinas de las Indias Orientales*, 1578), who copied much from Garcia da Orta, but added some matter of his own, wrote (page 170): 'Another scented wood which much resembles the white sandal, is to be found in certain parts of the coast of Melinde and the island of S. Llorante and in some parts of Malabar: with this the blacks anoint themselves against fevers, but none of these is sandal nor has it its qualities. I saw this scented wood in Malabar (which is called among other names Sambarane), at Tanor and at Cranganor, but it is not sandal nor do the doctors of these lands hold it for such.'

Unfortunately I have so far failed to trace what this Sambarane[1] may be.

The fact that the true sandal was exported from Indian ports westwards during the period of the Roman Empire and later is not conclusive, for we know that these ports, and Calicut in particular, served as clearing houses for the products brought from further East. For example; Gibbon (*Decline and Fall of the Roman Empire*. Everyman Edition, vol. i, page 55), writing on the trade with the East from a port in the Red Sea, says: 'The Coast of Malabar, or the Island of Ceylon, was the usual term of their navigation, and it was at these markets that the merchants from the more remote countries of Asia expected their arrival.' Moreland and Chatterjee (*A Short History of India* by W. M. Moreland, C.S.I., C.I.E. and Sir Atul Chandra Chaterjee, G.C.I.E., K.C.S.I.) give similar evidence. Garcia da Orta (l.c. pages 397 and 398) has the following illuminating passages: 'The City of Calicut, where all kinds of merchandise were brought and sold, was celebrated in these parts. Thither goods were brought from elsewhere, and the Chinese came with their trade, including sandal which they sold there, whence it was taken to the West. I have told you that the Chinese factory, called Chinacota, in which the Chinese reside, is today still established there. . . . This is the reason why Antonio Musa said that sandal grew in the plain of Calicut. There is no plain in Calicut, but palm groves along the beech, and hills inland.'

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[1] 'Sambarane' is evidently *sāmbrāṇi*, the Dravidian name for gum-benzoin and the tree that produces it, *Styrax Benzoin* (Canarese, Malayalam, Tamil, Telugu). By extension the name is given to such balsamiferous trees as *Boswellia serrata* (Canarese, Tamil) and *Canarium commune* (Canarese), and to their products [J. F. Caius].

It is true that modern authors refer to *Santalum album* as a native of India and even correct the older authors in some cases as to the derivation of sandalwood, but this is simply because they know that it now grows freely in some parts of Peninsular India and no one had suggested that it had not grown there from all time.

Evidence opposed to an Indian origin.

In Abul Fazl's (1551-1602 A.D.) *Ain-i-Akbari*, vol. i, Ain 30, page 81, we read: '9. Sandalwood called in Hind *Chandan*. The tree grows in China. During the present reign, it has been successfully planted in India.' Too much stress must not be placed on the word China, for in those days of comparative geographic ignorance it was a generalised term comprehending all lands east of Sumatra. In any event, it is obvious that the author was in no doubt that the tree referred to did not grow naturally in India. By virtue of his position as Akbar's Minister of State and his training Abul Fazl was, above all men of that time, specially fitted to obtain correct information; moreover he is reputed to have been particularly trustworthy.

Garcia da Orta (l.c. page 399) also refers to the introduction of the sandal tree, he wrote: 'I would have you also to know that the sandal tree is found in other parts: I saw it in Amdanaga [Ahmednagar] where it was brought to be sown . . . I saw there at a pleasure house . . . trees of sandalwood.'

It is unnecessary to make room here for all the references I have found testifying to the occurrence of *Santalum album* in the Malay Archipelago and to its import into India, and I will confine myself to a few, citing others in an appendix.

Cosmas (*Indicopleustes*; written about 545 A.D. Hakluyt Society vol. 98, page 363), concerning Taprobane [the ancient name of Sumatra] states: '. . . is much frequented by ships from all parts of India and Persia and Ethiopia, and it likewise sends out many of its own, and from the remotest countries, (the countries inside Cape Comorin, that is, east of it), I mean Tzinista and other trading places it receives silk, aloes, cloves, sandalwood and other products and these are passed on to marts on this side, such as Male [the Malabar littoral] and to Calliana [Kalyan near Bombay] . . . to Sindu . . . and to Persia.'

Ebn Baithar, somewhen about 1250 A.D., in his account of eastern medicinal plants (*Grösse Zusammenstellung über die Kräfte der bekannten einfachen Heil*—and *Narungsmittel von Abu Mohamed Abdulla ben Ahmed aus Malaga, bekannt unter den namen Ebn Baithar*, . . . übersetzt von Dr. Joseph v. Sontheimer, 1842, page 138) records of sandal: '. . . this name betokens a wood which is brought from China.'

Barbosa (*The Coasts of East Africa and Malabar*. Hakluyt Soc., vol. 35), writing in or about 1500 A.D., mentions the uses of sandalwood in India. He asserts its occurrence in Timor but in no other locality, nor does he include it in the products exported from Cochin or Calicut. His evidence is of special value for (as pointed

out to me by Mr. W. H. Moreland) he served chiefly on the Malabar Coast, was employed in commerce and, moreover, his experience was gained before the Portuguese upset the previously existing conditions of Asiatic trade.

Magellan (*First Voyage Round the World* by Magellan. Hakluyt Soc., vol. 35 page 153) tells us in reference to Timor '. . . for white sandalwood only grows in this country.'

Finally I must direct attention to the officially published records of the East India Company. (*The English Factories in India.* 14 volumes covering the period 1618 to 1677.) In 1618, we find the agents writing to the East India Company (vol. for 1618-1621 page 53): 'They know not whether sandalwood grows in the Island of St. Lawrence [Madagascar], but it is in good request in Surat and the Dutch have sold some. . . . Kerridge and his colleagues have accordingly written to the Bantam factory for a supply.' In subsequent volumes, up to that for 1665-1677, there are frequent references to sandalwood, but only in connection with vessels captured on the high seas or as being procured from Bantam for sale; this shows that there was a considerable trade in the wood at that period. Never, however, is there any record of the wood being obtained in India though there is much concerning traffic along the West Coast of India and also mention of trade with Seringapatam in the later years.

Discussion.

We have seen that the occurrence of *Santalum album* as a naturally growing tree in India is supported by very dubious evidence. While Barbosa does not mention it as growing in India, Garcia da Orta positively stated that it did not. It is not mentioned in Rheede's *Hortus Malabaricus* (1678-1703). It was not exported from India by the East India Company from 1618 to 1677, though it was much in use in India at the time and imported by them.

There is no possible doubt as to its being indigenous in Timor and in one or two of the neighbouring islands, whence it was exported from the earliest times. It was introduced from these islands into others in the same region, especially in the vicinity of old Indian temples. We have seen that it was also introduced, possibly on a very small scale, into India at the period of Akbar and that planted trees of sandal were seen by Garcia da Orta about the year 1550.

Those who maintain an Indian origin are faced with the extraordinary distribution of the species: in Timor and some of the neighbouring islands and in South India with none between, a gap of nearly 3,000 miles and still further between the latter locality and the habitat of any other species of the genus (see *Kew Bulletin*, 1937, page 193). It may be put forward that *Santalum album* did once occur in between the present habitats or, on the other hand, that the artificial introduction was actually in the reverse direction, but there is no evidence in support of either theory.

Further, if this tree has been growing in South India since its evolution, why was it confined, until the second half of the 19th Century, to so small an area and then spread so much wider during the present Century? Rao Sahib S. Rangaswami (*Indian Forester*, 1937, page 527) writes that in 1869 Col. Campbell Walker, Conservator of Forests, estimated the area occupied by sandal in the North Salem District at 8540 acres, whereas in 1937 it had spread to over 93,000 acres in the same District. Of recent years there have been many more or less successful efforts towards the same end by artificial means and there has also been much expansion by natural means, that is through the agency of birds. I may cite the case of the Palmaner Plateau. In about 1900, according to the inspection notes of a very capable and experienced Forest Officer (the late Mr. C. E. Brasier), sandal was confined to a few small plantations started in 1876; by 1921 the tree was abundant in the forests around (see *Kew Bulletin*, 1927, page 200).

I, therefore, put forward the theory that at a very early period a scented wood (or woods) was produced by a tree growing in India, probably mainly in the South. This wood was used for various purposes and went by the name of *Chandan*. Later on the wood of *Santalum album* began to be imported and as it became more and more available gradually replaced the indigenous wood. At first it may have shared the same name and in due course supplanted the original even in that respect. Eventually some enlightened person thought of introducing the plant itself, but the spread, except where enforced, would be slow. The fact that the tree where it grows at present appears to be indigenous need not impress one greatly when one considers the establishment of other non-indigenous plants in India. Who seeing lantana or prickly-pear-infested localities would imagine that they are aliens were the history of their introduction not known? I must now leave the decision to my readers.

In conclusion I wish to express my thanks to the following helpers: Mr. W. S. Millard, who obtained the kind offices of Mr. F. E. Bharucha to whom I am indebted for certain useful items and for extracts from Sanskrit literature furnished by Sir C. P. Ramaswamy Aiyar, the Dewan of Travancore; Mr. I. H. Burkill for advice and suggestions; Dr. D. Hooper, who referred me to the *Ain-i-Akbari*, which he had himself quoted a good many years ago in a paper on the 'Perfumes of the Moghuls'; Mr. K. Jacob for valuable information; Mr. G. P. Mazumdar for information through Dr. K. P. Biswas; Dr. R. Mookerji of the University of Lucknow; Mr. W. H. Moreland, who also referred me to the *Ain-i-Akbari* and gave me further most useful information; Dr. H. N. Randle at the India Office Library, who, besides kindly translating passages from Sanskrit works, afforded me other valuable citations; Dr. van Steenis of the Buitenzorg Herbarium who has taken great pains to obtain for me much information connected with the Dutch East Indies; and to Dr. E. H. Warmington, author of 'The Commerce between the Roman Empire and India.'

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BIRDS OBSERVED IN AND NEAR TAMBARAM, CHINGLEPUT DISTRICT, SOUTH INDIA.

(December 1932 to April 1938).

BY

ALICE M. BARNES.

Tambaram lies 16 miles south-west of Madras city, about 9 miles inland, at an average elevation of 100 ft. The surrounding country is very largely uncultivated scrub jungle with several groups of low rocky hills, the highest of which rise only to 600 ft. Round the foot of the hills the scrub becomes much thicker and forms dense thickets of small trees and thorny shrubs, wothia, dalbergia, albizzia and neem being some of the commonest trees. These hills and the elevated land round them form the catchment areas for several large tanks, from which rice fields are irrigated. There is very little other cultivation.

Four hundred acres of this scrub jungle were acquired and enclosed in 1930 for the new site of the Madras Christian College, and since October 1932 we—my husband and I—have lived on this estate, with the exception of April to December 1936 when we were on leave. The following notes are based on observations made during the periods October 1932 to April 1936, and January 1937 to April 1938; they refer to birds seen either on the college compound or in the immediate neighbourhood. The records are necessarily incomplete as we do not shoot, and are therefore unable to identify some birds, or to determine the races of others with any certainty.

During the years 1931 to 1938 several acres of the college estate have been cleared of scrub for buildings and playing fields, and a very large number of trees have been planted, but considerably more than half the area is still untouched jungle. The whole estate has been declared a sanctuary for wild life, so that it still affords ample opportunity for careful bird observation, in spite of its greatly increased human population. As the trees grow, birds which haunt large trees are beginning to make their appearance, though at present only occasionally.

The scientific names given in the list are taken from *Birds of Southern India* by Baker and Inglis and the notes on the Vernay Ornithological Survey of the Eastern Ghats published in the Bombay Natural History Society's *Journal*.

LIST OF BIRDS.

1. **The Jungle Crow**: *Corvus macrorynchos culminatus* Sykes.

Observed throughout the year; in jungle and garden; common, but not so numerous as the House Crow.

2. **The Common Indian House Crow**: *Corvus splendens splendens* Vieillot.

Observed throughout the year; in jungle and garden. In the earlier part of the period of observation, there were few houses and therefore few crows

in this neighbourhood; the crows have increased with the human population, and are now very common.

3. **The White-headed Babbler** : *Turdoides striatus polioplocamus* Ober.

Observed throughout the year; very common, in jungle and garden. The heads of many are conspicuously white.

A nest with 3 eggs was found in a casuarina hedge in the garden in July 1934; two chicks were hatched, but stolen before they were fully fledged.

Two very young fledglings were observed in a bush, being fed by their parents, on September 3rd, 1937.

4. **The Common Babbler** : *Argya caudata caudata* Dumont.

Observed throughout the year; very common. Flocks are mainly seen in the scrub jungle, and very seldom come into the garden, though their pretty tinkling song is frequently heard in the bushes just beyond the garden limits.

5. **The Indian Yellow-eyed Babbler** : *Pyctorhis sinensis sinensis* Gmel.

Throughout the year; very common; in garden and jungle; nearly always seen in pairs.

6. **The Common Iora** : *Aegithina tiphia humei* Stuart Baker.

Throughout the year; very common; in garden and jungle.

7. **The Red-vented Bulbul** : *Molpastes cafer cafer* Linn.

Throughout the year; one of the commonest birds in this neighbourhood, large numbers always about in jungle and garden.

Nests and eggs have been found as follows :—

January 1933—nest finished but not used.
February 1938—3 eggs.
August 1934—1 egg.
November 1937—3 eggs.
December 1932—three nests : (*a*) 3 eggs, (*b*) 2 eggs, (*c*) 3 eggs.

These nests have all been identified by the presence of the parent birds; a good many other bulbul nests have been found but as they were not in use, have not been recorded.

In some cases the time of incubation could be observed, e.g. (*a*) November 11th, 1937—1 egg in nest, 12th—2 eggs, 13th— 3 eggs; November 25th—2 newly hatched chicks and 1 egg in this nest. (*b*) February 13th, 1938—1 egg in nest, 14th—2 eggs, 15th—2 eggs at 7-30 a.m., but 3 eggs at 5 p.m. February 25th—three newly hatched chicks in this nest.

These observations were made about seven o'clock each morning.

The November 1937 nest was built, and the family reared, during the N.-E. monsoon rains. Three of the above nests were built about 6 ft. from the ground in forks near the ends of branches in a bauhinia tree close to our house; others have been at about the same height in young wothia trees in the garden or jungle, and one in a casuarina hedge. The foundations of all the nests seem to have been of cobwebs.

8. **The Southern Red-whiskered Bulbul** : *Otocompsa jocosa emeria* Linn.

Throughout the year. This is as common as the Red-vented Bulbul, and seems to be one of the most numerous birds in this neighbourhood. It is always about both garden and scrub jungle, and also in the thicker jungle near and on the neighbouring hills.

There is no doubt about its race, as it conforms exactly to the description of *emeria* given by Whistler; the tail is tipped with white.

Nests have been found as follows :—

August 1934—2 eggs. Nest in a bush in the garden. These eggs were both stolen and sucked, presumably by a rat.

March 1938—this nest was placed too high for its contents to be seen; it was at least 12 ft. up in a bauhinia tree in the garden. Parents were observed bringing food to the nest.

9. **White-browed Bulbul** : *Pycnonotus luteolus luteolus* Linn.

Throughout the year. It is very common in both jungle and garden, but less frequently seen, and perhaps less numerous, than the two preceding bulbuls.

10. **The Pied Bush-Chat** : *Saxicola caprata.*

Observed throughout the year. Not very numerous, but as each pair seems to have definite 'territory', they can almost always be found in certain spots of garden and jungle.

11. **The Black Redstart** : *Phoenicurus ochrurus.*

Observed at Tambaram only in January and February 1936, when it frequented uninhabited buildings on the college compound and could be seen almost any day for nearly two months.

A Redstart was observed at Tada, about 40 miles due north of Madras on January 29th, 1938.

12. **The Black-backed Indian Robin** : *Saxicoloides fulicata* Linn.

Throughout the year; one of our commonest birds in jungle and garden. Nests have been found as follows :—

April 1933, a nest being built in a rain gutter; eggs not seen.

August 1933, a nest being built in more or less the same spot in the rain gutter.

June 1934, another nest in the gutter.

June 1935, a nest being built in another gutter.

August 1935, a nest being built in an empty, broken flower-pot in the garden; this was disturbed by the gardener just as the nest was finished, and it was therefore deserted.

March 1937; on the 21st we first noticed the nest being built; both birds help with the work. On the 31st we found two eggs in the nest. The nest was abandoned before the eggs were hatched, probably because it had been disturbed by a gardener.

April 1937; a hen robin was discovered sitting on a nest in a dwarf date palm in the jungle; number of eggs not seen.

13. **The Indian Magpie Robin** : *Copsychus saularis saularis* Linn.

Has been observed in January, March, August and November, and is almost certainly resident in this neighbourhood, but as there are still no really large trees in the gardens or scrub jungle of the College compound, it only rarely visits us; more frequently it is seen in the forest and in big trees near villages a mile or two away.

14. **The Indian Brown Flycatcher** : *Alseonix latirostris.*

Observed once only, October 5th 1935, in bushes near the garden.

15. **The Blue-throated Flycatcher** : *Cyornis rubeculoides rubeculoides* Vigors.

Seen once only, on November 8th 1937, when a male spent a whole afternoon in a Persian Lilac tree just outside my window and in bushes close to the house, giving excellent opportunities for observation and identification.

16. **The Indian Paradise Flycatcher** : *Tchitrea paradisi* Linn.

Seen only on the following dates :—

December 23rd 1934, male in full white plumage and long white tail, in the Vandalur forest, about 2 miles S.-W. of the college estate at the foot of Vandalur hills.

July 6th 1935, female or immature male, in chestnut plumage, short tail, in Vandalur forest.

August 22nd 1935, female or immature male, in Vandalur forest.

January 14th 1936, chestnut bird, with long chestnut tail streaming behind as it flew, in Vandalur forest.

October 1937, a female or immature male spent about a week in and near this garden; the only time a Paradise Flycatcher has been seen on this estate.

March 23rd 1938, female or immature male in Vandalur forest.

April 19th 1938, female or immature male in another part of Vandalur forest.

17. **White-browed Fantail Flycatcher** : *Leucocirca aureola.*

Seen only in January 1938, when two spent about a fortnight in and near this garden. During this period they appeared punctually in the garden at

seven o'clock each morning; their song could be heard approaching for five or ten minutes before they reached the trees near the house. They spent about half an hour in the garden and then moved on, and we did not see or hear them again till the next morning.

A White-browed Fantail Flycatcher was also seen on March 6th, 1936 in a mango orchard near St. Thomas' Mount, eight miles N.-E. of Tambaram.

18. **The Bay-backed Shrike :** *Lanius vittatus* Val.

Seen throughout the year, but is rare both in jungle and garden from April to August, and very common from September to the end of March. These birds seem to have hunting territory over which they assert a monopoly for weeks at a time, and no other shrike is allowed within the limits. They are tame little birds, and will let one approach quite near their perch before flying off to a little distance.

19. **The Rufous-backed Shrike :** *Lanius schach caniceps* Blyth.

Observed throughout the year, in jungle and garden. Very common. Like the Bay-backed shrike, this bird also seems to monopolise definite hunting grounds and to stay in that territory for weeks together. One which thus haunts the rather jungly garden behind our house is frequently seen singing a not unmelodious twittering song, very different from its usual raucous screech.

20. **The Indian Common Wood-shrike :** *Tephrodornis pondicerianus* Gmel.

Observed in the months of January, February, March, April, September and November; occasional visitor to the garden trees. Also seen in Vandalur forest, but not observed in the scrub-jungle of the college compound.

21. **The Little Minivet :** *Pericrocotus peregrinus* (Linn.).

Never seen in the garden or scrub jungle, but small flocks observed in fig and other big trees in Vandalur forest in March 1934, December 1935, November 1937, and one pair seen at Chembarambakkam Lake about six miles N.-W. of Tambaram on March 17th, 1938.

22. **The Black-headed Cuckoo-Shrike :** *Lalage sykesi* Strickland.

Seen only on the following dates :—

October 15th, 1934—a female, on a tree in the garden close to the house.

March 15th, 1936—male in Vandalur forest.

March 17th, 1938—male and female in big trees on the bund of Chembarambakkam Lake, about six miles N.-W. of Tambaram.

23. **The Ashy Swallow-Shrike :** *Artamus fuscus* Vieil.

Small flocks seen on the following dates :—

September 10th, 1933; August 24th, 1934; January 12th, 1936; September 5th, 1937. Those observed on August 24th, 1934 were sitting on the branch of a tall dead tree in Vandalur forest; all the others were on the leaf stalks of palmyra trees, or flying about in the vicinity of palmyras, on tank bunds a mile or two south of the college estate.

24. **The Black Drongo :** *Dicrurus macrocercus peninsularis* Ticehurst.

Seen throughout the year, very common, in garden and jungle.

25. **The Indian Tailor-bird :** *Orthotomus sutorius guzurata* Latham.

Throughout the year; very common in garden and nursery; not observed in the scrub jungle.

Nests seen as follows :—

July 1933—made of leaves of a *Saraca* seedling in the nursery—two chicks in nest, very young.

August 1934—made of one large *Bauhinia* leaf folded, in garden—three eggs.

November 1933—made of two *Bauhinia* leaves, in garden, two chicks, very young.

June 1935—nest made but deserted before use.

26. **The Ashy Wren-Warbler** : *Prinia socialis* Sykes.

I have not yet learnt to distinguish this species from the next satisfactorily, but either this, or the Indian Wren-Warbler, or both, are constantly about both garden and jungle.

27. **The Indian Wren-Warbler** : *Prinia inornata* Sykes.

A nest and four eggs which corresponded exactly to the description of the nest and eggs of this bird given in *Birds of Southern India*, were found in a big clump of tall grass in the scrub jungle on September 27th, 1934. On September 30th the nest was deserted and empty. The bird itself was not seen.

28. **Warbler ?** *Prinia sylvatica* Jerdon?

A largish bird of warbler build is a permanent resident of the scrub jungle; it is brownish above and ashy to white below; its distinctive habit is sitting on the topmost twig of high bushes in the scrub and shouting lustily.

29. **The Indian Oriole** : *Oriolus oriolus kundoo* Sykes.

Seen once only in Vandalur forest, October 1933. In Madras city it is common, but is very rarely seen or heard in this neighbourhood.

30. **The Brahminy** or **Black-headed Myna** : *Temenuchus pagodarum* Gmel.

From September to early April this bird is very common in this neighbourhood, larger or small flocks being constantly about garden and jungle, but by the middle of April the flocks have disappeared, though an occasional bird may be seen for another week or two. They generally begin to return in August; dates on which birds have been noticed are as follows :—

August 12th, 1933—one bird; August 21st, 1934—one bird, August 19th, 1935—two birds; July 30th, 1937—two birds. Their return is always by ones and twos; the earliest flock seen was on August 26th 1933, but generally no flock is observed until well into September. From September till the end of March these birds roost every night in large bushes or small trees in the scrub jungle, the same bush or tree being occupied quite regularly. The birds settle down early—about 6 o'clock—but are very easily disturbed; we have frequently seen hundreds fly from one bush when we approached too near.

31. **The Common Myna** : *Acridotheres tristis tristis* Linn.

Throughout the year, in garden and jungle. It seems to have increased in numbers with the increase of population on this estate. Nests and young were observed in August 1937 in crevices in the roofs of a College hostel and the cricket pavilion.

32. **Baya** or **Weaver Bird** : *Ploceus philippinus* (Linn.).

A colony of nests was seen in trees near rice fields at Futtur, about 3 miles east of Tambaram, but no birds were observed.

33. **The White-throated Munia** : *Uroloncha malabarica* Linn.

Observed frequently in small flocks in jungle and garden in July, August, September, October and November 1933 and 1934, but not noticed here since then. On August 5th 1933 and August 30th 1934 munias were observed collecting fine dry grass, presumably for nesting, but the nests could not be located in the thick and thorny scrub.

34. **The Yellow-throated Sparrow** : *Gymnorhis xanthocollis* Burton.

Appears to be a winter visitor to this neighbourhood; has been observed frequently in the garden in February and March 1934, March 1935 and January and February 1938; there seemed to be only one pair at a time.

35. **The Indian House Sparrow** : *Passer domesticus indicus* Jardine and Selby.

Throughout the year; very common, and increasing in numbers as the number of houses on the college compound increases.

36. **The Red-rumped Swallow** : *Hirundo daurica erythropygia* Sykes.

Throughout the year; first observed and identified in November 1935; plentiful in jungle and about the houses on this estate. Nests observed as follows :—

August 25th, 1935; a partially constructed nest found under a small concrete bridge; on August 29th the nest was complete, the long entrance tunnel having been added, but heavy rains on September 3rd flooded the water course below the bridge, and destroyed the nest.

December 1936—a nest under the bridge in the same spot as the 1935 nest. Swallows flew out when we approached.

June 1937—swallows made a nest on the verandah of one of the staff houses; the nest was destroyed by the occupant of the house, but the swallows built it again immediately and were allowed to remain. They are said to have reared two babies in this nest during July and August.

July 1937—another nest in the same site under the bridge; on September 5th we found a nestling on the ground below the nest; it could not fly; we put it in the entrance tunnel and it crawled at once into the nest.

October 1937—a nest under construction in another arch of the bridge. Rains in early November washed away both the nests under the bridge.

January 1938—a newly constructed nest on the old site under the bridge; swallows flew out of it, but no young were observed.

37. **The Large Pied Wagtail** : *Motacilla maderaspatensis* Gmel.

Throughout the year; very common in jungle and about the buildings. This wagtail frequently collects in large flocks and perches on roofs, twittering and singing.

38. **Bush Lark ?** *Ammomanes phœnicura* (Franklin).

Throughout the year, very common, in large flocks in open grassy patches in the scrub jungle and along the unfrequented roads of the college estate.

There is also a lark which appears to be a solitary bird, and spends much of its time in the garden flying up about 20 ft. and then parachuting down with a shrill whistling cry.

I find it very difficult to identify these larks with any certainty. [*?Mirafra affinis* cf. Jerdon *B. of I.*, ii, 418. 'It frequently perches on shrubs and even trees and takes short flights in the air, descending again with outspread wings . . . it has a pleasant little song which it utters during its short flights.'—ED.]

39. **The Ashy-crowned Finch-lark** : *Eremopterix grisea grisea* Scopoli.

Throughout the year; very plentiful in the jungle, and on the grassy tank beds just beyond the college land. These little birds seem to spend the day on the tank beds and other open spaces but very large numbers come every evening to roost in little saucer-like depressions which they make in the unfrequented sandy or gravelly roads of the college estate.

40. **Loten's Sunbird** : *Cynnyris lotenia* Linn.

Observed in thick scrub jungle on a hillside about 5 miles south of Tambaram in December 1932. A pair frequented our garden for a fortnight or more in October 1937, but this is the only time that this sunbird has been noticed in this neighbourhood.

41. **The Indian Purple Sunbird** : *Cynnyris asiatica asiatica* Latham.

Observed in almost every month of the year, in the garden and jungle. There is generally at least one pair frequenting the hibiscus and other flowering bushes, but occasionally they disappear for a time.

42. **The Purple-rumped Sunbird** : *Cynnyris zeylonica* Linn.

Throughout the year; always about the garden and jungle. In the jungle they seem to have special affection for *Helicteres isora* and *Rivea hypocrateriformis*.

Sunbirds' nests have been found as follows :—

March 1934—a hen was observed taking food to the nest.

This was believed to be a purple sunbird, but as the male was not seen it is not possible to be certain.

February 1938—believed to be a purple-rumped sunbird's nest, but only the female was seen. One egg.

March 1938—a nest too high to be examined; it was a new nest, and the outside had been more or less covered with the papery winged fruits of *Tecoma*.

43. **The Pitta** : *Pitta brachyura* Linn.

Observed in garden and adjacent scrub jungle in February, March and April 1937, but not again till October 1937. Since October pittas have been resident in the bushes near our garden. Their regular habits are interesting; for example, for nearly two months—January and February—one appeared on the grass behind our house every morning about 6-30, coming always from the same direction, staying about five minutes and then going off in the opposite direction. Twice we saw it take a bath in the small sunken bird bath en route. Pittas still about in garden and jungle in April 1938, but not so vocal as in the colder weather, nor so frequently seen in the early mornings and late evenings as before.

44. **The Southern Golden-backed Woodpecker** : *Brachypternus benghalensis.*

As there were no big trees on this estate, no woodpeckers came here until June 1937, by which time a few trees had grown to a fair size. One woodpecker was observed in the garden three times in June, July and August 1937, but has not been seen here again since then. They are occasionally observed or heard in Vandalur forest.

45. **The Coppersmith** or **Crimson-breasted Barbet** : *Xantholaema haemocephala indica* Latham.

Owing to the absence of really big trees the Coppersmith is not resident on the College estate, but occasional birds have been seen and heard here lately —i.e. in February 1937, July 1937, October and November 1937. They have, however, been observed throughout the year in the big trees of the trunk road which runs through Tambaram, and in Vandalur forest.

46. **The Pied Crested Cuckoo** : *Clamator jacobinus jacobinus* Bodd.

Throughout the year; quite common in the scrub jungle and occasionally seen in the garden.

47. **The Small Green-billed Malkoha** : *Rhopodytes viridirostris* Jerdon.

Has been noted in January, February, March, April and July to December, but is probably a permanent resident of the scrub jungle. Appears occasionally in the garden; by no means uncommon; also frequently observed in Vandalur forest.

48. **The Southern Crow-Pheasant** : *Centropus sinensis parroti* Streseman.

Not in the scrub jungle or garden, but seen occasionally and heard more frequently, in Vandalur forest, at all times of the year.

49. **The Rose-ringed Paroquet** : *Psittacula krameri manillensis* Bechst.

Occasionally flies over garden and jungle, but has not yet been observed to settle in any of our trees.

50. **The Southern Indian Roller** : *Coracias benghalensis indica* Linn.

Throughout the year; very common in garden and jungle, and particularly fond of the chimney and roofs of the College Science Block.

51. **The Common Indian Bee-eater** : *Merops orientalis orientalis* Lath.

Throughout the year; very common, but somewhat erratic. At times there are dozens constantly about the garden for weeks, and then they seem to move on. This does not seem a seasonal and local migration: at any rate no definite rhythm or routine has yet been noted.

52. **The Blue-tailed Bee-eater** : *Merops superciliosus javanicus* Horsf.

Has been observed about here in all months between July and April. The note about the erratic appearances of the little green Bee-eater applies equally

to this one also. At times, for two or three weeks a large flock will be constantly about the garden and adjoining scrub jungle, and then for a while no bee-eaters will be seen.

Two very young birds were about the garden in July and early August 1933.

53. **The Indian Pied Kingfisher** : *Ceryle rudis leucomelanura* Reich.

Two of these birds haunted a big well in the garden for about a month, December 1932 to January 1933. Pied kingfishers were often observed about the garden in 1933 and 1934; since then none have been noted here, but they are frequently seen near irrigation tanks in the neighbourhood in all months.

54. **The Common Ceylon Kingfisher** : *Alcedo atthis* subsp.?

Throughout the year; less common on the estate than in 1933 and 1934, but frequently observed on the irrigation tanks in the neighbourhood.

55. **The White-breasted Kingfisher** : *Halcyon smyrnensis smyrnensis* Linn.

Throughout the year; very common in the garden. Nesting in the earthen walls of a big unused well in the garden in March 1938; two young ones were flying about the garden with their parents in April 1938.

56. **The Hoopoe**. *Upupa epops* Linn.

Probably resident in the neighbourhood, but only an occasional visitor to the college compound; observed here only in November 1933, July, August, October 1935, January 1936, March and August 1937 and February 1938. Seen more frequently in Vandalur forest and on roofs in Tambaram village.

57. **The Bengal Palm-Swift** : *Cypsiurus parvus* subsp.?

Throughout the year; very common about the scattered palmyra trees on the estate, and wherever there are palmyras in the neighbourhood—e.g. on the outskirts of Vandalur forest.

58. **The Common Indian Swift** : *Micropus affinis* (Gray).

Observed only once, on August 8th 1937, about some rocky hills 2 miles north of Tambaram. When the hills were revisited in February 1938 the swifts had disappeared.

59. **The Little Indian Nightjar** : *Caprimulgus asiaticus asiaticus* Latham.

Throughout the year; very common in garden and jungle.

July 11th, 1937 a nightjar discovered sitting; one egg; on stony ground on a hillside in the jungle. August 1st nestling nearly fully fledged; August 5th, young bird flying.

60. **The Indian Great Horned Owl** : *Bubo bubo bengalensis* (Franklin).

What we believe to be this bird was sitting on the ridge of our house roof, hooting, late in the evenings of November 17th and 19th, 1934. It was clearly seen in the bright moonlight.

January 27th, 1935, a horned owl was disturbed by us from the nest, on the top of a low rocky hill about 4 miles east of Tambaram; two eggs in the nest. The nest was a mere depression in the ground.

61. **The Southern Spotted Owlet** : *Athene brama* (Temminck).

Probably common in this neighbourhood, but still appears only occasionally on the college estate. Observed once in November 1934, for several evenings in succession in August 1935, and similarly in January 1936. Not observed near the house again till April 1938.

62. **The Black** or **Pondicherry Vulture** : *Sarcogyps calvus* Scopoli.

Throughout the year; for the five years during which observations have been made, several of these vultures have frequented a group of palmyras at the uninhabited end of the college estate. They are also frequently seen over the Vandalur forest.

63. **The White-backed Vulture :** *Pseudogyps bengalensis* Gmel.

Probably permanently resident in the neighbourhood, but has only been noticed within the last year. On February 9th, eight of these vultures were found roosting on one palmyra tree and six on a neighbouring one in jungle about two miles north of Tambaram.

64. **The Smaller White Scavenger Vulture :** *Neophron percnopterus gingin-ianus* Latham.

Throughout the year, but not common in the immediate neighbourhood, probably owing to the attraction of large tanneries about five miles north of Tambaram, where they congregate in large numbers.

65. **The Kestrel :** *Falco tinnunculus.*

Observed twice only, March 17th, 1934 and March 10th, 1938. Each time the bird was seen on the grassy maidan of an irrigation tank, and allowed us to approach quite near and observe it for a considerable time with the field-glasses. Wren disturbed it flew a short distance and settled again on the ground or on a low rock. Both birds were definitely kestrels, but the race could not be determined.

66. **The Common Pariah Kite :** *Milvus migrans govinda* Sykes.

Throughout the year ; very common over garden and jungle.

67. **The Brahminy Kite :** *Haliastur indus indus* Bodd.

Throughout the year ; very common over garden and jungle.

68. **The Black-winged Kite :** *Elanus caeruleus.*

Observed once only, on October 27th, 1935. This bird, answering exactly to the description given in *Birds of Southern India*, was sitting on top of an electric installation pole in the compound ; we watched each other for a considerable time.

69. **The Pale Harrier :** *Circus macrourus* Gmel.

Observed frequently over jungle and garden in all months October to March inclusive, every year since 1932.

First and last dates on which it has been seen each season are as follows :—

1933-34. First seen on October 23—Last seen on March 17th.
1934-35. First seen on November 2nd—Last seen on March 19th.
1935-36. First seen on October 19th—Last seen on March 26th.
1937-38. First seen on November 6th—Last seen on March 30th.

These dates apply only to the male bird, as I have not yet learnt to distinguish the female Pale Harrier from the females of other species of harriers ; females have been noted earlier and later than males each year.

70. **The Pied Harrier :** *Circus melanoleucas* Pennant.

Observed in January, February and March of the years 1934, 1935, 1936, 1937, over stubble fields south of the college ; never observed over the scrub jungle of the college estate. This note refers to the male.

71. **The Marsh Harrier ;** *Circus aeruginosus aeruginosus* Linn.

Observed over wet rice fields in this neighbourhood in February 1936 and January 1938 ; never seen over the jungle.

72. **The Indian Spotted Dove :** *Streptopelia chinensis suratensis* Gmel.

Throughout the year. Numerous in garden and jungle.

73. **The Little Brown Dove :** *Streptopelia senegalensis cambayensis* Gmel.

Throughout the year ; very numerous in garden and jungle.

Two nests were found in thorny bushes in the scrub jungle in April 1938 ; both contained one white egg. They are believed to be nests of the spotted Dove, but the sitting bird flew off so quickly among the bushes, that it was difficult to be quite definite as to which species it was.

74. **The Grey Partridge** : *Francolinus pondicerianus* Gmel.
Throughout the year; very numerous and very noisy in garden and jungle.

75. **The Little Ringed Plover** : *Charadrius dubius* Scop.
Observed on the moist shores of irrigation tanks in January and February and March each year; fairly common.

76. **The Yellow-wattled Lapwing** : *Lobipluvia malabarica* Bodd.
Observed each year in January, February, March, April, August, September and October; probably here all the year round. Very frequently seen on the college playing fields in the early mornings and late evenings; very noisy on these fields on moonlight nights in February, March and April 1938.

77. **The Common Sandpiper** : *Tringa hypoleucos* Linn.
Observed in January, February and March each year on the edges of irrigation tanks in the neighbourhood. Very common.

78. **The Pond Heron** or **Paddy Bird** : *Ardeola grayii* Sykes.
Observed on the marshes and wet paddy fields two miles east of Tambaram in December, January, February, March and April. Very common.

79. **The Tufted Pochard** : *Nyroca fuligula fuligula* Linn.
Seen once. A large flock was riding the water of Chembarambakkam Lake, about six miles N.-W. of Tambaram, on February 28th, 1938. When the Lake was again visited on March 17th, these birds had entirely disappeared.

80. **The Grebe or Dabchick** : *Podiceps ruficollis* (Vroeg).
Seen in January and February 1938 on an unfrequented pond at Puttur, about two miles east of Tambaram.

PROTECTIVE ADAPTATION AMONG SOME INDIAN SPIDERS.

BY

T. V. SUBRAHMANYAM.

(*With one photo and 3 text-figures*).

Nature, a mother kind alike to all, has bestowed on every living being a special virtue by which it is enabled to thrive, to obtain its sustenance and to protect itself from its enemies. In some animals defence takes the form of extreme swiftness of movement, some have warning colours, some the power of mimicry, and others resort to one or the other of the hundreds of different devices and modifications. Innumerable examples of such adaptations are found in the insect world. Among spiders, which form the subject of this article, many interesting examples of protective adaptation are found. But as these creatures are generally looked upon with horror and repellance, few care to observe the instinct displayed by them. A study of the varied habits of spiders does in itself provide to the Naturalist an ample field which has been explored only imperfectly so far.

Though most of the familiar orders of spiders are represented abundantly in India, many Indian species still remain unidentified and even some of the orders are omitted altogether. To a certain extent this incomplete taxonomical study renders it difficult for the field naturalist to describe comprehensively the habits of all the spiders that he comes across during his collection work. However enthusiastic a collector may be, unless he familiarizes himself at least with the generic names of the specimens he secures, he cannot write a comprehensive and detailed account of their habits although he may know for himself that 'X' specimen behaves this way and 'Y' specimen in that. With regard to such Indian spiders as the Hersiliids, Attids, Thomisids and Theridiids the above difficulty is felt much as the literature concerning them is scarce.

Apart from the scientific classification, based on their habits Spiders can be grouped under the following heads:—

I.—SEDENTARY SPIDERS.

(Including Argyopids, Theridiids, Pholcids and Eresids).

II.—ROVING SPIDERS.

(*a*) Hunting Spiders or Wolf Spiders (Lycosids).
(*b*) Jumping Spiders (Attids).
(*c*) Bark Spiders (Hersiliids).
(*d*) Grass Spiders (Oxyopids).
(*e*) Crab Spiders (Thomisids).

I.—Sedentary Spiders.

Sedentary spiders construct webs of their own and reside within. Among the snare builders Argyopids are the most common and abundant in our gardens. They construct beautiful circular snares with geometrical precision. A careful study of an Argyopidean web reveals that almost always its foundation lines have direct connection with the leaves of the plant or tree by whose side the web is located. The slightest disturbance on any part of the web is telegraphically conducted by the radii to the central hub where the spider usually sits. If the source of disturbance is an enemy, the spider with electric speed rushes to the contiguous leaf and hides on the underside, failing which, it abruptly drops to the ground and disappears. On the other hand, if the shaking of the web is caused by the struggle of a captive insect, which has accidentally fallen on it, the spider at once approaches the prey along one of the radii, binds its legs and wings with a profuse flow of silk from the spinnerets and drags it to the centre. Sometimes at the sight of an enemy, the Argyopid purposely vibrates its web with such an astonishing speed that both spider and web are rendered invisible. In a way this swinging action enables the spider to secure its prey, for, if the glutinous threads happen to touch the insects flying near the web, they are instantaneously caught.

These methods of capturing their prey and concealing themselves from enemies are the characteristics of Argyopids in general. Besides these, special adaptations of both protective and aggressive significance are also found in some of the Argyopidean genera.

Its huge black body with deep yellow bands and its scarlet mandibles, make *Nephila maculata* such a formidable and grotesque creature that it is rightly called the Giant Wood Spider. If at all the common enemies of Araneids, like the birds and lizards, prey upon this series they would do so only with shuddering qualms. The orange bands on the body of the common Argyope and the white drawings on that of *Epeira diadema* must have also a protective significance. Another common species met with in our gardens, especially during the rainy season, is the *Tetragnatha*. Its small cylindrical body assists it to a great extent in concealing itself from its enemies. Approached by an enemy, it at once runs to hide itself on the underside of the nearest leaf by assuming a peculiar linear position (see figure). Some species of *Tetragnatha* are dull green in colour which serves as an additional protective advantage. *Leucauge*, a genus closely allied to *Tetragnatha*, behaves in a similar way. Some species of *Leucauge* found in India are light green in colour and successfully harmonize with the surrounding verdure. The common *Gastercantha* with its small dark rhomboid body and minute legs resembles a chip of wooden bark suspended in air. Epeirans often sit motionless in the axils of leaves folding their legs in such an artistic fashion that they appear at first sight to be lifeless objects. Some of them rest on branches of trees imitating patches of lichen growth, while other members (*Caerostris*) living on the bark of trees are easily mistaken for woody knots.

Theridiids agree to some extent in their general habits with the Argyopids. They also are good web builders; but their webs are made of irregular threads without any geometrical plan. They are common both in gardens and in corners of houses. They are mostly of small size and more secretive in habit than the Argyopids. When chased they instantaneously sham death, a device which to some extent enables them to escape attack.

Pholcids are represented abundantly in India. They are a tribe of harmless spiders, shy by nature, occupying safe and unfrequented localities such as the roofs and rafters of old houses, and never venturing to stir out of their irregular webs. Perhaps their long legs prevent them from falling a prey to their enemies. A pholcid caught by the legs generally escapes by shedding the limb or limbs.



Nest of Eresidian spider.

The common Indian Eresids, belonging to the genus *Stegodyphus*, are also sedentary spiders constructing a very complicated type of nest. A peculiarity with these creatures is that they are very social, a number of them forming a colony and living in a single nest. Such a social life is found nowhere else in the Araneid world. The architecture of the Eresidian web is entirely different from that

of other spiders. It is saccular in appearance and consists of numerous chambers perceptible from outside in the form of small round apertures. The nests are usually found fixed to the extremities of the branches of trees and bushes or along fences (*vide* photograph). Sometimes, attached to the main nest is an extensive net whose threads are arranged irregularly in a vertical and horizontal fashion, not concentrically, as with Argyopids. Insects that fall into this net seldom escape from its highly viscid threads. The grey colour of the Eresidian web agrees with the colour of the spiders and it is only with some difficulty that they can be detected within their webs. At the sight of an enemy they retreat deep into the concavity of their nest which, due to its complicated structure, is impervious to the attack of birds and dragon flies. Again, the fibres of the nest being highly sticky, birds generally do not tamper with it.

II.—Roving Spiders.

The Roving Spiders are not sedentary but hunt in search of prey. Though generally not web builders like the sedentary tribes, some weave small patches of web during certain stages of their life. The females weave such webs for the protection of their cocoons during the breeding season. Again, during the moulting period they construct webs and remain sedentary till the critical phase is safely passed. Even during other periods many possess permanent abodes for retirement.

Of all the roving spiders perhaps the most cunning and powerful are the Lycosids. From their voracious habits and perseverance in making expeditions in search of prey they are called Wolf Spiders or Hunting Spiders. Examples of various modes of life are found within this group. Many of them build no snares, yet are vigorous hunters running zig-zag along the ground. Some like *Lycosa annandalei* are amphibious in habit. *Hippasa pantherina* is a species which constructs intricate webs and is mostly of sedentary habits.

Hippasa generally builds its abode in burrows in the ground, in natural crevices by the buttress roots of trees, or among the whorls of the suckers of the *Pandanus*. The webs are cylindrical and are often an inch in diameter. The tube runs into the ground vertically to a depth of about 9 inches and bends at an obtuse angle. The spider sits at the mouth of its web, a vigilant sentry, but at the sight of man or an enemy it immediately recedes to the bent portion of the tube. Pursued further, it rushes to the deepest recess and is completely out of sight.

One peculiarity with regard to the Lycosids in general is that when hunting they never move straight but go zig-zagging, stopping here and there in the manner of a fly. This deceptive resemblance to the movements of a fly is supposed to be both aggressive and protective.

Some Lycosids are capable of staying below water for more than 20 minutes. They live in small holes near water

and evade their enemies by diving in. They creep down the stems of aquatic weeds and plants to hide, if chased further, they sham death, fold their limbs, drop into the water and float on the surface. They feed on aquatic flies, and some are said even to hunt small fishes.

Jumping Spiders come under the Order *Attideae*. Attids are ubiquitous and are found commonly on walls and in corners of houses, among plants, on tree trunks—everywhere. All of them are of moderate or small size, but they differ much in colour and habits. Mimicry of the most wonderful type is present in this group. They perform surprising acrobatic jumps to escape from their enemies.

Once, while passing along a foot-path near a fence, I was attracted by the infloresence of a plant. It appeared at first sight to consist of white and black flowers. On examnation, however, what appeared to be black flowers proved to be dead bees. The problem of how these dead bees came to be there puzzled me. I scrutinized every part of the plant and at last was able to find out. Hidden under the small flowers were three small Attid spiders, beautifully coloured with metallic blue and white stripes which, with their minute legs, resembled floral stamens. One of them was actually sucking a bee at the time. Hence there could be no doubt that the dead bees were the remains of the meals of these spiders. This illustrates how, not only Thomisids, but also Attids practise the same method of capturing prey, by hiding inside flowers. This kind of protective adaptation has a dual advantage: the spiders avoid the notice of their enemies and at the same time get their food ready at the door.

In the case of *Myrmarachne*, which is an Indian ant-mimic spider, 'the mimicry is so perfect that quite often it requires the second glance of even an experienced collector to distinguish one of these spiders from the ants amongst whom they are often seen moving about'. There is some controversy with regard to this ant-mimicry. Is it protective or aggressive? No doubt, ant-mimicry has its protective value, but does it necessarily follow that it has no aggressive value because the mimics do not feed on the models? In the false garb of an ant, the spider may feed on other minute insects which are not attacked by ants. By their shy nature and quick movements coupled with their mimicry, the ant-mimics successfully evade their enemies.

Attids, though termed vagabonds, and typical roving spiders, more often than not weave a small patch of membraneous canopy for retirement. During breeding time this patch is made thicker and more elaborate to protect the cocoons. Just like the Sparassids, some Attids bind the margins of one or two contiguous leaves and live within. Others hunt in the grass and imitate the life of an Oxyopid. On more than one occasion, I have seen Attids living within the cast-away shells of garden snails. Once on breaking open an old pupa of a butterfly I was surprised to find an Attid residing comfortably within, with its cocoon. A life similar to that of a Hermit-Crab. Was it after feeding upon the original inmate that the spider used this covering as its house, or was it after

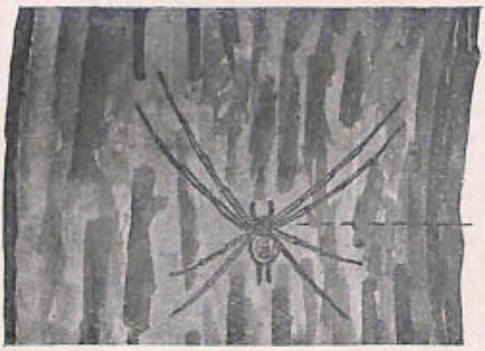


Fig 1.—A Hersiliid spider on tree bark.

Hersiliids also are vigorous hunting spiders. As a rule they inhabit small holes and crevices in the bark of trees. They are also found in plenty on old walls. The species that hunt on old, white, mortar walls are generally pale white, quite in uniformity with the colour of the wall; while the more common species that occupy the tree trunks are brownish black, harmonizing with the colour of the bark. Add to this colour adaptation their peculiar posture: with a flat body and long-spread-out legs they adhere so closely to the surface that it is not easy to detect their presence at first sight (vide fig. 1). When pursued, they crawl sideways and up the tree trunk in an ascending spiral, leaving the pursuer disappointed alike.

Oxyopids are small or moderate sized spiders found abundantly among grass and small vegetable growths. They are better jumpers than runners and their sharp spined legs may be of some protective value. The more common species found in India are either *Peucitia virdiana* or *Peucitia elegans*. The light green or dull yellow colour of the body and the black spines on their legs agree so harmoniously the emergence of the chrysalis that the spider met with the cast-away shell and converted it into a residence? If the former, it necessarily follows that the Attids also contribute to the destruction of Lepidopteran pupae. However so much is certain: among all the roving spiders, Attids seem to show the least discrimination in the selection of their residential quarters.



Fig. 2.—A Psechrid spider on grass.

with the surrounding ears and corns of the grass, that they are very safely hidden and difficult to detect. Remaining undetected by small insects the Oxyopid darts at and preys upon them. They have no webs of their own excepting in the breeding season when the female spins a small patch of silky web on the plant leaf to protect its cocoon. Oxyopids are common in rainy months when all sorts of vegetative growths spring up.

The *Psechrideae*, another Order easily distinguished by the prominence of the first two pairs of legs, spend their lives amongst grass blades, just like the Oxyopids (Fig. 2).

Next come the Thomisids. Their general shape and architecture resemble those of a miniature crab. Like crabs they move sideways and are hence called Crab Spiders. Thomisids are generally small in size and are mostly preyed upon by other spiders. Perhaps



Fig.—3. A Thomisid spider in a Bauhinia flower.

their lateral movements help them to escape from their enemies. I have seen an Attid spider pouncing on a Thomisid, but the former missed its prey as the latter escaped by a sideways somersault. Thomisids are often found resting inside flowers where their upward

thrust legs are easily mistaken for floral stamens (fig. 3). Flower visiting insects, like bees, become their easy prey. Thomisids inculde only a few species, compared with other groups, and even these few are but poorly worked out.

Clubionids are another group of hunting spiders. So also are the Sparassids. Both are found commonly in our gardens. *Olios tener*, a Clubionid rolls up leaves into a cylinder and resides within. By so doing it protects itself both from its enemies and from the sun and rain. *Palystes flavidus* is a Sparassid. It is green in colour and usually lives on the underside of leaves. Its colour is so near in tone to that of the leaf, that it is difficult to discover.

It will be observed from the foregoing that the colour scheme, mimcry and other adaptations—all have an important bearing upon the lives of spiders, since they enable them either to escape from their enemies or to secure their prey with less effort.

Who then are the enemies of spiders and what is their prey?

Of all the enemies of spiders, perhaps the most powerful are birds. Birds have a very keen vision and that peculiar habit of pecking at every small creature that comes within reach. Only after thorough experimental tasting do birds discriminate as to which spiders or insects are edible and which are not. Most spiders that are not protected either by warning colours or spiny coverings fall an easy prey to birds. Certain birds make judicious employment of spiders' silk in lining their nests.

House lizards like Geckos, often prey upon Pholcids and Theridiids, while Bloodsuckers (*Calotes*), skinks (*Mabuia*), and insectivorous mammals like shrews make a good meal of spiders inhabiting gardens.

Solitary and social wasps are the most vehement enemies of spiders. They persistently hunt them and store them up in their nests for the sustenance of their offspring.

Ants are also enemies of spiders; though the ant-mimic spiders are on friendly terms with them. The common red ants feed on the *Tetragnatha* and *Palystes*. The eggs of the Epeirans and other garden spiders are also sumptuously feasted upon by ants.

Spiders also should be regarded as the enemies of spiders. Cannibalism is a characteristic of this group.

I also know of a solitary instance of a Dragon-fly catching an Attid spider most probably for food.

As to food, spiders prey on almost all sorts of insects and other minute creatures. Web weaving spiders first bind their prey with silk, making it inert and powerless and then sucking out its juices. But vagabond and other webless spiders like Oxyopids, Lycosids, etc. seize their prey and feed on them direct. Aquatic flies and dragon flies and even small fishes constitute the food of water spiders.

There are numerous books on spiders written by ancient authors and although many of them are interesting, when dealing with the habits of spiders they display more of literary beauty than scientific fact.

McCook, in one of his works *American Spiders and their Spinning Work* (Philadelphia 1893), gives a splendid account of the habits

of spiders. The habits of *Lycosa* and *Epeira* have been dealt with in a very exhaustive way in J. H. Fabre's *Life of Spiders*. The researches of two American Arachnologists, George and Elizabeth Peckham are published under the title of 'On Mental Powers of Spiders' in the *Journal of Morphology* (Boston, U.S.A.) 1887, p. 403. Spiders are included also in works of general nature like *Intelligence of Animals* and *Protective Colours of Animals* written by authors like Houssary, Poulton, and a host of others. So far as the Indian Spiders are concerned a comprehensive and comparative work on the habits of Spiders is still wanting.

In writing this article I have only taken into consideration the more common genera of the Indian Archnomorphic Spiders. There must be equally interesting instances among the Mygalomorphic Spiders as well. Closer study of the habits of spiders will disclose yet more interesting examples of protective adaptation. 'Believing firmly from the evidence afforded by the causes that all animals are coloured in such a way as to best secure their safety and other interests, and not so as to expose them to danger, I am sure that as we progress we have found in every instance part of the great Creator's wonderful plan to ensure the welfare of His creatures and at the same time add brightness and beauty to the world.'—(T. Carreras.)

THE INDIAN CADDIS FLIES (*TRICHOPTERA*).

BY

MARTIN E. MOSELY, F.R.E.S., F.Z.S.

(*With twelve plates*).

PART V.

(*Continued from page* 478 *of Volume* XXXVIII, 1936).

SERICOSTOMATIDAE McLACHLAN.

Sericostomatidae.—McLach., Rev. & Syn. Trich., pp. 221-223, 1876.

CHARACTERS OF THE FAMILY.

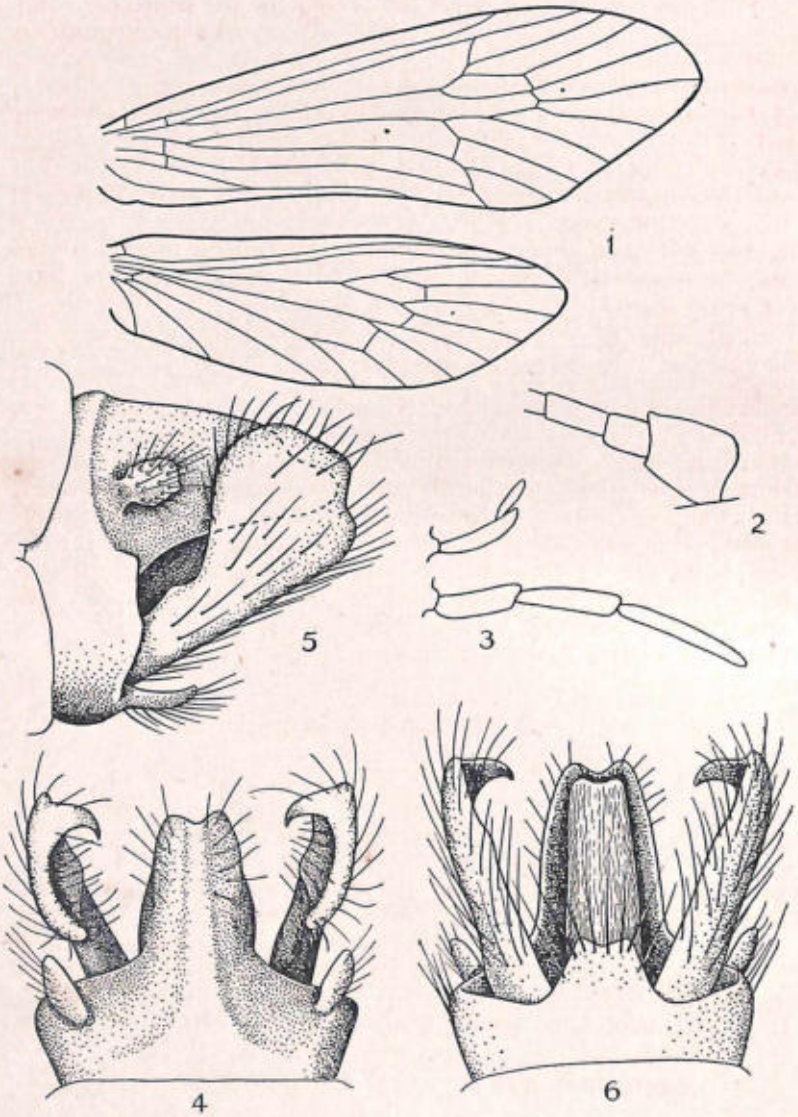
Antennae as long as the wings or slightly shorter; moderately stout, basal joint often much longer than the head; generally thickly clothed with hair; sometimes furnished with processes or spines; ocelli generally absent; present in the genus *Eothremma*. Maxillary palpi of the ♂ always different in form to those of the ♀, frequently membranous and clothed with specialised hairs or scales; they may be pressed against the face, or merely carried upturned; they are frequently, in this sex, associated with scent-diffusing apparatus; the number of joints varies from one to four but in the ♀, there are always the usual five; labial palpi alike in both sexes, the basal joint small, the second considerably larger, about the same length as the third: wings usually densely pubescent, often with scales or specialized hairs mingled with hairs of the ordinary form; frequently with scale-lined grooves and sometimes with folds as well, or folds without additional grooves; posterior wings generally without folds but frequently with grooves; neuration varying greatly according to genus, or even in the same genus, or between the sexes of the same species; neuration generally more regular in the ♀ than in the ♂.

KEY TO THE SUB-FAMILIES.

1. Ocelli present. THREMMINAE
—Ocelli absent. 2

2. Fork no. 4 in the posterior wing generally present. HELICOPSYCHINAE
—Fork no. 4 in the posterior wing always absent. 3

3. Spurs 2, 2, 4. SERICOSTOMATINAE
—Spurs other than 2, 2, 4. 4



Notidobia nigra sp. n., ♂.—Fig. 1, wings. Fig. 2, basal joints of the antenna. Fig. 3, palpi. Fig. 4, genitalia, dorsal. Fig. 5, lateral. Fig. 6, ventral.

4. Spurs 2, 2, 2 or 2, 3, 3. BRACHYCENTRINAE
—Spurs other than the above. 5

5. Fork nos. 1, 2, 3, 5 present in the posterior wing. GOËRINAE
—Fork nos. 1, 2, 3, 5 never all present in the posterior wing. LEPIDOSTOMATINAE

Genera not placed in sub-families.

Ashmera spurs 2, 4, 3. Discoidal cell in the posterior wing closed.

Noleca spurs 2, 2, 2, (maxillary palpi single-jointed).

Gastrocentrides spurs 1, 4, 4: forks nos. 1, 2, 3, 5 not all present in the posterior wing.

It has not been found practicable to give keys to the species in the Sericostomatid genera. The student must therefore have direct recourse to the descriptions and figures.

SERICOSTOMATINAE Ulmer.

Sericostomatinae Ulm., Abh. Natur. Ver. Hamb., 18, p. 78, 1903.

Head differently formed in the sexes; basal joint of the antenna shorter than the head; maxillary palpi pressed closely against the face, two- or three-jointed; wings elongate, densely pubescent, neuration alike in both sexes; apical forks nos. 1, 2, 3, and 5 present in the anterior wing, nos. 1, 2, and 5 in the posterior; discoidal cell closed in both wings, the anterior open or closed in the posterior wings. Spurs, 2, 2, 4.

Only one genus, *Notidobia,* has so far been found to occur in India.

Notidobia Stephens.

Notidobia Steph., Ill. Ent., p. 185, 1836.

Spurs 2, 2, 4.

Antennae stout with a stout, nearly rhomboidal basal joint; maxillary palpi pressed against the face, two-jointed in the single, known, Indian species; discoidal cell of the anterior wing oblong, the first apical sector connected with the radius by a nervule at or near the base; posterior wing, discoidal cell not connected to the radius by a transverse nervule. Other characters as detailed in the specific description.

Genotype: *Notidobia ciliaris* L.

Notidobia nigra sp. n. Pl. 1, Figs. 1-6.

Insect black. In the ♂, basal joint of the antenna stout, somewhat rhomboidal; maxillary palpi two-jointed, basal joint slightly curved and longer than the second; labial palpi with the first and second joints approximately equal in length, third rather longer; wings black, neuration conforming generally with that of the genotype, *ciliaris,* but differing in detail.

Genitalia ♂.—Apical margin of the ninth tergite strongly produced at its centre to form a dorsal plate, apex excised; at the base of the plate, on each side, is a small, rounded process as seen from the side; penis large, covered by the pent sides of the dorsal plate; inferior appendages with greatly dilated apices slightly notched at the lower apical margin, a stout claw arising at the upper angle of the notch, directed inwards; centre of the margin of the ninth sternite produced in a small ventral plate with an excised apical margin.

Length of the anterior wing ♂ 9 mm.

N.-E. Burma: Kambaiti, 6,800 ft., 9-iv-1934; 7,000 ft., 10-iv-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum. Paratype ♂ in the British Museum collection.

Goërinae Ulmer.

Goërinae Ulm., Abh. Natur. Ver. Hamb., 18, p. 81, 1903.

Ocelli absent; basal joint of the antennae about twice the length of the head, very hairy; maxillary palpi of the ♂ closely applied to the face, hairy, often with thickened or clavate hairs; joints varying in number, labial palpi long and stout; wings short and broad, densely pubescent, often with grooves or folds, especially in the posterior region in the ♂, that partly obliterate the neuration which, otherwise, is the same in both sexes; in the anterior wings, discoidal cell present, open in the posterior; apical forks nos. 1, 2, 3, and 5 in both wings; generally a ventral process to the sixth or seventh ventral segments, sometimes both.

In the ♀, the ninth dorsal segment is rather small and from it proceeds the tubular piece which is deeply divided, forming two narrow, hairy valves; ninth ventral segment nearly obsolete, eighth forming a polished plate, seventh regularly rounded; a tooth to the sixth. Spurs 2, 4, 4 or 1, 4, 4.

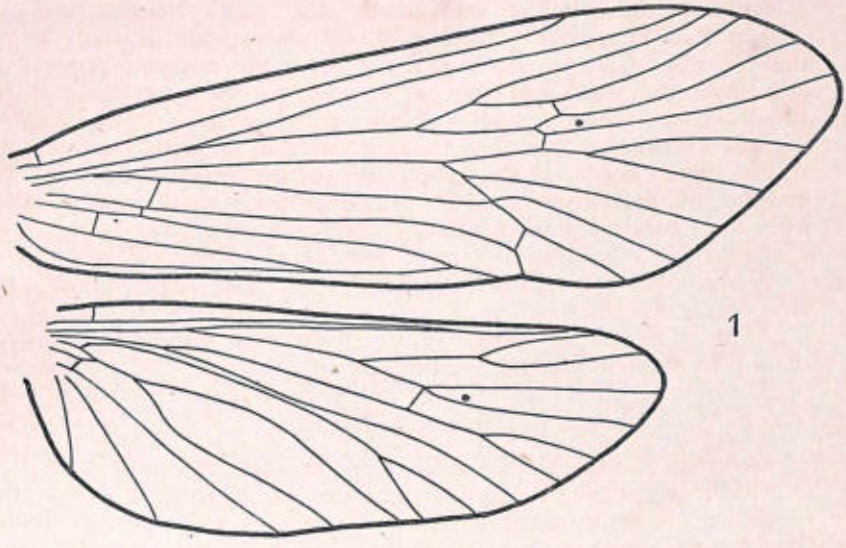
Goëra Leach.

Goëra Leach, Edinb. Enc., p. 136, 1815;
,, McLachlan, Rev. and Syn. Trich., p. 240, 1876;
,, Ulmer, Gen. Insect., fasc. 60a, p. 87, 1907.

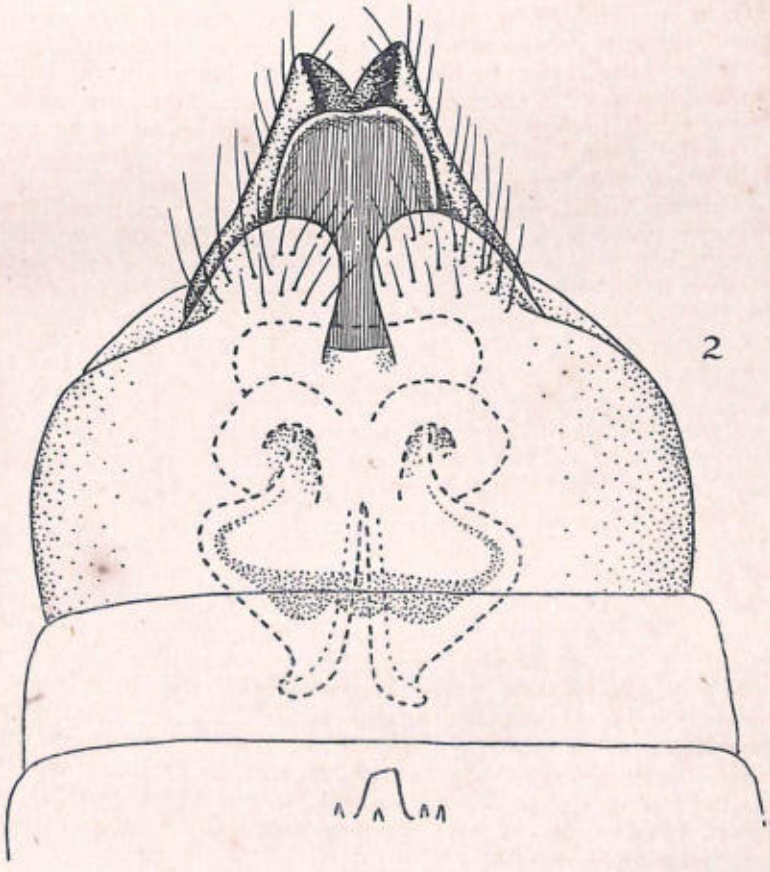
Spurs 2, 4, 4 or 1, 4, 4.

Maxillary palpi, generally three-jointed, the two basal joints very short, terminal joint sometimes capable of being inflated in a membranous sac bearing specialized hairs or androconia; wings generally short and broad, covered with dense pubescence, but there are no intermingled scales; neither folds nor grooves in the male wings; in the anterior wings in both sexes, the area below the *cellula thyridii* is generally dilated at the end, forming a small, irregular, circular space free from pubescence; external post-costal cellule in the anterior wing, very long and narrow; a transvervse nervure connecting the lower branch of the sector to the upper branch of the medius in the posterior wing; spurs 1, 4, 4 or 2, 4, 4.

Genotype: *Goëra pilosa* F.

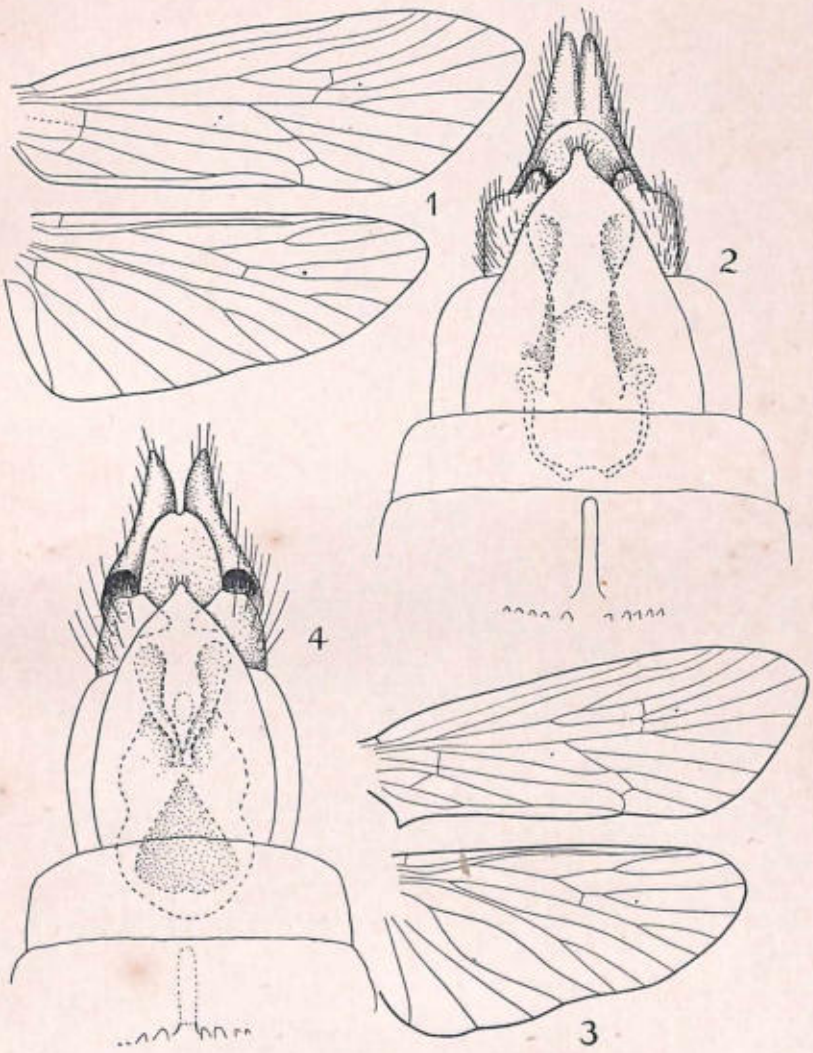


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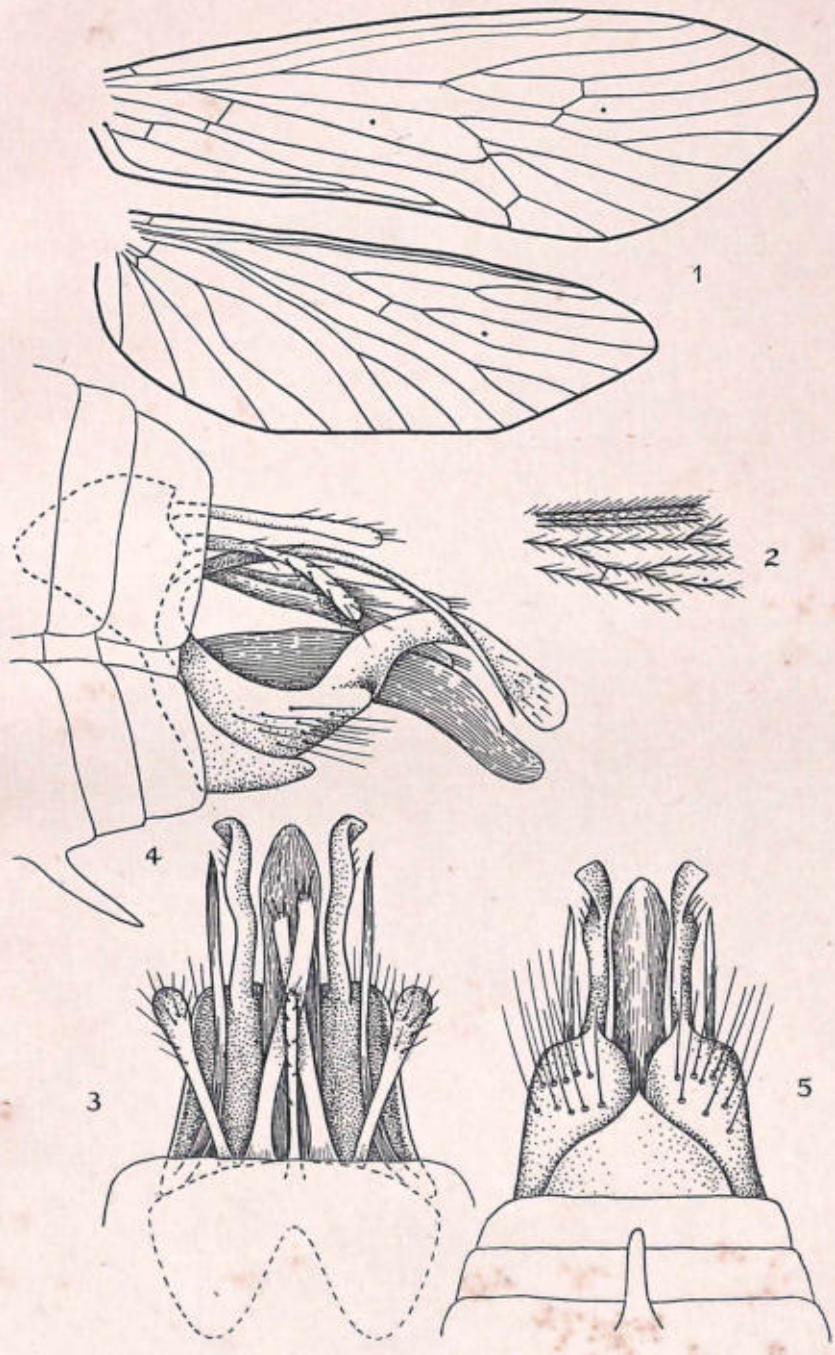


2

Goëra atra sp. n , ♀.—Fig. 1, wings. Fig. 2, apex of the abdomen, ventral.



Goëra kursea sp. n., ♀.—Fig. 1, wings. Fig. 2, apex of the abdomen, ventral.
Goëra kalimpa sp. n., ♀.—Fig. 3, wings. Fig. 4, apex of the abdomen, ventral.



Goëra minor sp. n., ♂.—Fig. 1, wings. Fig. 2, portion of the posterior wing. Fig. 3, genitalia, dorsal. Fig. 4, lateral. Fig. 5, ventral.

Goëra atra sp. n. Pl. 2. Figs. 1-2.

Insect blackish. Neuration conforming to the usual pattern in the genus. The abdomen terminates in a pair of processes which are rather shorter and blunter than is usual with species of *Goëra*; structures connected with the vagina very strongly chitinized; a short (? broken), wide process to the sixth sternite, flanked on each side by one or two small teeth or tubercles. Spurs, 2, 4, 4.

Length of the anterior wing ♀ 9 mm.

N.-E. Burma: Kambaiti, 11-v-1934, R. Malaise.

Type ♀ in the collection of the Stockholm Museum. A ♀ paratype in the British Museum collection.

The unusual colour for a *Goëra* should render this species easily recognizable.

Goëra kursea sp. n. Pl. 3. Figs. 1-2.

Having regard to the similarity in neuration in both sexes in this genus, there should be no difficulty in correctly associating the males on this character, and I have therefore described this species from a female type.

Both neuration and the structures connected with the vagina serve to identify the species in the female sex.

The insect is brownish and in the anterior wing, fork no. 1 extends about halfway across the upper margin of the discoidal cell and is rather broad. The structures of the vagina are shown in the accompanying figure. Spurs 2, 4, 4.

Length of the anterior wing ♀ 10 mm.

Sikkim: Kurseong, 7 to 20-vi-1922, Fletcher collection.

Type ♀ in the collection of the British Museum.

Goëra kalimpa sp. n. Pl 3. Figs. 3-4.

Insect brown; in the anterior wing, fork no. 1 is long and narrow, extending more than halfway along the upper margin of the discoidal cell; structures of the vagina differing from those of *kursea* as shown in the figure. Spurs 2, 4, 4.

Length of the anterior wing ♀ 9 mm.

Sikkim: Kalimpong, Lindgren collection.

Type ♀ in the collection of the British Museum.

Goëra minor sp. n. Pl. 4. Figs. 1-5.

Insect small and yellowish. The type was collected in fluid and is considerably denuded as to the anterior wings; in the posterior, the nervures are set with stout hairs directed outwards, an unusual vestiture. Spurs 2, 4, 4.

Genitalia ♂.—Ninth tergite cut away above; in the cavity is a pair of slender superior appendages with dilated apices as seen from above, from the side, slightly arched; between them is a central process a little shorter than the appendages; beneath this is a pair of long, rod-like processes, crossing at the truncate apices which are armed with a few bristles; penis long and stout, curving slightly downward; inferior appendages branched; there is

a long, spine-like upper branch, curving upwards and distally, adjacent at its base to the margin of the ninth segment as seen from the side also and, a lower branch, much stouter and elbowed so that its apical half is curved and directed distally; from beneath, the base of the appendage is stout and the apex of the lower branch is turned slightly outward; apical margin of the ninth sternite strongly produced to form a triangle with a slender, produced apex; a strong ventral process to the sixth sternite.

Length of the anterior wing ♂ 5 mm.

Burma: Washaung, 20k. east of Myitkyina, 16-vii-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum.

Goëra mandana sp. n. Pl. 5. Figs. 1-6.

Insect light ochraceous; maxillary palpi ♂, two-jointed, basal joint small, terminal joint capable of being extended so as to form a membranous sac which is covered on the inner surface with dark androconia towards the basal half, and with pale androconia in the apical half; there is a small, membranous branch at the base, carrying a tuft of black hair; labial palpi, basal joint very short, second and third much longer, approximately equal; wings, neuration of the typical *Goëra* pattern; fork no. 3 of the anterior wing long. Spurs, 2, 4, 4.

Genitalia ♂.—Dorsal margin of the ninth tergite widely and deeply excised; in the cavity thus formed are three processes, the two outer, short, one directed asymmetrically outwards, possibly broken in the type; the central process rather longer, with a truncate apex; beneath these is a pair of strongly chitinized, asymmetric processes, the one in the form of a very fine spine, the other stouter, with a flattened, blade-like apex; penis with a membranous apical part, curled and terminating in a strongly chitinized point; it is armed on its upper surface with a pair of short and very strongly chitinized, acute spurs; there is also a small, concave plate on the upper surface before the apex; penis-sheaths stout, bent downward from about midway; inferior appendages apparently with two joints fused together, three-branched; basal (?) joint very broad; the lower branches more strongly chitinized than the other two; from beneath, straight and divergent; behind this are the upper branches which are semi-transparent and plate-like, the inner wider than the outer, separated from each other by a rounded excision; from the side, the upper branches are the longest; ninth segment from beneath, produced in a broad triangle; a large, comb-like structure to the sixth ventral segment.

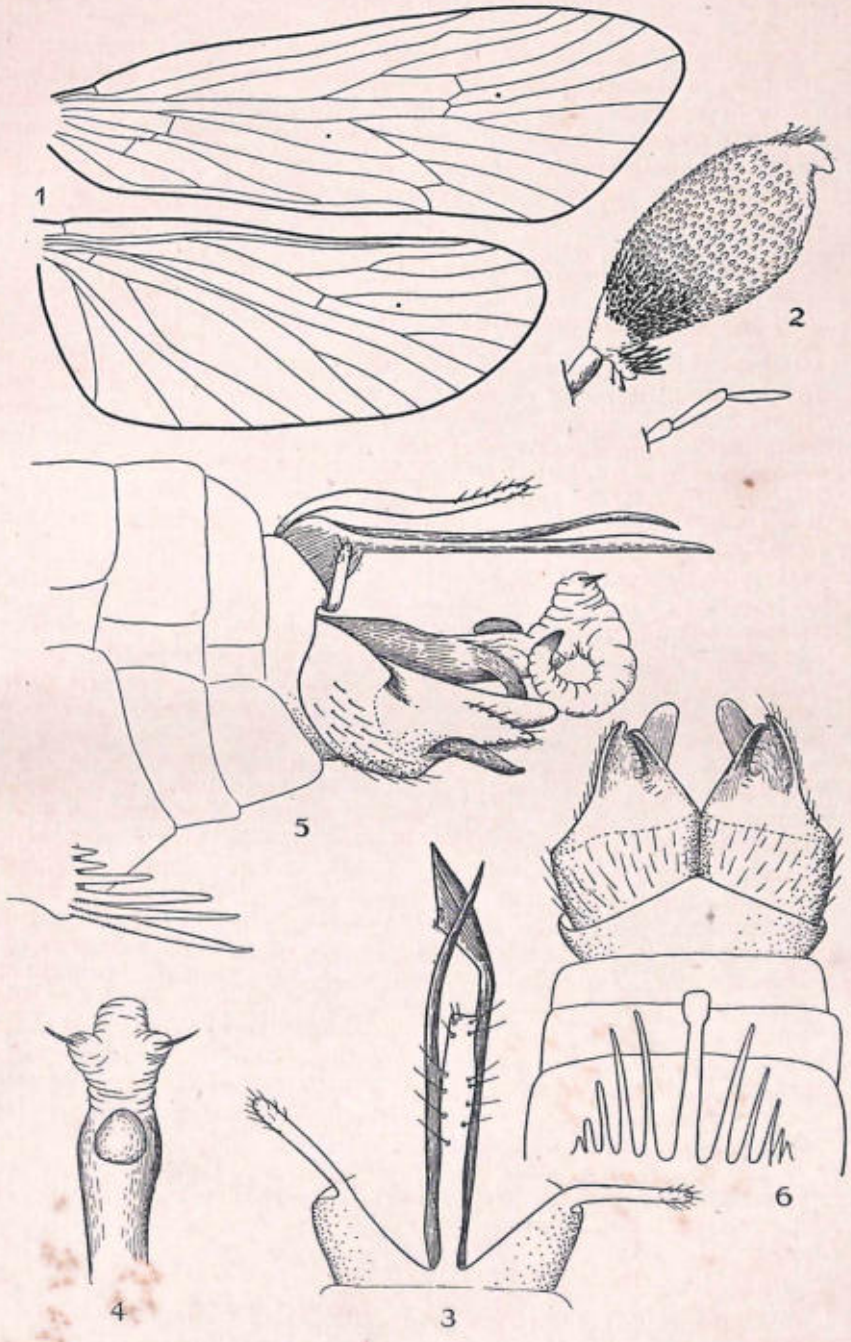
Length of anterior wing ♀ 8 mm.

Andamans: Mt. Harriet, 1,200 ft., 6-iv- 7-v-1927, Ferrar coll.

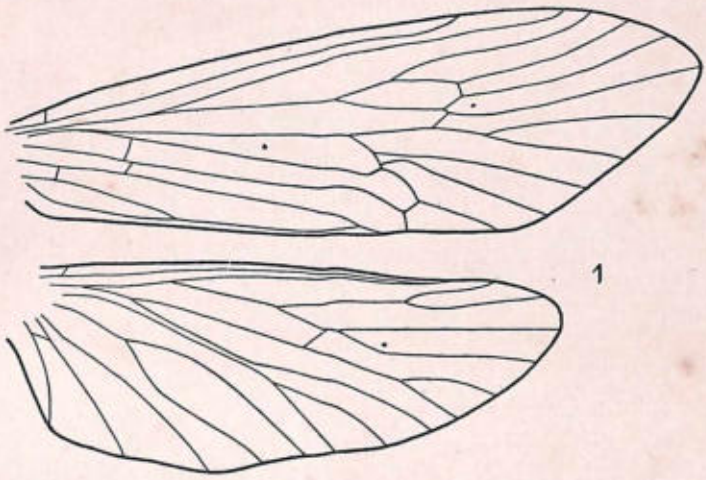
Type ♂ in the collection of the British Museum.

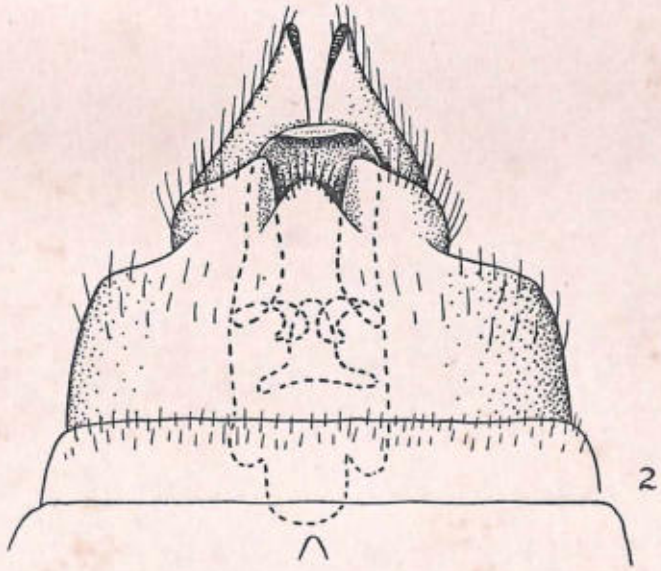
Goëra mishmia sp. n. Pl. 6. Figs. 1-2.

Insect yellowish-brown, unusually small; wings clothed with dense, yellowish pubescence; neuration conforming to the usual

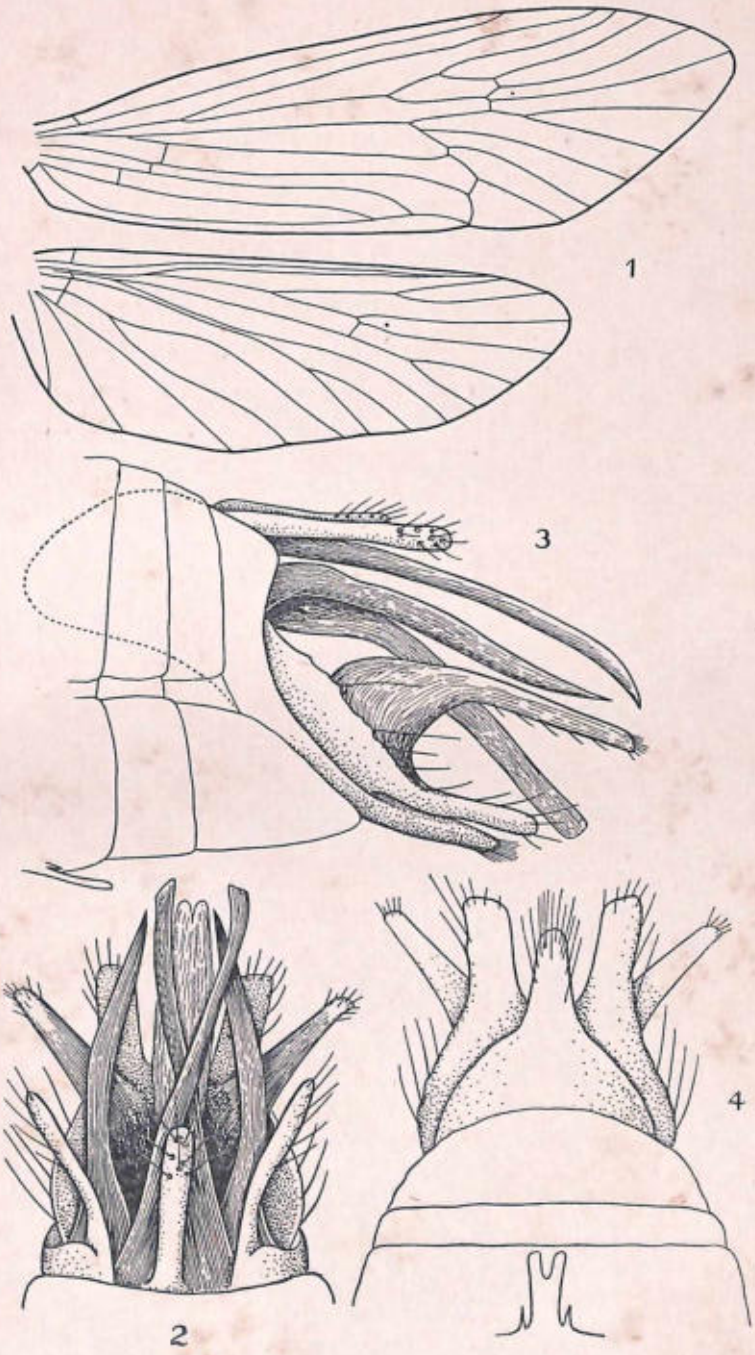


Goëra mandana sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, dorsal processes. Fig. 4, penis, from above. Fig. 5, genitalia, lateral. Fig. 6, ventral.





Goëra mishmia sp. n., ♀.—Fig. 1, wings. Fig 2, apex of abdomen, ventral.



Goëra rumabia sp. n., ♂.—Fig. 1, wings. Fig. 2, genitalia, dorsal. Fig. 3, lateral. Fig. 4, ventral.

Goëra pattern; in the anterior wing, the eighth apical sector is bent upwards nearly to meet the seventh towards its base; structure of the vagina as shown in the figure. Spurs 2, 4, 4.

Length of the anterior wing ♀ 6 mm.

Assam: Mishmi Hills, Lohit River, vi-1935, M. Steele.

Type ♀ in the collection of the British Museum.

Goëra nigricornis Navás.

Goëra nigricornis Nav., Rev. Ac. Cienc. Fis. Nat. Zaragoza, 15, p. 39, 1932.

Navás describes this species as follows:—

'Caput fulvum, fulvo pilosum; oculis nigris; antennis nigris, primo articulo fulvo, fulvo piloso, elongato, longiore spatio interoculari.

'Thorax inferne fuscus, superne fulvo-ferrugineus, mesonoto ad latera fuscescente; pilis fulvis.

'Abdomen fulvo-flavum, primo segmento subfusco, appendicibus fulvo-flavis.

'Pedes fusco-nigri, tarsis ferrugineo-fulvis; calcaribus fusco-nigris; tibiis posterioribus ferrugineis.

'Ala anterior apice parabolico, pubescentia densa et reticulatione ferrugineis; cellula discali breviore suo pedunculo; furca apicale 1 longa, ad medium cellulae discalis penetrante; membrana fulvo leviter tincta in speculo suborbiculari in apice areae cubitalis laevi, hyalino.

'Ala posterior membrana levissime fulvo tincta; furca apicali 2 breviter, 3 longius pedunculata; reticulatione forti, conspicua, fusca, itemque pilis fimbriisque fuscis.

'Long. corp. ♀ 9 mm.

'Long. al. ant. 10.6 mm.

'Long. al. post. 8.2 mm.

'Patria. Khandala (Bombay), 20-x-1929.'

Type ♀ in the Navás collection.

Goëra rumaba sp. n. Pl. 7. Figs. 1-4.

General appearance light fulvous; antennae fairly stout, basal joint not so long as the greatest breadth of the head without the oculi; maxillary palpi three-jointed, partly membranous, first joint small, strongly chitinized and pigmented, second about three times the length of the first, membranous, but with a strongly chitinized and pigmented nodule at the base, third, membranous, slightly longer than the second; labial palpi, basal joint short, second and third equal, rather longer than the first; wings rather broad, clothed mainly with ordinary hairs but there are some clavate hairs in the post-costal region, no scales; no scales or clavate hairs on the posterior wing; spurs 2, 4, 4.

Genitalia ♂.—The apical margin of the ninth tergite bears at its centre three membranous processes, the central, rather the shorter; beneath them is a pair of long, strongly chitinized spines crossing each other about the middle, apices truncate; there are two, long, rod-like intermediate appendages with acute apices;

beneath these is a long, straight penis with an excised apex; inferior appendages bifurcate; the upper forks from above, widely divergent on each side of the penis, with wide bases, tapering to truncate apices; the direction of the forks appears to vary in individuals; lower forks long, rectangular, with truncate apices; from the side, the upper and lower forks are separated by an excision represented by three sides of a square; the ninth sternite strongly produced, the centre of its margin still further produced in a narrow, fringed process with a rounded apex; the sixth sternite bearing a bifurcate process with a spine on each side of its base; this process is variable in shape in individuals.

Length of the anterior wing ♂ 9 mm.

N.-E. Burma: Kambaiti, 6,800 ft., 9-iv-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum. Paratypes in the collection of the British Museum.

Goëra tridens sp. n. Pl. 8. Figs. 1-4.

Insect deep, yellowish brown, wings covered with dense pubescence of the same shade. Spurs 2, 4, 4.

Genitalia ♂.—Ninth tergite cut away to leave a wide cavity in which is a pair of slender superior appendages and between them, a central process, similar in shape but slightly longer; immediately beneath this process is a pair of very long, stout spines, crossing at their apices; beneath these is the penis, furnished with a trough-shaped lower penis-cover with excised apex; inferior appendages branched at the apices; from the side, basal part bulbose, covered with very stout hairs; lower branch, from above, slender, terminating at its apex in a hook; from beneath, it tapers to an acute apex, the upper branch being shorter, oval and with a rounded apex; process to the sixth sternite formed of three prongs, the central the longest.

Length of the anterior wing ♂ 8 mm.

India: Kharsis. (McLachlan collection.)

Type and paratypes ♂ in the collection of the British Museum.

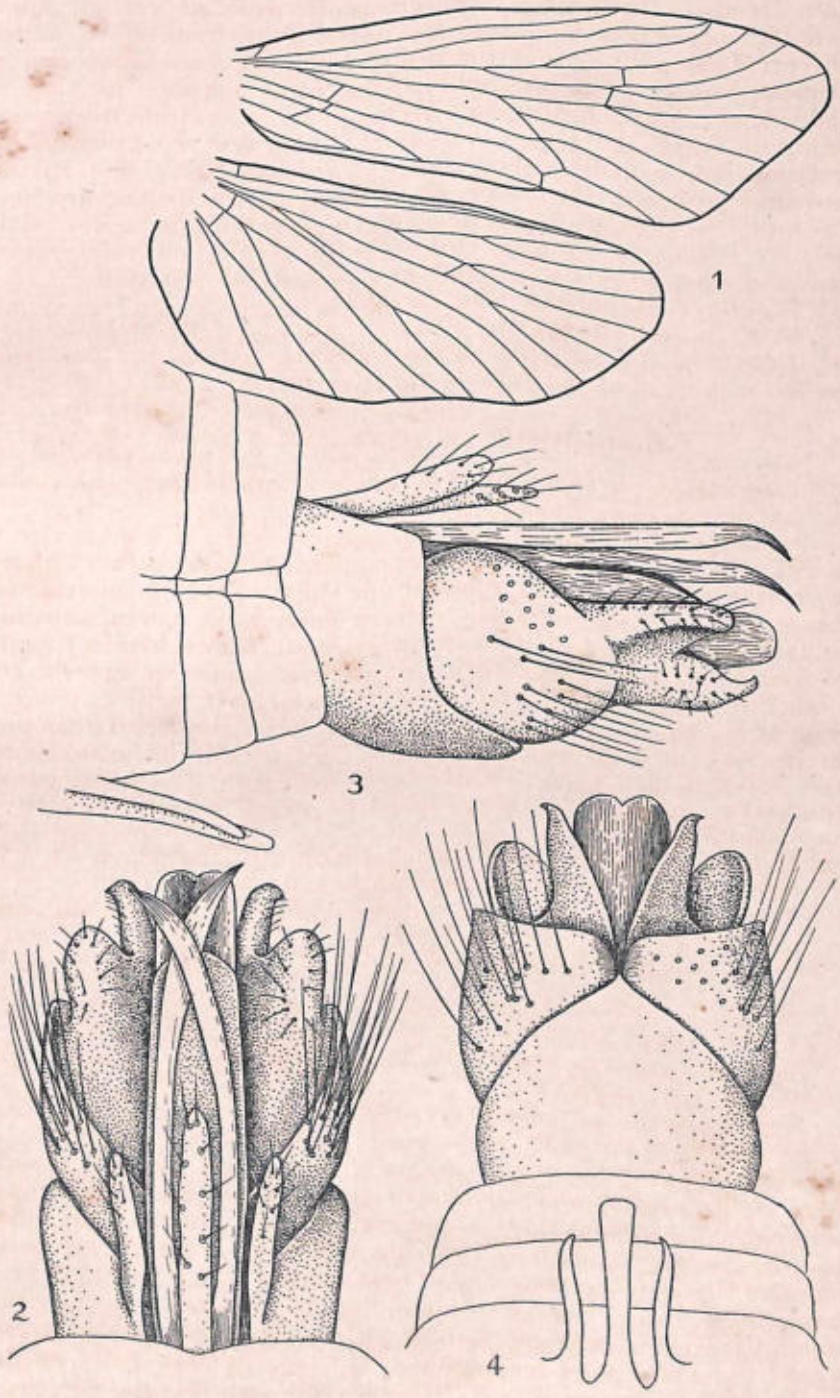
Goëra vulpina Hagen. Pl. 9. Figs. 1-7.

Mormonia vulpina Hagen *partim*, Verh. zool.-bot. ges. Wien, ix, p. 208, 1859.

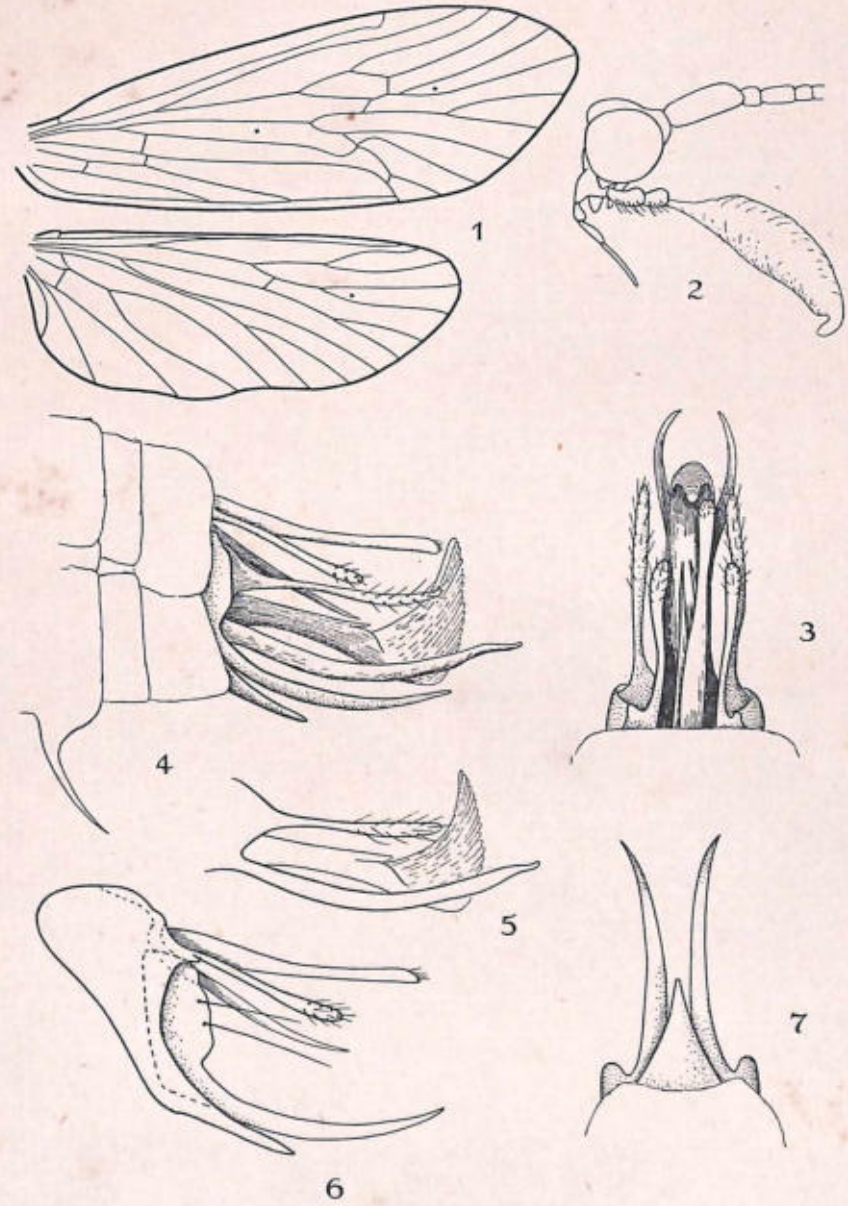
Goërodes vulpina Ulmer *nec* Hagen, Coll. Selys, fasc. vi (i), p. 40, fig. 64, 1907.

Goërodes vulpina Ulmer *nec* Hagen, Gen. Insect. fasc. 60a, p. 106, 1907. Deut. ent. Zeit., 1915, p. 75, 1915.

Description of the ♂. Insect light ochraceous generally; basal joint of the antenna about as long as the width of the head without the oculi; second joint short, about half the length of the third which is twice as long as each of the remaining joints towards the base, but these tend to become longer towards the apex; the third joint bears an impressed line halfway round its circumference on the inner side so that it is probably formed by the welding together of two joints; maxillary palpi three-jointed, a fringe of dark hairs on the under side; when cleared in KOH, it may be seen that the two basal



Goëra tridens sp. n., ♂.—Fig. 1, wings. Fig. 2, genitalia, dorsal. Fig. 3, lateral. Fig. 4, ventral.



Goëra vulpina Hagen, ♂.—Fig. 1, wings. Fig. 2, head and palpi. Fig. 3, dorsal processes. Fig. 4, genitalia, lateral. Fig. 5, penis and intermediate (?) appendages. Fig. 6, dorsal processes, upper penis-cover, inferior appendages and ninth sternite. Fig. 7, ventral plate and inferior appendages, from beneath.

joints are small and more strongly chitinized than the third which forms a membranous sac, large, upturned in front of the face, the extreme apex constricted and bent; the joint is clothed with a few scattered and broadened hairs; labial palpi with a small basal joint, second more than twice the length of the first and shorter than the third; legs, anterior pair rather darker than the rest of the insect; spurs 1, 4, 4; anterior leg with a single short, stout spur and a heavily fringed tibia; wings thickly clothed with yellowish pubescence; anterior, discoidal cell short and broad, fork no. 2 with a minute foot-stalk; in the posterior wing, fork no. 2 with a long foot-stalk

Genitalia ♂.—Ninth dorsal segment retracted within the eighth; the centre of its margin is produced in three long, strongly chitinized rods of which the central is the longest; the apices of the outer (possibly superior appendages), slightly dilated; beneath them is a pair of long, transparent spines, perhaps an upper penis-cover; penis straight with a membranous apex shaped like a foot with the toes turned up as seen from the side; there is a small dorsal spur at the base of the membranous apex; then there is a pair of bifurcate processes, possibly intermediate appendages, the upper forks long and fringed, appearing above the penis, the lower still longer and slightly upcurved with sinuous apices but no fringes; inferior appendages in the form of a pair of strongly chitinised spines, about the same length as the penis, curving upward; centre of the margin of the ninth ventral segment produced in a ventral plate forming a stout spike; a strong and long down-curving process to the sixth ventral segment.

Length of anterior wing ♂ 7 mm.

Ceylon: Rambodde, (Nietner).

The Hagen series of cotypes of his species *Mormonia vulpina* is mixed, containing at least one insect either a *Goëra*, or very closely allied to species in this genus, and others belonging to a genus in the *Lepidostomatinae*.

Hagen, whilst he refers to scales on the wings of the males of all the other *Mormonia* species he describes, writes of *vulpina* in the following terms, '*alis anticis luteis, luteo hirtis* (masc); there is no mention of scales.

I describe *vulpina* from a ♂ example, bearing a label in Hagen's own handwriting, in the type series to which he referred and which was received in exchange from the Harvard Museum of Comparative Zoology, Cambridge, Mass., U.S.A., where the Hagen collection is lodged. This description conforms with that of Hagen.

Ulmer, in the Cat. Selys. Coll., figures the wings of one of the two ♀ cotypes in the Brussels Museum but does not actually designate this ♀ as the type of the species; his figure shows clearly that the Brussels insect belongs to the sub-family of the *Lepido-stomatinae* in which nearly all the known ♂ species in Ceylon bear scales on the wings; moreover, the female wing of a *Goëra* species or of a species with a neuration such as I have figured, would not resemble Ulmer's figure.

I am therefore of opinion that the Brussels females belong to a different species, and I here designate the male cotype, mounted in

balsam and figured here, the type of *vulpina*. This type has been returned to Mr. Banks, at the Harvard Museum.

Brachycentrinae Ulmer.

Brachycentrinae Ulm., Abh. Natur, Ver. Hamb., 18, p. 85, 1903

Basal joint of the antenna shorter than the width of the head with the oculi. Maxillary palpi cylindrical, hairy, curved upward, not applied against the face, three-jointed, basal joint shorter than the others; labial palpi longer than the maxillary palpi, stout, basal joint short, second and third approximately equal; wings varying in form, usually rather broad, posterior generally much shorter than the anterior; no grooves or folds in either pair; pubescence usually dense but never mixed with scales; neuration generally differing in the sexes; in the anterior wing, the discoidal cell is ordinarily short and broad; apical forks nos. 1, 2, 3 and 5 usually present in the ♂ and often fork no. 4 in addition in the ♀; in the posterior wing, discoidal cell is usually open; ordinarily, forks nos. 1 and 5 in the ♂, with frequently additional forks in the ♀; a transverse nervure connects the radial sector to the medius; spurs varying; often a lobe or tooth to the 7th ventral segment.

Key to the Brachycentrinae.

1.	Spurs 2, 3, 3.	Brachycentrus
	Spurs 2, 2, 2.	Micrasema

Brachycentrus Curt.

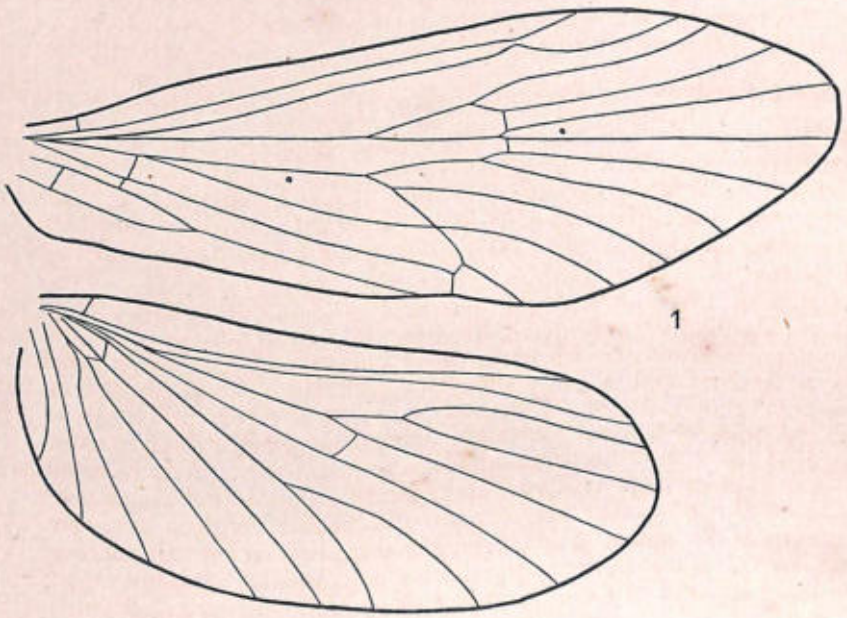
Brachycentrus Curtis, Phil. Mag., 1834, p. 215.

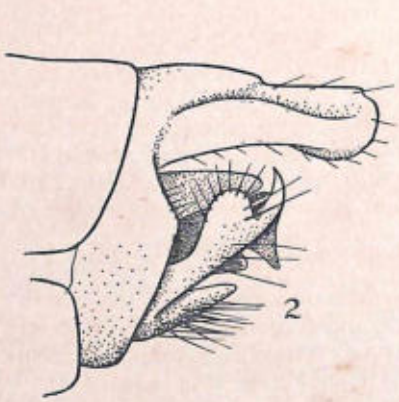
Spurs 2, 3, 3.

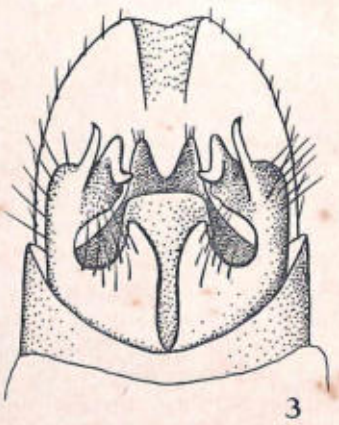
Antennae slender, about the length of the wings, basal joint stout, maxillary palpi of the male upturned, three-jointed, middle joint longer than the first or last; maxillary palpi of the female long and slender, terminal joints thin, third joint the longest, second, fourth and fifth nearly equal in length, basal joint short; anterior wings moderately broad and elongate, without folds or scales in the male; apical margin somewhat oblique, much more oblique and produced in the female than in the male; in the anterior wing male, forks nos. 1, 2, 3 and 5 are present, all extending to the anastomosis; in the anterior wing female, forks nos. 1, 2, 3, 4 and 5 are present; no. 4 does not reach the anastomosis; discoidal cell short and broad in both sexes, more particularly in the female; posterior wings much shorter than the anterior, broad and very obtuse (slightly less so in the female); discoidal cell open; only forks nos. 1 and 5 present in the male, but nos. 1, 2, 3 and 5 in the female; lower branch of the sector connected with the medius by a nervule.

Genitalia male.—A large dorsal hood covers the various genital appendages. The species are best separated by the form of the inferior appendages.

Genotype: *Brachycentrus subnubilus* Curt.







Brachycentrus kozlovi Mart., ♂.—Fig. 1, wings. Fig. 2, genitalia, lateral Fig. 3, from behind.

The species belonging to this genus are wont to appear in great swarms, early in the season. The females are frequently seen carrying an ovoid mass of bluish-geen eggs at the oviducts; if the insect be examined when in this condition, it will be noticed that the terminal segments are inturned to make a kind of cup in which the eggs are carried.

Brachycentrus kozlovi Martynov. Pl 10. Figs. 1-3.

Brachycentrus kozlovi Mart., Ann. Mus. Zool. Ac. Sci. Peters., xiv, pp. 291-4, figs. 6-9, 1909.

Head and throax fuscous with light, honey-coloured hairs; oculi black; antennae fuscous with pale annulations; palpi and legs testaceous; spurs 2, 3, 3; wings greyish with light honey-coloured pubescence.

Genitalia ♂.—Ninth dorsal segment produced in a large hood with a slightly excised apical margin; this hood obscures all the genital parts from above; upper penis-cover deeply excised; penis with a swollen and slightly cleft apex; lower penis-cover in the form of a rectangular plate; inferior appendages rather complicated; in each, there is a lower, strongly chitinized, triangular basal fork separated from the remainder of the appendage by a deep rounded excision as seen from beneath; the apical portion of the appendage consists of two leaves, the outer from behind, with a strongly produced, inner, apical angle, from the side, very acute and curving upwards, the outer apical angle shorter and rounded; the inner leaf with the lower apical angle produced downward and the upper angle rounded.

Length of anterior wing ♂ 9, mm., ♀ 10-11 mm.

Kashmir: L. Vishensar, 12,000 ft., F. J. Mitchell; W. Tibet: Basgo, 20-ix-1932; Chushol, 14,228 ft., 10-viii-1932, G. E. Hutchinson.

The female insect is seen frequently with a ball of olive-green eggs carried at the oviducts. The insect bears a close resemblance to the European species, *Brachycentrus subnubilus* Curt., well-known to anglers under the popular name, the Grannom.

Micrasema McLachlan.

Spurs 2, 2, 2, those of the anterior tibiae very short. Antennae slender, about as long as the wings, those of the ♀ slightly shorter than those of the ♂, basal joint stout. Maxillary palpi ♂ greatly curved and extending to or near the apex of the basal antennal joint, not applied against the face. Anterior wings broad, oval, unicolorous, generally black, neuration obscured by dense pubescence; fork no. 3 of the anterior sometimes with a footstalk, generally sessile; discoidal cell present and short in the anterior wing, absent in the posterior; in the former wing, forks Nos. 1, 2, 3 and 5 present in the ♂, Nos. 1, 2, 3, 4 and 5 in the ♀; in the posterior wing, forks nos. 1 and 5 in both sexes; lower branch of the medius sometimes present, sometimes obsolete or partly obsolete.

Genotype: *Micrasema tristellum* McLach., here designated.

Micrasema baitina sp. n. Pl. 11. Figs. 1-4.

Insect black; fork no. 3 in the anterior wing sessile. Lower branch of the medius in the posterior wing entirely obsolete.

Genitalia ♂.—Dorsal plate forming a large triangle with a slightly excised apex; beneath it may be seen the fringed and rounded apices of the intermediate (?) appendages; penis broad and spatulate, tapering to a slender apex from the side; inferior appendages stout and two-branched, the short, sausage-shaped second branch arising from a deep, nearly right-angular excision on the inner surface towards the apex which is slightly excised.

Length of the anterior wing ♂ 4.5 mm.

N.-E. Burma: Kambaiti, 2,000 m., 4-iv-1934; 7,000 ft., 30-iv-1934; 2,000 m., 12-v-1934.

Type ♂ in the collection of the Stockholm Museum. Paratypes ♂ and ♀ in the Stockholm and the British Museum collections.

Micrasema punjaubi sp. n. Pl. 12. Figs. 1-2.

The single example known of this species has been mounted in balsam and I am unable to describe its general appearance. In the anterior wing, fork no. 1 extends nearly to the middle of the upper margin of the discoidal cell; posterior wing, the lower branch of the medius is partly obsolete.

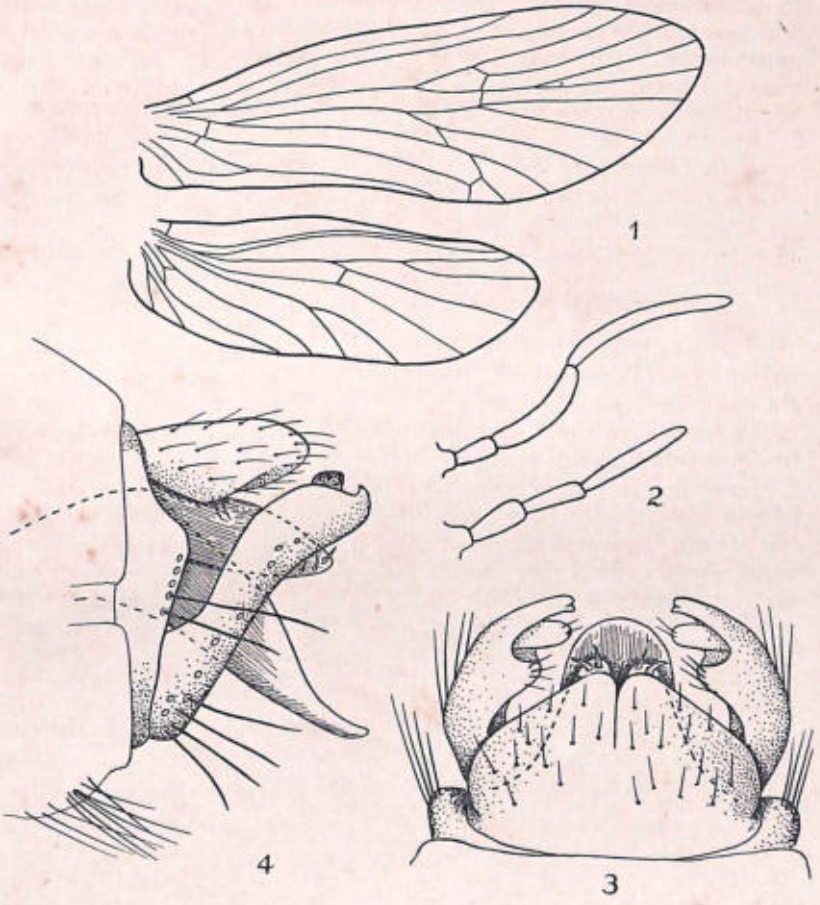
Genitalia ♂.—From above, the dorsal plate is formed of a pair of triangular plates fused together on the ventral side and tectiform on the upper; intermediate appendages broad, with a row of short, stout spines along the apical margin; penis short and straight; inferior appendages two-jointed, basal joint large, terminal joint very short.

Length of the anterior wing ♂ 5 mm.

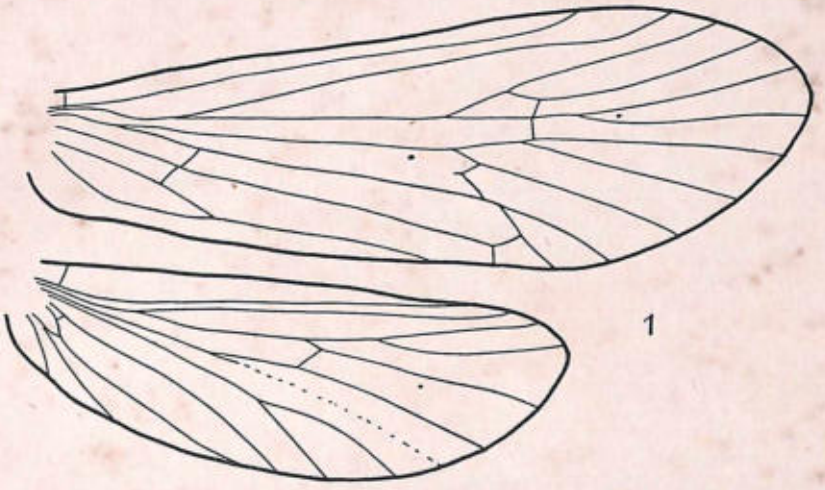
India: Punjab, R. Uhl, Chotah Bagahal, vi-1914, G. C. L. Howell.

Type ♂ in the author's collection, now in the British Museum.

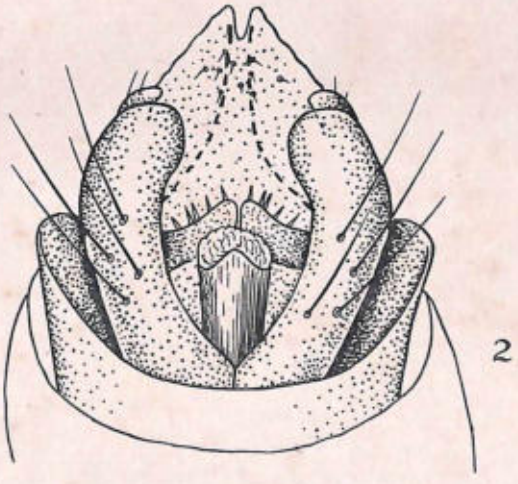
(To be continued).



Micrasema baitina sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, genitalia, dorsal. Fig. 4, lateral.



1



2

Micrasema punjaubi sp. n., ♂.—Fig. 1, wings. Fig. 2, genitalia, ventral.

AN ADDITIONAL LIST OF BIRDS FROM HYDERĀBAD STATE.

BY

SÁLIM ALI.

The following species, not listed in my report of the Hyderābād State Ornithological Survey (concluded on p. 454 of volume xxxvii), were met with mainly during a visit to Mūlūg (Warangal District) in company with Col. R. Meinertzhagen in February 1937. Other species noted, or records brought to my notice since the Survey, have also been included. Specimens of several species not collected during the Survey have since been procured which has enabled a determination of the races occurring in Hyderābād.

SPECIES NEW TO THE SURVEY LIST.

Locustella nævia straminea Seebohm. The Eastern Grasshopper-Warbler.

♂? 22-2-37 Mūlūg 1,500 ft. (Meinertzhagen Collection). Two others shot on 24 and 26 February, not preserved.

Fairly common in tall coarse grass on the margin of Rāmappa Tank. Flushed singly. Diving into the stems after a short flight, scuttling swiftly through the rootstocks, and difficult to flush a second time.

Chætornis locustelloides (Blyth). The Bristled Grass-Warbler.

♂, ♂?, ♂? 24 and 25-2-37 Mūlūg 1,500 ft. (Meinertzhagen Collection).

Fairly common in the same facies as the foregoing. Flushed singly. Has a habit of soaring a few feet above the grass every now and again, flying indirectly—up and down and zig-zag—for a short distance, and then diving into the stems. Similar behaviour to that of *Schœnicola platyura*. Difficult to flush a second time. Like *Locustella* it works its way swiftly through the rootstocks and rises several yards away from where one expects it to.

Emberiza striolata (striolata Licht.). The Striolated Bunting.

Noted: Daūlatābād Fort 29-2-36 and 3-12-37.

Males singing from ramparts, etc. Rich *whee-chi-whee-wichee* ending in an extra, subdued, *chi*. On 29 February a pair was nest-building in a niche in Chini Mahal. Both sexes were bringing grasses and turning in the unfinished shallow cup.

Ptyonoprogne rupestris (Scop.). The Crag Martin.

♂? 31-12-37 Daūlatābad Fort (not preserved). Wing 134 mm. Several seen about the rock scarps. Obviously a winter visitor.

Anthus richardi richardi Vieill. Richard's Pipit.

♂♂ 20-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Shot near Rāmappa Tank. Several seen.

Ichthyophaga ichthyaëtus subspecies? The Grey-headed Fish-Eagle.

♂ imm. 21-2-37 Mūlūg. 1,500 ft. (Meinertzhagen Collection).

Colours of bare parts: Iris yellowish-brown; bill horny brown, greyish plumbeous on lower mandible; legs and feet greyish creamy-white or ivory; claws brownish-black.

Shot at sunset off old nest—a huge collection of twigs, about 3 feet deep—which on the same morning was being added to by a *Neophron percnopterus*! The latter was shot by Col. Meinertzhagen as it came to the nest with a twig in its bill. It is curious that both these species should be actively interested

in the same nest. The original owners—presumably the Fish-Eagles—apparently roosted at night in or near the nest. When the specimen was shot no Neophrons were about. The Eagles were observed at the nest in the morning also, but no Neophrons were in the vicinity then.

The nest was about 30 ft. up in the fork of a large *Albizzia* tree, 2 furlongs from a tank among low, stony hillocks in deciduous forest.

The crop of the specimen contained portions of a fish.

Circus melanoleucus (Forst.). The Pied Harrier.

Colours of bare parts: Iris bright lemon yellow; cere greenish-yellow, upper mandible and terminal half of lower mandible blackish-brown; base of lower mandible plumbeous; gape greenish-yellow; legs and feet bright chrome yellow; claws brownish-black.

Shot in open scrub country and rank grassland bordering Rāmappa Tank.

♂ 24-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Excalfactoria chinensis chinensis (Linn.). The Blue-breasted Quail.

♂ ♀ 24-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Singly or pairs in tall grass by Rāmappa Tank. Not abundant.

Turnix maculatus tanki Blyth. The Indian Button-Quail.

♀ 22-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Several singly or in pairs in grassland near Ramappa Tank.

Nyroca rufa rufa (Linn.). The White-eyed Pochard.

A pair shot by P. H. Allen at Nālgonda, lat. 17° 22′. (*Vide* Stuart Baker, *Indian Ducks and their Allies*, p. 228.)

Specimens obtained since the Survey, establishing subspecies or confirming sight records.

Emberiza melanocephala Scopoli. The Black-headed Bunting.

o? 17-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Noted also at Daūlatābād between 18 November and 31 December as fairly common.

Chrysocolaptes festivus (Boddaert). The Black-backed Woodpecker.

oo 18-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

Noted also at Ajanta (28-12-37) in deciduous forest on hillside.

Micropus melba bakeri. Hartert. The Indian Alpine Swift.

♂ ♀ 20-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

♂ W=200 mm.; testes 16×6 mm. ♀ W=198 mm.; ovarian follicles ca. 1 mm. in diameter.

Several birds seen hawking the bugs (*Agnoscelis nubila* Fb.) at heights of 150-200 ft. in the vicinity of Rāmappa Tank. Their gape and gullet were packed with them. Probably breeding on the crags nearby.

Noted also at Daūlatābād, 24-12-37. About 100 birds flying low in overcast weather.

Ketupa zeylonensis leschenaulti (Temm.). The Bengal Brown Fish-Owl.

♂ ♀ 21-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

♂: testes 10×5 mm. ♀: largest ovum 7 mm. diameter.

Hieraëtus fasciatus fasciatus (Vieill.). Bonelli's Eagle.

♀ (W=ca. 530 mm.) 27-12-37 Daūlatābād, ca. 1,800 ft.

Shot in the morning off large stick nest on ledge of rock-scarp. When the nest was visited again the same evening the male was on it. He sat tight on the eggs until the climber reached the ledge and was within a few feet of him. C/2 taken, measuring 70×53 and 68×53 mm. (St. Xavier's College Museum.) Nest sparsely lined with small dry leaves. The stomach of the

specimen contained pieces of skin and claws of a lizard (*Varanus?*) and some green vegetable matter.

Elanus cæruleus vociferus (Latham). The Black-winged Kite.

♂ 23-2-37 Mūlūg, 1,500 ft. (Meinertzhagen Collection).

One of a pair on tree in coarse grassland by Rāmappa Tank. Largest ovum 3 mm. in diameter. Stomach contained compact ball of rat fur and bones.

Porphyrio poliocephalus poliocephalus (Latham). The Indian Purple Moorhen.

♀ 19-2-37 Mūlūg 1,500 ft. (Meinertzhagen Collection).

Largest ovum 9 mm. diameter. Several specimens shot for Mallophaga on a reedy, lotus-covered tank.

Phylloscopus griseolus Blyth. The Olivaceous Willow-Warbler.

In my note on this species (vol. xxxvi, p. 719) I said: 'Met with singly in tall trees in deciduous forests.' Since then I find that it is much more addicted to old fort walls and escarpments, often running up their faces like a tree- or wall-creeper.

Merops superciliosus javanicus Horsf. The Blue-tailed Bee-eater.

A few seen in grass and scrub jungle near Rāmappa Tank, Mūlūg, 17-2-37.

Pandion haliaëtus (Linn.). The Osprey.

Noted at Rāmappa Tank, Mūlūg, 17-2-37.

Falco peregrinus peregrinator Sund. The Shahin Falcon.

Noted on Daūlatābād Fort 21-12-37. A single bird on ledge of rock-scarp feeding on a pigeon squab within 10 yards of several adult pigeons! The slaty-blue upper parts and rufous thighs and undertail were diagnostic.

Falco jugger. J. E. Gray. The Lagar Falcon.

A pair nesting on a small minaret at Bibi-kā-Makbara, Aūrangābād, 29-12-37.

SUPPLEMENTARY OBSERVATIONS ON THE MUNNAR SECTION OF THE ORNITHOLOGICAL SURVEY OF TRAVANCORE AND COCHIN.

BY

J. B. PRIMROSE,

Wilson College, Bombay.

These notes are the result of two visits to Munnar, one from April 29th to June 1st, 1937, and one from April 9th to May 31st, 1938. My earlier arrival in 1938 enabled me to observe a larger number of the winter visitors who apparently leave before the end of April. As it happened, several birds observed by Mr. Sālim Ali had already departed before the 9th of April. Before going on any further, I must pay tribute to the excellence and accuracy of the observations made by Mr. Sālim Ali and his party during the survey of Travancore. The eight parts of the *Journal* of the B.N.H.S. were always found helpful and accurate too.

I should say that I shot no birds, and so I am ready to admit that some of my observations may be liable to question. All I can say is that as great care was taken as was possible, and that several observations made have been omitted through inability to give satisfactory confirmation. I also saw some birds which I could not confidently identify, and I think that there are probably more birds in Munnar than have yet been recorded.

In May 1937, the weather in Munnar was broken and showery, and the Monsoon winds had not begun by the 1st of June. In 1938 the weather was broken till the end of April. Early in May the S. W. winds began, accompanied by mist and long drizzles. On May 14th the N. or N.E. wind re-asserted itself, and a spell of fine weather followed which lasted till near the end of the month when heavy rain began to fall. It was noticed that when the rain fell in May, a general exodus of birds began from Munnar. During the return of fine weather, a few returned, but the majority remained away. Many of the birds that left Munnar may simply have moved to other areas in the High Range, for one of the features of the Kanan Devan Hills is the extraordinary variation in annual rainfall within a limited area. At the western edge, on the Pettimudi Estate, nearly 400 inches of rain have been recorded. Lockhart and Periakanal to the south record from 100 to 90 inches, and to the east, at Top Station and Chittavurrai the average fall is from 60 to 50 inches. Munnar itself has an average of 153 inches, and Devicolam, 5 miles away has an average of 113 inches. Of the Munnar average of 153 inches, about 107 inches fall in June, July, and August. I have had some opportunity of seeing the bird-life outside the immediate area of Munnar, and the impression I have gained while visiting some of the estates east of Munnar during

the second half of May was that birds were still being seen there which were no longer being seen in Munnar itself. I suggest that there is a considerable amount of local migration within the limits of the Kanan Devan Hills.

I think also that birds on migration northwards fly over these hills by a route from the Pullivassal Gap to Munnar town and then up the Kanniamallai river to the Nyamakad Gap, and thence *via* Maraiur to the plains. Mr. H. A. Ragg whose estate lies on this route seems to have more records than other observers, and I think that very probably the reason is that the birds pass his estate on their southern and northern journeys.

In my notes 'S.A.' refers to records specifically stated by Mr. Sālim Ali to have been made in Munnar. They are found in the *Journal* of the B.N.H.S., vols. xxvii, 4; xxxviii, 1-4; xxxix, 1-3. My own notes are indicated by 'J.B.P.'

Corvidæ.

Corvus machrorhynchus culminatus. Noted as absent. S.A.

Seen in April and May, but not in large numbers. Also seen in Silent Valley and at Madupatty (25th May), and reported from Kalaar to the west. A few of these birds seem to ascend the hills in the hot weather. J.B.P.

Corvus splendens protegatus. Noted as absent. S.A. and J.B.P.

Machlolophus xanthogenys travancorensis. S.A. and J.B.P.

A few were seen as members of flocks.

Sitta frontalis frontalis. S.A. and J.B.P.

Fairly common in April but noted till the end of May.

Timaliidæ.

Trochalopteron jerdoni fairbanki. S.A. and J.B.P.

Distribution wrongly given in *Fauna*, vol. i, p. 178, as S. Travancore. It should be N. Travancore, and that of the following bird *T. j. meridionale* as S. Travancore. Very common. Young birds seen early in May.

Pomatorhinus horsfieldi travancorensis. S.A. and J.B.P.

Very common and very vocal in April, but less heard in May. Seen both in sholas and on *Grevillea robusta* shade trees amongst the tea. In May commoner in the drier areas. Probably a local migrant.

Pycnonotidæ.

Microscelis psaroides ganeesa. S.A. and J.B.P.

More commonly seen in April than in May, but still fairly common in May up to about the 14th; then growing scarcer till, at the end of the month, it was absent.

Molpastes cafer cafer. Noted as absent. S.A. So also J.B.P.

Otocompsa jocosa fuscicaudata. S.A. and J.B.P.

Very common. Frequently observed feeding on *Rubus ellipticus*. Once a bird hung to the fruit by its bill and vibrated its wings until the fruit was detached from the stalk. Also observed taking nectar from garden bushes, e.g. Japanese Lantern.

TURDIDÆ.

Brachypteryx major albiventris. S.A.

Doubtful. Very difficult to distinguish between this and *Eumiyas albicaudata* in the field. I found it easier to note its presence by the song than by sight. J.B.P.

Tarsiger brunnea brunnea. Not observed. Probably had already migrated. S.A. and J.B.P.

Saxicola caprata atrata. S.A. and J.B.P.

Very common. Young males were seen in late April and early May in brown plumage with white patches appearing.

Turdus simillimus mahrattensis,
T. bourdillioni. } S.A. and J.B.P.

Difficult to distinguish. Blackbirds were heard singing up to the end of May. My impression is that Bourdillon's blackbird was most common. Other observers also agree. Towards the end of May the birds seemed to be found more at the 6,000 ft. level.

Monticola solitaria pandoo. S.A. and J.B.P.

One bird seen once, at end of April.

Myophonus horsfieldii S.A. and J.B.P.

Quite common, and sang well especially when the mists came up. This bird has a high-pitched whistle repeated at intervals when feeding, less in volume than, but similar to that of the Grackle and Scaly-bellied Green Woodpecker, and greater in volume than that of the White-eye.

MUSCICAPIDÆ.

Siphia parva albicilla. Not recorded. S.A.

Twice doubtfully seen on the edge of a shola towards the end of April. The red breast caught the eye. J.B.P.

Muscicapula tickelliæ tickelliæ. Not seen. S.A. and J.B.P.

Eumiyas albicaudata. S.A. and J.B.P.

Frequently heard and seen in April, but rarely in May near Munnar. It was seen in the higher and drier areas later in May, but some of these records may be confusions with *Brachypteryx*.

Alseonax muttui. Not recorded. S.A.

One pair was seen in the Parsonage compound, in which I was staying right up to the end of May. I had almost daily opportunities of watching them. The large brown-eye with the whitish ring round it was noticeable. Mr. Sālim Ali doubts whether this bird is resident. From the fact that I saw it up till the end of May in Munnar and also at Arivikad on May 25th ca. 5,500 ft. it seems as if the *Fauna* prediction had some evidence in support of it. Cf. *Fauna*, vol. ii, p. 252. I watched carefully for signs of breeding in Munnar, but found none. The Munnar birds were quite tame. I often watched them, perching on a wire fence, and on a poinsettia bush, and making sallies to capture flies, descending occasionally to the ground. J.B.P.

Ochromela nigrorufa. Not recorded. S.A.

Very curiously I saw this bird frequently in 1937, but did not see it at all in 1938 though I often was at its former haunts.

Culicapa ceylonensis ceylonensis. Not recorded. S.A.

Frequently seen in Munnar and at Old Devicolam, 1,000 ft. higher up, and elsewhere in the hills, singly and in pairs in April and in May. J.B.P.

Tchitrea paradisi. Not recorded. S.A.

One bird in the chestnut plumage was seen near the High Range Club in the third week of April. Probably it had come up through the Pullivassal Gap. Residents say that the Paradise Flycatcher is seen, but rarely, in all plumages. Probably all are passage migrants. J.B.P.

LANIIDÆ.

Lanius schach caniceps. Not recorded. S.A.

Seen quite frequently in April and in May near Munnar and in the neighbourhood. One bird with a twig in its mouth was seen about the end of April. Noted at 6,400 ft. on May 17th and at 6,000 ft. on May 25th. J.B.P.

Lanius cristatus cristatus. S.A. and J.B.P.

Seen in much the same facies as caniceps, but not after the end of April. In April, the numbers of this shrike and the previous were fairly equal.

Hemipus picatus picatus. Not recorded. S.A.

Very commonly seen both in April and in May right up to the end. Parties numbering from 3 to 5 frequented the high trees, and went round the compound daily, several times in a regular route, sometimes with other small birds and sometimes with *Pericrocotus flammeus*. Their sweet notes were easily distinguishable whenever they appeared. J.B.P.

Pericrocotus flammeus Not recorded. S.A.

Seen frequently in Munnar and in other parts of the district in April, and up to the end of May. J.B.P.

DICRURIDÆ.

Chaptia aenea malayensis. Not recorded. S.A.

I thought I saw it once in the Parsonage compound, but it may have been the common King Crow. It was dusk so I could not be certain. Others, however, have recorded *aenea* in these hills. J.B.P.

SYLVIIDÆ.

Acrocephalus dumetorum. Not seen. S.A. and J.B.P.

Phylloscopus nitidus. S.A. and J.B.P.

Either *nitidus* or *viridanus*, probably *viridanus*, was common in April and disappeared early in May. It was associated with *Cinnyris minima*, *Zosterops*, and sometimes with *Hemipus* in the daily tours of the garden trees. I watched the birds carefully for considerable periods, and came to the conclusion that *viridanus* was the subspecies, but they move so rapidly, and keep so well hidden that accurate observation is not easy.

There are other warblers to be seen on the grasslands in the dry parts of the district, but I could not achieve certainty in identification.

EULABETIDÆ.

Gracula religiosa indica. S.A. and J.B.P.

Several pairs were nesting when I arrived in Munnar in the second week of April. One pair had its nest in a hole in an acacia tree in the Parsonage compound about 25 ft. above ground. In another hole of the same tree, about 8 ft. above ground, a pair of Jungle Mynas were nesting at the same time. The Grackles held their nest up till the end of May.

STURNIDÆ.

Æthiopsar fuscus mahrattensis. S.A. and J.B.P.

Very common both in the High Range and in the Palnis as high as Kodaikanal. This is one of the species whose range appears to be extending

with the increased areas of cultivation in the hills. A pair nested in the Parsonage compound as noted above.

FRINGILLIDÆ.

Carpodacus erythrinus roseatus. Not seen. S.A. and J.B.P.

HIRUNDINIDÆ.

Riparia concolor. Not recorded. S.A.

Seen at about 5,500 ft. near Periyakanal. Three young were seen on a rocky ledge in a cliff while the parent birds fed them on the wing. The young birds vibrated their wings and showed great excitement as the parents swooped near, and dropped food into their bills. This was on April 23rd. J.B.P.

Hirundo javanica domicola. Not recorded. S.A.

Seen frequently in and around Munnar. Common also in Kodaikanal. Young birds were been in a nest in the third week of April under the eaves of a bungalow in Munnar. J.B.P.

MOTACILLIDÆ.

Motacilla maderaspatensis. S.A. and J.B.P.

Common in Munnar and beside the larger streams. One young bird with ashy brown back was seen feeding near the Pullivassal Power House on 14th May.

Motacilla cinereas caspica. S.A. and J.B.P.

Common in April, but wholly absent in May. The last was seen on April 29th.

Motacilla flava simillima. Not recorded. S.A.

One flock of over 30 birds was seen in the river bank in Munnar Golf Course on April 12th. They were not seen again. Probably they had come up through the Pullivassal Gap, and were resting preparatory to their flight north. J.B.P.

Anthus hodgsoni hodgsoni Not recorded. S.A.

Seen once or twice in April in the Parsonage compound. Probably on migration. J.B.P.

Anthus rufulus malayensis. S.A. and J.B.P.

Seen on the grasslands above Munnar.

ALAUDIDÆ.

Alauda gulgula australis. Not recorded. S.A.

Seen often on the grasslands above Munnar. J.B.P.

ZOSTEROPIDÆ.

Zosterops palpebrosa nilghiriensis. S.A. and J.B.P.

Common in gardens and in sholas. Usually associated with the Small Sunbird and the Greenish Willow Warbler in the daily rounds. In probing the flowers of the Japanese Lantern, the bill is inserted, not into the cup, but from outside between the calyx and the petals. The Red-whiskered Bulbul does this also; why? The numbers in May diminished towards the end of the month but some were always present.

NECTARINIDÆ.

Cinnyris minima. Not recorded. S.A.

Common in Munnar and in the sholas up to over 6,000 ft. Seen both in full plumage and in eclipse plumage. In May only eclipse plumage was seen. J.B.P.

Arachnothera longirostra longirostra. Not recorded. S.A.

Not seen, but reported by other observers from Periyakanal (5,000 ft.) in September. J.B.P.

DICAEIDÆ.

Dicaeum concolor concolor. Not recorded. S.A.

Not seen. This seems very surprising. The bird is very common in Kodaikanal, 2,000 ft. higher than Munnar, and the trees and bushes on which it feeds are found in Munnar. It is recorded from Sānthanpāra, about 18 miles S.E. from Munnar, and 1500 ft. lower. I looked for it often, but never observed it. J.B.P.

PITTIDÆ.

Pitta brachyura. S.A.

Not seen, though I thought I heard one in a shola below Lockhart Gap on April 23rd. Residents say that this bird is only occasionally seen on some of the estates near Munnar in the cold weather. J.B.P.

PICIDÆ.

Picus xanthopygæus. Not recorded. S.A.

Seen at Munnar and up to 6,000 ft. and over. It is not common. A pair frequented the Parsonage compound in April and May. They feed on the same trees as a pair of Malherbe's Golden-backed Woodpeckers but not at the same times. J.B.P.

Chrysocolaptes guttacristatus chersonesus. S.A. and J.B.P.

Fairly common in April and May in and around Munnar. Their loud strident cry is often heard.

CAPITONIDÆ.

Thereiceryx viridis. Not recorded. S.A.

Fairly common in April and May, but heard and seen more often in April. A local migrant. I have heard it in May in the drier areas of the Kanan Devan Hills up to 6,000 ft. J.B.P.

CUCULIDÆ.

Centropus sinensis parroti. S.A. and J.B.P.

Common in Munnar and up to at least 6,000 ft. Their deep hoots are a feature of walks along the tea-estate roads. Met with both on grasslands and in shola.

PSITTACIDÆ.

Psittacula columboides. Not recorded. S.A.

Not seen in Munnar, but reported from Periyakanal (5,000 ft.). Many flocks seen at the Neriyamangalam Bridge (200 ft.) on the Alwaye-Munnar road. J.B.P.

ALCEDINIDÆ.

Halcyon smyrnensis fusca. S.A. and J.B.P.

Common on all the streams in and near Munnar, and seen on Devicolam Lake, ca. 6,000 ft. Said to nest in the banks of the lake.

UPUPIDÆ.

Upupa epops ceylonensis. S.A. and J.B.P.

Seen in April and May quite often. In Kodaikanal I have seen a nest in May.

CHAETURINÆ.

Chætura gigantea indicus. Not recorded. S.A.

This swift was seen several times in April and May in the Munnar valley. I do not think that it was there every day. There did not seem to be many of them, and I think that the few who were there ranged over a wide area.

I saw one or two other swifts, but was unable to identify them properly. One might have been a house swift, and another small and brownish, was fairly common. If it was the undernoted, I did not see a colony. J.B.P.

Collocalia fuciphaga unicolor. See S.A. on this bird.

I heard of a colony being found in a small cleft of a rock in these hills but did not see it myself. *N.B.*, vol. xxxix, no. 1, p. 29, 7 lines from top, for 'famous Pillar Rocks' should be read 'Travancore'.

BUBONINÆ.

Ketupa ceylonensis leschenaulti. Not seen. S.A. and J.B.P.

Several owls were seen all apparently of the same species, and the description agrees best with that of this owl. It has been reported from near Madupatty, and one was seen by me on the Perriavurrai estate ca. 5,500 ft. as well as lower down in and near Munnar. Residents say that this is the common owl of the district, and M. H. A. Ragg once shot an owl of this kind which was harrying the nest of a Malabar squirrel. J.B.P.

FALCONINÆ.

Falco tinnunculus objurgatus. Not recorded. S.A.

Seen in May over Munnar, and reported from near Madupatty. Common also on the Palnis up to over 7,000 ft. J.B.P.

Hieraaëtus fasciatus fasciatus. Not recorded. S.A.

One was seen on a tree in the Parsonage compound in April. For two or three hours on end it sat on the lower branch of a pine and repeated its shrill creaking call. After that day I did not certainly see it again. J.B.P.

Hæmatornis cheela melanotis. S.A. and J.B.P.

Seen occasionally in April and May flying high over Munnar. Identified by shrill triple whistle, though at times the whistle sounded only double.

Haliastur indus indus. Not recorded. S.A.

A pair was seen for some weeks over Munnar river. The birds departed about the middle of May, and re-appeared again towards the end of the month. J.B.P.

Milvus migrans govinda. S.A. and J.B.P.

One pair shared with the Brahminies the patrolling of the Munnar valley. They remained throughout April and May.

COLUMBINÆ.

Ducula badia cuprea Not recorded. S.A.

Seen twice; one bird ca. 5,500 ft. below the Lockhart Gap, and one flock of three on the Rajamally Ghat road about 6,000 ft. J.B.P.

Chalcophaps indica indica Not recorded. S.A.

Seen once feeding by the roadside at Devicolam, ca. 5,500 ft. J.B.P.

Though I did not see them, there appear to be other Green Pigeons in the Kanan Devan Hills. Of these the Southern Green Pigeon was probably one.

Columba livia. Not recorded. S.A.

A small flock was seen several times flying down the Munnar valley in the early morning, and returning in the evening. This was in April. Not seen in May. J.B.P.

Streptophilia chinensis suratensis. Noted as absent. S.A.

Very common in April and seen often in May up to the end of the month in Munnar and other places. One fed regularly on the lawn of the Parsonage garden. J.B.P.

PHASIANINÆ.

Gallus sonneratii. Not recorded. S.A.

Not seen, but reported by residents as being fairly common. J.B.P.

PERDICINÆ.

Galloperdix spadicea stewarti. Not recorded. S.A.

Not seen, but reported by residents as being occasionally seen. J.B.P.

Cryptoplectron erythrorhynchum. Not recorded. S.A.

A covey of about 6 birds was once seen. Residents say it is fairly common. J.B.P.

TRINGINÆ.

Tringa ochropus. Not seen. S.A. J.B.P.

Tringa hypoleucos. S.A. and J.B.P.

Seen, up to about the middle of May, on the Munnar river flowing through the Golf Course.

SCOLOPACINÆ.

Scolopax rusticola rusticola. Not recorded. S.A.

Mr. H. A. Ragg says that the Woodcock is still met with but very infrequently. The same remark applies to the following bird. J.B.P.

Capella nemoricola. Not recorded. S.A. Not seen. J.B.P.

Capella stenura. Not seen. S.A. and J.B.P.

ARDEIDÆ.

Ardeola grayii. Not recorded. S.A.

Seen often on the Munnar river and Golf Course in April, but not after the middle of May. J.B.P.

A PROPOSAL TO ADVANCE THE TEACHING AND RESEARCH IN ENTOMOLOGY IN INDIA.

BY

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(Opening remarks in a discussion of the Sections of Zoology and Entomology in the Silver Jubilee Session of the Indian Science Congress Association, Calcutta, 1938.)

The importance of entomology to agriculture, medicine, veterinary science and forestry is being felt more and more every day. It is increasing in view of the fact that in India alone the insects are responsible for an annual loss of about 200 crores of rupees. On account of the economic factor much attention has been devoted to this science during the last thirty years, and as a consequence it has made very rapid progress in some advanced countries of the world. It is, therefore, desirable that the teaching of entomology in our universities should be separated from that of zoology and be placed on a sound footing as in other countries like the United States of America and England. If possible, every university should be requested to have a separate department for the teaching of entomology with a course extending over four years. It should be given the same status as zoology and botany: for the B.Sc. classes it may be taken along with botany and zoology in those universities which teach three science subjects, but in those universities where only two science subjects are taken for the B.Sc. degree examination it may be combined with zoology so as to constitute one of the two papers in this subject.

The advantage of extending the course of entomology over four years and of teaching it along with zoology in the B.Sc. classes, is that a student will have a better grasp of the subject. After the first two years the B.Sc. students in entomology will be required to appear in two papers and a practical examination—the first paper being on general insect morphology, development and metamorphosis, and the second paper on taxonomy, classification and biology of insects. For the M.Sc. examination the entire subject can easily be distributed into five papers of 100 marks each, and a practical examination carrying 200 marks. The distribution of question papers will be as follows :—

Paper I.—Detailed insect morphology, physiology, development and metamorphosis.

Paper II.—Principles of taxonomy and classification with a detailed study of some representatives of each order.

Paper III.—Special aspects of insect biology, insect ecology and its relation to biological control.

Paper IV.—Principles of economic entomology in relation to agriculture, medicine, veterinary science and forestry; methods of insect control (mechanical, chemical and physical).

Paper V.—General principles of evolutionary biology (evolution, heredity, variation, cytology, distribution and palæontology) with special reference to insects.

Paper VI.—Practical.

The advantage of such a course is that it would give a student a thorough training in all aspects of entomology and zoology, and thereby equip him better for further research than the course hitherto followed can do. If, however, the universities find it impracticable to introduce entomology as one of the subjects for the B.Sc. classes, it may be exclusively taught in the M.Sc. classes, so that a student may have an opportunity of studying pure entomology for two years. This will give an opportunity to those students who pass the B.Sc. (Ag.) examination with entomology as an optional subject from agricultural colleges, to take the M.Sc. degree in entomology in the pure science faculty. It is, however, essential that an advanced student in entomology should have a good foundation in zoology, but if entomology is not separated from zoology, then there is a danger of entomology being ignored as is happening at present in the Indian universities.

So far the teaching of entomology has been confined to some agricultural colleges in our country, with a view to produce agricultural entomologists. Their outlook of entomology is very limited and they confine themselves to the knowledge of pests only. It is unfortunate that the universities in India have neglected the teaching of pure entomology, the importance of which has been rightly emphasized in some of the more progressive countries. In the United States of America, to quote Professor Faure (1933, p. 2) 'Most of the leaders in university teaching seem to be convinced that the best approach to entomology is through pure science rather than applied agriculture. They recognize that an entomologist sent out soon after graduation on extension work may find himself handicapped in gaining the confidence of the farmer if he lacks a knowledge of the farm practices obtaining in the locality, but they maintain that it is comparatively easy for a university graduate to acquire sufficient knowledge of agriculture for his purpose. On the other hand, most graduates in entomology are employed in research rather than in extension teaching, and it is essential for the research worker to have a good foundation in the basic sciences.

In some universities the department of entomology forms part of both the agriculture and pure science faculties, but the tendency seems to be to emphasize the science side rather than the agricultural side. An interesting feature of the work in several universities, such as Minnesota and Iowa State College, is the close association of zoology and entomology; in some cases both subjects are handled by the same department, in others the

two departments work together in intimate coöperation to their mutual advantage.'

It is now fully recognised that for the purpose of achieving any success in applied work in entomology a mere knowledge of one branch of entomology is not enough, but a comprehensive understanding of entomology and other allied sciences is necessary, as nobody knows what particular line of attack on harmful insects will bear fruitful results. To waste time and money on those lines of attacks on insects, which in view of our previous knowledge of allied sciences would have been futile, is not a wise policy. In the past the training extending over a year or two given to students along with other subjects, left them extremely ill-equipped. They may be very good in one or two branches of entomology but their unfamiliarity with other allied branches has made them poor entomologists and consequently of little utilitarian value in solving the pressing insect problems of the country. The Indian Plague Commissioners working for seven years (1905-1912) in India failed, in spite of their efforts, to explain why certain large areas in India are comparatively free from plague and others having similar ecological conditions are not. The reason was found out by Hirst, who submitted a collection of fleas from two plague-free cities of Madras and Colombo to the late Hon'ble N. C. Rothschild. He determined these fleas to be different from *Xenopsylla cheopis*, which is the most efficient vector of plague bacilli, and they belonged to a new species *Xenopsylla astia* which later on was experimentally proved to be an inefficient vector of plague bacilli. Thus a pure systematic entomologist was able to solve a problem of great economic importance, which the applied entomologists with enormous funds at their disposal could not do within a period of seven years. Mis-identification of species have often hampered the work of applied entomologists.

The teaching of entomology has been separated from that of zoology in most of the important universities of England and America. In the universities of Cambridge, Oxford and London there are separate departments of entomology with separate teachers. In America, to quote Faure once again, 'In recent years there has been great expansion of entomological activities in the United States, with the result that the "old timer" who last visited the country in 1913 finds himself almost bewildered by the large departments and extensive developments encountered today. Universities that one had hardly heard about in entomological circles in 1913 now have four or five professors of entomology, and perhaps twenty or twenty-five post-graduate students, all actively engaged in research. And in general the growth in buildings and equipment seems to have kept pace with the growth in staff and in student numbers.' The problem of unemployment amongst university graduates in zoology in India can be solved to some extent by introducing entomology as a separate subject for post-graduate teaching in the universities. This will give an opportunity to unemployed graduates to do research in different aspects of entomology, which, if financed by the Imperial Council of Agricultural, Research and the Indian Research Fund Association, will go a long

way to improve agriculture and the health of the people in India, and at the same time give opportunities for work to graduates trained in entomology. Rather than spend their time in idleness, the students will continue their studies in the hope that higher qualifications will improve their chances of getting work.

Another reason for the separation of entomology from zoology is that in some of the Indian universities the teachers of zoology having never done entomology as a special subject themselves, neglect entomology altogether, and hardly any lectures are delivered on entomology to the post-graduate students of zoology. Even insect-types which are prescribed for the under-graduates are either not taught or wrongly taught from old books on zoology in which old and wrong terminology is used. Taking the instance of the cockroach which is taught both in the Intermediate and B.Sc. classes, the frons in the head is wrongly described as the clypeus and the latter structure is described as the labrum in almost all the text-books on zoology. The description of the mosquito given in the text-books on zoology, which is also taught to the under-graduate classes is hopelessly inadequate and wrong; though excellent papers on the morphology of the mosquito were published as early as 1901 and 1902 by Nuttall and Shipley, and in 1907 and 1908 by Imms. Such an indifferent attitude taken by university teachers in zoology towards entomology and the stepmotherly treatment given to pure entomology by agricultural entomologists in our country cannot, I am afraid, further the cause of pure entomology; therefore we should adopt the same method of teaching which has been found useful in the advanced countries of Europe and America.

Pure entomology is a very progressive science and our concept of insect morphology and other branches of entomology has gone far ahead of that of zoology during the past thirty years, and the whole subject has become so vast that it demands an intensive study of its generalised principles extended over a period of at least two years. Without adequate fundamental knowledge of the pure science of entomology no tangible progress is possible in applied entomology.

The quality of research work, which usually suffers for lack of thorough acquaintance with the subject and modern research methods —and thorough acquaintance cannot be imparted in a year or so— will undoubtedly improve when the course of teaching entomology is extended over four years, or exclusively over two years, as suggested above.

Entomologists trained on the above-mentioned lines in the Indian universities, if given a chance to carry on their work for two years in any one of the institutions like the Imperial Agricultural Research Institute, New Delhi, Imperial Veterinary Research Institute, Muktesar, Forest Research Institute, Dehra Dun, Haffkine Institute, Parel, Bombay, or School of Tropical Medicine and Hygiene, Calcutta, can take the PH.D. degree from their respective universities, and a certificate or diploma for advanced work in applied entomology from the institutes in which they would work. Such trained entomologists would be an asset to the country and would

contribute a good deal to protect us against our insect enemies in our different walks of life.

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MEDICINAL AND POISONOUS PLANTS OF INDIA: *WATERLILIES, POPPYWORTS, FUMITORIES.*

BY

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I.

The NYMPHAEACEÆ are aquatic perennial herbs, with a submerged rhizome. Several members of this family were venerated by the ancients, not only for the magnificence of their flowers and leaves, carpeting the surface of the tranquil waters, but also on account of their utility. Their young rootstocks contain an abundance of starchy, mucilaginous, and sugary matters, which render them nutritive. The flowers, which have a peculiar scent like brandy, are narcotic. The seeds, filled with a floury albumen, are edible. The family consists of 8 genera and 50 species inhabiting the temperate and tropical regions of the globe.

The medicinal waterlilies of the world belong to 5 genera:—BRASENIA (cosmopolitan, except in Europe); EURYALE (south-eastern Asia); NELUMBO (Pennsylvania to Colombia; Asia and Australia); NUPHAR (northern temperate and cold regions); NYMPHAEA (tropical and temperate regions). The genus NUPHAR is not represented in India.

A.	Sepals and petals 3 each. Carpels free. Ovules few ...	BRASENIA.
B.	Sepals 4-6; petals and stamens indefinite. Carpels confluent with one another or with the disk into one ovary; ovules many.	
	1. Sepals, petals and stamens half-superior, inserted on the disk which is confluent with the carpels ...	NYMPHAEA.
	2. Sepals, petals and stamens superior. Carpels sunk in the torus	EURYALE.
C.	Sepals 4-5; petals and stamens indefinite. Carpels irregularly scattered, sunk in pits of the turbinate disk ...	NELUMBO.

Nupharine, an amorphous physiologically inactive alkaloid of unknown constitution, has been isolated from the fresh rhizome of *Nuphar luteum* Sibth. & Sm. The seeds of this same plant contain nuphar-tannic acid. The amino-acid, l-asparagin, has been obtained from *Nelumbo nucifera* Gaertn.

BRASENIA.

The only species, **B. Schreberi** J. F. Gmel., is cosmopolitan, except in Europe. In India it is to be found in Bhutan at an altitude of 6,000 feet, and in the Khasia Hills at 4,500 feet.

The leaves are astringent, and have been used in phthisis and dysentery in North America.

In Indo-China the stems and leaves are ground and applied to boils and abscesses. The seeds, in decoction form, allay thirst, neutralise the effects of certain poisons, strengthen the gums; they are considered cooling, digestive, and anti-dysenteric.

China: Ch'un, Shui K'uei, Shun—; *Indo-China*: Chuyen—; *Malaya*: Sooi kwai—; *North America*: Frog-leaf, Water-leaf, Water-lily, Water-shield, Water-target—.

EURYALE.

The only species, **E. ferox** Salisb., extends from Kashmir to Oudh and Eastern Bengal, and thence to China.

The seeds are much used for their tonic, astringent, and deobstruent properties.

In China an infusion of the seeds is used for ear-ache, and an infusion of the leaves is given after a painful delivery.

Bengal: Makhana—; *China*: Ch'ien Shih—; *English*: Foxnut—; *Hindi*: Machana, Makhana—; *Indo-China*: Ke dau, Khiem—; *Malaya*: Siew sat—; *Persian*: Mukareh, Mukhareh—; *Punjab*: Jewar—; *Sanskrit*: Makhanna, Padma—; *Telugu*: Mellunipadmanu—; *Urdu*: Makhana—; *Uriya*: Kunta-padma—.

NELUMBO.

The only Asiatic species, **N. nucifera** Gaertn. (=*Nelumbium speciosum* Willd.), extends from Persia eastwards to Australia, and is to be found throughout the warmer parts of India.

The plant is used medicinally all over the East. Nearly every part has a distinct name and economic use, and supplies one or more drugs.

The powdered *root* is prescribed for piles as a demulcent; also for dysentery and dyspepsia. It is used as a paste in ringworm and other cutaneous affections.

In Ceylon an aqueous extract of the fresh rootstock of the white-flowered variety is given internally in doses of 1 to 4 ounces for the bites of snakes and tarantulas. It is said to be especially useful in the bites of the cobra.

The flour of the root is used as an arrowroot by the Chinese. It is given in diarrhœa and dysentery; and it is the base of a diet for infants.

The long white rhizomes resemble a string of sausages, each about a foot long and separated from the others by a constricting fibre. These constricting fibres are used medicinally in China and are credited with the property of restoring to health persons suffering from nervous exhaustion. Their special action is regarded as hæmostatic.

The large *leaves* are used as cool bedsheets in high fever with heat and burning of the skin. The milky viscid juice of the leaf and flower stalks is given in diarrhœa.

The *flowers* are used as an astringent in diarrhœa, also cholera, in fever and diseases of the liver; and are also recommended as a cardiac tonic. Koman found that a syrup of the dried flowers in half ounce doses was efficacious in curing mild cases of dysentery.

In the Tamil country the flowers are considered diuretic and cooling. Boiled in milk with an equal amount of flowers of *Eugenia Jambolana* to a pasty consistence, and made into boluses about the size of an areca nut, they are administered to women for false pains in the early months of pregnancy.

The dried red petals are used by the Chinese as a cosmetic application to the face to improve the complexion.

The *stamens* are considered astringent and cooling, useful in burning sensation of the body, bleeding piles and menorrhagia. In bleeding piles they are administered with honey and fresh butter, or with sugar.

The carefully dried and yellow fragrant stamens are an astringent and diuretic remedy in China, where they are also used as a cosmetic. In Tongking they are employed for flavouring and improving the appearance of tea.

The *seeds* are used to check vomiting, and are given to children as a diuretic and refrigerant. They form a cooling medicine for cutaneous diseases and leprosy, and are considered an antidote for poisons.

In China the seeds, roasted and divested of their shells are a favourite article for dessert. Boiled and ground into flour the kernels form a valuable food and medicine, and are considered a general tonic recommended in diarrhœa, spermatorrhœa and erotic dreams.

The *plumule*, caulicle, or germinating embryo of the ripe seed is given in China to reduce high fever, and is said to be useful in the treatment of cholera, hæmoptysis and spermatorrhœa.

A sherbet of the plant is used as a refrigerant in small-pox, and is said to stop eruption; it is also used in all eruptive fevers.

Caius and Mhaskar have reported that no part of the plant is an antidote to either snake or scorpion venom.

Annam: Lien hoa, Sen—; *Arabic*: Karambe-ul-ma, Nilufer, Uss-ul-nilufer—; *Australia*: Aquaie, Pink Water-lily, Sacred Lotus—; *Bengal*: Kombol, Komol, Padama, Padma, Pudmapodu—; *Bijnor*: Besenda—; *Bombay*: Kamala, Kankadi—; *Burma*: Padung ma—; *Cambodia*: Chhuk—; *Canarese*: Kamala, Tavaribija, Tavarigadde—; *China*: Hoa Lien, Lien, Lien Jou, Lien Ou—; *Deccan*: Kungvel—; *English*: Chinese Water-lily, Egyptian Bean, Indian Lotus, Pythagorean Bean, Sacred Lotus—; *French*: Fève d' Egypte, Lis rose du Nil, Lotus sacré, Nénuphar de la Chine—; *Gujerati*: Suriyakamal—; *Hasada*: Kombolba, Upalba—; *Hindi*: Ambuj, Bhe, Kamal, Kanval, Kanwal Kakri, Kaul, Lalkamal, Padam, Padma—; *Ilocano*: Sucao—; *Khandesh*: Dudhamalidakand—; *Konkani*: Salloc—; *Malay*: Seroja, Teratai—; *Malayalam*: Bemtamara, Tamar—; *Marathi*: Kamal—; *Muzaffarnagar*: Pabbin—; *Persian*: Baklakoobtee, Beykhne-el-ufer, Nelofir, Nilufer, Nilufu—; *Poona*: Pandkanda—; *Pondicherry*: Nénuphar—; *Porebunder*: Motunkamal—; *Portuguese*: Flor de loto, Nenuphar—; *Punjab*: Bhen, Kanwalkakri, Pamposh, Pamposh kammal—; *Sanskrit*: Abja, Ambhoja, Ambhoruha, Ambuja, Ambujanma, Ambupadma, Amburoha, Amlana, Arvinda, Asyapatra, Bisakusuma, Bisaprasuna, Drishopadma, Harivetra, Indiralaya, Jalajanma, Kamala, Kawar, Kunja, Kusheshaya, Kutapa, Mahapadma, Mahotpala, Nala, Nalika, Nalina, Padma, Pankaja, Pankeruha, Pathoja, Pundarika, Pushkara, Putaka, Rajiva, Sahsrapatra, Sarojanma, Saroruha, Sarsija, Sarsiruha, Sharada, Sharapadma, Shatapatra, Shri, Shriparna, Shrivasa, Shuklapadma, Sitambuja, Sujala, Tumarasa, Vanashobhana, Varisoha—; *Sind*: Pabban—; *Sinhalese*: Nelumbo, Nelum—; *Tagalog*: Baino, Bayno—; *Tamil*: Ambal, Sivapputamarai, Tamarai—; *Telugu*: Kalung, Erratamara, Tamara—; *Urdu*: Nilufer—; *Uriya*: Padam—.

NYMPHAEA.

The genus consists of 40 tropical and temperate species.

Acrid, astringent, demulcent and diaphoretic properties are attributed to this genus.

The following species are used medicinally in Europe—*N. alba* Linn.—; in Egypt—*N. caerulea* Sav., *N. Lotus* Linn.—; in Nigeria, Sierra Leone, Senegal—*N. Lotus* Linn.—; in Guinea—*N. caerulea* Sav., *N. stellata* Willd.—; in Madagascar—*N. stellata* Willd.—; in China—*N. alba* Linn.—; in Indo-China—*N. alba* Linn., *N. stellata* Willd., *N. tetragona* Giorgi—; in North America—*N. alba* Linn., *N. polysepala* (Engelm.) Greene, *N. odorata* Ait.—.

Four species are used medicinally in India: *alba, pubescens, rubra, stellata.*

A.	Flowers white, about 5-11.2 cm. diam.	1. *N. alba.*
B.	Flowers red, pale rose or white, 7.5-20 cm. across ...	2. *N. rubra.*
C.	Like *rubra* but leaves more densely pubescent beneath. Flowers smaller, 7.5-10 cm. across	3. *N. pubescens.*
D.	Flowers usually pale violet, less commonly blue or purple, 7.5-15 cm. diam.	4. *N. stellata.*

1. **Nymphaea alba** Linn. occurs in Kashmir, Siberia and Europe.

The mucilaginous and somewhat acrid root and stock are administered in some countries for dysentery. It is an astringent and slightly narcotic medicine, which is reputed to have aphrodisiac properties. In some parts of England the juice is made into an ointment to stimulate the scalp so as to prevent falling out of the hair.

The flowers are reputed to be anti-aphrodisiac, and to have cooling and astringent properties. They are given in Persia for fevers and chest troubles.

An infusion of the flower and fruit is administered in diarrhœa, and as a diaphoretic.

Akwapim: Ntanowa—; *Annam*: Kien thiet—; *Arabic*: Nilufar—; *Bombay*: Pandharenkamal—; *Catalan*: Cadells, Escudet, Escut de riu, Ninifa, Platis-giradors—; *China*: Hung Pai, Lien Hua—; *Danish*: Soeblomster—; *Dutch*: Witte Zeebloem—; *English*: Flatter-dock, Lotus-lily, Nenuphar, Water-rose, White Water-lily—; *French*: Baratte, Blanc d'eau, Burette, Crugeon, Herbe aux plateaux, Lis d'eau, Lis d'étang, Lis des étangs, Lune d'eau, Lunette, d'eau, Nénuphar blanc, Grand nénuphar, Nymphe, Plateau à fleurs blanches, Pyrote, Volant d'eau, Volet, Volet blanc—; *Ga*: Tertermantrer—; *German*: Wasser Lilie, Wasserrose, Weisse Seeblume, Weisse Seerose—; *Greek*: Nymphaia, Sidi—; *Hausa*: Bado—; *Hindi*: Nilofar—; *Indo-China*: Bach lien tu, Hat sen trang—; *Irish*: Duilleoghuidhebhaitighe—; *Italian*: Carfano, Nenufaro bianco, Ninfea, Papeo—; *Kashmir*: Brimposh, Kamud, Nilofar—; *North America*: White Pond Lily, White Water Lily—; *Persian*: Nilufar—; *Polish*: Grzybienie, Wodna lilia—; *Portuguese*: Niniphea branca—; *Punjab*: Kammian—; *Roumanian*: Plumiera alba, Plumuna alba, Pluta, Nufar alb, Titva de apa—; *Russian*: Kubishka, Wodanoi lelei—; *Spanish*: Escudete de rio, Higos de rio, Nenufar blanco, Ninfea blanca—; *Swedish*: Sjoebad—; *Teheran*: Nilafar—.

2. **Nymphaea rubra** Roxb. is common throughout India in the warmer parts.

The powdered rootstock is given in dyspepsia, diarrhœa and piles.

A decoction of the flowers is prescribed in palpitation of the heart.

The flower is much used by Ayurveda practitioners. They prescribe it to allay thirst, cough, and vomting. They use it as a cooling and antibilious medicine; as a blood purifier, a febrifuge, and an aphrodisiac.

Arabic: Nulufar—; *Bengal*: Buroruktokumbal, Chotasundi, Nal, Raktakambal, Saluk, Shaluk—; *Burma*: Kiyani, Kyahphyu—; *Canarese*: Bilitavarai, Nyadalehuvu—; *Deccan*: Alliphul—; *Gujerat*: Kanval, Nilophal—; *Hasada*: Kombolba, Upalba—; *Hindi*: Chotakanval, Kanval, Raktachandana—; *Malayalam*: Ampala—; *Marathi*: Lalakamal, Raktakamal—; *Orissa*: Dhabalakain, Rangkain—; *Persian*: Nilufar—; *Sanskrit*: Alagandha, Alipriya, Alohita, Alpapatra, Aravinda, Arunakamala, Bhadra, Charunalaka, Hallaka, Indivara, Kalharamu, Kamala, Kokanada, Krishnakanda, Kumuda, Kuvalaya, Nilotpala, Raktakairava, Raktakalhara, Raktakamala, Raktakumuda, Raktambhoja, Raktasandhyaka, Raktasaroruha, Raktavarija, Raktavarna, Raktotpala, Ravipriya, Rochana, Sandhyaka, Shonapadma, Somakhya—; *Sind*: Kuni, Puni—; *Sinhalese*: Olu, Otu—; *Tamil*: Allitamarai, Ambal—; *Telugu*: Allitamara, Errakaluva, Kalharamu, Koteka, Tellakalava—.

3. **Nymphaea pubescens** Willd. is found all over India in the warmer parts.

The powdered root is prescribed for piles as a demulcent; also for dysentery and dyspepsia.

The flowers are astringent and cardiotonic.

Bengal: Burro, Shaluk—; *Bombay*: Kummul—; *Hindi*: Bombhur, Kawal zutto—; *Madras*: Alli—; *Persian*: Nelofir—; *Sind*: Koonce—.

4. **Nymphaea stellata** Willd. inhabits the warmer parts of India, and extends to tropical Asia and Africa.

In India the plant is used in the same ways and for the same purposes as *N. rubra*. It is moreover much employed to stimulate and promote the growth of the hair.

In Indo-China the seeds are considered a powerful stomachic and restorative.

In Cambodia the maceration of the leaves is used as a lotion in eruptive fevers. In Madagascar the leaves are applied topically in erysipelas.

In Guinea the infusion of the roots and the stems is considered emollient and diuretic; it is taken against blennorrhagia and diseases of the urinary tract. A decoction of the flowers is considered narcotic and antiaphrodisiac.

Bengal: Chotashaluk, Nilpodma, Nilsaphala, Nilsapla, Sundhi—; *Bijnor*: Bambher—; *Bombay*: Upliakamal—; *Burma*: Kyanyu—; *Cambodia*: Pralit—; *Ceyon*: Niltelolu, Katutelolu, Sudatelolu—; *English*: Blue Water-lily—; *Gujerati*: Nilkamal—; *Hindi*: Bambher, Bhengt, Lilophal, Nilkamal, Nilophal, Nilpadma—; *Hova*: Betsimihilana, Tantama, Tsiazonafo, Voahirana—; *Imerina*: Voalefoka—; *Indo-China*: Cu sung nho, Khiem tuc—; *Jodhpur*: Be—; *Madras*: Karunaydel, Nilotpalam—; *Malay*: Ati-ati payah, Kelipoh, Teratai Kechil—; *Malayalam*: Sitambel—; *Malinke*: Kuludion, Kulukulu—; *Marathi*: Krishnakamal, Poyani—; *Porebunder*: Kalakamal, Kamal, Kumtan—; *Sakalave*: Tatamo—; *Sanskrit*: Asitotpala, Indiwar, Kandota, Kandotha, Kuvalaya, Mridutpala, Nilakamala, Nilaliya, Nilambujanma, Nilapadma, Nilapatra, Nilotpala, Nilpankaja, Nilpatraka, Saugandhika, Utpala, Utpalaka—; *Sinhalese*: Manel, Monch, Nilupul—; *South Africa*: Water-lily—; *Tagalog*: Lauas—; *Telugu*: Nitikulava—; *Uriya*: Subaikain—; *Zulu*: Izibo—.

II.

The PAPAVERACEÆ inhabit the temperate and subtropical regions of the northern hemisphere; but few are met with in the tropics or southern hemisphere. Some species are now dispersed over cultivated ground throughout the world. The family consists of 28 genera and 600 species—annual or perennial herbs, rarely shrubs or small trees.

The members of this Order have sedative, narcotic, stupefying, at times caustic and rubefacient, properties. The seeds are oleaginous, some emetic and cathartic.

The following substances are among the products isolated:—(1) *alkaloids*—α and β—allocryptopines, aporeidine, aporeine, berberine, chelerythrine, chelidonine, homochelidonine, codamine, codeine, cryptopine, dicentrine, glaucidine, glaucine, gnoscopine, lanthopine, laudanidine, laudanine, laudanosine, meconidine, morphine, pseudomorphine, narceine, narcotine, neopine, oxynarcotine, papaveramine, papaverine, protopapaverine, pseudopapaverine, protopine, rheadine, sanguinarine, thebaine, isothebaine, tritopine—: (2) *bitter substances* —chelidoxanthin, glaucopicrin, papaverosin—; (3) *acids*—erratic, fumaric, meconic, rhoeadinic, sulphuric thebolactic—; (4) *fixed oils*; (5) *dyes*; (6) *gums, resins, starch, mucilage*; (7) *neutral principles*—meconin, meconoisin, opionin—; (8) *glucose sugar*; (9) *cyanogenetic glucosides*.

The medicinal and poisonous poppyworts of the world belong to 10 genera:—ARGEMONE (tropical America); BOCCONIA (warm America; West Indies); CHELIDONIUM (Europe; Asia Minor); ESCHSCHOLZIA (Pacific North America); GLAUCIUM (Europe; Asia); HYPECOUM (Mediterranean; Central Asia); MECONOPSIS (northern temperate regions); PAPAVER (Europe, Asia, America, South Africa, Australia); ROMNEYA (California); SANGUINARIA (Atlantic North America).

The medicinal and poisonous poppies of India belong to four genera: ARGEMONE, HYPECOUM, MECONOPSIS, PAPAVER.

A. Capsule usually short, opening by short valves or pores
   1. Stigmas 4 or more, radiating on a sessile disk ... PAPAVER.
   2. Stigmas 4-6, radiating from the top of a depressed style ... ARGEMONE.
   3. Stigmas 4-6, decurrent on the top of the style ... MECONOPSIS.

B. Capsule slender, transversely septate within, breaking up into joints or longitudinally 2-valved ... ... HYPECOUM.

ARGEMONE.

The genus includes 12 species, natives of Tropical America.

A. alba Lestib. is used medicinally in North America, and *A. mexicana* Linn. is so used in every country where it is found growing.

Argemone mexicana Linn., indigenous in tropical America, was introduced in India where it has become naturalized, and where it may be found throughout up to an altitude of 5,000 feet.

Far from being treated as a foreigner the plant occupies a very honourable place in the Materia Medica of both Hindus and Mahommedans. Hakims and vaids are at one in their encomium of this valuable medicinal herb.

The root is an alterative. The Hausas in Nigeria use an infusion of it as a wash for drummers who have to sustain their vigour through an all-night play. Among the Yorubas the root is chiefly used as a children's remedy, as a wash, or worn as a charm, or by fumigation in holding the head over a steaming pot containing this along with other medicines; also as an infusion taken internally by a child who is fretful or frightened at night. Women too are given an infusion to drink at the commencement of the pains of parturition.

The use of the root is attended with benefit in some chronic cases of skin diseases. In La Reunion it is given as a decoction in blennorrhagia; and in French Guiana this same decoction is prescribed for vesicular calculus. In French Guinea the decoction is used as an eye-wash and lotion for inflammatory swellings; also as a mouth-wash for tooth-ache, and taken internally for gleet.

In Gold Coast the pulverised root mixed with onions and applied to the guinea-worm sore is said to be effective in extracting the worm.

In La Reunion and in French Guinea the stem is considered diuretic; a decoction of it is prescribed for vesicular calculus in French Guiana.

The Mandingos of the Gambia use an infusion of the leaves for coughs.

In French Guiana the flowers are considered narcotic. The honey made by bees which visit this flower is said by the Hausas to make men mad.

The latex has slight corrosive properties, and is applied to warts, chancres, etc.

The seeds are laxative, emetic, nauseant, expectorant and demulcent. They are useful in cough and catarrhal affections of the throat and pulmonary mucous membrane, and in pertussis and asthma. Though they do not appear to possess any anti-spasmodic property, they have a distinct control over asthma, apparently from their combined actions of nauseant, emetic, expectorant and demulcent. As their use is often accompanied by more or less vomiting and nausea, they are as a laxative medicine more suited to some pulmonary affections than to other diseases.

In Mexico the seeds are considered an antidote to snake venom. In French Guiana they are used as a cathartic and an emetic.

The smoke from the burning seeds is used in Delhi to relieve tooth-ache; it is also said to be useful in caries of the teeth.

The seeds yield on expression a fixed oil, which has long been in use amongst West India and West Africa practitioners as an aperient. Applied to herpetic and other forms of skin disease, it is reported to exercise a well-marked soothing influence. It is serviceable in some cases in which jalap, rhubarb and castor-oil are indicated, and also in some bronchial and catarrhal affections. In Delhi and in Sind the oil is applied to indolent ulcers and eruptions, also as an external application for headaches.

The yellow juice of this plant is used as a medicine for dropsy, jaundice, and cutaneous affections. It is also diuretic, relieves blisters, and heals excoriations and indolent ulcers. It is held in

much esteem as a local application to indolent and ill-conditioned ulcers. It is also used as an external application to the eyelid in conjunctivitis. In the Konkan, the juice with milk is given in leprosy.

In Jodhpur the yellow juice is used in eye affections and rubbed on the body to relieve rheumatic pain. In the West Indies it is reported to be used as a substitute for ipecacuanha.

The seeds are not an antidote to snake venom (Mhaskar and Caius).

The alkaloids of *A. mexicana* have been correctly identified as berberine and protopine (A. C. Santos and P. Adkilen; *Journ. Am. Chem. Soc.*, July 1932).

Annam: Ca gai—; *Arabic*: Bagel—; *Ashanti*: Akusiribie, Kokosekiyatuduru —; *Bengal*: Baroshialkanta, Karikanta, Shialakontha, Shialkanta, Siakanta, Siyalkanta—; *Brazil*: Cardo santo—; *Burma*: Khyaa—; *Canarese*: Balurakkisa, Datturi, Datturi-gidda, Mulludaturi, Parangidatturi—; *Cape Peninsula*: Bathurst Burweed, Steekbossie—; *Chinese*: Lao Chou Li—; *Colombia*: Cardosanto—; *Deccan*: Bharamdandi, Daruri, Farangidhatura, Pila, Piladhatura—; *English*: Gamboge Thistle, Jamaica Yellow Thistle, Mexican Poppy, Prickly Poppy, Yellow Mexican Poppy—; *Falor*: Bidjor—; *French*: Chardon bénit des Antilles, Figuier infernal, Pavot épineux, Pavot massue, Pavot du Mexique, Tache de l'oeil—; *French Guiana*: Argémone—; *Fulani*: Nyie gilangeru—; *German*: Mexicanische Argemone, Stachelmohn—; *Gujerat*: Darudi—; *Hasada*: Rangainijanum—; *Hausa*: Hakorin kada, Ka ki ruwan Allah, Kamukamu, Kankama, Kankamarka ta bi ka, Kaya geiva, Kurar fatake, Ya ki ruwan Allah—; *Hindi*: Bharbhand, Biladhutura, Brahmadundi, Brahmi, Farangidhutura, Kutaila, Kutila, Satiyanashi, Shialkanta, Suchianas, Ujarkanta—; *Ilocano*: Cachumba, Chicalote, Casubangaso, Casubhangaso—; *Indo-China*: Lao thu lac—; *Jodhpur*: Sattiyanasi—; *Kano*: Kwarko, Kwarkoro, Wagiri—; *Kathiawar*: Darudi—; *Katsina*: Karanko, Kwarakko, Kwaranko—; *Kolami*: Karikanta, Siyalkanta—; *Konkani*: Firingidutro, Redonoxi—; *La Reunion*: Chardon—; *Malayalam*: Brahmadanti—; *Malinke*: Ba, Guame-moni—; *Mandingo*: Tombong suma—; *Marathi*: Daruri, Firangidhotra, Kantedhotra, Kontedhotra, Pinvaladhotra—; *Mexico*: Cardo santo, Chicalotl, Figo del inferno—; *Mundari*: Bakulajanum—; *North America*: Jamaica Yellow Thistle, Mexican Poppy, Mexican Prickly Poppy, Thorn Poppy, Yellow Poppy-thistle—; *North-West Africa*: Devil's Fig, Golden Thistle of Peru, Mexican Poppy, Prickly Poppy—; *North-Western Provinces*: Bharbhurwa, Kantela, Karwah—; *Oudh*: Karwah—; *Portuguese*: Figo do inferno—; *Punjab*: Bhatkateya, Bhatmil, Bherband, Kandiari, Katsi, Satyanasa, Sialkanta—; *Sanskrit*: Brahmadandi, Bramhi, Hemadugdha, Hemashikha, Hemavati, Hemavha, Kanchanakehiri, Kanchani, Karhini, Katuparni, Kshirini, Patuparni, Pitapushpa, Rukmini, Srigalakanta, Suvarna, Svarnadagdha, Svarna-Kshiri, Svarnavha, Tiktadugdha, Yavuchincha—; *Santali*: Gokulapanum—; *Sinaloa*: Cardo, Chicalote—; *Sokoto*: Boginahi—; *Spanish*: Adormidera espinosa, Cardo santo, Fico del inferno, Figo del inferno—; *Suto*: Nthswantsane, Sehlohlo-se-seholo—; *Tagalog*: Diluario, Duluario—; *Tamil*: Bramadandu, Bramarayakash, Kurukkum—; *Telugu*: Brahmadandi— *Twi*: Anansemmenyan—; *Urdu*: Baramdandi—; *Uriya*: Dengbejari, Kantakusham, Sarpuni—; *Wolof*: Homhom bu djiguen, Hompay bu djiguen—; *Yoruba*: Akawn-ekkun, Egunarigbo, Ekan-chun, Kada ka taba yaro—.

HYPECOUM.

The genus includes 18 species of the Mediterranean region, distributed to Western and Central Asia.

1. Exterior petals elliptico-rhomboid, entire. Lobes of leaves linear-awl-shaped ... ... *H. pendulum.*
2. Exterior petals trilobed. Lobes of leaves linear-lanceolate or lanceolate, acute, mostly entire ... ... *H. procumbens.*

1. **Hypecoum pendulum** Linn. is found in Waziristan and Baluchistan, and extends to the Mediterranean region and the south of Europe.

An extract is used as a cooling drink by the Waziris.

Waziri: Margaypal, Zirgulaki—.

2. **Hypecoum procumbens** Linn. occurs in Peshawar, Multan, the Salt Range, and Baluchistan. It spreads over Western Asia as far as the Mediterranean region.

The juice has the same effect as opium. The leaves act as diaphoretic.

In Bavaria the plant is used as a tonic, aperient, and suborific.

English: Horned Cumin—; *Italian*: Cornacchina de grani, Cornacchina verdemare—; *Malta*: Cornacchina, Karn il Moghza—.

Meconopsis.

The genus includes 30 species of the northern temperate region.

1. Radical leaves linear-oblong or lanceolate, remotely and irregularly pinnatifid-lobed ... ... 1. *M. aculeata.*
2. Radical leaves pinnatipartite ... ... 2. *M. napaulensis.*

I. **Meconopsis aculeata** Royle occurs in Kashmir, Garhwal and Kumaon ascending up to 11,000-15,000 feet.

The plant, especially the root, is considered narcotic and poisonous.

Jhelum: Guddikum—; *Kumaon*: Kanda—; *Ravi*: Gudi—; *Simla*: Kanta—; *Sutlej*: Kanada—.

2. **Meconopsis napaulensis** DC. is found at 9,000-10,000 feet in Nepal, Sikkim and Bhutan, whence it extends to Sze-chuan.

The root is used as a narcotic.

Papaver.

The genus numbers 110 species scattered over Europe, Asia, Australia, America, and South Africa.

The flowers and flower heads are sedative; the milky juice is narcotic, sometimes caustic. Every species of poppy yields opium to a greater or less extent.

The following are used medicinally:—in Europe—*P. alpinum* Linn., *P. Argemone* Linn., *P. dubium* Linn., *P. hybridum* Linn., *P. somniferum* Linn.—; in Indo China—*P. somniferum* Linn.

A. Leaves 5-10 cm., all radical, obovate or oblong, pinnatifid. Flowers orange-yellow. Capsule obovoid, hispid. 7. *P. nudicaule.*

B. Leaves 2-3-pinnatifid. Flowers 2.5-5 cm. diam., scarlet with a black disk. Capsule 13 mm. long, subglobose, hispid. Stigma convex, rays 4-8 ... ... 4. *P. hybridum.*

C. Leaves 1-2-pinnatifid. Flowers 7.5-10 cm. diam., scarlet; pairs of petals unequal. Capsule stalked. Stigma convex, rays 8-12 ... ... 1. *P. Rhoeas.*

D. Leaves 1-2-pinnatifid. Petals scarlet in unequal pairs. Capsule obovoid, glabrous, sessile. Stigma 6-12-rayed ... 2. *P. dubium*

E. Leaves oblong, amplexicaul, lobed, 2-serrate. Flower large, white, purple or scarlet. Capsule 2.5 cm. diam., stalked, globose, glabrous. Stigmatic rays 5-12 ... 5. *P. somniferum.*

F. Leaves bipinnatisect with acute lobes. Petals pale scarlet. Capsule oblong-elliptical, sparingly beset with weak straight bristles ... ... 3. *P. Argemone.*

G. Leaves subcoriaceous, hispid on both sides, pinnatipartite. Flowers large, more than 10 cm. across. Petals 4-6, all scarlet or at the base with a black violaceous spot. Capsule glabrous, glaucous, subglobose, about 2-3 cm. diam. Stigmatic rays 13-15 ... ... 6. *P. orientale.*

1. **Papaver Rhoeas** Linn. is grown in gardens in Gujerat and Northern India. It is common in Kashmir, Tibet, Western Asia, Europe, and North Africa.

There is little to be found in Indian works about this poppy. Ayurvedists credit it with the same properties as *P. somniferum.* Yunanists use the leaves and seeds as tonics in low fevers, and recommend the cooked roots for rheumatism.

Quoth Culpeper of English fame: 'A syrup is made of the seed and flowers, which is useful to give sleep and rest to invalids, and to stay catarrhs and defluxions of rheums from the head into the stomach and lungs, which causes a continual cough, the forerunner of consumption; it helps hoarseness of the throat, and loss of voice, which the oil of the seed does likewise. The black seed boiled in wine, and drunk, stays the flux of the belly, and women's courses. The poppy-heads are usually boiled in water, and given to procure rest and sleep; so do the leaves in the same manner; if the head and temples be bathed with the warm decoction, or with the oil, the green leaves or heads bruised, and applied with a little vinegar, or made into a poultice with barley-water, or hog's-grease, cools and tempers all inflammations, and St. Anthony's fire. It is generally used in treacle and mithridate, and in all other medicines that are made to procure sleep and rest, and to ease pains in the head as well as in other parts. It cools inflammations, and agues. It is put in hollow teeth, to ease the pain; it is also good for the gout'.

Robert Turner says 'how excellent is that flower in diseases of the pleurisie with similar surfeits hath been sufficiently experienced'. But Gerard writes: 'most men being led rather by false experiments than reason, commend the flower against the Pleurisie, giving to drink as soon as the pain comes, either the distilled water, or syrrup made by often infusing the leaves. And yet many times it happens, that the paine ceaseth by that meanes, though hardly sometimes'.

The petals are, no doubt, sudorific; and they have mild sedative properties.

The milk from the capsules has, in a weak form, the same properties as opium; it is used in France as a sedative.

In England the bruised leaves, if applied to a part which has been stung by a bee or a wasp, are said to give prompt relief.

A non-toxic alkaloid, rhoeadine, occurs in all parts of the plant.

Anglo-Saxon: Chebole, Chesebolle, Chybolle—; *Arabic*: Khashkhashulsuda, Nabatulkhashkhash—; *Bengal*: Lalposht—; *Bombay*: Janglimudrika—; *Burma*;

Bhainbinami, Bhinbinami—; *Canarese*: Kempugasgase, Kempukhasakhasi—; *Catalan*: Caputxins, Gallarets, Paparotes, Parama, Pipiripip, Quicaraguichs, Quiquiriquic, Roellas, Rosella, Ruella—; *Chinese*: Li Ch'un Ts'ao—; *Deccan*: Lalkhaskhas—; *Dutch*: Heul Klaproos, Kankerbloem, Kolbloem, Roode Koorenbloem, Wilde Heul Klaproos—; *Egypt*: Qarun, Zaghlil—; *English*: Bledewort, Blind Eyes, Blindy Buff, Blindy-buffs, Canker, Canker Rose, Cheesebowl, Cockrose, Cock's-comb, Collin-hood, Copper-rose, Cop Rose, Corn Flower, Corn Poppy, Corn Rose, Cuprose, Cusk Darnel, Ear-aches, Fireflout, Head Ache, Head Foppy, Head Wark, Joan Silverpin, Lightnings, Maws, Poison Poppy, Pope, Red Weed, Ridweed, Scarlet Poppy, Soldiers, Thunder Bolts, Yedwark—; *French*: Babiot, Babiou, Babot, Babou, Cornrose, Confanon, Coprose, Coq, Coq ponceau, Coquelicot, Coquelicot-pavot, Gravelotte, Gueringuingo, Mahon, Moine, Onder, Pavot coq, Pavot-coquelicot, Pavot des champs, Pavot rouge des champs, Pavot rouge sauvage, Ponceau, Rose de loup—; *German*: Ackerschnalle, Blatsblume, Blutmohn, Boschblume, Fallblume, Feldmangenblume, Feldmohn, Feldrose, Feuerblume, Feuermohn, Flattermohn, Flitschrose, Gaublume, Glatschen, Glatzenblume, Glitsche, Grimmagblume, Haferkrautblaum, Halsrose, Hirnschalblume, Hirnschnalz, Jammerblume, Juffer, Klapperrose, Klatschmohn, Klatschrose, Kohlrose, Kokeschblume, Koklico, Koleblume, Kornmohn, Rote Kornrose, Maagsamen, Makufken, Wilder Mohn, Paterblume, Pflappenrose, Pugerlitze, Schnallen, Schnellerblume, Windmohn—; *Greek*: Roias—; *Gujerat*: Lala, Lalkhaskhas—; *Hindi*: Lal, Lala, Lalpost, Post, Postekebija—; *Hungarian*: Mak—; *Italian*: Bambagella, Bubboline, Citole, Papavero selvatico, Papavero serchione, Rosolaccio, Scitole—; *Languedoc*: Graousella, Graouselle, Roalo, Rouzello—; *Malayalam*: Chovannakashakasha—; *Malta*: Corn Poppy, Poppy, Papavero, Rosolaccio, Pepprin—; *Marathi*: Tambadakhasakhasa—; *Persian*: Gulelalakebija, Khashkhashsiyah, Koknaresurkh—; *Polish*: Maczek—; *Portuguese*: Papoila, Papoila vermelha, Papoula—; *Roumanian*: Mac iepuresc, Mac rosiu, Paparoane, Paparuna—; *Russian*: Mak samosyika—; *Sanskrit*: Raktapostavrikshaha—; *Spanish*: Ababol, Adormidera silvestre, Amapola, Arabol—; *Tamil*: Siguppuppostaka, Sivappugashagasha—; *Telugu*: Erragassagassala, Errapostakaya—; *Turkish*: Gelincik—; *Urdu*: Gulelalakenija, Khashkhashsiyah—; *Waziri*: Kolejhdarai, Zirdgul—.

2. **Papaver dubium** Linn. is found in the Western Himalaya from Hazara to Kashmir and Garhwal. It extends to Afghanistan, Western Asia, Europe and North Africa.

The petals are sudorific.

Two alkaloids, aporeine and aporeidine, have been isolated from this plant. The former is described as a tetanising poison similar to thebaine.

English: Pale-red Poppy, Smooth long-headed Poppy—; *Malta*: Long-headed Poppy—; *Portuguese*: Dormideira, Papoula—.

3. **Papaver Argemone** Linn. is indigenous in Europe in the Mediterranean region. It is cultivated in Indian gardens.

In Spain an infusion or a syrup of the petals is much esteemed as a sudorific.

English: Rough-headed Poppy, Rough long-headed Poppy—.

4. **Papaver hybridum** Linn. occurs in the Punjab in the Jhelum Valley. It is distributed over Central and Western Asia, Europe, and North Africa.

The petals are diaphoretic.

The species contains the non-toxic alkaloid rhoeadine and another base.

Egypt: Abunnom, Aul el num—; *English*: Rough-headed Poppy, Rough round-headed Poppy—; *Malta*: Rough Poppy, Pepprin—.

5. **Papaver somniferum** Linn. is cultivated in the warm and temperate regions of Asia, Europe and North Africa. It is doubtful whether the plant has ever been found wild. In India it is grown here and there throughout the country. In France a form is specially grown on account of its oil-yielding seed.

Opium, the inspissated juice obtained by incision from the immature capsule, is well known for its therapeutic and poisonous properties, and is official in all Pharmacopoeias.

The seeds are used medicinally in Jodhpur, and the capsules are soaked in water which, after being strained, is taken as an intoxicant.

In Indo-China the roasted seeds are considered tonic.

Poppy heads are used in China for diarrhoea, dysentery, and all kinds of fluxes. The seeds ground in cold water are given in diarrhoea and dysentery.

A weak decoction of the dried capsule is good for those complaints which require sedatives, and native practitioners in India administer it as a restrainer in bowel troubles. In Europe, however, the decoction is not given internally, but is employed as an external application to allay pain and soothe.

In Europe syrup of poppy is still often employed to allay cough and likewise as an opiate for children. This syrup is prepared from the capsules. Another syrup, made of the leaves and flowers, is also used in pleurisy and erisypelas.

The green leaves, the fresh flowers, the crushed capsules are all made into various ointments, or used as such for poulticing.

Opium, in combination with other drugs, is recommended for the treatment of snake bite and scropion sting. Caius and Mhaskar have proved experimentally that the drug is not an antidote to snake venom, and is useless in the treatment of scorpion sting.

Arabic : Abunom, Afiun, Bizrulkhashkhash, Khashkhashulbaiza, Khish khash, Qishrulkhashkhash—; *Bengal* : Pasto, Post—; *Bombay* : Aphim, Appo, Khaskhas, Post—; *Burma* : Bhain, Bhainzi—; *Canarese* : Afim, Biligasgase, Gasagase, Khasakhasi—; *Catalan* : Cascall Pintacogues—; *Chinese* : Ying Tzu Su—; *Danish* : Valmue—; *Deccan* : Afim, Khashkhash—; *Dutch* : Heul, Slaapruid—; *Egypt* : Abun-nom, Shikh-shakh—; *English* : Bale-wort, Carnation Poppy, Joan Silverpin, Opium Poppy, Peony Poppy, White Garden-poppy, White Poppy—; *French* : Pavot, Pavot blanc, Pavot des jardins, Pavot à opium, Pavot somnifère—; *German* : Mohn, Saatmohn, Schlafmohn—; *Greek* : Agria, Milkon hymeros—; *Gujerat* : Aphina, Khuskhus, Posta—; *Hamadan* : Khash-khash—; *Hindi* : Afin, Afyun, Kashkash, Pest, Post, Potekebija—; *Indo-China* : A phien, A phu dung, Co tu tuc—; *Italian* : Papavero, Papavero domestico—; *Kachhi* : Doda, Post—; *Kumaon* : Posht—; *Malaya* : Bungapion, Yin soo hock—; *Malayalam* : Afiun, Kashakasha—; *Malta* : Opium Poppy, Poppy, Papavero, Pianta da oppio, Papavru, Xahxieh—; *Marathi* : Aphu, Khuskhus, Posta—; *Nepal* : Aphim—; *Oudh* : Posta—; *Persian* : Afiun, Khashkhash, Khashkhash-sufaid, Koknar, Postekoknar, Tukhmekoknar—; *Portuguese* : Dormideira, Papoula branca—; *Punjab* : Afim, Doda, Khashkhash, Khishkhash, Post—; *Roumanian* : Mac, Mac somnisor, Somnisor—; *Russia* : Mak snotvornyi—; *Sanskrit* : Ahifen, Chosa, Khasa, Khakasa, Ullasata—; *Sinhalese* : Abin, Albinatta—; *Spanish* : Adormidera, Dormidera—; *Swedish* : Vallmo—; *Tamil* : Abini, Gashagasha, Kasakasa, Postaka—; *Telugu* : Abhini, Gasagasala, Gasalu, Kasakasa—; *Turkish* : Hashash—; *Urdu* : Khashkhashsufaid—; *Uruguay* : Adormidera, Amapola—; *Waziri* : Afin, Kolijhdarai—.

6. **Papaver orientale** Linn. is cultivated in Indian gardens. It is common in North Persia, Armenia, and the Mediterranean region.

The petals are sudorific.

A series of alkaloids have been isolated from the plant: thebaine, isothebaine, glaucidine, two phenolic bases, and one non-phenolic base.

7. **Papaver nudicaule** Linn. is found in the Northern Himalaya, up to an altitude of 17,000 feet. It extends through Afghanistan to Northern Asia and to Central and Northern Europe.

The flowers and capsules are mildly diaphoretic.

Waziri: Kakavai—.

III.

The FUMARIACEÆ are often considered as a sub-family or a tribe of the Papaveraceae. They are annual or perennial herbs broadly distributed in temperate and warm regions, mainly in the temperate zone of the northern hemisphere. The family includes 7 genera and about 260 species.

Most fumitories contain in their herbaceous parts mucilage, saline substances, and a peculiar acid or acrid juice, so combined that they are classed among tonic and alterative medicines.

The following have been isolated from members of the Order:—(1) *alkaloids*—bulbocapnine, corybulbine, isocorybulbine, corycavamine, corycavidine, corycavine, corydaline, dehydrocorydaline, corydine, corypalmine, corytuberine, dicentrine, fumarine, protopine, sanguinarine, d-tetrahydropalmatine—; (2) *acids*—fumaric.

The medicinal fumitories belong to three genera: CORYDALIS (Mediterranean region, Europe, Asia); DICENTRA (Asia, North America); FUMARIA (Europe, Asia, Africa; chiefly Mediterranean).

No Indian DICENTRA is credited with therapeutic properties.

1. One outer petal spurred; capsule many-seeded ... CORYDALIS.
2. One outer petal spurred; fruit indehiscent, nut 1-seeded. FUMARIA.

CORYDALIS.

The genus numbers about 140 species, natives of the Mediterranean region, inhabiting Europe and Asia.

The genus is tonic, diuretic, and alterative. The roots are used as emmenagogues and vermifuges.

The following species are employed medicinally in Europe—*C. bulbosa* Pers., *C. claviculata* Pers., *C. fabacea* Pers., *C. lutea* DC., *C. ochroleuca* Koch.; in China—*C. ambigua* Cham. and Sch., *C. incisa* Pers.—; in Indo-China—*C. bulbosa* Pers.—.

Some twenty alkaloids have been isolated from various Corydalis roots.

1. Stems erect. Flowers 2.5 cm. long ... ... 1. *C. Govaniana.*
2. Stems procumbent. Flowers 12 mm. long ... ... 2. *C. ramosa.*

1. **Corydalis Govaniana** Wall. is found in Western Himalaya from Kashmir to Kumaon at 8,000-12,000 feet.

The root is considered tonic, diuretic, alterative, and antiperiodic. It is prescribed in syphilitic, scrofulous, and cutaneous affections.

Bengal: Bhutkesi, Bhutkis—; *Hindi*: Bhutkesi, Bhutkis—; *Punjab*: Bhutkes, Bhutkis—; *Sanskrit*: Bhutakesi—.

2. **Corydalis ramosa** Wall. inhabits the temperate portion of the Himalaya from Kashmir to Sikkim, at 12,000-15,000 feet.

In the Kurram Valley the plant is, like all other plants with yellow sap, employed in the treatment of eye diseases.

Kurram Valley: Mamiran—.

FUMARIA.

This genus includes 46 species, natives of the Mediterranean region, and distributed over Central Europe, Asia, Africa; one being almost cosmopolitan.

The genus is tonic, aperient, and resolvent.

The following are used medicinally in Europe: *F. capreolata* Linn., *F. densiflora* D.C., *F. media* Lois., *F. officinalis* Linn., *F. parviflora* Lam., *F. Schleicheri* Soyer-Willem., *F. spicata* Linn., *F. Vaillantii* Lois.—; in Indo-China—*F. officinalis* Linn., *F. parviflora* Lam.—.

1. Flowers pink with wings of upper petal reflexed upwards, bracts about as long as the pedicel or longer. Flowers purplish pink with wings of upper petal at most obscurely purple. Fruit of moderate size, subtruncate, rarely apiculate ... ... 1. *F. indica.*
2. Flowers white, sometimes flushed with pink, with erect spreading, patent or reflexed wings to the broad upper petal; sepals usually present; outer petals not emarginate; the wings of the upper usually with a purple blotch. Fruit often subacute, rugose ... ... 2. *F. parviflora.*

1. **Fumaria indica** Pugsley is distributed over the greater part of India up to 8,000 feet on the Himalaya. It extends through Baluchistan and Afghanistan to Persia, Turkestan, Songaria and Mongolia.

The plant is diuretic, diaphoretic, and aperient.

An extract is drunk by the Waziris for the purpose of cooling the body, and it is also applied externally for the same purpose.

Waziristan: Lavang, Levanai, Margyapal, Parparie, Sevae—.

2. **Fumaria parviflora** Lam. is found in Baluchistan, the Taurus, and Persia.

The herb is highly esteemed by the Mahommedans in India; it is said to purify the blood and act as a laxative and diuretic. In Persia it is often mixed with chicory for medicinal purposes.

The dried plant is regarded as efficacious in low fever, and is also used as an anthelmintic, diuretic, diaphoretic and aperient, and to purify the blood in skin diseases.

Along with black pepper, it is used in the treatment of ague.

It is used in Europe as an alterative, aperient, and antifebrile drug. It is given in Spain in visceral obstructions, in scorbutic affections, and in various eruptive diseases.

Decoctions of the entire plant were given to cases of mild pyrexia and the result was unsatisfactory (Koman).

The plant contains fumaric acid and the alkaloid fumarine.

Arabic : Baglat-ul-mulk, Bukslat-ul-mulik, Rizud-dejaj, Shahatraja, Shatraraj—; *Baluchi* : Kahurkah, Kankechk—; *Bengal* : Bansulpha, Shulpha—; *Bombay* : Pitpatra—; *Deccan* : Pitpapara, Shatra—; *Egypt* : Shahtarag, Shatreyg—; *English* : Fine-leaved Fumitory, Small-flowered Fumitory—; *Gujerat* : Khasudlio, Pitpapda, Pittapapado—; *Hamadan* : Shahtara—; *Harboi Hills* : Kafutkawa—; *Hindi* : Banshulpha, Pitpapada, Pitpapara, Pitpapra, Shahatra—; *Indo-China* : Tug sha tu chinh—; *Kumaon* : Khairuwa—; *Marathi* : Pitpapda—; *Persian* : Shahatra, Shah-tarra, Shatra—; *Punjabi* : Pitpapra—; *Pushtu* : Papra, Pitpapra, Shahtara—; *Quetta-Pishin* : Shatara—; *Sanskrit* : Araka, Charaka, Kalapanga, Katupatra, Kavachanamaka, Krishnashakha, Ksheparpata, Nakra, Panshu, Panshuparyaya, Parpata, Parpataka, Pragandha, Pittari, Renu, Shita, Shitavallabha, Sutikta, Tikta, Trishnari, Triyashti, Varatikta, Varmakantaka—; *Sind* : Shahatra, Shatra—; *Tamil* : Tusa—; *Teheran* : Shahtara—; *Telugu* : Chatarasi—; *Urdu* : Shahatra—; *Waziri* : Lavang—.

PLANTS OF KUWAIT, NORTH EAST ARABIA.

BY

MRS. V. DICKSON.

The following is a list of wild flowers of Kuwait State, (N.E. Arabia Dist. IV) including the islands of Failaka (pr. loc. Failicha) and Masjan, together with a few notes on the edible and medicinally used plants and shrubs.

I have collected specimens over a period of nine years, since 1929, and all these have been identified by the late Mr. Horwood, and determinations sent to me by Sir Arthur Hill of the Royal Botanic Gardens, Kew, London.

This list will be found much more complete than the one in *Records of the Botanical Survey of India*, vol. vi, no. 6; by Humphrey G. Carter, M.B., Ch.B. with notes by Sir Percy Cox, K.C.S.I., K.C.I.E. and Lt.-Col. S. G. Knox, C.I.E., which is as far as I know the only publication (excluding Blatter?) on flowers of Kuwait. Some plants mentioned by Carter such as Oleander do not grow wild in Kuwait, and were possibly found growing in gardens.

There is still one plant which has not yet been identified for me by Kew: a Cruciferae which appears to be a new species, and is probably referred to in the above publication as *Erucaria* Boiss.

My husband, Lt.-Col. H. R. P. Dickson, C.I.E., has been Political Agent in Kuwait from 1929-1936, and is now in the Kuwait Oil Company, so I have had great opportunities to collect flowers, as we have had a permanent camp each spring out with the Badawin in the desert some 50 to 100 miles in the interior. We were both of us also fortunate to visit His Majesty King Bin Saud last November in his capital Riyadh. The names of the flowers collected on this trip will be found at the end of this list.

The plants listed below were collected by me between the years 1933-1938.

PAPAVERACEÆ.

Hypecoum pendulum L.
Papaver Rhoeas L.
,, *Rhoeas* L. var. *subintegrum* Willk.
,, *somniferum* L.
,, *somniferum* L. var. *leplocanlolum* Fedde.
Roemaria hybrida DC.

CRUCIFERÆ.

Brassica Tournefortii Gouan.
Carrichtera annua Asch.
Diplotaxis Harra (Forsk.) Boiss.
,, *acris* (Boiss.)
Eruca sativa Lam. var. *eriocarpa*.

Erucaria aleppica Gaertn.
Farsetia aegyptia Turra
Fibigia longisiliqua Dcne.
Lepidium sativum L.
,, *ruderale* L.
,, *Aucheri* Boiss.
Leptaleum filiforme DC.
Malcolmia africana (L.) R. Br.
,, *assyriaca* Hausskn. et Bornm.
,, *pulchella* Boiss. var. *pygmaea* R. Br.
,, *torulosa* (Desf.) Boiss. var. *leiscarpa* Boiss.
Matthiola bicornis DC.
,, *troida* DC.
Notoceras bicorna Cav.
Savignya oblonga Boiss.
,, *parviflora* (Del.) DC.
Schimpera arabica Boiss.
,, *persica* Boiss.
Sinapis (*Brassica*) *arvensis* L.
Sisymbrium cf. *erucastroides* Stapf.
Torularia torulosa (Desf.). O. E. Schultz.

RESEDACEÆ.

Ochradenus baccatus Del.
Oligomeris subulata (Del.) Boiss.
Reseda arabica Boiss.
,, *decursiva* Forsk.
,, *muricata* Presl.

CISTACEÆ.

Helianthemum ellipticum Pers.
,, *kahiricum* Del.
,, *ledifolium* Mill.
,, *Lippii* (L.) Pers.
,, *salicifolium* Mill.

FRANKENIACEÆ.

Frankenia pulverulenta L.

CARYOPHYLLACEÆ.

Ankyropetalum gypsophiloides Fenzl.
Gypsophila porrigens Boiss.
Loeflingia hispanica L.
Paronychia argentea L.
Polycarpaea repens (Forsk.) Asch. et Schwein.
Polycarpon tetraphyllum L.
Robbairea prostrata (Del.) Boiss.
Saponaria Vaccaria L.
Silene conoidea L.
,, *conica* L.
,, *leyseroides* Boiss. (calyx reticulate).
,, *villosa* Forsk.

TAMARICACEÆ.

Tamarix articulata Vahl
,, *macrocarpa* Bge.

MALVACEÆ.

Malva parviflora L.

ZYGOPHYLLACEÆ.

Fagonia Bruguieri DC.
,, *glutinosa* Del.
Nitraria tridentata Desf.
Seetzenia orientalis Dcne.
Tribulus terrestris L.
Zygophyllum coccineum L.

GERANIACEÆ.

Erodium ciconium Willd.
,, *cicutarium* L'Herit.
,, *glaucophyllum* Ait.
,, *laciniatum* Cav.
,, *triangulare* Musch.
,, *triangulare* Musch. var. *pulverulentum* Boiss.
Monsonia nivea J. Gay.

RUTACEÆ.

Haplophyllum tuberculatum (Forsk.) A. Juss.
Peganum Harmala L.

RHAMNACEÆ.

Zizyphus Spina-Christi Willd.
,, *Spina-Christi* Willd. var. *inermis* Boiss.

LEGUMINOSÆ.

Acacia Seyal Del.
Alhagi maurorum DC.
Astragalus annularis Forsk.
,, cf. *baeticus* L.
,, *bombycinus* Boiss.
,, *brachyceras* Led.
,, *corrugatus* Bent. ex DC.
,, *cruciatus* DC.
,, *dactylocarpus* Boiss.
,, *Forskahlei* Boiss.
,, *gyzensis* Del.
,, *peregrinus* Vahl
,, *Schimperi* Boiss.
,, *striatellus* Pall.
,, *tenuirugis* Boiss.
,, cf. *tribuloides* Del.
Hippocrephis cf. *bicontorta*.
,, *unisiliquosa* L.

Hymenocarpos nummularius Boiss.
Lotus pusillus Viv.
Medicago Aschersoniana Urb.
,, *laciniata* Willd.
Melilotus parviflora Desf. (*M. indica* L.)
Onobrychis ptolemaica DC.
Ononis serrata Forsk.
,, *reclinata* L.
Prosopis Stephaniana (Willd.) Spreng.
Scorpiurus muricatus L.
Trigonella anguina L.
,, *hamosa* L.
,, *stellata* Forsk.
,, cf. *maritima* Del.
Vicia peregrina L.

ROSACEÆ.

Neurada procumbens L.

CUCURBITACEÆ.

Citrullus Colocynthis (L.) Schrad.

FICOIDEÆ.

Aizoon canariense L.
,, *hispanicum* L.
Cryophyton (*Mesembryanthemum*) *nodiflorum* (L.) N.E. Br.

UMBELLIFERÆ.

Ammi majus L.
Anisosciadium lanatum Boiss.
,, *orientale* DC.
Bupleurum semicompositum L.
Cuminum cyminum L.
Pimpinella puberula Boiss.
Tordylium persicum Boiss. in Haussk.

RUBIACEÆ.

Crucianella membranacea Boiss. (*C. ciliata* Lam.)
Galium Decaisnei Boiss.
,, *sinaicum* Boiss.

DIPSACACEÆ.

Cephalaria syriaca (L.) Schrad.
Scabiosa Olivieri Coult.
,, *palaestina* L.
,, *palaestina* L. var. *calocephala* Boiss.

COMPOSITÆ.

Aaronsohnia Factorovskyi Wart. et Eig.
Acantholepis orientalis Less.
Anthemis deserti Boiss.

Anvillea Garcini DC.
Artemisia monosperma Del.
Atractylis cancellata L.
,, *flava* Desf.
Calendula aegyptica Desf.
,, *persica* C.A.M.
Carduus pycmocephalus Jacq. and var. *arabicus* (Jacq.) Boiss.
Carthamus oxyacantha M. Bieb.
,, *tinctorius* L. (cultivated).
Centaurea mesopotamica Bornm.
,, *phyllocephala* Boiss.
,, *solstitialis* L.
Crepis parviflora Desf.
Filago spathulata Presl. var. *prostrata* (Parl.) Boiss.
Ifloga spicata (Forsk). Sch. Bip.
Koelpinia linearis Pall.
Launaea arabica (Boiss.) Cass.
,, *mucronata* (Forsk.) Musch.
,, *nudicaulis* (Less.) Hook. f.
Leontodon hispidulum Boiss. var. *tenuilobum* Boiss.
Matricaria (Chamomilla) aurea (L.) J. Gay.
Odontospermum pygmalum B. et H.
Picris saharae Batt.
Reichardia tingitana (Desf.) Roth.
Rhanterium epapposum Oliv.
Senecio coronopifolius Desf.
Urospermum picroides L.

PLUMBAGINACEÆ.

Statice spicata (L.) Willd.
,, *thouini* Viv.
,, *suffruticosa* L.

PRIMULACEÆ.

Anagallis arvensis L. var. *carnea* Koch.
,, *femina* Mill.
,, *latifolia* L.

BORAGINACEÆ.

Anchusa aggregata Lehm.
Arnebia decumbens Coss. et Kral. (*A. cornuta* Led.) F. et M.
,, *tinctoria* Forsk.
,, *hispidissima* DC.
Gastrocotyle hispidia (Forsk.) Bge. and var. *songarica*.
Heliotropium undulatum Vahl
Lappula spinocarpos Aschers.
Lithospermum callosum Vahl and var. *asperrimum* Bornm.
,, *incrassatum* Guss.

CONVOLVULACEÆ.

Convolvulus aff. *lineatus* L.
,, *oxyphyllus* Boiss.

Convolvulus pilosellaefolius Desf.
,, *sp.* cf. *sericeus* Burm.
Cressa cretica L.
Cuscuta planiflora Ten.

SOLANACEÆ.

Hyoscyamus pusillus L.
Lycium arabicum Schweinf.
,, *barbarum* L.

SCROPHULARIACEÆ.

Antirrhinum Orontium L.
Linaria chalepensis (L.) Mill.
,, *micrantha* Cav.
,, *simplex* DC. var. *flaviflora* Boiss.
Scrophularia deserti Del.

OROBANCHACEÆ.

Cistanche tubulosa Schenk.
Orobanche aegyptiaca Pers.
,, *cernua* Loefl. var. *desertorum* Beck.

LABIATÆ.

Salvia aegyptiaca L.
,, *spinosa* L.
Teucrium Polium L. var. *lanuginosum* Celak.
,, *Oliverianum* Ging.

PLANTAGINACEÆ.

Plantago albicans L.
,, *amplexicaulis* Cav.
,, *ciliata* Desf.
,, *coronopus* L.
,, *cylindrica* Forsk.
,, *Lagopus* L.
,, *ovata* Forsk.
,, *Psyllium* L.

ILLECEBRACEÆ.

Herinaria cinerea DC.
,, *hemistemon* J. Gay.
Paronychia arabica DC.
Pteranthus dichotomus Forsk.

CHENOPODIACEÆ.

Anabasis articulata Forsk.
,, *setifera* Moq.
Arthrocnemum glaucum Ung.
Atriplex dimorphastegia Kar. et Ker.
,, *sp.* aff. *A. parviflora* Lowe.
,, *leucocladum* Boiss.

Bassia eriopora Schrad.
Beta maritima L.
Chenopodium album L.
,, *murale* L.
Cornulaca monacantha Del.
Echinopsilon muricatum (Schrad.) Moq.
Haloxylon salicornicum Bge.
Polycnemon sp.
Salsola hispidula Bge.
,, *Kali* L.
,, *longifolia* Forsk.
,, *verrucosa* MB.
Suaeda baccata Forsk.
,, *vermiculata* Forsk.

POLYGONACEÆ.

Calligonum comosum L'Hérit.
Emex spinosus Camped.
Polygonum Bellardi All.
Rumex pictus Forsk. var. *bipinnatus* (Lil.) Maire.
,, *vesicarius* L.

THYMELAEACEÆ.

Lygia Passerina L.
,, *pubescens* (Guss.) Boiss.

BALANOPHORACEÆ.

Cynomorum coccineum L.

EUPHORBIACEÆ.

Andrachne telephioides L.
Crozophora oblongifolia A. Juss. (*C. obliqua* Vahl) A. Juss.
Euphorbia cornuta Pers.
,, *sp.* cf. *E. hieroglyphica* DR.

ASCLEPIADACEÆ.

Calotropis procera R. Br.

VALERIANACEÆ.

Valerianella leiocarpa Koch. (*V. Dufresnei* Bge.).

FUMARIACEÆ.

Fumaria parviflora Lam.

CHARACEÆ.

Chara vulgaris L.

GENTIANACEÆ.

Centaurium (*Erythraea*) *ramosissimum* (Pers.) (sensu Fl. Orient.)

LINACEÆ.

Linum usitatissimum L.

JUNCACEÆ.

Juncus acutus L.

MONOCOTYLEDONS.

IRIDACEÆ.

Iris Sisyrinchium L.
Gladiolus segetum Ker.—Gawl.

LILIACEÆ.

Allium desertorum Forsk.
,, *laceratum* Boiss. et Noe
,, *sphaerocephalum* L. and var. *arvense* Parl.
Asphodelus tennifolius Cav.
Bellevalia flexuosa Boiss.
,, cf. *longipes* Post.
Dipcadi erythraeum Webb et Benth.
Gagea reticulata (Pall.) Schult. and var. *rigida* (Boiss. et Sprun.) Pasch.
Muscari comosum (L.) Mill.

AMARYLLIDACEÆ.

Ixiolirion montanum Herb.

CYPERACEÆ.

Cyperus conglomeratus Rottb. var. *arenarius* Coss.
,, *rotundus* L. (probably).
,, *arenarius* Retz. (cf. Auch no. 5483).

GRAMINEÆ.

Ammochloa palaestina Boiss.
Argilops triunciatis L.
Aristida ciliata Desf.
,, *obtusa* Del.
,, *plumosa* L.
Avena barbata L.
Bromus tectorum L.
Cenchrus ciliaris L.
Cutandia memphitica Batt. et Trab.
Cynodon Dactylon Pers.
Koeleria phleoides Pers.
Lolium rigidum Gaud.
Panicum turgidum Forsk.
Phragmites communis Trin.
Sphenopus divaricatus Reichb.
Stipa tortilis Desf.

FILICES.

Ophioglossum vulgatum L. var.

PLANTS OF RIYADH, SAUDI ARABIA.

(*Collected in October* 1938.)

Acacia sp. (probably A. Seyal Del).
Aerua javanica (Burm.) Lam.
Amaranthus Blitum L.
Anvillea Garcine (Burm.) DC.
Artemisia monosperma Del.
Blepharis edulis (Forsk.) Pers.
Capparis galeata Fres.
,, *spinosa* L.
Cassia obovata Coll.
Corchorus trilocularis L.
Daemia cordata R. Br.
Digera arvensis Forsk.
Haloxylon Schweinfurthii Asch.
Lycium Barbarum L.
Morcandia arvensis DC.
Oxalis corniculata L.
Peganum Harmala L.
Picridium tingitanum Desf. var. *subintegrum* Boiss.
Pulicaria crispa (Forsk) Benth. and Hook.
Punica Granatum L.
Rhazya stricta Dcne.
Solanum nigrum L.
Trisetum pumilum Kunth. (grown from seed collected in Dahana).
Zizyphus nummularia Walk et Arn.

SOME NOTES ON THE EDIBLE PLANTS OF KUWAIT AND THOSE USED MEDICINALLY.

Asphodelus tenuifolius Cav. 'Burwug'.

This plant is used by the Badawin of Kuwait in making ' 'Igt', which is a form of dried milk; it is made especially for use during the summer and is mixed with water and eaten with dates.

Citrullus Colocynthis (L.) Schrad.

This plant known to the Arabs as 'Esherri' is their main purgative. The seeds are collected when the fruit is ripe and seven seeds are taken at once as a strong purgative. Sheep sometimes eat the fruit when it is green.

Dipcadi erythraeum Webb et Benth. 'Busal Mow'.

The bulb of this plant is very juicy though rather tasteless; it is dug up and eaten by all Badawin children.

Heliotropium undulatum Vahl 'Rum-Rām'.

This plant is used by Badawin as a cure for snake bite. The plant is dried and pounded up, and made like tea with hot water. This is then strained, and the patient is given the liquid to drink, and the 'leaves' are bound on to the bite. Other methods, such as branding and keeping the patient awake are also used, as the 'Rum-Rām' will not effect a cure by itself. The Badawins tell you

that the Monitor lizard ('Wurral') when bitten by a snake, has been seen to go to this plant and roll in it.

Lygia Passerina L. 'Kharāit'.

This is also used among the Badawin as a purgative, mainly in spring when it is picked and eaten green. It may be dried also and pounded up.

Malva parviflora L. 'Khubāiz'.

Among the Persian community in Kuwait this plant is eaten a great deal when it is young and green. It is cooked like spinach.

Neurada procumbens L. 'Sa'adān'.

Badawin children are very fond of the young circular seeds of this plant to eat.

Haplophyllum tuberculatum Juss. 'Al Masāicha'.

This plant is used among the Badawin of N.-E. Arabia as a cure for a scorpion sting. The plant is picked and quickly put into a pocket and then in a dark bag to dry. Some of the leaves are pounded up and mixed with a few drops of hot water and bound on to the place where the person was stung. It is said to be a quick cure and to relieve pain at once.

Rumex pictus Forsk. 'Hambusis' and *Rumex vesicarius* L. (Hamēth) are both eaten by townspeople and Badawin alike.

Emex spinosus Camped. 'Al Hambizān'.

The white root of this plant is eaten by Badawin children.

Scorzonera papposa DC. 'Rubāhla'.

The brown carrot-like root of this plant when peeled is eaten by Badawin and is very tasty.

Teucrium Polium L. 'Al Jādah'.

This plant is used as a cure for Basrah fever and is sold dried in the bazaars of Kuwait. The leaves are pounded up and brewed with boiling water into a kind of tea. Some of this is drunk and some of it poured over the person. Sheikh Mubarak of Kuwait always used this cure when he had fever. A specimen was sent by Dr. C. S. G. Mylrea of the American Mission Hospital in Kuwait to the School of Tropical Medicine, who sent it on to Messrs. Parke Davis & Co.

Following is a report from them by Mr. E. M. Holmes dated 30-11-20.

Report on a woolly leaved herb.

'The specimen received from Messrs. Parke Davis & Co. has been carefully examined by me, with the following result :—

"The minute flowers are evidently those of a Labiate plant possessing the character of the genus *Teucrium* of the species *Teucrium Polium*. The plant was formerly used as a herb in

Europe, and in Spain still retains the vernacular name of *Poleo montano*. The plant is supposed to be the Polion of the Greeks and is said by Arabian writers to be deobstruent, diuretic, and anthelmintic and tonic. It is mentioned by Dioscorides, III, 115, Pliny, 21, 7, 120. In Bombay it is one of the drugs sold under the name of 'Jadah' and comes from Bandar Abbas. It is described by Dr. M. Dymock in *Mat. Med. West India*, 2nd ed. p. 616, and accords exactly with the specimen received''.'

The United States Dispensatory further says:—

'Plant said to have been used advantageously in cholera in the Levant, a specimen of which was sent to Paris proved to be *Teucrium Polium*—which we have no doubt was identical with the drug you sent to us.'

Trigonella stellata Forsk. 'Nifl'.

The Badawin women of the great Shammar tribe of Northern Arabia use this plant when dried to put on their hair after it has been washed.

Arnebia decumbens Coss. et Kral. 'Chahil'.

The root of this plant, which is crimson, is used by some Badawin women and girls as a 'rouge'. The freshly pulled up root is rubbed lightly on the cheeks and it gives a perfect colour to them.

Atriplex sp. aff. *A. pariflora* Lowe. 'Hartabeel'.

This plant when young is eaten by the Persian population of Kuwait as a kind of spinach.

SOME TREES AND BUSHES OF KUWAIT AND THEIR USES.

Calotropis procera R. Br. 'Ashurr'.

This tree is used for making gunpowder. The bark is first made into charcoal, and then pounded up very fine and used with saltpetre. The tree has no doubt been brought up from Hassa where it is very common, and grows here only in one village (Fantas) some 20 miles south of Kuwait town.

Zizyphus Spina-Christi Willd. 'Sidr'.

The dried and pounded leaves of this tree are used by the town women of Kuwait as a hair wash. It is also used for washing the dead.

The Badawin makes his camel stick 'Misha'ab' from the branches of these trees which grow in great quantities in the Summan region of Saudi Arabia. The fruit is sold in the bazaars and is much liked by the town people and Badawin alike.

Haloxylon salicornicum Bge. 'Hamdh' or 'Rimdh'.

There are many bushes of the Chenopodiaceae which are classed under the Arabic names given above. These are all valuable as firewood in the desert and also for grazing for camels, owing to their salt properties.

A NOTE ON THE EMBRYOLOGY OF THE GROUND NUT (*ARACHIS HYPOGAEA* L.)

BY

I. BANERJI.

(Department of Botany, Calcutta University).

(With two text-figures).

Arachis hypogaea is a crop plant of great economic importance. In India, it is cultivated extensively in Bombay, Madras and the Central Provinces. In Bengal, Mysore and in other parts of India attempts are now being made to grow ground-nut on an extensive scale. The plant is grown as a *rabi* crop.

The literature on the embryology of Leguminosae is extensive. It has recently been reviewed by Schnarf (**9**), Roy (**6**) and others. Excepting a few cases which, however, require reinvestigation, the development of the female gametophyte in the family was found to be of the normal type. Guignard (**1**), Souèges (**11**), Samal (**8**) and others have studied the development of the embryo. Considerable variation has been noted in the development of the pro-embryo and the suspensor.

Reed (**4**) appears to be the only investigator who has worked on the embryology of *Arachis hypogaea*. He has only described the fully developed gametophyte and certain stages in the development of the embryo in connection with his studies on the anatomy, ecology and embryology of the plant.

The material used in this investigation was obtained from plants grown in the University College experimental ground and was studied according to the customary methods.

As is characteristic of the family Leguminosae, the monocarpellary ovary bears the ovules on the ventral suture. Generally the ovules are two in number, but sometimes three or only one have been noted. The ovule initials are at first noted as small papillate processes on the placenta. Due to more active cell division on one side of the ovule they gradually curve and take up an anatropous position. At this time the outer wall of the ovule generally comes in contact with the wall of the ovary, but the curvature of the ovule does not appear to be due to the contact with the ovarian wall as has been suggested by Reeves (**5**) working on *Medicago*. Both the ovules curve in the same direction and the curvature is always towards the stylar end of the ovary. It is interesting to note in this connection that Reeves (**5**) working on *Alfalfa* found the curvature of the ovule towards the base of the ovary. In *Albizzia Lebbeck* and *Phaseolus vulgaris*, Maheshwari (**2**) and Weinstein (**12**) found the ovules curving towards the stylar end of the ovary.

The origin of the integuments becomes apparent along with the curvature of the ovule. Both the integuments arise from the outer layer of cells of the ovule and in the early stages of their development are composed of two layers of cells. The inner integument is first noted, but very soon the outer integument makes its appearance. At the time of differentiation of the integuments the megaspore mother cell is generally in the early stages of heterotypic prophase. The growth of the outer integument is more rapid than the inner and by the time the megaspore mother cell is in synopsis, the outer integument reaches the same level as the inner. From this stage onwards, the growth of the outer integument is more rapid on the side of the ovule opposite to that of the placenta, and as a result it very soon completely encases the ovule. Both the integuments take part in the formation of the micropyle, at which region they are comparatively thick.

A single archesporial cell usually differentiates in the third layer of the nucellus and directly functions as the megaspore mother cell. The origin of the archesporial cell or cells, in the third layer of the nucellus appears to be a common feature in the Papilionatæ and has been noted previously by

Europe, and in Spain still retains the vernacular name of *Poleo montano*. The plant is supposed to be the Polion of the Greeks and is said by Arabian writers to be deobstruent, diuretic, and anthelmintic and tonic. It is mentioned by Dioscorides, III, 115, Pliny, 21, 7, 120. In Bombay it is one of the drugs sold under the name of 'Jadah' and comes from Bandar Abbas. It is described by Dr. M. Dymock in *Mat. Med. West India*, 2nd ed. p. 616, and accords exactly with the specimen received''.'

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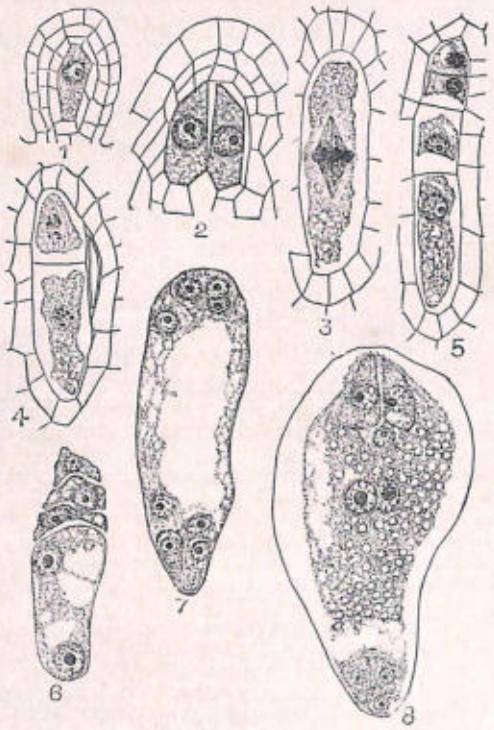
The material used in this investigation was obtained from plants grown in the University College experimental ground and was studied according to the customary methods.

As is characteristic of the family Leguminosae, the monocarpellary ovary bears the ovules on the ventral suture. Generally the ovules are two in number, but sometimes three or only one have been noted. The ovule initials are at first noted as small papillate processes on the placenta. Due to more active cell division on one side of the ovule they gradually curve and take up an anatropous position. At this time the outer wall of the ovule generally comes in contact with the wall of the ovary, but the curvature of the ovule does not appear to be due to the contact with the ovarian wall as has been suggested by Reeves (**5**) working on *Medicago*. Both the ovules curve in the same direction and the curvature is always towards the stylar end of the ovary. It is interesting to note in this connection that Reeves (**5**) working on *Alfalfa* found the curvature of the ovule towards the base of the ovary. In *Albizzia Lebbeck* and *Phaseolus vulgaris*, Maheshwari (**2**) and Weinstein (**12**) found the ovules curving towards the stylar end of the ovary.

The origin of the integuments becomes apparent along with the curvature of the ovule. Both the integuments arise from the outer layer of cells of the ovule and in the early stages of their development are composed of two layers of cells. The inner integument is first noted, but very soon the outer integument makes its appearance. At the time of differentiation of the integuments the megaspore mother cell is generally in the early stages of heterotypic prophase. The growth of the outer integument is more rapid than the inner and by the time the megaspore mother cell is in synopsis, the outer integument reaches the same level as the inner. From this stage onwards, the growth of the outer integument is more rapid on the side of the ovule opposite to that of the placenta, and as a result it very soon completely encases the ovule. Both the integuments take part in the formation of the micropyle, at which region they are comparatively thick.

A single archesporial cell usually differentiates in the third layer of the nucellus and directly functions as the megaspore mother cell. The origin of the archesporial cell or cells, in the third layer of the nucellus appears to be a common feature in the Papilionatæ and has been noted previously by

Roy (**6**), Paul (**3**) and others. Two megaspore mother cells lying side by side have been noted in some preparations (text-fig. 2). Reeves (**5**) records the occurrence of two or more sporogenous cells side by side in *Alfalfa*, Singh and Shivapuri (**10**) in *Neptunia oleacea* and Paul (**3**) in *Tamarindus indicus*. The cell covering the megaspore mother cell usually divides before the reduction division and as a result the megaspore mother cell is pushed inside the nucellus (text-fig. 1 and 2). The megaspore mother cell passes through the usual stages of meiosis. During the heterotypic metaphase a bipolar spindle is oriented (text-fig. 3) and the movement of the chromosomes is regular. There is a

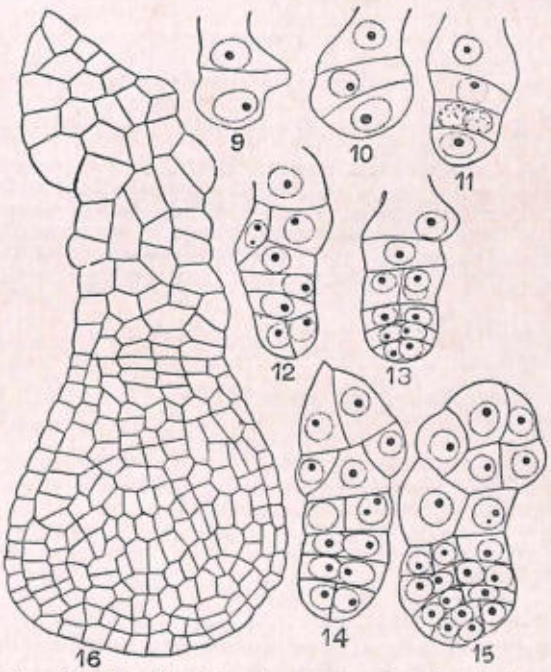


Text-figures 1-8. *Arachis hypogaea* L. Fig. 1. Megaspore mother cell ×500. Fig. 2. Two megaspore mother cells lying side by side ×900. Fig. 3. Heterotypic metaphase ×900. Fig. 4. Homotypic division ×900. Fig. 5. Linear tetrad of megaspores ×900. Fig. 6. Binucleate stage of the embryo-sac; note that the upper three megaspores have not degenerated ×900. Fig. 7. Eight-nucleate embryo-sac ×900. Fig. 8. Mature female gametophyte; note presence of starch grains in the embryo-sac ×900.

well defined interphase and the daughter nuclei become well organised and separated by a cell wall. During the homotypic division both the cells usually divide at about the same time (text-fig. 4). As previously noted by Maheshwari (**2**) and Roy (**6**) the lower cell of the dyad is comparatively longer than the upper. This inequality in the size of the dyads appears to be a characteristic feature of the Papilionatæ. As a result of the homotypic division four macrospores are produced which are arranged in a linear row and separated by cell walls (text-fig. 5). In no case was a *T*-shaped arrangement of tetrads observed. The lower or the chalazal macrospore alone functions while the rest degenerate. It appears from the results obtained by previous investigators that in most Papilionaceous plants the chalazal megaspore is functional. Saxton (**7**), however, found the third megaspore from the micropylar end to be functional in *Cassia tomentosa*.

The functioning megaspore is usually capped by dark staining masses—the remnants of the other degenerated macrospores. It is usually deeply embedded in the nucellus due to the repeated division of the cover cells. The nucleus of the functioning megaspore next divides and gives rise to the primary micropylar and primary chalazal nuclei. It is interesting to note that sometimes the binucleate stage is reached before the degeneration of the three upper megaspores. Text-fig. 6 illustrates such a condition. By two-nuclear divisions an eight-nucleate embryo-sac is produced and a big vacuole is noted in the centre of the sac. From the two-nucleate stage onwards the parietal cells surrounding the embryo-sac show signs of disintegration. At the eight-nucleate stage the embryo-sac increases considerably in size and the chalazal end becomes very narrow.

The mature embryo-sac is somewhat oval with the antipodal end tapering. The three antipodals become separated from the main body of the embryo-sac and appear to be surrounded by cytoplasmic membranes. They degenerate very soon, as appears to be common in the sub-family Papilionatæ. The synergids are pear-shaped in appearance with the nuclei disposed at the micropylar end and the vacuole below. No filiform apparatus could be detected. The egg cell is placed between the synergids and extends beyond them into the embryo-sac. There is a large vacuole at the apical region of the egg and the nucleus is placed in the denser cytoplasm at the base. The two polar nuclei lie close together, near the central region of the sac, they fuse later. The mature embryo-sac as previously noted by Reed (**4**), is full of starch grains (text-fig. 8). The occurrence of starch grains in the embryo-sac of higher plants seems to be of frequent occurrence.



Text-figures 9-16. *Arachis hypogaea* L. Stages in the development of the embryo. Figs. 9-15 ×400: Fig. 16 ×180.

As stated previously, Reed (**4**) has only described the mature gametophyte of *Arachis hypogaea*, and has not worked out its development. His account of the female gametophyte agrees with our observation, but his figures illustrating the structure of the synergids, the egg and the polar fusion nucleus appear to give an entirely wrong impression of the organisation of the mature embryo-sac.

Fertilisation appears to be porogamous as remnants of pollen tubes were seen in the micropylar end of the embryo-sac in a number of cases. Before the first division of the endosperm nucleus the cells of the gynophore immediately surrounding the ovules divide rapidly; as a result each of the ovules appears to be encased by 4 to 6 layers of brick-shaped cells, one above the other in tiers, and without any intercellular space. These present a characteristic appearance. These cells, however, disappear during the later stages of the development of the fruit and are replaced by a few layers of ordinary parenchymatous cells beyond which are noted large cells with abundant starch grains.

The fertilised egg rests for some time before division. The first division is transverse resulting in an apical and a basal cell (text-fig. 9). The apical cell divides again by a transverse wall and a three-celled proembryo is produced (text-fig. 10). Mostly, however, due to the division of the basal cell a 4-celled proembryo is produced (text-fig. 11). This is followed by vertical division in the terminal cell (text-fig. 12). The nature of the succeeding divisions could not be determined. At an early stage the embryo-forming region is clearly distinguished from the suspensor region by its smaller cells and denser cytoplasm (text-figs. 13, 14 and 15). It is interesting to note that similar differentiation of the embryo-forming region has been noted by Samal (8) working on *Crotalaria juncea*. The cells of the embryo-forming region divide mostly by anticlinal and periclinal walls, whereas the cells above divide mostly by oblique walls and give rise to the massive suspensor which functions as a haustorium (text-fig. 16). The dermatogen is differentiated in the embryo comparatively late. At this time the suspensor enlarges, its end becomes sagittate and is pushed inside the groove of the micropyle. After the differentiation of the dermatogen, cell division in the embryo-forming region continues and a pear-shaped embryo is formed where tissue differentiation appears to be complete (text-fig. 16). The cotyledonary primordia appear as two swellings on opposite sides of the pear-shaped embryo and soon develop into diverging projections, between which the plumule is located. The suspensor is massive, but comaratively short, its cells as observed by Reed (4) are large and haustorial in nature. The embryo is straight and the plumule consists of a terminal and two lateral buds developed in the axils of the cotyledons.

Reed (4) has described certain stages in the development of the embryo. He states that after the first division of the egg, the further divisions are in three planes. Our investigation shows that division in three planes only results after the proembryo consisting of four cells has been formed, and it appears that the last two cells of the proembryo give rise to the embryo-forming region while the cell above takes part in the development of the suspensor.

Summary.

The development of the female gametophyte in *Arachis hypogaea* was found to be of the normal type. The chalazal megaspore always functioning. The mature gametophyte is 8-nucleate and is filled up with starch grains. Fertilisation is porogamous. A proembryo of four cells is formed. The last two cells of the proembryo appear to give rise to the embryo. The upper cells of the proembryo form the suspensor which is composed of comparatively bigger cells and functions as an haustorium.

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EARTH-EATING AND SALT-LICKING IN INDIA

BY

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ANALYSES XL—XLVII

XL. *Soil from Salt Lick*

Serial No. 25.

Locality—Madanpur Beat, Marora Range, Jhansi Forest Division.

Collected and sent by—The Divisional Forest Officer, Jhansi.

Buff coloured clayey lumps crumbling fairly easily to powder. Powder soft.

Minerals	4·25	per cent
Clay	17·33	,,
Sand	61·19	,,
Organic debris	1·52	,,
Moisture	3·40	,,
Fine Earth (20 mesh sieve)	91·773	per cent.
Insoluble in nitric acid	45·619	,,
Soda (Na_2O)	2·127	,,
Potash (K_2O)	1·457	,,
Magnesia (MgO)	2·048	,,
Lime (CaO)	4·650	,,
Alumina (Al_2O_3)	3·411	,,
Silica (SiO_2) soluble	16·987	,,
Carbon dioxide (CO_2)	3·388	,,
Phosphorus (P_2O_5)	0·178	,,
Manganese (Mn)	0·064	,,
Ferric oxide (Fe_2O_3)	6·839	,,
Moisture and organic matter	4·952	,,

Remarks : 1. The soil contains traces of chlorine, 0·046 per cent. water-soluble organic matter, and 0·043 per cent. water-soluble inorganic matter.

2. The soil disintegrates when acted upon by nitric acid (sp. gr. 1·42) in the proportion of 1 part of acid to 15 parts of water.

3. Analysed by S. K. Chhapgar, B.SC.

XLI. *Common Earth*

Serial No. 26.

Locality—Madanpur Beat, Marora Range, Jhansi Forest Division.

Collected and sent by—The Divisional Forest Officer, Jhansi.

Fine dark-fawn powder with grit, and debris—straw, twigs, rootlets, dead leaves, etc.

Minerals	19·94	per cent.
Clay	4·32	,,
Sand	68·47	,,
Organic debris	3·52	,,
Humus	0·32	,,
Moisture	1·71	,,

Fine Earth (20 mesh sieve)	77·772	per cent
Insoluble in nitric acid	59·084	,,
Soda (Na_2O)	0 853	,,
Potash (K_2O)	0·419	,,
Magnesia (MgO)	0·211	,,
Lime (CaO)	0·274	,,
Alumina (Al_2O_3)	1·190	,,
Silica (SiO_2) soluble	7·219	,,
Phosphorus (P_2O_5)	0·058	,,
Ferric oxide (Fe_2O_3)	3·161	,,
Moisture and organic matter	5·494	,,

Remarks : 1. The earth contains traces of manganese, 0·078 per cent. of water-soluble inorganic matter and 0·132 per cent. of water-soluble organic matter.

2. The soil was collected in an area adjoining Salt-Lick No. 25.

3. Analysed by S. K. Chhapgar, B.Sc.

XLII. *Common Earth*

Serial No. 40.

Locality—Dudhai Zamindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Friable cement-grey lumps with a few rootlets and other organic detritus. Powder soft.

Minerals	3·01	per cent.
Clay	26·97	,,
Sand	64·86	,,
Organic debris	1·00	,,
Humus	0·34	,,
Moisture	3·74	,,
Fine Earth (20 mesh sieve)	94·040	per cent
Insoluble in nitric acid	64·977	,,
Soda (Na_2O)	2·980	,,
Potash (K_2O)	1·283	,,
Magnesia (MgO)	0·444	,,
Lime (CaO)	0·987	,,
Alumina (Al_2O_3)	3·040	,,
Silica (SiO_2) soluble	10·930	,,
Phosphorus (P_2O_5)	1·758	,,
Manganese (Mn)	0·030	,,
Ferric oxide (Fe_2O_3)	2·250	,,
Moisture and organic matter	4·343	,,

Remarks : 1. The soil contains traces of carbon dioxide and chlorine, 0·115 per cent. of colloidal silica and other inorganic matter, and 0·118 per cent. of water-soluble organic and inorganic matter.

2. The earth was collected from the neighbourhood of Salt-Lick No. 41.

XLIII. *Soil from Salt-Lick*

Serial No. 41.

Locality—Dudhai Zamindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Hard greyish and yellowish lumps. Powder soft.

Minerals	6·94	per cent.
Clay	34·70	,,
Sand	66·43	,,
Organic debris	2·58	,,
Humus	0·02	,,
Moisture	3·74	,,

Fine Earth (20 mesh sieve)	...	90·820 per cent.
Insoluble in nitric acid ...	...	57·433 ,,
Soda (Na_2O) ...	...	4·804 ,,
Potash (K_2O) ...	...	1·263 ,,
Magnesia (MgO) ...	...	0·183 ,,
Lime (CaO) ...	...	1·363 ,,
Alumina (Al_2O_3) ...	...	0·272 ,,
Silica (SiO_2) soluble ...	...	13·410 ,,
Phosphorus (P_2O_5) ...	...	1·022 ,,
Manganese (Mn) ...	...	0·128 ,,
Ferric oxide (Fe_2O_3) ...	...	0·617 ,,
Moisture and organic matter	...	9·356 ,,

Remarks: 1. The soil contains traces of chlorine and carbon dioxide 0·016 per cent. colloidal silica, 0·587 per cent. water-soluble inorganic matter and 0·102 per cent. water-soluble organic matter.

2. 'The licks are visited by all animals alike, there is no distinction in species. Only timings of visits differ. The pigs and blue bulls go early after sunset to eight in the night, but sambhars are always late frequenters. It is used after meals as well as before meals. There is restriction as regards season, they begin licking from October and after, till March. They use it mostly during the winter, especially after a spell of winter rain, when the ground is wet.' (M. A. Gani, Forest Ranger; 10–2–1929.)

XLIV. *Common Earth*

Serial No. 42.

Locality—Richa Mahoti Zemindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy friable lumps with rootlets. Powder soft.

Minerals	...	3·26 per cent.
Clay	...	14·43 ,,
Sand	...	83·48 ,,
Organic debris	...	0·28 ,,
Humus	...	1·06 ,,
Moisture	...	1·30 ,,
Fine Earth (20 mesh sieve)	...	96·230 per cent.
Insoluble in nitric acid	...	78·539 ,,
Soda (N_2O)	...	1·699 ,,
Potash (K_2O)	...	0·766 ,,
Magnesia (MgO)	...	0·198 ,,
Lime (CaO)	...	0·272 ,,
Alumina (Al_2O_3)	...	0·171 ,,
Silica (SiO_2) soluble	...	8·966 ,,
Phosphorus (P_2O_5)	...	0·116 ,,
Manganese (Mn)	...	0·118 ,,
Ferric oxide (Fe_2O_3)	...	1·798 ,,
Moisture and organic matter ...	...	7·889 ,,

Remarks: 1. The soil contains traces of sulphur, chlorine and carbon dioxide, 0·030 per cent. water-soluble inorganic matter, and 0·033 per cent. water-soluble organic matter.

2. The sample was collected in the neighbourhood of Salt-lick No. 43.

XLV. *Soil from Salt-Lick*

Serial No. 43.

Locality—Richa Mahoti Zemindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy friable lumps. Powder soft.		
Minerals	4·41	per cent.
Clay	23·53	,,
Sand	69·61	,,
Organic debris	2·63	,,
Humus	0·05	,,
Moisture	2·93	,,
Fine Earth (20 mesh sieve)	92·210	per cent.
Insoluble in nitric acid	65·217	,,
Soda (Na_2O)	3·635	,,
Potash (K_2O)	0·888	,,
Alumina (Al_2O_3)	0·348	,,
Magnesia (MgO)	0·288	,,
Lime (CaO)	0·091	,,
Silica (SiO_2) soluble	13·330	,,
Phosphorus (P_2O_5)	0·077	,,
Manganese (Mn)	0·021	,,
Ferric oxide (Fe_2O_3)	0·402	,,
Moisture and organic matter	3·211	,,

Remarks : 1. The soil contains traces of chlorine, sulphur and carbon dioxide, 0·071 per cent. colloidal silica, 0·173 per cent. water-soluble inorganic matter, and 0·067 per cent. water-soluble organic matter.

2. Same as for salt-lick No. 41.

3. When sending samples of salt-licks the Range Officer of the Lalitpore Range (M. A. Gani) wrote to say that the droppings of animals which have eaten the earth of the licks can be easily recognized : they are dusky earth-coloured and heavier than ordinary droppings. He also said that the soil seems to be excreted separately, and further added that he had examined different droppings and found that they carried very little vegetable matter and appeared to be made almost wholly of the soil in colour and composition.

At our request we were supplied with samples of nilgai dung taken from Richa Mahoti No. 42 Forests.

The ordinary dung (*B*) of animals that had not yet visited the lick consisted of light dark chocolate-brown balls or lumps. They contained 8·109 per cent. moisture, and left on calcination 13·607 per cent. of a greyish white ash of specific gravity 2·313 at 30°C.

The dung (*A*) of animals that had visited the licks consisted of dull grey balls or lumps. They contained 3·058 per cent. moisture, and left on calcination 76·039 per cent. of a rusty brown ash of specific gravity 2·545 at 30°C.

On analysis (S. K. Chhapgar) the dungs were found to have the following centesimal composition :

	B	*A*
Moisture	1·491	0·612
Insoluble in nitric acid	11·964	74·593
Sodium (Na_2O)	1·973	1·457
Potassium (K_2O)	3·023	1·394
Magnesium (MgO)	4·900	1·181
Calcium (CaO)	31·466	1·955
Aluminium (Al_2O_3)	2·371	7·555
Iron (Fe_2O_3)	11·464	4·206
Silica (SiO_2) soluble	13·456	6·046
Carbon dioxide (CO_2)	13·339	traces
Sulphur (SO_3)	0·090	...
Phosphorus (P_2O_5)	3·986	0·451
Chlorine (Cl)	0·277	0·250
Manganese (Mn)	...	traces

Fine Earth (20 mesh sieve)	90·820	per cent.
Insoluble in nitric acid	57·433	,,
Soda (Na_2O)	4·804	,,
Potash (K_2O)	1·263	,,
Magnesia (MgO)	0·183	,,
Lime (CaO)	1·363	,,
Alumina (Al_2O_3)	0·272	,,
Silica (SiO_2) soluble	13·410	,,
Phosphorus (P_2O_5)	1·022	,,
Manganese (Mn)	0·128	,,
Ferric oxide (Fe_2O_3)	0·617	,,
Moisture and organic matter	9·356	,,

Remarks : 1. The soil contains traces of chlorine and carbon dioxide 0·016 per cent. colloidal silica, 0·587 per cent. water-soluble inorganic matter and 0·102 per cent. water-soluble organic matter.

2. ' The licks are visited by all animals alike, there is no distinction in species. Only timings of visits differ. The pigs and blue bulls go early after sunset to eight in the night, but sambhars are always late frequenters. It is used after meals as well as before meals. There is restriction as regards season, they begin licking from October and after, till March. They use it mostly during the winter, especially after a spell of winter rain, when the ground is wet.' (M. A. Gani, Forest Ranger ; 10–2–1929.)

XLIV. *Common Earth*

Serial No. 42.

Locality—Richa Mahoti Zemindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy friable lumps with rootlets. Powder soft.

Minerals	3·26	per cent.
Clay	14·43	,,
Sand	83·48	,,
Organic debris	0·28	,,
Humus	1·06	,,
Moisture	1·30	,,
Fine Earth (20 mesh sieve) ...	96·230	per cent.
Insoluble in nitric acid	78·539	,,
Soda (N_2O)	1·699	,,
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Ferric oxide (Fe_2O_3)	1·798	,,
Moisture and organic matter	7·889	,,

Remarks : 1. The soil contains traces of sulphur, chlorine and carbon dioxide, 0·030 per cent. water-soluble inorganic matter, and 0·033 per cent. water-soluble organic matter.

2. The sample was collected in the neighbourhood of Salt-lick No. 43.

XLV. *Soil from Salt-Lick*

Serial No. 43.

Locality—Richa Mahoti Zemindari Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy friable lumps. Powder soft.		
Minerals	4·41	per cent.
Clay	23·53	,,
Sand	69·61	,,
Organic debris	2·63	,,
Humus	0·05	,,
Moisture	2·93	,,
Fine Earth (20 mesh sieve)	92·210	per cent.
Insoluble in nitric acid	65·217	,,
Soda (Na_2O)	3·635	,,
Potash (K_2O)	0·888	,,
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Ferric oxide (Fe_2O_3)	0·402	,,
Moisture and organic matter	3·211	,,

Remarks : 1. The soil contains traces of chlorine, sulphur and carbon dioxide, 0·071 per cent. colloidal silica, 0·173 per cent. water-soluble inorganic matter, and 0·067 per cent. water-soluble organic matter.

2. Same as for salt-lick No. 41.

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Aluminium (Al_2O_3)	2·371	7·555
Iron (Fe_2O_3)	11·464	4·206
Silica (SiO_2) soluble	13·456	6·046
Carbon dioxide (CO_2)	13·339	traces
Sulphur (SO_3)	0·090	...
Phosphorus (P_2O_5)	3·986	0·451
Chlorine (Cl)	0·277	0·250
Manganese (Mn)	...	traces

XLVI. *Soil from Salt-Lick*

Serial No. 44.

Locality—Danwar Reserve Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Yellowish-brown earth with clayish lumps either yellowish-brown or cement-grey. Powder soft.

Minerals	4·10	per cent.
Clay	23·29	,,
Sand	65·42	,,
Organic debris	0·70	,,
Humus	0·53	,,
Moisture	2·03	,,
Fine Earth (20 mesh sieve)	93·530	per cent.
Insoluble in nitric acid	76·367	,,
Soda (Na_2O)	2·476	,,
Potash (K_2O)	0·387	,,
Magnesia (MgO)	0·138	,,
Lime (CaO)	0·336	,,
Alumina (Al_2O_3)	0·349	,,
Silica (SiO_2) soluble	13·000	,,
Phosphorus (P_2O_5)	0·019	,,
Ferric oxide (Fe_2O_3)	2·375	,,
Moisture and organic matter	4·390	,,

Remarks : 1. The soil contains traces of carbon dioxide, sulphur, chlorine, and manganese, 0·013 per cent. water-soluble inorganic matter, and 0·006 per cent. water-soluble organic matter.

2. Same as for salt-lick No. 41.

XLVII. *Common Earth*

Serial No. 45.

Locality—Danwar Reserve Forest, Lalitpore Range, Jhansi Division.

Collected and sent by—The Forest Ranger, Lalitpore Range, Jhansi.

Buffy earth and friable lumps. Powder soft.

Minerals	4·77	per cent.
Clay	23·74	,,
Sand	72·52	,,
Organic debris	0·43	,,
Humus	2·81	,,
Moisture	1·93	,,
Fine Earth (20 mesh sieve)	93·930	per cent.
Insoluble in nitric acid	76·730	,,
Magnesia (MgO)	0·239	,,
Lime (CaO)	0·279	,,
Alumina (Al_2O_3)	4·108	,,
Silica (SiO_2) soluble	10·470	,,
Manganese (Mn)	0·022	,,
Ferric oxide (FeO_3)	2·231	,,
Moisture and organic matters	3·322	,,

Remarks : 1. The soil contains traces of chlorine and carbon dioxide.

2. The sample was collected in the neighbourhood of salt-lick No. 44.

REVIEWS.

I.—THE FIGHT TO LIVE, by Raymond L. Ditmars. Lovat Dickson Ltd., 8/6 net.

Raymond Ditmars is the Curator of Mammals and Reptiles in New York Zoological Park and has to his account several readable books on Natural History. His present theme is an attempt to sketch in broad outline the struggle to which all living creatures are condemned if they are to survive and have their being. The right to live implies a fight to live. To each creature Nature has given the implements whereby it might earn its livelihood. To the predator the weapons of attack, to the prey the means of defence. Mr. Ditmars takes stock of this armoury; commencing with the teeth, claws, horns and weapons of offence of the higher animals, he goes down the scale to snakes with their deadly fangs and to lower creatures which slay with their stings. More ingenious than these outright weapons of attack are the methods of defence employed by the victims. A body covered with bristling spines is one notable way to avoid being eaten. The device has been adopted by a host of unrelated creatures from the bristling porcupine to spiny fishes, crustaceans and hairy caterpillars. The author describes the porcupine as defending himself with vigorous jerks of his bristling tail. This is certainly not true of the Indian Porcupine whose way is to rush backwards at the attacker and so to impale him with his battery of sharp pointed quills. Armour plating has gone out of fashion with animals, at present the Armadillos and Scaly Ant-eaters are the only large animals which adopt this defence. From actual body armour we come to yet more subtle means of defence—mimicry, camouflage, smoke screens and poison gas. Mr. Ditmars writes interestingly about these various devices and of the creatures which employ them. Man has copied and vastly improved on the means of defence and attack employed by animals and uses them now largely for the more rapid and wholesale destruction of his fellow men. He is intelligent. Man, Nature's insurgent son, defies her laws. His intelligence enables him to prolong life, to sustain and multiply his unfit, to adapt himself to any environment. A victor over Nature he becomes a victim to his own ingenuity.

II.—THE VALLEY OF FLOWERS, by Frank S. Smythe. Hodder and Stoughton. 18 sh. net.

All Mr. Smythe's books on mountaineering are good to read. This book is the story of a Himalayan holiday; a rest after four strenuous expeditions. It tells of four happy months of wandering in the Central Himalayas and nowhere in their vast range are the Himalayas more impelling in grandeur. From east to west the towering peaks fill the northern sky. Within that grand panorama rise Nanda Kot and Nanda Devi, goddess of the Himalayas, the great massif of Hathi Parbat, Kamet climbed by the author in 1931, the snows of sacred Badrinath and Nilkanta, which in its isolated splendour is perhaps the most beautiful mountain in all the Himalayas. Mr. Smythe writes as a mountaineer freed from the thraldom of cities and happy in his mountains. He has read and now interprets the message of flower decked valleys and steep gorges, of serene vistas of alp, forest, snow field and glacier hung peaks, swept with tempest and rain, veiled in white mists, or gladdened with bursts of sunshine. This is the essence of his book. His valley of flowers is the Bhyundar Valley, where grow primulas so blue that they seem to light the hill sides. Here are asters and gentians and lush meadows carpeted with snow white drifts of anemones, golden lily-like *Nomocharis*, marigolds, delphiniums, violets and blue *Corydalis*, wild roses, flowering shrubs and rhododendrons—flower filled pastures set against a frieze of silver birches and shining snow peaks. Earth has fewer fairer vistas to offer. Mr. Smythe writes in his book of the *Abominable Snowman* whose mysterious tracks he saw on the snows of Nilgiri Parbat. The

mysterious foot prints on the snows of the higher Himalayas, seen by the author and other explorers, have drawn various conjectures as to the identity of the owners. Most appealing to the popular imagination is the theory that the foot prints were made by a mysterious race of mountain men to whom local legend ascribes the name 'Abominable Snow Men'. This legend probably has its origin in Hindu Mythology. Hindu Epic Literature abounds in stories of warriors and sages who, relinquishing the world and its vanities, retired to the Himalayan fastnesses, where by fasting and meditation they overcame the forces of evil and acquired such spiritual power as made gods and men tremble. It is a pity to strip the meat of romance from the dry bones of fact. The most likely explanation is that the foot prints are those of bears—either the Kashmir Brown Bear which inhabits the Western Himalayas or the Tibetan Blue Bear which occurs in the eastern portion of the range. These bears keep to the high levels in summer, living on the grassy slopes above the tree line. The human-like impress of their broad feet in the snow might easily be taken for giant human tracks. Mr. Smythe's book is illustrated with many colour photos of Himalayan scenery and contains appendices of the flowering plants collected by him in the region, which botanists and horticulturists will find useful.

III.—LAC CULTIVATION IN INDIA, by P. M. Glover. Pp. 147; 9 text-figures, 2 coloured plates, 14 black-and-white plates. Indian Lac Research Institute, Namkum, Ranchi, Bihar; 1937. Price Rs. 2.

This is a second and revised edition of *A Practical Manual of Lac Cultivation*, published by the author in June 1931. 'During the past six years a great deal of work has been done at the Indian Lac Research Institute, and as a result much information of practical value to the cultivator has been obtained, and is incorporated in this book, the scope of which has been widened to include matter likely to be of interest to the educated cultivator. The illustrations with a few exceptions are entirely new.'

The value of this volume cannot be overstated. It will prove an aid in the hands of every person interested in lac cultivation.

J. F. C.

IV.—SUPPLEMENT TO THE FLOWERING PLANTS OF MADRAS CITY AND ITS IMMEDIATE NEIGHBOURHOOD, by E. Barnes. Pp. 46; 4 plates. *Bulletin of the Madras Government Museum*; 1938. Price Re. 1-10-0.

This brochure is a welcome addition to the *Flora of Madras City*, published in 1929. It contains a description of 50 species and several varieties not included in the previous publication. The author first gives notes for distinguishing the plants described in this supplement from those included in the main volume of the *Flora of Madras City*, and then passes to the detailed descriptions of families, genera and species. An excellent production.

J. F. C.

V.—HINTS ON MUSEUM EDUCATION, by J. C. Basak. Pp. 1-282 (1938).

It is very difficult to review a work which deals with subjects quite alien to what one would expect from its title; such unfortunately is the case with the work under review. From the title 'Hints on Museum Education' one would expect a guide for museum authorities, such as museum curators and others responsible for the management of museums, regarding the methods to be adopted for making museums serve for the advancement of knowledge, but this is exactly what is wanting. In an introductory chapter the author deals with the importance of educational museums, but his method of treatment is very subjective, and so many subjects are mixed up in the short compass of 14 pages that the main issue becomes almost shrouded in details that have little to do with museum education. In a second chapter under the heading

'Preliminary Remarks' are discussed such diverse subjects as the Spread of Museum Knowledge, Useful *versus* Ornamental Knowledge, Well-directed Education, Memory not to be Taxed Improperly, Instances of Useful Knowledge, Study of Arts and Sciences and Exhibits of the Three Kingdoms, General Knowledge of Technical Subjects with sub-headings 'Botany' and 'Zoology', Mental Hygiene and Child Psychology, Curious or Wrong Notions about Educational Museums, Mass Education in the Indian States, Children's Museums, and Properties of Objects as Perceived by the Five Sense Organs. The variety of subjects treated in this chapter makes one wonder what the author's conception of the functions of a museum is. No one denies the great service rendered to education by educational museums and exhibitions of industrial objects in science museums, but the author devotes a page or so to museum work and several pages to defective curricula of educational institutions, instances of useful *versus* useless knowledge, the importance of the study of arts and sciences, etc. In fact the work appears to be based on such an imperfect acquaintance with the work of museums either in Europe and America or even in India that it is very doubtful whether his analysis would serve any useful purpose. The major part of the book (pp. 57-270) is devoted to classification of exhibits under headings like Foods, Ordinary Drugs, Medical Appliances, Houses and Architecture, Stamps and Coins, Mechanics and Machines, Arts and Manufactures, Physics, Electricity, Some Mysterious Sciences, School Exhibits, Pictures, Nativities, Horoscopes, Useful and Interesting Information, Museum Library, Children's Museums, etc., arranged in 34 chapters. These accounts are useful compendia of a heterogeneous mass of information on very varied subjects, but their utility for museum education is very doubtful. As an instance may be noted the fact that whereas some 98 pages are devoted to a description of the properties of ordinary foods and drugs, less than half a page deals with objects that should be exhibited in the Food section, and not a word about Drug exhibits. In a final chapter under the heading 'Suggestions for Reformation' the author discusses certain recommendations of the representatives of the Museums Association as laid down in their report on the 'Museums of India' and offers suggestions for the improvement of the Indian museums. One of these is to transform the National museum of India, the Indian Museum, Calcutta, into what he considers to be an urgent need of the country, *viz.*, a science museum, a technical museum, a public health museum, a children's museum and everything else in museum line all combined into one; such an octopus, the exact functions of which the author has not set forth, has not been possible either in Europe or America, and one cannot understand how such an institution could ever be established in India with the very meagre funds that are available for museums in this country. Even if established, the incubus of such a gigantic institution is sure to stultify the main purposes which it is expected to serve.

B. P.

VI.—MORE DIFFICULTIES OF THE EVOLUTION THEORY. by Douglas Dewar. Pp. 206. London: Thynne & Co.; 1938. Price 8*s.* 6*d.* net.

This volume is a sequel to the author's *Difficulties of the Evolution Theory*, and a reply to Dr. Morley Davies' *Evolution and its Modern Critics*. Its aim is to question the validity of the theory of organic evolution and to set forth a number of objections to the theory, so coupled with the arguments of its supporters as to afford the student and the layman some sort of a basis on which to found judgment as to the soundness or otherwise of the theory. The objections are based solely on scientific ground, biological and palaeontological.

The book is well written and closely packed with information, excellent for reference.

J. F. C.

AN ASSURANCE.

I very much regret if my criticism of Major Handley's book *Hunter's Moon* in the *Journal* of the Bombay Natural History Society, dated 15th December 1934, caused him worry and pain, and I wish to make it clear that my criticism was not intended as a personal attack on Major Handley.

R. C. MORRIS.

[The criticism of *Hunter's Moon* which appeared in No. 3, Vol. xxxvii of the Society's *Journal* was an unsolicited contribution from Mr. R. C. Morris.—EDS.]

MISCELLANEOUS NOTES.

I.—OCCURRENCE OF TIGER IN NORTHERN SIKKIM AT 8,800 FT.

I am told you would be interested to hear of a tiger being killed in the extreme north of Sikkim.

At Lachung (8,800 ft.) in the valley of that name (the eastern confluent of the Tista R.), the Pipun (headman) showed me early this month the skin of a large tiger drying on a wall which he had just shot a little above the village after it had killed 6 ponies. None had ever been heard of in that region before by natives.

HANFORD HOUSE,
BLANFORD, DORSET,
ENGLAND.
April 19, 1938.

F. H. LISTER,
Lt. Colonel.

II.—MEASUREMENTS OF TIGERS SHOT IN THE NILGIRIS—1925-37.

Sex	Place	Body	Tail	Total length	Height at shoulder	Girth of Body	Girth of Neck	Remarks
Female	Mudumalai ...	...	...	8′4″	...	...	...	
Male	Plateau ...	...	...	9′4″	...	...	...	
Male	Plateau ...	...	...	8′1″	...	...	...	A young male.
Male	Plateau ...	6′0″	3′5″	9′5″	...	...	...	
Female	Plateau ...	...	...	8′8″	...	...	...	Recovered stiff.
Male	Plateau ...	6′3″	3′5″	9′8″	38″	51″	27″	Forearm 18″, a very heavy tiger.
Male	Plateau ...	...	...	8′11″	...	...	...	
Female	Mudumalai ...	5′5″	3′2″	8′7″	...	...	24″	
Female	Plateau ...	5′7″	3′1″	8′8″	34″	41″	27″	
Female	Plateau ...	5′10″	3′4″	9′2″	...	...	...	Measured round curves, as recovered stiff and tucked up—pegs not less than 8′9″.
Male	Mudumalai ...	6′3½″	2′11½″	9′3″	...	...	...	Curves 9′8″.
Male	Anaikatti ...	5′10″	2′10″	8′6″	38″	47″	31″	Forearm 20″.

Note.—All measurements taken between pegs except where otherwise stated.

WINCHCOMBE,
KALHATTI P.O.,
NILGIRIS, S. INDIA.
August 24, 1938.

E. G. PHYTHIAN-ADAMS,
Major.

III.—MEASUREMENTS OF PANTHERS.

Sex	Place	Body	Tail	Total length	Height at shoulder	Girth of Body	Girth of Neck	Remarks
Female	Poona ...	...	...	6′2½″	...	...	...	
Male	Raipur ...	54″	31″	7′1″	28″	29″	...	Forearm 11″.
Female	Poona ...	...	...	6′7″	...	...	...	Very long tail.
Male	Chittoor ...	...	...	7′2½″	...	...	...	
Male	Chittoor ...	...	...	7′4½″	...	...	...	
Male	Secunderabad	...	...	6′7″	...	...	...	
Male	Secunderabad	...	...	7′2″	...	...	...	
Female	Mysore ...	...	...	6′10″	...	...	...	
Male	Mysore ...	...	...	7′1″	...	...	20″	Very old male with short tail.
Female	Mysore ...	...	...	6′5″	22″	...	18″	Old female.
Male	Mysore ...	43″	29″	6′0″	...	...	16″	
Female	Bangalore	41″	30″	5′11″	24″	...	13″	
Female	Mysore ...	44″	26″	5′10″	...	...	...	
Female	Mysore ...	46″	31″	6′5″	23″	26″	16″	
Female	Mysore ...	47″	30″	6′5″	24″	27″	16″	
Male	Mysore ...	56″	32″	7′4″	29″	33½″	20½″	Very old male with two old wounds.
Male	Mysore ...	57″	33″	7′6″	29″	32″	21″	
Male	Mysore ...	55″	32″	7′5″	24″	31″	19½″	
Female	Mysore ...	48″	30″	6′6″	22″	26″	17″	
——	Mysore ...	45″	31″	6′4″	22½″	24″	15″	Sex omitted in register but presumably a young male.
Female	Mysore ...	51″	31½″	6′10½″	23″	28″	18½″	
Male	Mysore ...	46″	29″	6′3″	23″	24″	15″	} Two young males
Male	Mysore ...	45″	26″	5′11″	21″	22″	14″	} shot R and L.
Male	Mysore ...	54″	34″	7′4″	26½″	33″	21″	
Male	Nilgiris ...	46″	28″	6′2″	20″	25″	16″	
Female	Nilgiris ...	47″	31″	6′6″	23″	25″	16″	
Male	Nilgiris ...	48″	34″	6′10″	23½″	26″	16½″	
Female	Mysore ...	45″	28″	6′1″	23″	27″	16″	
Male	Mysore ...	55″	33½″	7′4½″	26½″	33½″	22½″	
Female	Nilgiris ...	44″	29″	6′1″	23″	25″	14″	
Female	Mysore ...	43″	29″	6′0″	24″	26½″	16″	
Female	Nilgiris ...	45″	30″	6′3″	23″	28″	16″	
Male	Mysore ...	44″	30″	6′2″	21″	25½″	17″	Recovered stiff.
Male	Nilgiris ...	49½″	32″	6′9½″	27″	31″	20½″	Recovered stiff—curves 7′3″.
Female	Nilgiris ...	46″	31″	6′5″	20″	...	16″	
Female	Mysore	44″	28″	6′	20½″	33″	16″	
Male	Nilgiris	54½″	33″	7′3½″	28″	32½″	20½″	Forearm 12″.
Female	Nilgiris	45½″	30½″	6′4″	22½″	25″	15″	Weight 78 lbs.

Note.—All measurements taken between pegs. Except the first seven on the list all the above were shot between 1926 and 1937.

WINCHCOMBE,
KALHATTI P.O.,
NILGIRIS, S. INDIA.
August 24, 1938.

E. G. PHYTHIAN-ADAMS,
Major.

IV.—MEASUREMENTS OF TIGER, PANTHER, BISON AND SAMBHUR.

I give below further measurements and weights:—

Tiger—

Female	— 8′	(Mysore)
Male	— 9′ 1″	(do.)
Female	— 8′ 3″	(North Coimbatore)
Male	— 9′	(South Coimbatore) — — weight = 421 lbs.
Do.	— 8′ 8″	(North Coimbatore) — — 9′ 1″ over curves — skull = 13″ × 9″.
Do.	— 9′ 5″	(North Coimbatore) do do. — skull = 14″ × 9½″.
Do.	— 9′ 3″	(Nilgiris) — 9′ 8″ over curves—skull = 14¼″ × 9½″ — Circumference of head = 34″.
Do.	— 8′ 8″	(Nilgiris) — Body = 70″; Tail = 34″; Height = 38″: Circumference of head = 34″; Circumference of neck = 31″; Circumference of body 57″; Circumference of forearm = 20″.

Panther—

Male	— 7′ ¼″		North Coimbatore.
Do.	— 6′ 5½″		
Do.	— 6′ ¾″		
Do.	— 6′ 10″	— — Weight = 118 lbs.	
Do.	— 7′ 1″		
Female	— 6′ 2″		
Do.	— 6′ 2″		
Male	— 7′ 2½″		
Do.	— 7′	— — Skull = 9″ × 6″	

Bison—

Bull—Horn spread = 36″ — weight = 2438 lbs.* } North Coimbatore.
Bull— ,, = 34″ — weight = 1966 lbs. }

Sambhur—

Stag—Horn length = 38½″; weight = 776 lbs.*; Height = 60″; Length = 7′ 4″. (North Coimbatore).

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O., R. C. MORRIS.
S. INDIA.

July 23, 1938.

V.—METHOD ADOPTED BY LEOPARDS IN HUNTING MONKEYS.

About 3 months ago, during the month of May 1938, I had the Ranipur block in the Banda Forest division of the United Provinces reserved for tiger shooting. Besides securing a magnificent tiger,

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* These bison and sambhur, were quite the most colossal specimens of their species I have ever seen: especially the bull, which weighed no less than 472 lbs. more than the next largest weight I have recorded to date, nearly 200 lbs. over a ton.

I again had the good fortune of witnessing a very interesting incident, which does not often fall to the lot of a shikari.

I actually saw a couple of leopards hunting and killing a langoor, the common black-faced monkey of our jungles. I suppose many sportsmen before this have observed leopards killing langoors, but as I have not seen this method described, I thought it would be rather interesting to send in my observations to the *Journal*. The incident took place as follows:—

The tiger mentioned above had killed the previous night at a place called Bhainsdara, in my block, and a beat had been arranged. The beaters had been sent about a mile away from my machan, from whence they proposed beating up the tiger. Stops had been duly placed and the utmost silence prevailed. Suddenly, langoors began swearing some distance away. My machan, which was on the top of a tree leafless at this time of the year, commanded a wonderful view of the surrounding jungle. Suddenly, through the clump of bamboos I saw a large leopard appear. The langoors leapt from tree to tree, in awful panic. The next instant I caught glimpse of another leopard bounding along below these trees.

In pursuit the leopards showed neither stealth nor discretion, theirs was the bold open plan of attack. One of them now jumped on to an isolated tree and began climbing it with great agility. One of the langoors observing this, instead of leaping to safety, jumped down to the earth, and was instantly caught and killed by the second leopard waiting below. Its death-cries were terrible and very piteous indeed.

I refrained from shooting as I thought that this incident would be unique of its kind, showing the tactics employed by leopards when hunting monkeys. The langoor was dragged into the thick bamboos and there much snarling and growling took place.

The hunt had ended and just as I began to make rough notes in my pocket-book, the sound of the beat became audible, and my attention was drawn to the business in hand. I heard a stop cough and then the rattle of stones, and then before me there stood the jungle king in all his magnificence, but panting from the terrible heat. A shot from my rifle laid him low. A lovely tiger measuring 9 ft. 8½ in. between pegs. The leopards momentarily came into view but disappeared in a nullah.

After the beat was over we examined the remains of the langoor, which had not been greatly eaten, owing to the approach of the beat. It is very extraordinary that during the terrible heat of a May day, leopards should be out hunting. I suppose they were driven to this extreme by the pangs of hunger.

I would be very grateful if other sportsmen would send in their observations of similar occurrences.

It would be very interesting to know as to whether this is the normal method adopted by leopards in hunting monkeys. It is a well-known fact that monkeys in forests live generally in company with deer such as *Chital*, and on the slightest suspicion of danger, specially at the approach of their deadly foe, the leopard, the *chital* give the warning cry and the monkeys in their turn

take up the alarm and jump away from tree to tree to safer quarters.

MALERKOTLA STATE, PUNJAB. IFTIKHAR ALIKHAN, *Heir Apparent.*

August 24, 1938.

[Deer frequently associate with monkeys. The explanation is the advantage they derive from being able to eat the fallen fruit and leaves which the monkeys drop in their careless and destructive feeding. Incidentally it is possible that the association is mutually beneficial, the persistent watchfulness of either being a safeguard against attack. Blanford speaks of langoors giving out their characteristic alarm call at the sight of bolting deer: which may be taken as an instance of the effectiveness of the association between these animals.—EDS.]

VI.—OTTERS AND CROCODILES.

Some weeks ago I went out to Pushkar Lake, which you probably know of by reputation.

The tank is sacred and naturally all shooting is very strictly prohibited. Crocodiles used to abound there living on fish and an occasional stray cow or unwary pilgrim.

As there seemed to be fewer crocodiles than usual that day I asked the care-taker of the lake side house where I was, why the usual numbers were not visible. He told me that they were being killed off by families of *Jalmanus* which had recently come to the lake. Not knowing this name I asked for a description of the animal. At that moment the heads of a family of otters showed up in the middle of the lake and the man pointed them out as the slayers of the crocodiles.

A few days later when I was retailing this tale to some College boys I was interrupted by a boy from Bundi who told me that he had actually seen an otter attacking a crocodile.

This is his story. He was out with His Highness of Bundi and a party late one night shooting fish by the light of a strong searchlight. These fish—variety unknown—but of some considerable size, are apparently attracted to the surface by the beam of light. While out on the lake their attention was drawn to a noisy commotion at some distance from their boat. The beam was directed towards the noise and they saw a crocodile on the surface mouth wide open making a sort of barking noise and on the back of the crocodile scratching and biting at the back of his upper jaw and eyes was a large otter. The boy who told me this story is very keen on Nature study and knows quite a lot about animals and birds. He was very definite about all the details he gave me and said the fight or struggle showed up very clearly in the beam of the searchlight. They watched the struggle for some time

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The hunt had ended and just as I began to make rough notes in my pocket-book, the sound of the beat became audible, and my attention was drawn to the business in hand. I heard a stop cough and then the rattle of stones, and then before me there stood the jungle king in all his magnificence, but panting from the terrible heat. A shot from my rifle laid him low. A lovely tiger measuring 9 ft. 8½ in. between pegs. The leopards momentarily came into view but disappeared in a nullah.

After the beat was over we examined the remains of the langoor, which had not been greatly eaten, owing to the approach of the beat. It is very extraordinary that during the terrible heat of a May day, leopards should be out hunting. I suppose they were driven to this extreme by the pangs of hunger.

I would be very grateful if other sportsmen would send in their observations of similar occurrences.

It would be very interesting to know as to whether this is the normal method adopted by leopards in hunting monkeys. It is a well-known fact that monkeys in forests live generally in company with deer such as *Chital*, and on the slightest suspicion of danger, specially at the approach of their deadly foe, the leopard, the *chital* give the warning cry and the monkeys in their turn

take up the alarm and jump away from tree to tree to safer quarters.

MALERKOTLA STATE, PUNJAB. IFTIKHAR ALIKHAN, *Heir Apparent.*

August 24, 1938.

[Deer frequently associate with monkeys. The explanation is the advantage they derive from being able to eat the fallen fruit and leaves which the monkeys drop in their careless and destructive feeding. Incidentally it is possible that the association is mutually beneficial, the persistent watchfulness of either being a safeguard against attack. Blanford speaks of langoors giving out their characteristic alarm call at the sight of bolting deer: which may be taken as an instance of the effectiveness of the association between these animals.—EDS.]

VI.—OTTERS AND CROCODILES.

Some weeks ago I went out to Pushkar Lake, which you probably know of by reputation.

The tank is sacred and naturally all shooting is very strictly prohibited. Crocodiles used to abound there living on fish and an occasional stray cow or unwary pilgrim.

As there seemed to be fewer crocodiles than usual that day I asked the care-taker of the lake side house where I was, why the usual numbers were not visible. He told me that they were being killed off by families of *Jalmanus* which had recently come to the lake. Not knowing this name I asked for a description of the animal. At that moment the heads of a family of otters showed up in the middle of the lake and the man pointed them out as the slayers of the crocodiles.

A few days later when I was retailing this tale to some College boys I was interrupted by a boy from Bundi who told me that he had actually seen an otter attacking a crocodile.

This is his story. He was out with His Highness of Bundi and a party late one night shooting fish by the light of a strong searchlight. These fish—variety unknown—but of some considerable size, are apparently attracted to the surface by the beam of light. While out on the lake their attention was drawn to a noisy commotion at some distance from their boat. The beam was directed towards the noise and they saw a crocodile on the surface mouth wide open making a sort of barking noise and on the back of the crocodile scratching and biting at the back of his upper jaw and eyes was a large otter. The boy who told me this story is very keen on Nature study and knows quite a lot about animals and birds. He was very definite about all the details he gave me and said the fight or struggle showed up very clearly in the beam of the searchlight. They watched the struggle for some time

I again had the good fortune of witnessing a very interesting incident, which does not often fall to the lot of a shikari.

I actually saw a couple of leopards hunting and killing a langoor, the common black-faced monkey of our jungles. I suppose many sportsmen before this have observed leopards killing langoors, but as I have not seen this method described, I thought it would be rather interesting to send in my observations to the *Journal*. The incident took place as follows:—

The tiger mentioned above had killed the previous night at a place called Bhainsdara, in my block, and a beat had been arranged. The beaters had been sent about a mile away from my machan, from whence they proposed beating up the tiger. Stops had been duly placed and the utmost silence prevailed. Suddenly, langoors began swearing some distance away. My machan, which was on the top of a tree leafless at this time of the year, commanded a wonderful view of the surrounding jungle. Suddenly, through the clump of bamboos I saw a large leopard appear. The langoors leapt from tree to tree, in awful panic. The next instant I caught glimpse of another leopard bounding along below these trees.

In pursuit the leopards showed neither stealth nor discretion, theirs was the bold open plan of attack. One of them now jumped on to an isolated tree and began climbing it with great agility. One of the langoors observing this, instead of leaping to safety, jumped down to the earth, and was instantly caught and killed by the second leopard waiting below. Its death-cries were terrible and very piteous indeed.

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and then the otter dropped off into the water and the crocodile sank.

It has struck me that these details may be of interest to some of the members of your society. They are hearsay but with regard to the story from Bundi I can easily ask for evidence of other members of the party who were out that night.

Are otters the natural enemies of crocodiles? The number of crocodiles now to be seen at Pushkar is less than it used to be. The lake is full of fish of the carp variety who are fed by pilgrims. They come up in vast shoals to take parched gram and on two occasions, in my presence, the commotion made by the fish on the surface fighting for the gram has attracted the attention of crocodiles.

The first time a crocodile cruising about some 75 yards from the shoal turned and swam slowly in our direction, eyes just showing above the water. Some 20 yards from the bank the crocodile sank and a few seconds later came up with a rush and swirl, mouth wide open, from under the centre of the shoal not more than five feet from where I was standing feeding the fish. On the second occasion the crocodile adopted similar tactics to begin with but instead of submerging at about 20 yards carried on, on the surface, and when some 4 or 5 yards from the shoal suddenly put on a terrific spurt and sailed into the middle of the shoal mouth wide open.

The tank in a normal winter is about 700 yards long by 300 to 400 yards wide and is surrounded by temples and bathing ghats. In flood the area is trebled.

According to the belief of the natives of the place each female crocodile lays 108 eggs in the laying season—the number of beads in the Hindu Rosary.

MAYO COLLEGE,
AJMER.
July 8, 1938.

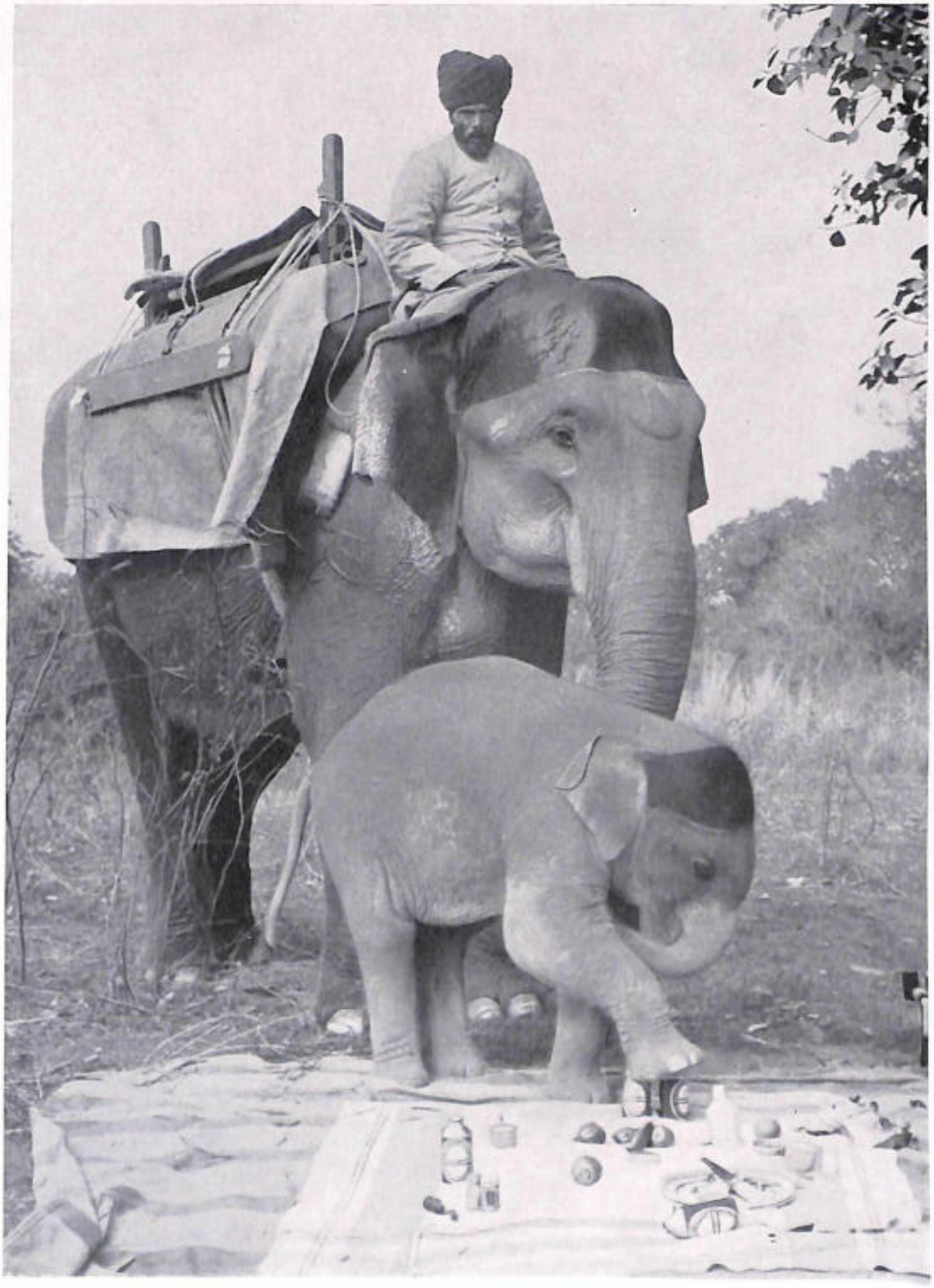
C. HOWSON,
Lt.-Col.

VII.—A BABY ELEPHANT.

A baby elephant produced as a surprise by one of the Forest Department elephants in the Naini Tal district, has been presented to the Zoological Society of London.

Nine months old, after a happy life of adventure, beating in line with nineteen other elephants for birds and big game;—being made a great pet of by the Viceroy's household, when in his camp at Kaladhungi where four tigers were shot;—she has now left her native country, and experiences for the first time in her young life travel by rail and sea.

She travelled down to Bombay with her Mahout in a horse box. There, by the kind assistance of the Bombay Natural History Society, she was put on board a B.I. boat, in charge of Mr. Weeks, one of the officers, with full instructions as to feeding and care.



RAJ PIARI WITH HER MOTHER.

Mr. Weeks and Raj Piari got on very well; he wrote from Port Said to say 'Everything has gone fine and our charge is well behaved.

'She has a walk every morning and follows me all around the ship. We had a very cool and calm run so she was not ill or off her food at all, but we certainly have a job oiling her pads.'

No film star can claim such 'snapping' and success, such petting and publicity; or being such topical news as Raj Piari at the age of from one to nine months.

Her pictures have appeared in many English papers heralding her arrival. There is no doubt that she will be as great a success in London.

On one occasion in a beat for big game a tiger charged right up to her mother, who although untested for staunchness stood her ground unconcernedly while her baby, after one look at the tiger, thought 'safety first', and retired for shelter under her mother's belly.

Her mother Indra Kali was bought at the Sonpur Mela for Rs. 1,500. She had not been in captivity long, and no one knew about the possibility of a family.

She came up to the foot hills of the Himalayas and began work in the forests.

There was great interest among the Mahouts when the unexpected birth took place in Ramnagar.

Very seldom is an elephant born in captivity, although curiously enough, thirty years ago in almost identical circumstances an elephant was born in Ramnagar and sent to the London Zoo.

From the beginning this baby knew no fear. About the size of a boar, she enjoyed chasing the Mahouts' children, who tumbled round her trying to get a ride.

She has never known constraint, going everywhere with her mother. When her mother was chained at the Elephant Camp, Raj Piari was left free. She never went very far from mamma, but at night, to make sure and ease her maternal anxiety Indra Kali used to fasten her trunk round a baby leg, as her beloved slept by her side.

The weaning had to take place very gradually. Mother and child trumpeted for each other. They were separated for a few minutes at a time at first, and then for longer periods, until they ceased to fret. Raj Piari was made a great fuss of and she loved it. Indra Kali was given lots of company of other elephants, and so they parted.

A cable and letter from the London Zoo stating she had arrived in good condition and was eating well and how pleased they were to have her, puts all anxiety aside,—she has evidently carried her 610 lbs. safely and without any hitch to the Pets' corner of the London Zoo.

ARDWELL,
NAINI TAL, U.P.
June 29, 1938.

J. IBBOTSON.

VIII.—CURIOUS BEHAVIOUR OF ELEPHANTS.

In March this year I was after elephant in the Kale Valley in Burma. Having unfortunately badly wounded one elephant I was not entitled to shoot another on my license.

On leaving my camp to go down country, I ran into a herd of elephants in *kyaing* grass on the edge of heavy jungle with thick cane undergrowth.

Hurrying forward, I climbed into a small tree between the elephants and the jungle they were making for; the man with me, a pensioned Gurkha Jemadar, getting up only four feet off the ground. My object was to have a good look over the herd. More than fifty elephants passed within five or six paces of the tree I was in. One elephant only showed signs of unease and let out a minor squeal. At the last a party of eight elephants passed us, but I think must have been suspicious as they turned round and stood round the tree with all heads in; four of them were within one foot of the Gurkha Jemadar, looking directly at him. He was waving the barrel of my small rifle within six inches of the eyes of one elephant, whilst I took aim at the head of another at one foot-range in case of trouble.

The elephants stayed for perhaps five minutes before slowly going off into thick jungle. There was a slight cross breeze at the time.

I wonder why the elephant did not spot us as neither of us kept still, and one elephant looked straight at me at six feet without a sign of recognition of my presence. Any of the elephants could have pulled us off the tree. Perhaps when an elephant is very close with its trunk on the ground, it is unable to get the wind of a man three or four feet up. It is obvious that these elephants made no use of sight or hearing.

F. W. HASWELL, I.A.,
Major.

BAKLOH,
PUNJAB.

May 3, 1938.

IX.—'STAMPING GROUNDS' AND 'SORE NECK' IN SAMBAR.

Mr. W. S. Thom refers in his note in your issue of 15th April, 1937 (vol. xxxix, no. 2) to (*a*) what he calls sambar 'stamping grounds' and (*b*) the sore patch frequently seen on a stag's neck.

In regard to the first there is no longer any doubt that these cleared patches or 'stamping grounds', frequently to be found at the base of a tree or in the open as well, are made by stags during the breeding season.

I have on more than one occasion seen a sambar stag behaving in the manner described by Mr. F. W. F. Fletcher, and have also seen this done by a muntjac (barking deer); and in each case the hinds were close by. To my mind it is equivalent to the dance of the peacock and other birds, in fact a display.

The sore patch on the neck of a sambar stag is very common in South India and the cause is probably glandular. As described, it is generally to be found where normally exists a whorl of hair, but in the case of a stag I shot some years ago the patch was higher up the neck, in the ruff, and the sore was not circular, but elongated. This may have been of course due to other causes.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O., R. C. MORRIS.
S. INDIA.

August 25, 1938.

X.—OCCURRENCE OF THE WHITE-HEADED WAGTAIL [*MOTACILLA FLAVA LEUCOCEPHALA* (PRZEWALSKI)] IN THE ATTOCK DISTRICT OF THE PUNJAB.

On April 27th 1938 I shot a male White-headed Wagtail (*Motacilla flava leucocephala*) from amongst a number of *M. f. beema* on passage near Chhoi in the Attock District of the Punjab. There is only one previous record of this bird from India, Whistler having obtained a male at Jhelum on May 2nd 1913 (*Ibis* 1916, p. 75). He informs me that my specimen agrees absolutely with his.

RAWALPINDI, H. W. WAITE, M.B.O.U.
PUNJAB. *Indian Police.*

June 12, 1938.

XI.—EGG STEALING BY KHASIA HILLS CUCKOO (*CUCULUS CANORUS BAKERI* HARTERT).

I have been the witness today, May 14, 1938, between the hours of 3-45 p.m. and 4-45 p.m. of a series of interesting and exciting incidents at a chat's nest in my garden. The nest in question is that of a Burmese Stone Chat (*Saxicola caprata burmanica*) and is situated on a slope of grass land some sixty yards from my verandah, where I command it perfectly with a ×30 telescope, mounted on a tripod.

This nest had four eggs in it, which had been incubated for about four days. Yesterday, May 13, I surprised a cuckoo on the ground within three paces of the nest. This was a female bird and obviously interested in the whereabouts of the chat's nest, so I kept a watch over most of the evening of that day in case she would come to lay. A number of rain storms however came on and I saw nothing more of the cuckoo.

This morning I went to verify the number of eggs in the nest and found the same four eggs in it. I had another look into the nest about 1 p.m. when there were still four eggs.

As I was expecting the cuckoo to come and lay I kept the nest under observation, and sure enough, at a quarter to four o'clock in the afternoon the cuckoo came and settled on the grass slope some three paces below the nest. I had marked the exact position of the nest with a twig and of course with a telescope of ×30 magnification I could see every blade of grass at that distance and the expression in the chats' eyes as they dived and mobbed the cuckoo.

Then a long and protracted fight took place between the chats and the cuckoo lasting on and off for just over one hour!

As I could read the expression of the combatants, it was really an exciting encounter to witness. I was particularly anxious to see the cuckoo lay at this nest as it was an open nest, perfectly accessible to the cuckoo to sit on, and I wanted to see whether she would sit on it, as she has been seen to do in England, or whether she would squirt her egg in and fly rapidly off as I have seen this cuckoo do at an inaccessible nest here. In the former case, sitting on the nest she would close her tail and take some time to lay; and in the latter case she would spread her tail and wings and squirt in and be off within three seconds or so.

The grass in the vicinity was quite short except for a few tufts of longer grass in one of which the nest was situated. This being so the cuckoo was always in full view when near the nest, and through my telescope appeared to be but six feet distant.

The cuckoo was obviously searching for the nest, but the repeated onslaughts of the two chats caused her continually to duck and open her mouth, so that she could not concentrate on her purpose. I could see her peering into the grass everywhere as she hopped in her search some way below the nest. It was apparent that she did not really know its exact situation. This hopping about and mobbing of the intruder went on for a considerable time. It was quite obvious she had no egg in her throat by the sudden twists of her head and the opening wide of her mouth at the attackers.

The cock chat was doing most of the mobbing, and indeed was doing some damage to the cuckoo. I noticed he knocked a feather out of her back, and soon afterwards I saw the little hen chat pick it up off the grass and fly off with it!

The hen chat would often go and sit on a twig just by her nest and I could not make out why the cuckoo was so slow in finding it. The battle went on fast and furious, the cuckoo hopping about, and often when she fell over she had to spread her wings to regain her balance. Eventually she flew up onto the wire railings three or four paces beyond the nest. Another chat now joined in the attack—a young bird of the year.

While the cuckoo was perched on the railings within such a short distance of the nest, the hen chat actually went back to her nest and sat on it. I thought then that the cuckoo could not fail to have exactly located it. I could see her peering at the place. Now she came down and the battle was renewed, but she was unsuccessful again and was driven off. She returned and gradually worked her way up to the nest, losing some feathers

from the back of her head in the final assault. She got to the nest this time and dived straight at it, thrusting her head in and was off in one second! She had not spread her tail, and it was obvious that she had not laid. Her action was so rapid that I could not see whether she had flown away with an egg or not. I continued to wait, noting that the battle had so far lasted 20 minutes.

As I thought she had flown off, I left my house and walked slowly down the garden to inspect the nest. Half way down however I saw the cuckoo sitting on top of a willow tree some ten yards from the nest, so I returned quietly to continue my watch through my telescope from the verandah.

As she now knew the position of the nest, I hoped she would come and lay. At the same time I knew the chat's eggs were not quite fresh and so not suitable for that purpose.

The cuckoo waited some ten minutes on the willow tree and then she flew down and settled in a small bush within five paces of the nest and below it. The chats at once began the attack. Soon after the cuckoo came to ground and began hopping up towards the nest. She was savagely attacked and was not having it all her own way. It took her a considerable time to reach the nest under the continual mobbing, which became more and more severe as she got nearer and nearer to the nest.

When she did reach it this time, she dived in as before, but spread her tail to half extent, keeping it more or less horizontal and not pressed down as in the laying position. She was but a second at the nest and then she flew off with an egg very clearly seen in her bill, pursued by the angry chats.

A pause of perhaps five minutes followed. I could not see the cuckoo and I did not know in which direction she had gone. She returned after a short time and the battle was renewed. She eventually reached the nest again and dived in with half-spread tail and was gone in two seconds! As again her tail had not been depressed and her stay at the nest had been so short I considered that she had not laid.

She flew off this time to a considerable distance without giving out the bubbling notes that a cuckoo usually gives out after laying. I decided the time had come to walk over to the nest and investigate matters. On reaching the nest, I saw *one* chat's egg in it! So the cuckoo had taken three eggs. That she had not laid I attribute to the fact that the chat's eggs were some four days incubated. Several of the cuckoo's feathers were scattered about near the nest.

The little hen chat had from time to time given away the position of her nest, though I cannot think that it was done deliberately, seeing how fiercely they had both attacked the cuckoo. At one time she went back and sat on her nest when the cuckoo was *within four paces of it*. When she was on her nest she was just hidden from view in the grass. I was amused to see her head suddenly appear on one occasion as she looked out anxiously at the cuckoo hopping up from below, then she ducked her head and continued to brood her eggs.

This account will show how a cuckoo will persist over a whole hour at a nest, and how she will take the eggs if they are not fresh ones suitable for her purpose by returning time after time to steal them. Finally, it may be noted that no male cuckoo put in an appearance to assist her the whole of the time these incidents were under observation.

That cuckoos lay their eggs not in the early morning as most birds do, but in the late afternoon or evening, is perhaps a part in the adaptation that the cuckoo has perfected against its dupes, for in the fading light the cuckoo's egg stands a better chance of acceptance.

It has not yet been shown that cuckoos eat birds' eggs indiscriminately. I believe they only take away and eat the eggs of those species of small birds they are habitually parasitic on, and that there is *very good reason for this*, for by so doing they prevent their intended fosterers from sitting and hatching off their young, and cause them to start nesting operations all over again and so provide suitable fresh eggs for them to lay with.

It is hardly credible that a cuckoo would battle for a whole hour with two angry chats merely in order to eat their small eggs—the reward would not justify the trouble involved. We must look for some more cogent reason, such as the one I have suggested.

Sixty yards beyond this chat's nest and outside my compound fencing I found a chat's nest about a week ago.

The chat flew out at my feet, and on looking into her nest I saw a young cuckoo in the nest and fallen outside two of the young chats. They appeared to be about six days old and their pale yellowish colour contrasted with the black skinned young cuckoo in the nest.

It was a curious coincidence in finding the nest at the very moment the young cuckoo had kicked the young chats out. The young chats were upside down struggling and about 8 inches apart. They had fallen down the sloping bank a foot or so.

Knowing what their fate was bound to be if I put them back in the nest I took them off and put them in another chat's nest in my garden which had two hard set eggs in it. Even then however they met an unkind fate for 2 days after they had mysteriously disappeared.

T. R. LIVESEY.

TAUNGGYI,

S. SHAN STATES, BURMA.

XII.—CALL NOTES OF THE BURMESE PLAINTIVE CUCKOO (*CACOMANTIS MERULINUS QUERULUS*).

I have seen no account of the call notes of this bird and so I would like to put on record what I have been able to make of them from observations over several years. The notes are probably very similar to the notes of the Indian race the notes of which appear to me to be inadequately, and possibly wrongly, described in the *Fauna*.

The characteristic, plaintive cadence-call—from which this cuckoo has derived its name of 'Plaintive Cuckoo'—is very well known, but it has two other distinctive calls that have not, I think, been described. Then it remains to consider what the meaning of these call notes are, and by what sex they are uttered.

The first, and best known, is the cadence-call which may be syllabified as follows:

'Tēe-tēe-tēe-tēe-tītā-tītā-tītā-tēē'

The first four notes are plaintive, and prolonged over a period of about two seconds each, with an interval of about three seconds between each. The next three notes are double ones, twice as fast, and with about one second between each—and the final 'teē' is rather prolonged and mournful—say over three seconds. The whole 'song' is a plaintive cadence down the scale.

This is the call of the cock bird telling the hen what a very fine fellow he is, and is usually emitted from a high perch. It may be compared to the 'cuckoo' call of *Cuculus*. Like the cuckoo too, the cock Plaintive Cuckoo seems to be on tour round the country, flying from tree to tree—calling—and passing on. He seems to have no regular beat which, as in *Cuculus*, suggests that they too are indiscriminate in their mating.

This cadence-call is often uttered at night—and over long hours, sufficiently so to annoy anyone trying to get to sleep. After each call there is an aggravating pause, as with the Hawk Cuckoo, and one waits for the beginning of the next call, which may come at any time. It is difficult to ignore it. It is made on dark nights as well as on moonlight nights, and that suggests that these birds can see at night—at any rate well enough to dodge the owls.

Sometimes the first two notes only are uttered—and so the call shortened, but only to be resumed in full later. At the beginning of the season, and at the very end, imperfect call notes are emitted as in *Cuculus*—before the bird gets into full voice, and again when he is 'sung out' at the end of the season. This cadence-call is only uttered in the breeding season.

The second type of call note is in contrast to the cadence-note, a call in the *rising* scale and quite different in every way. It is a cheerful little call and is made by the same sex that calls the cadence-call—that is to say the cock. It is uttered all through the year.

It may be syllabified as follows:—

'Twēēt-tā-twēē . . twēēt tā-twēēt . . twēēt-tā-twēēt'.

The first note prolonged—over say, four or five seconds, then at once follows the second part of the call, over one second and then two seconds. The whole will be seen to consist of three calls and the interval between each is not regular but is usually with an interval of some five seconds. Sometimes only one call of 'twēēt-ta-twēēt' is given. The whole three calls are in a rising scale and somewhat piercing in character and may be heard a long way off.

A cock bird will emit the cadence-notes and then often switch onto this rising and cheerful call. They may alternate these calls

Whether the hen bird gives this call note, or not, I cannot say, as I am averse from shooting a calling bird to satisfy my curiosity. I have not however observed a bird in the brown, barred plumage make it, and it may be that this call is confined to the cock bird.

Perhaps the meaning of this call is 'Here I am—here I am—here I am'. That is how I am inclined to interpret it.

I have not heard it uttered at night.

The third note is in the nature of a harsh screech and is nearly always emitted in the undergrowth or thick cover. It may be described as:—

'Tchree—tchree—. . . tchree tchree'.

It is usually uttered three or four times, but is quite irregular. It sounds rather like an alarm note but I do not think it is. *Cuculus* does not appear to have an alarm note and these small cuckoos seem to have very similar habits to *Cuculus*.

I have heard this screech call uttered by birds in the usual plain plumage, but I cannot say whether they were cock birds or hens. It is the characteristic call however of the brown, barred-plumaged bird. There is a good deal of mystery about these brown birds that somewhat resemble the Bay Banded Cuckoo. (Their skins were mixed up and confused in the British Museum.) It is sometimes referred to as the 'juvenile' or 'immature' plumage of the Plaintive Cuckoo, but the only two birds I have shot appeared to be old birds, and both were females with clusters of eggs in them.

I should like to know if all these brown birds are females—or not; and also what their age is. I am inclined to think that they are females and represent the so-called 'hepatic' females in *Cuculus*.

Perhaps this screech call is the call of the hen bird only and corresponds to the 'bubbling' call note of the female *Cuculus*. Any further information on the subject will be very welcome by the writer and others interested. I have never heard the brown bird utter the cadence call note—nor the 'Tweet-ta-tweet' call.

That, briefly, describes the three types of call notes, but it is apparent that there is more to discover in connection with them.

Particular attention is drawn to the call notes of the parasitic cuckoos since a knowledge of their calls is essential in the fascinating study of the many problems they set us in their parasitism. It is not known for instance how these tiny Plaintive Cuckoos get their eggs into the nests of the small birds they victimise. It has been suggested that they may hover over the nest and drop their eggs in, but that would be quite impossible in the case of nests of tailor birds and warblers (*Franklinia*)—the commonest fosterers in this area. Such nests are invariably overhung by the green leaves they are sewn into and they are moreover in thick undergrowth. They probably squirt the egg in as I have proved to be the case with *Cuculus*, when confronted with an inaccessible nest, but even that would call for an acrobatic balancing that is almost incredible. If they are eventually found to put their eggs in *with the bill* it will come as a very great surprise indeed—for such a method has

never been known to have been made use of by any parasitic cuckoo.

TAUNGGYI,
S. SHAN STATES,
BURMA.
June 1, 1938.

T. R. LIVESEY.

XIII.—THE SHAN BROWN WOOD OWL (*STRIX INDRANEE SHANENSIS* BAKER).

This very fine owl was first obtained by me at Sintaung some fifteen miles to the south of Taunggyi in 1933, at an elevation of about 6,000 feet. A young one just able to fly was secured and an old bird which unfortunately had her wing broken by a Taungyo who struck her with a stick as she came out of a rocky cave. I kept these birds in captivity for some time and then Mr. Carrott of Maymyo kept them.

Eventually the skins were sent to Mr. Stuart Baker who described them in the *Ibis. Bulletin*, no. cccxc of Nov. 23, 1935 and named them suitably '*shanensis*'. The cowl of this owl is darker and the throat patch of white, more extensive than in the other two races.

Subsequently—last year—I had two more in captivity from the neighbourhood of Taunggyi where these owls may be heard calling sometimes up in the crags. After studying them for some months I released them on the Taunggyi crags.

This year, on February 17, a Taungthu brought two eggs to me that appeared to me to be the eggs of this owl and so next day I rode out with him to the place where he had secured them. As the nidification of this owl has not yet been described the following account is of interest since it is almost certain that the nest and eggs found were of this new subspecies.

I rode out about six miles from Taunggyi and at approximately an elevation of 4,700 feet we came to a secluded nala which was well wooded and about half a mile under a limestone precipice. The Taungthu ascended the nala till he came to a large peepul tree and then he pointed out to me the hole some twenty feet up from which he had obtained the eggs on the previous day. Unfortunately the parent birds were not at home. I sent him up to examine the hole again. He reported that there were no pellets inside or stray feathers, nor could I discover any at the foot of the tree. We then worked our way further up the nala hoping to catch sight of the owls. Some two hundred yards up the hill side one of the owls came back over the nala but against the light, and in the thick jungle I was not able to make certain of its identification. It appeared to be a Brown Wood Owl.

The only other big owl I know of in this neighbourhood is the Fish-owl but this particular locality was too dry for that species and the Taungthu assured me the parent bird had dark eyes.

The two eggs are beautifully shaped and of even and close texture. There is a satin like gloss and no signs of excrescences

anywhere on them. There are however some faint longitudinal undulations to be seen. The eggs measure—

54 × 44 mm.
52 × 44 mm.

TAUNGGYI,
BURMA. T. R. LIVESEY.
May 10, 1938.

XIV.—NESTING OF THE BOOTED EAGLE (*HIERAËTUS PENNATUS* [GMELIN]) IN THE SIMLA HILLS.

As authentic records of this bird's breeding in India are very few I venture to send you an account of a nest I took this year.

My shikari while out looking for butterflies on the previous day had found a nest which he assured me belonged to a hawk of some kind which was unknown to him.

On the following day, 10th May, I went with him to investigate. The locality I found was a quiet, secluded nullah in an extensive Deodar forest facing N.-W. The nest was placed on an horizontal branch 3 feet from the main trunk and 75 feet from the ground of this very fine Deodar (*Cedrus deodara*). The structure was composed entirely of Deodar and the prickly Berberis sticks with a lining of fresh foliage of Deodar. Littered about the edge of the nest were a few doves' and pigeons' feathers and a head of each of these birds. Other feathers of the same were lying on the ground in the vicinity of the nest. There were two highly incubated eggs of a pale skim-milk, faintly and evenly stippled and blotched with pale rusty red.

The elevation of the nesting site is 6,000 ft.

The bird made little demonstration. After leaving the nest she flew to an adjacent tree whence she uttered a sharp scream from time to time.

That this is a regular breeding species in these hills I have long suspected, having sight records of it on various occasions during the months April, May and June. To the ordinary observer it would be passed over as a Kite (*Milvus m. govinda*), but I think it is very rare as a nesting species in the Himalayas.

SIMLA. A. E. JONES.
July 13, 1938.

XV.—THE NIDIFICATION OF THE BURMESE BARRED-BACK PHEASANT (*SYRMATICUS HUMIAE BURMANICUS*).

The nidification of this lovely pheasant—the eastern race of Hume's Pheasant—has not yet been described, so it gave me great pleasure to secure a full clutch of eggs this year from the neighbourhood of Taunggyi.

On April 6th a Taungthu brought me seven eggs together with the hen bird alive. I placed it in my aviary, but it had such injuries to the top of its head from plunging about in the bamboo basket in which he brought it that it survived but a few days.

For identification I have kept the tail and lower back which is sufficient in view of the district in which it was secured.

The Taungthu described the nest as having been situated on the top of a small bank by a hill stream in forest, and from the locality pointed out to me, which is some six miles from Taunggyi, the elevation would be about 5,000 feet. The eggs remind me somewhat of francolin's eggs in shape, and character and proved to be very stout shelled. They are like the eggs of Hume's Pheasant so well described by Mr. Stuart Baker in his *Nidification of Birds of the Indian Empire*. They are however smaller than those of that bird.

They measure—

47×34 mm.; 45×34 mm.; 45×34 mm.; 45×33 mm.; 46·3×34·5 mm.; 46·3×34 mm.; 45×34 mm.

It was a full clutch apparently since they were slightly incubated.

These lovely birds were some years ago to be found on the forested crags over Taunggyi but since the Forest Service destroy by fire annually this wooded hill, birds of all kinds have become scarce and I need hardly say water too. The systematic firing of all jungle in this neighbourhood and the increase in the herds of half starved cattle have reduced this lovely part of the Shan States to a wilderness. Erosion of every kind is going on to such a lamentable extent here that yearly agriculture becomes more and more heart-breaking and wild life more and more scarce.

TAUNGGYI,
BURMA. T. R. LIVESEY.
May 10, 1938.

XVI.—AN EXTENSION OF THE RANGE OF THE WESTERN HORNED PHEASANT (*TRAGOPAN MELANOCEPHALUS* [GRAY]).

Reference your letter dated 27th July, 1938.

The Tragopans were found in the Duber Valley of the Indus Kohistan (right bank) and brought to the Wali in the Spring of 1938. Three eggs were also brought to the Wali lately. The Wali of Swat states that there are a few specimens west of the Indus and that only two specimens have been found in the Swat River Basin during living memory.

MALAKAND, E. H. COBB, *Major*,
August 3, 1938. *Political Agent*,
DIR, SWAT AND CHITRAL.

[Recently, we received three skins of the Western Horned Pheasant (*T. melanocephalus*) for mounting from Swat State. As

we were interested to know the locality the birds had been obtained from, we wrote to Major E. H. Cobb, the Political Agent, for further particulars. The above letter was the reply. According to the *Fauna*, 2nd Ed. the distribution of this species is given as 'From the west bank of the Bhagirathi River in Garhwal to Kashmir and Hazara'.—EDS.]

XVII.—GAME BIRDS IN THE ANAIMALAI HILLS AND THE SOUTH COIMBATORE DISTRICT—A CORRECTION.

(*Published in vol.* xxxix, p. 732).

I understand from friends who have connections in the Nilgiris that the alleged abundance of Fantail snipe in this area has caused comment and argument amongst a number of snipe shikaris there.

I based my identification of the Fantail and the Pintail snipe on the information given in Stuart Baker's *Game Birds of India*, volume ii. It is possible the identification may be wrong. To settle any doubt I will send you specimens for identification, but this will have to wait until next season as I am unable to use a gun at present and most of the snipe have left. Both of these snipe are found up here and in the country at the foot of the hills. One is common the other is uncommon.

As regards the statement that I had seen a mallard I am sorry that I included this note in the article. The record is unsatisfactory and lays itself open to the charge of mistaken identity. Mention of several other ducks was left out for this very reason but this one crept in without being noticed. I am quite certain in my own mind that the bird was a mallard and this led me into a reference which I should have avoided. If and when a mallard is shot here I will send you the skin.

MONICA ESTATE,
VALPARAI P.O.,
S. INDIA.
April 22, 1938.

J. WILLIAMS.

XVIII.—BREEDING OF PINTAIL SNIPE (?) IN BELGAUM DISTRICT.

On May 5th I received information from a shikari that some snipe had been seen at a certain place in the Belgaum district. Being rather sceptical of the truth of the report I went out to investigate and to my considerable surprise saw the birds myself. From their behaviour they obviously intended to remain in the locality and on enquiry with the local natives I was informed *that nests and eggs had been regularly found there in previous years, chiefly in the month of July.* Without actually shooting a specimen it was impossible to tell the exact species. But as they were found

on dry, newly ploughed rice fields I should say they are pintail. This is borne out by the fact that the first snipe to be obtained in this district in the shooting season in early September are almost invariably of this species.

In this case the nests are said to be made in the long grass on the bunds of rice fields. As in the standard reference books no mention is made of snipe remaining to breed in this part of India I am writing to enquire whether this is generally known to be the case. There can be no question of the birds being incapacitated and unable to migrate since as many as a dozen were seen in this particular neighbourhood, which incidentally is an intensely cultivated and well populated one. Since there are many other such suitable localities in the district there seems no reason why they should not breed fairly widely in these parts.

BUNGALOW NO. 51, O. H. DE ST. CROIX.
CANTONMENT BELGAUM.
May 6, 1938.

XIX.—BIRD NOTES FROM THE DRY ZONE OF UPPER BURMA.

So little is on record of the birds of the dry zone of Upper Burma since Macdonald wrote of Myingyan (*J.B.N.H.S.*, xvii, 1906 and meads of the Chindwin (*idem*, xviii, 1907) that I venture to record some notes made during two short trips through parts of the Shwebo and Sagaing districts in December 1931 and June 1936. I have not recorded a full list of the common birds seen. In December 1931 I marched from Wetlet to Shwebangon and down the newly canalised area to Thazin at the south end of the great Halingyi Lake. In June 1936 I spent two days on Wetlet Lake in Shwebo. On this occasion, the water was remarkably high. The huge bulrush beds of the lake were being harvested, which must have greatly disturbed their commonest occupants, the Yellow Bittern and the Purple Gallinule. I got the impression the ducks had not yet commenced to nest. One note recorded below was made at Maymyo (4,000 ft.) on the edge of the dry zone.

1. **Argya gularis.** White-throated Babbler.

It was interesting to note that, despite the flooding of large new areas by the extension of the canal zone, both this species and *Mirafra assamica* so typical of dry sandy country, still cling to the thorn-bushes fringing the canal though cornland stretches for miles on both sides. One would have expected both species to have moved elsewhere.

2. [**Acrocephalus stentoreus?** Great Reed Warbler?

I *thought* I saw two or three in the big reed-beds far out on Wetlet in June but was never sure. I certainly never heard a Reed-Warbler of any species singing.]

3. **Prinia flaviventris flaviventris.** Yellow-bellied Wren-Warbler.

Many were seen on Wetlet in June, some a long way from land. Two specimens were obtained and identified by Dr. C. B. Ticehurst.

4. **Mirafra assamica.** Burmese Bush Lark.

See no. 1 above. Still common in the narrow fringe of thorns along the canal.

5. **Butastur teesa.** White-eyed Buzzard Eagle.

Said in the *Fauna* to be found 'throughout north and western Burma', it seems to be in Burma largely a dry zone bird, though Armstrong and Davison recorded it from Thaton. The only place in which I have found it was near Shwebangon (Shwebo) in December 1931 when I saw several. The general appearance in flight is very pale. When at rest, the head is very falcon-like and the white patch on the nape is noticeable. It has a quick lilting flight.

6. **Streptopelia decaocto.** Indian Ring Dove.

The *Fauna* gives its distribution as 'all Burma'. This is probably wrong as Oates never got any south of Thayetmyo. It is almost certainly a dry zone bird. I saw a number in thorn-jungle on the edge of the canal and near Shwebo. The pale grey tail and yellow skin round the eye are distinctive characters in the field.

7. **Coturnix coromandelica.** Black-breasted Quail.

Common and calling all night in December in crops near Shwebo.

8. **Gallinula chloropus.** Moorhen.

One or two pairs on Wetlet in June 1921. I found a nest with one egg in it. All the breeding records of this Moorhen seem to be from central Burma and further observation is desirable on this bird's status in the province. In Myitkyina it appears to be a winter migrant.

9. **Gallicrex cinerea.** Watercock.

One pair seen on Wetlet in June and others heard. It would be interesting to know whether this curious and little-known bird is resident or a rains-immigrant.

10. **Porphyrio poliocephalus.** Purple Moorhen.

Abundant in the bulrush beds. I found no nests and they probably suffer much at this season from the bulrush harvesters.

11. **Hydrophasianus chirurgus.** Pheasant-tailed Jacana.

Many on Wetlet on June 21-22, apparently not yet breeding. They were in full plumage and usually sitting out on the open water, with their long tails held up in a curve clear of the water. I could find no trace of a nest.

12. **Rostratula benghalensis.** Painted Snipe.

In June 1932, when the Maymyo lake was nearly dry, several pairs of Painted Snipe undoubtedly bred there. On June 19 I saw a male with three small young ones crossing a patch of mud, and caught a brood a few days later, the male bird scrambling and fluttering about close to me.

13. **Burhinus oedicnemus.** Stone Plover.

A large gathering seen on some fields near Wetlet on June 22nd.

14. **Glareola maldivarum.** Large Pratincole.

Several, apparently with young, on the cultivated land west of Wetlet Lake on June 21.

15. **Lobivanellus indicus.** Red-wattled Lapwing.

A party were seen on June 22nd flying high along the edge of Wetlet from the north. It is so unusual to see these very sedentary birds flying at any height above the ground that it seems possible that they were migrating.

16. **Anhinga melanogaster.** Indian Darter.

The local name is *'U-ban'*. Only seen in December and not apparently breeding. (I saw no signs of nesting cormorants and only *Phalacrocorax niger* in June.)

17. **Pelecanus crispus.** Spotted-billed Pelican.

Several on Wetlet on June 21, some of which seemed to be immature. It is remarkable that no one has discovered Pelicans breeding in Burma in the last 40 years. Though such ungainly looking birds, they can turn on their own axis with amazing speed and rise off the water in three strokes.

18. **Ibis leucocephalus.** Painted Stork.

The Burma records of these conspicuous birds are remarkably few. It is not, I think, any longer 'very abundant in Southern Pegu' (Oates) and practically all the records are from the dry zone, though it does not seem to be known where it breeds. I saw seven or eight adults and one immature bird on Wetlet on June 22.

19. **Dissoura e. episcopus.** White-necked Stork.

20. **Xenorhynchus asiaticus.** Black-necked Stork.

I saw a few on both occasions but no signs of breeding. There seems astonishingly little on record in Burma of the breeding of both these large and easily-observed birds.

21. **Ardea purpurea.** Purple Heron.

A few on Wetlet in June but I could find no nest.

22. **Ardea cinerea.** Grey Heron.

Saw a very large gathering of 50 or 60 on Thazin in December, and one pair on Wetlet in June. I can only find two breeding

records in Burma (Macdonald's in Myingyan), and my own in Henzada.

23. **Sterna albifrons sinensis.**

I shot an immature bird out of a small party on Wetlet on June 22. No other Terns were seen and there were no signs of any *Chlidonias* nesting.

24. **Tringa erythropus.** Spotted Redshank.

A very large flock on Thazin in December.

25. **Bubulcus ibis.** Cattle Egret.

Common, no nesting colony seen.

26. **Egretta g. garzetta.** Little Egret.

Common, no nesting colony seen.

27. **Ixobrychus sinensis.** Yellow Bittern.

The common bittern of the Wetlet jheel in June and apparently breeding in the big bulrush swamps, though I failed to find a nest. Numbers were seen flighting to and fro and many were flushed from places where they clearly spent their time clambering from rush to rush. Like the Chestnut Bittern, they are not shy or crepuscular at this time of year.

28. **Ixobrychus cinnamomeus.** Chestnut Bittern.

Two or three pairs breeding on Wetlet. Flushed one pair off a very *kutcha* nest with one egg in bulrushes.

29. **Nettapus coromandelianus.** Cotton Teal.

In large parties on Wetlet on June 20, apparently of adults.

30. **Dendrocygna fulva.** Large Whistling Teal.

Several seen, nearly all in pairs, on June 22. The larger of the two Whistling teal seems to be mainly a bird of Central Burma. I have never seen any in Myitkyina and few in Lower Burma, and the records, what there are, suggest it is a dry zone bird.

31. **Anas poecilorhyncha.** Spotbill.

A good many seen in pairs and small parties which had probably not yet commenced to breed (cf. Macdonald, *Journal*, xvii, 503).

32. **Podiceps ruficollis.** Little Grebe.

Local name: 'On-salank'.

Very common: Saw several nests with clutches of two to five eggs some very imperfectly covered up.

KINGSCLERE. J. K. STANFORD.

April 1938.

XX.—SWIFTS IN SWALLOWS' NESTS.

Every one is aware of the manner in which cuckoos, well-known in Europe as in India, claim the services of foster parents to rear their young, and of the extraordinary complacency with which the foster parent submits to this form of parasitism. It seems one of the most remarkable things in Nature that although cuckoos are often mobbed and driven off by small birds such as pipits, yet there is no recorded case of a foster parent turning out a cuckoo's egg or refusing to feed the young cuckoo after hatching. On the other hand, it is believed that in many instances the cuckoo when planting her egg in the nest removes one of the foster parent's eggs. In India there are several species of cuckoos and the same inexplicable complacency on the part of the foster parent is observable in all.

There is also the robber, who steals other birds' eggs from their nest for eating purposes. I spent an amusing half-hour recently watching a battle royal in a thorny acacia tree. A tree-pie was sitting beside a dove's nest containing two eggs. The nefarious intention of the tree-pie was manifest, but there were some 30 or 40 smaller birds hopping, squealing, pecking round it, robins, magpie robins, bay-backed shrikes, king crows, ubiquitous mynahs and even a few sparrows. Curiously enough, neither dove was anywhere to be seen. The dove is a coward compared with most birds when it comes to protecting its eggs or young. Eventually the tree-pie, not daring to take the eggs with so much hostile demonstration, flew away discomfited and after an interval of time the timid dove reappeared and settled peacefully on her eggs.

Then there is the lazy type of bird which commandeers other birds' nests. It is comparatively common for certain species to use the old nests of other birds. The kestrel frequently uses old crows' nests, or in Europe, rooks' nests. I once found a kestrel lying dead on the edge of a rook's nest with two of her eggs in the nest. It was in a rookery situated on the artillery and machine gun practice ranges on Salisbury plain and the kestrel had been killed by a stray machine gun bullet. The common mynah is very partial to building up an old crow's nest. Even the peafowl is occasionally not averse to making use of an old vulture's nest and the various species of falcons quite commonly use old nests. But these are disused nests for which the original builders have no further use.

There are, however, some birds bold enough to thieve the newly built nests of another species. I watched one day on a sunny afternoon in England a most amusing contest between a starling and a green woodpecker for possession of the newly-excavated nest hole of the latter. Once the starling was inside the woodpecker was powerless to evict him.

Recently in India I have been watching the swallows and swifts in the Siwalik hills 8 miles from Dehra Dun and I have discovered what appears to be wholesale robbery on the part of the swifts. There is a large number of bridges and culverts under the road which runs through these hills and the majority of these serve as breeding places for the Red-rumped Swallow (*Hirundo daurica*).

Early in July I had seen these swallows flying in and out through the arches and had watched their characteristic retort-shaped nests being constructed, with their rounded egg-chambers lined with grass and feathers and the tubular entrance 5 or 6 inches long. On looking again at these nests after 10 days or so, I found them occupied in 80 or 90 per cent. of cases by the Common Indian House Swift (*Micropus affinis*), with the white rump, white throat and chin and square tail. At first I could not understand the meaning of this. I had never heard of swifts building these retort-shaped nests of mud. Nor were these nests built in close apposition as are usually the swifts', in no case did I find more than two nests in any one arch or culvert and then those two were widely separated from each other. Yet in many instances I actually took the typical adult swift from the nest by hand and examined it before letting it fly. I also later examined several of the young birds. Although I never actually saw the red-rumped swallows at the nests applying mud, yet I frequently sat on the parapet and watched these birds collecting mud from a nearby puddle and flying under the arch, there being no swifts in sight near the locality, and then 10 days or later found these nests occupied by swifts. There can be no doubt that the swifts made a habit of purloining the red-rumped swallows' nests as soon as they were completed. It seems that now, at the end of July, the red-rumped swallows are coming into their own, for a survey made on 30th and 31st July shows that new retort-shaped nests are now occupied by their rightful owners, both young and new-laid eggs being found, and the swifts appear to have finished breeding in these situations and have mostly departed probably for villages and cities where more flies can be obtained. It seems remarkable that a species no bigger than the swallow itself can oust it from its own nests in this wholesale manner, yet after a month's observation I have not the slightest doubt of its reality.

It would be interesting to know if any other forms of robbery or vandalism in bird life have been observed.

DEHRA DUN.
July 31, 1938.

KENNETH COMYN,
Colonel.

XXI.—ON CUCKOOS IN SUGAON, CHAMPARAN DISTRICT, BENGAL.

It may interest you or your readers to hear that while birds' nesting in a 'garchie' in village Sugaon on the 12 June I came across 6 eggs in the nest of the Common Babbler (*Argya caudata*)—4 Babbler's, 1 Hawk Cuckoo's (*Hierococcyx varius*) and 1 Pied Crested Cucukoo's (*Clamator jacobinus*)—and 2 nests of the Paradise Flycatcher (*Terpsiphone paradisi*) with 3 eggs in each—2 their own and one of the Indian Cuckoo (*Cuculus micropterus*) in each.

The cuckoo's egg was exactly the same colour as the Paradise Flycatcher's only at least twice as large and very much like some

of the eggs a King Crow (*Dicrurus*) lays. This is the first time I have found this bird's eggs.

This 'garchie' seemed a very popular one for I found no less than 26 nests there—Babbler, Golden Oriole, Chestnut-bellied Nuthatch, Purple Sunbird, King Crow, 5 Paradise Flycatcher, 1 White-browed Fantail Flycatcher, 7 White Eye, 1 Magpie Robin, 1 Tree-pie, 1 Little Minivet, 1 Iora, 2 Red-vented Bulbuls, 1 Common Mynah and 1 Spotted Dove.

By Hawk Cuckoo I mean the *'Ive feel it'* or Brainfever bird, by Pied Crested Cuckoo—what we call here the *'Rainweather'* bird as it arrives just before the rains.

By Indian Cuckoo I mean *'Who stole that book'—'Want more Pekoe'—'Go Calcutta'.*

I heard the European Cuckoo twelve times in my compound last week—this only the 3rd time I have heard him in the plains in 33 years!

TURKAULIA P.O.,
B.N.W.RY.,
CHAMPARAN.
June 14, 1938.

F. A. C. MUNNS.

XXII.—A COMMENT ON THE NAME 'BLOODSUCKER' APPLIED TO [*CALOTES VERSICOLOR* (DAUD.)].

Mr. McCann in his notes on *Calotes versicolor*, published in the issue of 15th December of the *Journal* of the Society has rightly deplored the name 'Bloodsucker' applied to the Calotes lizard. This misnomer might have originated through a popular superstition prevalent in many parts of India. I have met with this superstition in such distant parts of India as the Malabar district in Madras and the Birbhum and Burdwan districts of western Bengal. Common people believe that the Calotes lizard has the power of sucking a person's blood by simply looking at him. It is also believed that the Calotes changes into red colour due to the effect of the blood it has absorbed by staring. This superstition is the cause of very great persecution.

As to the name 'Chameleon', I know from personal experience that the tendency to apply this name to many members of the lizard family is common in other parts of the world too. South American Iguana lizard skins are known as Chameleon skins all over Europe and North America.

The habit of frequently ducking its head has brought further misfortune to the Calotes. I had noticed that the uneducated Mahommedans in Bengal never fail to kill a Calotes, when met with. When killing is impossible they throw at least one stone at it. On my enquiring, the following explanation was offered. The Prophet while flying from his enemies took shelter in an old well. His pursuers on approaching the well saw a Calotes lizard at the edge ducking its head. They interpreted it as an indication that some-

body was hiding there. I do not know whether this belief exists among the Mahommedans in other parts of India.

KHAR. BOMBAY 21. B. BASU.

April 24, 1938.

XXIII.—EXTENSION OF THE RANGE OF THE MOTH *NORRACA LONGIPENNIS* MOORE (*NOTODONTIDAE*).

I have lately taken a moth that appears to me to be a specimen of *Norraca longipennis*, Moore—Hampson's vol. i, page 137.

The range of this species is given as Ceylon, Penang. Would you kindly inform me if the range of this moth has been extended since the publication of the work?

A. C. HARMAN.

RAJGHAT CONCERN,
P.O. BETTIAH,
CHAMPARAN.

June 15, 1938.

[The specimen referred to by Mr. A. C. Harman was received and on examination was found to be a male of *N. longipennis*. There are also a male and female of this species in the Society's collection, collected by Mr. T. R. Bell at Belgaum, on the 20th October 1906 and 15 September 1910 respectively.—EDS.]

XXIV.—DESCRIPTION OF THE LARVA OF *ETERUSIA* (*SORITIA*) *LEPTALINA* KOLL. (*ZYGAENIDAE*).

(*With a plate*).

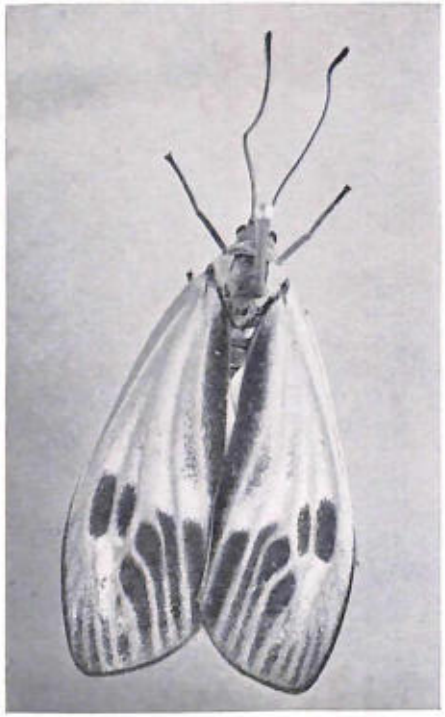
I have sent photos of a female and larva of the Zygaenid moth *Eterusia leptalina*. The moth (imago) is common here but I do not think the caterpillar has been previously described. It is umber brown in colour, covered evenly all over the upper surface with hairs of 8 to 10 mm. in length.

Col. E. A. Glennie and I found the larvae feeding, singly, on the foliage of the 'Raspberry' (*Rubus macilentus*), order *Rosaceae*. The cocoon is of a peculiar flat surface; the silk 'isabelline' and the whole structure has the appearance of a fungoid growth.

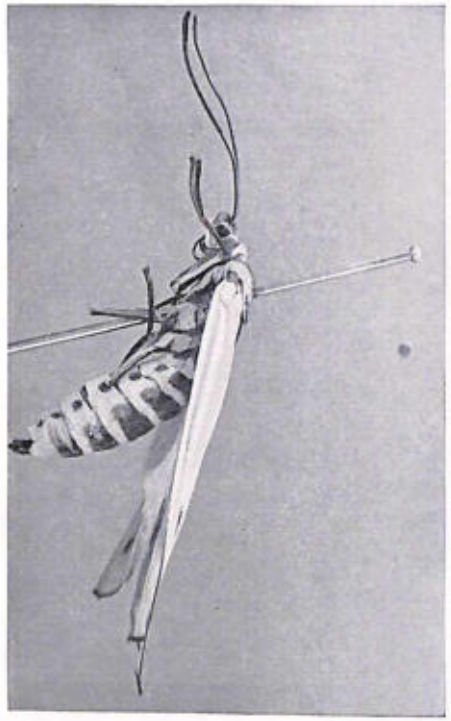
SIMLA. A. E. JONES.

November 3, 1937.

[As far as we are aware nothing is known of the life-history of this moth. It occurs in the Himalayas; Sylhet; Bernardmyo, Burma. The life-history of an allied species was described in vol. xviii, p. 430 of the *Journal*—*Heterusia magnifica* Butl.—EDS.]







Eterusia leptalina (Koll).

XXV.—DISTRIBUTION OF *STERNOCERA NITIDICOLLIS* C. AND G. (*BUPRESTIDAE*).

Maxwell Lefroy says (*Indian Insect Life*, page 330): '. . . they (viz. *Sternocera nitidicollis*) are rarely found outside the hills and forest areas, being occasionally captured . . .' In this connection, it may interest your readers to know that I have often come across these beautiful beetles in many parts of North Gujarat which borders on the Rann of Cutch. These beetles are very partial to the Ber tree. Professors Asana and Sutaria have also obtained a fairly large number of these beetles from the Ber trees in the vicinity of the Gujarat College and adjoining fields. These beetles are very hardy animals and have laid eggs in the laboratory.

AHMEDABAD, H. G. ACHARYA, F.Z.S.
NORTH GUJARAT.
June 29, 1938.

[There are three specimens of *S. nitidicollis* C. and G. in the Society's collection, all from Southern India; Anarapura, Trimulgherry and Madras.

Perhaps the commonest species is *S. chrysis* F. It occurs almost throughout India. There are specimens in the Society's collection taken at places as far apart as Afghanistan, Nepal and Madras. McCann has found it to be not uncommon in the hills round Mt. Abu.—EDS.]

XXVI.—THE DISTRIBUTION OF *BUTHEOLUS MELANURUS* KESSLER.

On June 26, 1938, Dr. E. W. Hayward, Principal Medical Officer, Jodhpur, sent for identification a specimen of *Butheolus melanurus* Kessler. The known distribution of this scorpion within the limits of the Indian Empire is at present:

Northern Baluchistan (Maynard and MacMahon); Waziristan: Sewa (Caius); Punjab (Kraepelin); Rajputana: Jodhpur (Caius); Ahmedabad: Shevgaon (Caius).

ST. XAVIER'S COLLEGE, J. F. CAIUS.
BOMBAY.
July 6, 1938.

XXVII.—*GLYRICIDIA MACULATA* AS A SHADE TREE FOR TEA.

I have just been reading *Some Beautiful Indian Trees* by Blatter and Millard. I was very interested in the meaning of the word *Glyricidia*—rat-destroying. I shall be grateful if you would let me know if there is any further information available as to this alleged property of the seed of this tree. I should be particularly interested to know whether there is any information as to how this rat poison

should be prepared. Do the seeds have to be cooked or ground and mixed with some other bait, or will rats eat them raw.

Glyricidia maculata was introduced here some eight or ten years ago and tried as a possible alternative to the Dadap, *Erythrina lithosperma,* as shade and green manure combined, for tea. The original seed sent to me came from Java. It has not proved to be a serious competitor of the dadap in usefulness as it is very much slower growing and, in our climate, most plants drop their leaves in the dry season from February to April just when the shade is most required for the tea. In addition it requires a great deal more attention and does not give anything like the same weight of loppings as the dadap. When planted from seed or cuttings the plant has an irritating habit of sending up multiple stems from the base each year as soon as the pre-monsoon rains arrive, and these have to be pulled off if a single stem tree and not a bush is required.

Apart from these drawbacks, the tree is hardy and easily struck from cuttings. Like the dadap it will strike from large branch cuttings of considerable length and size. It also stands up to continual lopping without any trouble.

The young trees here started to flower and seed some five years from planting both from seed and cuttings. The flowers generally appear in the dry weather towards the end of February and March about the same time as the trees begin to drop all their leaves.

This estate is some 3,600 ft. high and the average rainfall is about 120 inches per year. The South-West monsoon is very heavy giving about 30 inches a month for June, July and August. More or less light showery weather continues until the beginning of December. There is little if any rain in January, February and March and from the end of March until the monsoon breaks again there are heavy north east thunder-storms.

MONICA ESTATE,
VALPARAI P.O.,
S. INDIA.
May 27, 1938.

J. WILLIAMS.

[We have no information on the subject of the use of the seeds of this tree as a rat poison.—EDS.]

XXVIII.—GENERAL FLOWERING OF *STROBILANTHES* IN SOUTH INDIA.

As recorded in my note no. 25 published in the *Journal* of December 15, 1937 most of the species of *Strobilanthes* in this area flowered in 1936-37. The plants have died and disappeared so that a stranger visiting for the first time would conclude that very few Strobilanthes grew here.

Last month I found a single plant in flower in a swamp on the edge of a jungle belt on this estate. All the other Strobilanthes in this swamp had flowered and died last year. Specimens were sent to Mr. P. N. Mayuranathan, the Botanist of the Government



Fasciated inflorescence in a Banana.

Museum, Madras who has identified the species as *Strobilanthes lundus*.

MONICA ESTATE,
VALPARAI P.O.,
S. INDIA.
April 22, 1938.

J. WILLIAMS.

XXIX.—A FASCIATED INFLORESCENCE IN A BANANA.

(*With a photo*).

A very interesting phenomenon was noticed for the first time at Virarajendrapet, Coorg, in the banana variety Kali, locally known as 'Mara Bale' (*Musa paradisiaca*, Linn., var., *Kali*, K. C. Jacob[1]) the axis of which, after normal bunching, fasciated and produced a dozen different 'hearts' (cone-like inflorescence) of pistillate flowers developing into innumerable diminutive fruits while the original staminate 'heart' remained as such. The specimen is preserved in the Madras Herbarium, Coimbatore.

AGRICULTURAL RESEARCH INSTITUTE,
COIMBATORE.
April 7, 1938.

K. C. JACOB,
L.Ag., F.L.S.

XXX.—A NATURAL HISTORY TALE.

Scene: Honnametti Estate, Billigirirangans.

Planter's wife receives complaint from local Sub-Assistant Surgeon.

S.A.S.—'Madam, will you please report to Mr. M. that yesterday evening my wife was struck by a wild boar's tail while entering the ladies' retiring room near our Quarters'.

P.W. (surprised, bearing in mind the ridiculously small tail pig carry)—'Really, I should have thought that hardly possible'.

S.A.S. (slightly aggrieved)—'Madam, I can assure you that my wife *was* struck by the tail of a wild boar'.

P.W.—'Very well, I will inform Mr. M.; I saw a sounder of pig myself crossing the road near the dispensary a day or two ago'.

S.A.S.—'*Pig*, Madam?! My wife was struck by a *wild boa constrictor*'.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE P.O.,
S. INDIA.
August 22, 1938.

R. C. MORRIS.

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[1] *The Madras Agricultural Journal*, vol. xxii, no. 2, p. 41.

PROCEEDINGS.

Bombay Natural History Society.

A meeting of members of the Bombay Natural History Society and their friends was held at the Prince of Wales' Museum on Thursday the 28th July, 1938 at 6-15 p.m. Rev. Fr. J. F. Caius, S.J. presided.

The Honorary Secretary announced the election of the following twenty-eight members since the last meeting held on the 24th March, 1938:—

Mr. R. E. Hawkins, Bombay; Mr. R. T. Ashby, R.A., Peshawar; Mr. Mark A. Wynter-Blyth, M.A., Simla; The Officer-in-Charge, Central Agricultural Library, Hyderabad, Deccan; Mr. S. F. Christie, Bombay; H. H. The Maharana of Danta State; Mr. Paul de Launey, Bengal; Mr. John Abel, Peshawar; Raja Bahadur Jawahir Singh of Sarangarh; Raja of Mahmudabad, Mahmudabad, U.P.; Mr. N. H. Menesse, I.S.E., Hyderabad, Sind; Mr. R. W. Aitken, Bombay; The Hon'ble Lt.-Col. Sir S. Hissam ud Din, Peshawar; Maharaja of Patna State; Mr. A. B. Barrett, Sylhet, Assam; Mr. Derek Headly, Palestine; Rev. J. W. Ruddell, Bombay; Mr. F. W. Goodwin, Simla; Conte Georgio U. della Gherardesca, Italy; Mr. E. C. Ormond, Calcutta; Mr. G. W. Gemmell, Calcutta; Mr. P. Burnside, B.F.S., Rangoon; Mr. S. T. Moses, Baroda; Mr. J. I. Alfrey, Bombay; Mr. R. W. V. Palmer, Rangoon; Mr. Oscar Lindgren, Kalimpong; Mr. K. H. Fraser, Tellicherry; Mrs. Mehra K. A. Lalkaka, Bombay.

Sensitivity in Plants.

Dr. Bharucha, Professor of Botany, Royal Institue of Science, Bombay, in the course of his lecture pointed out that though plants seem immobile and inert and, therefore, unlike animals with their reflex movements and pulsating organs, yet a plant is as sensitive to its surroundings as an animal. By a series of slides the lecturer showed how the plant is stimulated or depressed on subjection to different stimulants or drugs. Even a passing cloud records its impressions on the plant. Just as an animal or man is fatigued with work so also does a plant show the effect of work by finally ceasing to function. Not only this, but it even betrays the expiring struggles that an animal shows before its death. In short, the lecturer showed, that a plant is as sensitive to light, temperature, humidity, drugs, chemicals and food as the animal is. As a matter of fact the various phenomena exhibited by plants are due to this characteristic of the plant, namely its high and animal-like sensitivity to changing environment. The opening and closing of flowers is a phenomenon brought about by the different degrees of sensitivity of flowers to light and temperature. Certain plants like the 'Four O'Clock plant' opens its flowers at four o'clock in the evening only, while others like the Water-lily open only about eight or nine in the morning. The movements of the leaves which droop down on a hot summer's day in the afternoon or which close down at night time, are again due to the same reason namely high temperature. Dr. Bharucha concluded by showing that the plant is just as apt to be stimulated or depressed as an animal and that it experiences pain and pleasure or fatigue and requires rest like any human being and that it is capable of all the nervous reactions felt by an animal.

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EDITORS: P. M. D. SANDERSON, S. H. PRATER, C. MCCANN, 6, APOLLO STREET, FORT, BOMBAY

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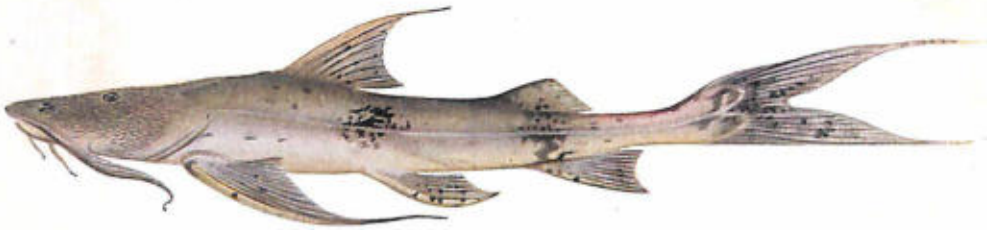
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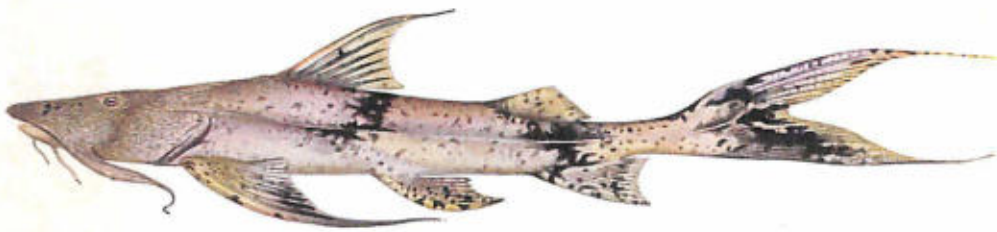
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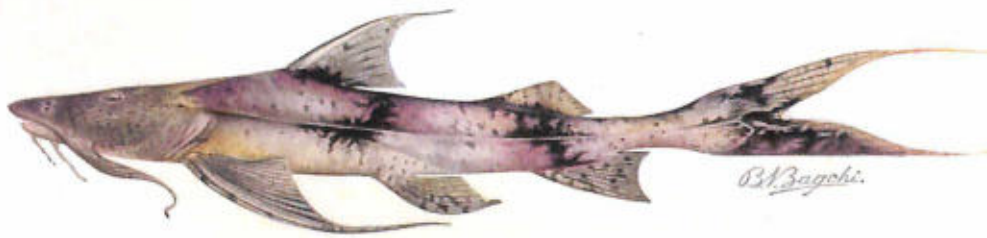
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THE GOONCH

Bagarius bagarius (Hamilton).

JOURNAL
OF THE
Bombay Natural History Society.

1939. VOL. XL. No. 4.

THE GAME FISHES OF INDIA[1]

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(With one plate and two text-figures).

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BAGARIUS BAGARIUS (Hamilton).

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INTRODUCTION.

The *Goonch* is well known, as an undesirable species, to anglers who fish for *Mahseer* in the large rivers of India. It lives in *Mahseer* waters, and must be cleared out of such areas as it is otherwise likely to break the tackle. The *Goonch* is one of the largest freshwater fish that has hitherto been caught in this country on rod and line. The smaller specimens generally give fairly good sport, but the monsters of the Ganges apparently give but little play. The name 'freshwater shark' is more aptly applied to the *Goonch*, not only on account of its great voracity but also owing to its underhung mouth and general ugliness; it grows to a size of six feet or more and to a weight of over 250 lbs.

[1] Published with permission of the Director, Zoological Survey of India.

The *Goonch, Bagarius bagarius* (Hamilton), is remarkable among the present-day Catfishes for its morphological features and great antiquity. Though several other genera are usually grouped with it in the family Bagaridae or Sisoridae, none approaches it in size. Most of them are of small size and live in clear waters of hill-streams adhering to rocks and stones. *Bagarius* is, however, known to descend to the lower reaches of the larger rivers as well. Fossil remains of the *Goonch* are known from the Tertiary deposits of the highlands of Padang in Sumatra and the Siwalik rocks of India. These records are not only helpful in indicating the first appearance of Catfishes (Siluroidea) but also show that the *Goonch* was as widely distributed in south-eastern Asia about five million years ago as it is at the present day. Further, it is remarkable that the *Goonch* has persisted throughout this long period without any appreciable change in its general appearance, and may thus be regarded as a 'Living Fossil'.

Nomenclature and Systematic Position.

Like the freshwater sharks dealt with in the two preceding articles of this series, the *Goonch* was also described for the first time by Hamilton (**7**)[1] in his composite genus *Pimelodus* and characterised as

> 'A *Pimelodus* with the tail fin divided into two very long-pointed unequal lobes; with eight tendrils not longer than the head; with a scabrous opaque body, variegated with black irregular marks; with thirteen rays in the fin behind the vent; and with eight in the foremost fin of the back.'

Swainson (**11**) included it in his genus *Pachypterus* along with a number of divergent forms and re-christened it *P. luridus*. Cuvier and Valenciennes (**5**), and in his earlier works Bleeker (**2, 3**) also, subscribed to Hamilton's views regarding the systematic position of the *Goonch*, but in 1853 Bleeker (**4**) proposed the generic name *Bagarius* for its reception and termed it '*Bagarius Buchanani*'. But as Sykes (**12**) had already described the *Goonch* from Poona under the specific denomination '*Bagrus Yarrelli*', the fish came to be known in scientific literature as *Bagarius yarrellii*. However, in accordance with the provisions of the International Rules of Zoological Nomenclature it is not permissible to change the specific name of the species except under very special circumstances. The correct scientific designation of the species should, therefore, be *Bagarius bagarius* (Hamilton), and it is under this title that the fish is generally referred to in modern literature.

Though Popta (**9**) described another species of *Bagarius—B. nieuwenhuisii*—from Central Borneo, Weber and de Beaufort (**14**) have shown it to be merely a colour variety of the *Goonch*. From the colour plate reproduced here and text-fig. 1 it will be seen that the fish is very variable both as regards its colour and form. In view of the above the genus *Bagarius* is monotypic so far.

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[1] Numerals in thick type within brackets refer to the serial number of the various publications listed in the bibliography at the end of the paper.

As indicated above the *Goonch* is included along with several other hill-stream genera in the family Bagaridae or Sisoridae. In these fishes the dorsal fin is short, with a pungent spine and 6 or 7 divided rays, and is situated considerably in advance of the ventral fins. The adipose fin is present and is placed opposite to the anal fin. The paired fins are horizontal; the pectorals are provided with a serrated spine and the ventrals contain only 6 rays. The body is usually flattened dorso-ventrally and the eyes are subcutaneous. The two nostrils on each side are situated close together, being separated by a membranous fold produced into a short nasal barbel. The mouth is usually overhung by the snout and is either transverse or crescentic. The jaws are provided with small teeth in bands; these are sometimes mixed up with larger teeth. The palate is edentulous. There are eight barbels; one pair nasal, one pair maxillary and two pairs mandibular. The maxillary barbles possess broad and stiff bases. According to Regan (**10**), the genus *Bagarius* is distinguished from the other members of the family by a combination of the following characters:—

'Anterior precaudal vertebrae with a series of processes on each side directed upwards and outwards from the bases of the neural arches; head depressed.

'Lips normal; mesopterygoid large, extending forward below the palatine and backwards to the hyomandibular; complex centrum rigidly united, but not ankylosed to cranium; parapophysis of fourth vertebra a half-cylinder, of fifth a stout horizontal process ending just beneath the skin.

'Ribs inserted on normal transverse processes; pelvics behind the dorsal; gill-membranes free or narrowly attached to isthmus.

'Thorax without longitudinal plaits.'

The other two allied genera of the family are *Glytothorax* Blyth and *Pseudecheneis* Blyth; the former possesses longitudinal and the latter transverse adhesive plaits in the thoracic region. In its general appearance the *Goonch* is so characteristic that it is impossible to mistake it for any other fish.

The fishes of the family Bagaridae were probably evolved from some generalised members of the large group of Bagrid fishes, from which they differ in certain features of specialisation likely to have been induced by life in rapid-running waters.

Synonymy and Description.

Bagarius bagarius (Hamilton).

1822. *Pimelodus bagarius*, Hamilton, *Fish. Ganges*, pp. 186, 378, pl. vii, fig. 62.
1839. *Pachypterus luridus*, Swainson, *Nat. Hist. Fish.*, etc., ii, p. 306.
1840. *Pimelodus bagarius*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, p. 146, pl. ccccxxxiii.
1841. *Bagrus Yarrelli*, Sykes, *Trans. Zool. Soc. London*, ii, p. 370.
1847. *Pimelodus bagarius*, Bleeker, *Verh. Bat. Gen.*, xxi, 1, p. 10.
1849. *Pimelodus yarrellii*, Jerdon, *Madras Journ. Litt. and Sci.*, xv, p. 141.
1850. *Pimelodus bagarius*, Bleeker, *Verh. Bat. Gen.*, xxiii, p. 10.
1853. *Bagarius Buchanani*, Bleeker, *Verh. Bat. Gen.*, xxv, p. 121.
1858. *Bagarius Buchanani*, Bleeker, *Ichth. Arch. Ind. Prodr.*, I Siluri, p. 212.
1862. *Bagarius Buchanani*, Bleeker, *Atl. Ichth.*, ii, p. 61.
1864. *Bagarius yarrellii*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 183.
1877. *Bagarius yarrellii*, Day, *Fish. India*, p. 495, pl. cxv, fig. 3.
1877. *Bagarius yarrellii*, Beavan, *Freshw. Fish. Ind.*, p. 145.

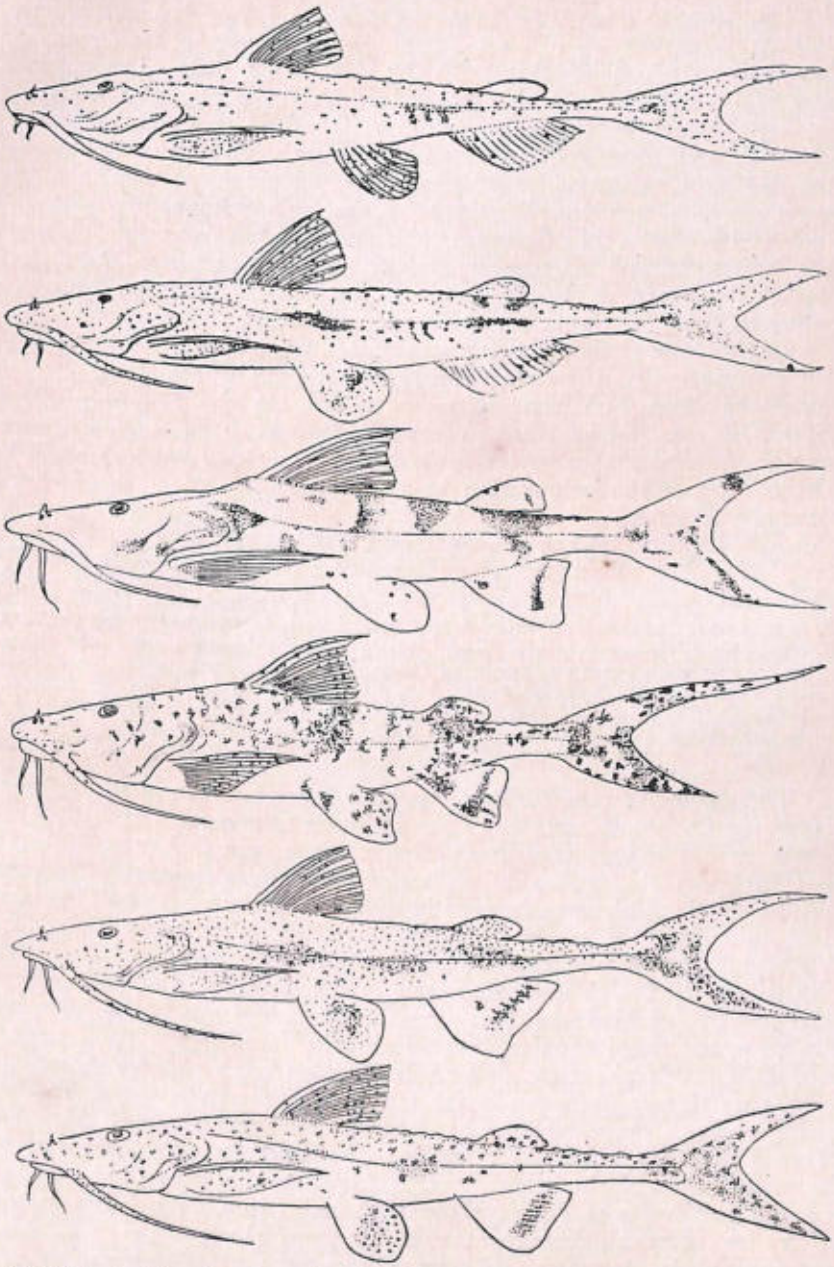
1889. *Bagarius yarrellii*, Day, *Faun. Brit. Ind., Fish.*, i, p. 194, fig. 71.
1890. *Bagarius Yarrellii*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, (2), ix, p. 243.
1904. *Bagarius Nieuwenhuisii*, Popta, *Notes Leyden Mus.*, xxiv, p. 190.
1906. *Bagarius Nieuwenhuisii*, Popta, *Notes Leyden Mus.*, xxvii, p. 66.
1912. *Bagarius bagarius*, Weber and de Beaufort, in Maass 'Durch Zentral-Sumatra', ii, Fische, p. 16.
1913. *Bagarius bagarius*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, ii, p. 270, fig. 105.
1929. *Bagarius bagarius*, Prashad and Mukerji, *Rec. Ind. Mus.*, xxxi, p. 181.
1933. *Bagarius yarrellii*, Spence and Prater, *Journ. Bombay Nat. Hist. Soc.*, xxxvi, p. 59, pl. xv.
1937. *Bagarius bagarius*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, lxxxix, p. 144, fig. 38-43.

Vernacular names:—*Bágh Ari* (Dinajpur and Rungpur); *Vágháir* (Purniah); *Boonch* or *Goonch* (N. W. Provinces); *Goreah* or *Bagh Machh* (Assam); *Rahti jellah* (Telugu); *Sah-lun* (Ooriah); *Kheerd, Moolandah* and *Guwch* (Poona and environs).

B 12; D. 1/6 | 0; A. 12-15; P. 13; V. 6; C. 17.

In *Bagarius bagarius* the head, the upper surface of which is naked, osseous and rugose in regular bands and lines, is greatly depressed. In consequence, the head and the anterior part of the body are flattened on the ventral surface. The skin on the body is also somewhat scabrous. The length of the head is contained from 2.9 to 3.3 times in the standard length; in medium sized specimens the height of head is contained from 1.6 to 2.0 times and its width from 1.2 to 1.3 times in the length of the head; but in a young specimen from Orissa the proportions are quite different as the head is relatively less broad but at the same time considerably depressed. In this young specimen the body is also greatly depressed, its height being contained 7.9 times in the standard length. Usually the height of the body is contained from 4.8 to 6.0 times in the length of the body. The width of the body is either equal to or greater than its height. The caudal peduncle is narrow and whip-like; its least height is contained from 3.1 to 3.8 times in its length. The eyes are small, dorsally placed and situated in the posterior half of the head. The mouth is situated on the ventral surface considerably behind the tip of the snout; the extent of its gape is equal to 4/7 of the length of the head. The teeth are sharp and of unequal size in the jaws. There is an outer widely separated row of larger ones in the mandibles. There are eight barbels; the nasal barbels are generally smaller than the diameter of the eye; the maxillary barbels possess broad bases and are generally shorter than the head; the two mandibular pairs are also very short.

The dorsal fin is considerably in advance of the ventrals; its spine is smooth, with an elongated soft termination of varying length; the osseous portion of the spine is almost as long as the head without the snout. The pectoral spine is stronger, as long as or slightly longer than the dorsal, serrated internally and provided with a soft prolongation. The caudal fin is deeply forked, the upper lobe is longer and both the lobes are produced into soft filamentous processes.



Text-fig. 1.—*Bagarius bagarius* (Hamilton), showing variation in form and colouration. (After Fowler, **6**.)

The air-bladder is small and is divided into two lateral chambers, which are situated one on each side in a deep groove formed in the consolidated transverse processes of the compound vertebra.

The *Goonch* is variable as regards its form and colouration, and as it grows to a very large size the body proportions are found to vary considerably with the size of the fish. The colouration of the species will also depend on the type of water inhabited by a particular specimen. Hamilton (**7**) noted that 'The *colour* is greenish ash, very pale below; and not only on the body, but on the fins, are scattered large irregularly shaped black marks. The eyes are golden-coloured'. In the case of specimens from Poona Sykes (**12**) found the 'Colour of the fish deep olive-brown, towards the belly yellowish brown, and marked with spots like a Dalmatian dog.' A nearly uniformly coloured variety of *Bagarius bagarius* was described by Popta (**9**) as *B. nieuwenhuisii.*

In the colour plate accompanying this paper, figure 1 represents the colouration of a Burmese specimen obtained by Mr. J. A. Burnes from the Nam Lon Stream, near Takaw, in the Southern Shan States on the 21st of July, 1934. Mr. Burnes sent a colour sketch of the specimen along with a description of its colouration. His description of the colouration is as follows:—

'Multicoloured fish, yellow black, brown and blue.
'Two blue streaks on head between eyes. One blue streak on back in front of anterior dorsal fin. Anterior dorsal fin: orange below and bluish with black spots above. Posterior dorsal fin: blue with black spots. Pectoral fins: reddish at roots with black spots throughout, tips yellow. Ventral fins: orange ground with black spots. Caudal and anal fins: same as ventrals. Anterior half of body: brown ground with black and yellow spots. Middle part of body: yellow ground with black spots. Part of body about the posterior dorsal fin: grey ground with black spots. Part of body behind the posterior dorsal fin: yellow ground with black spots.'

The outline of other figures on the colour plate are of a specimen from North Assam, but the colouration in the three figures represents variations exhibited by specimens taken near Calcutta. Figure 2 shows the colouration of a specimen obtained from the Settling Tanks of the Calcutta Corporation Water-works at Pulta. When just taken out of water the head was greenish grey while the dorsal surface was of a dark-greyish olive-green colour. The rayed dorsal was brownish pink anteriorly and light grey with black spots posteriorly. Behind the first dorsal and below the second dorsal there were two irregular, vertical black markings. The caudal peduncle was pink above and slightly yellow with pale grey below. The caudal was light yellowish grey. The anterior rays of the paired fins were yellowish while their remaining portions were light grey with black spots. The anal fin was light green anteriorly and light grey, with black spots, posteriorly. The ventral surface was light yellow with pale grey. An hour or so after its removal from water the colour changed to what is represented in figure 3. Figure 4 represents the colouration of a dead specimen caught in one of the canals in the neighbourhood of Calcutta and presented to the Zoological Survey of India.

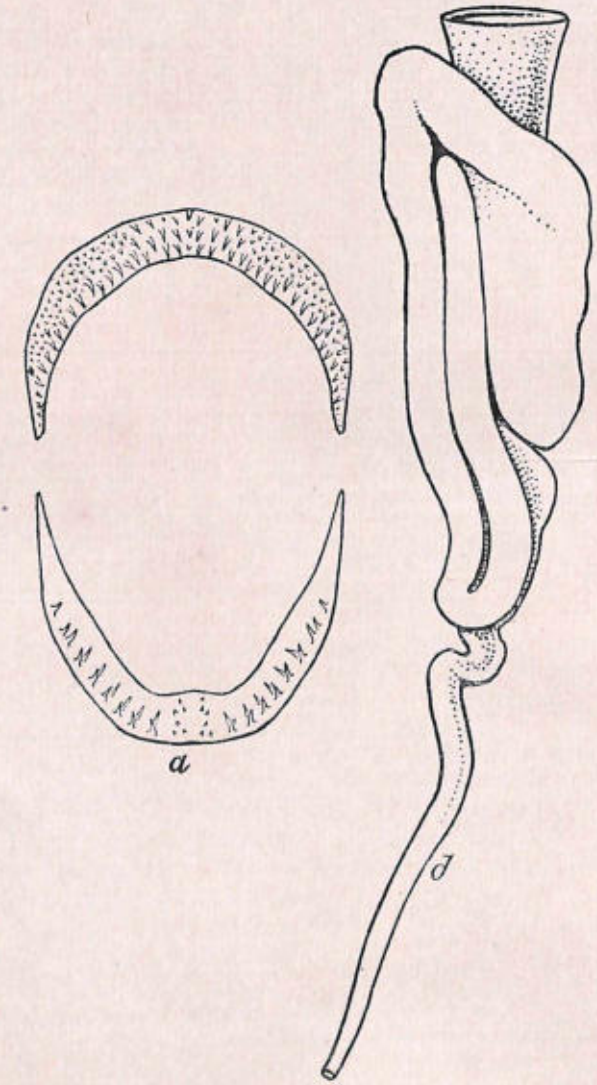
Distribution:—*Bagarius bagarius* is known from all over India, Burma, Siam, Malay Archipelago and Tonkin.

Measurements in millimetres.

	Orissa	Poona	Assam		Burma		
			Cachar	Mergh-erita	Myitkyina Dist.	S. Shan States	
Standard length	67·5	292·5	269·5	313·0	207·0	230·0	277·0
Length of head	23·0	90·0	81·5	98·5	65·1	72·0	84·0
Width of head	14·0	65·5	64·0	73·5	48·1	53·0	70·5
Height of head	9·0	54·5	43·5	49·5	33·0	37·5	49·5
Diameter of eye	3·0	8·0	8·0	8·0	6·5	6·5	7·5
Length of snout	10·0	43·0	39·5	48·0	32·0	37·0	44·0
Interorbital distance	6·0	28·5	24·5	28·5	18·0	19·5	23·5
Height of body	8·5	60·0	48·0	52·0	35·0	40·5	49·0
Width of body	8·5	56·5	50·5	52·0	37·0	40·5	55·0
Length of pectoral spine	12·0	44·0	46·0	55·0	Damaged	47·5	47·0
Length of dorsal spine	11·0	42·5	43·0	53·0	Damaged	47·0	Damaged
Length of nasal barbel	Not visible	6·0	3·0	6·0	2·0	1·5	3·0
Length of maxillary barbel	22·0	78·0	54·0	75·0	48·5	70·0	78·0
Length of outer mandibular barbel	6·0	27·0	17·5	29·5	20·0	24·0	25·0
Length of inner mandibular barbel	5·0	18·0	13·3	19·0	12·5	16·0	18·0
Length of caudal peduncle	13·5	47·0	41·0	47·0	34·0	46·0	52·0
Least height of caudal peduncle	3·5	13·0	13·1	14·0	9·5	12·5	14·0

Bionomics and Fishing Notes.

Reference has been made in the introduction to the voracity of the *Goonch*. Its formidable teeth (text-fig. 2*a*), bag-like, thick-walled stomach and only slightly convoluted alimentary canal (text-fig. 2*b*) fully testify to this habit.



Text-fig. 2.—Teeth and alimentary canal of a specimen of *Bagarius bagarius* (Hamilton) about 348 mm. in standard length. Nat. size.

A writer in the *Asian* of 27th February, 1883, thus described the general habits of *Bagarius bagarius*:—

'I generally find the Goonch occupying the very head of a rapid; they lie motionless with apparently no effort in the white water among the boulders

at the foot of a smooth incline down which the water rushes with immense force through the open sluices of the weir. Some idea may be formed of the strength of the stream from the fact that the river Jumna, which is at this point about three-quarters of a mile wide, is artificially narrowed by a bund to a width of about thirty yards, this being the length of the weir through which nearly the whole volume of water has to pass when the sluices heading the Agra Canal just above the weir are closed. The monster weighing 136 lbs. caught by Mr. Van Cortland was, I believe, caught in the white water of the rapid, or just below it in the full strength of the stream, and I have frequently seen a Goonch take my spoon or minnow here as soon as it touched the water.

'They lie very often with their backs just out of water and are easily shot with a bullet.'

'Doon' in the *Asian* of 28th October, 1879, describes the spearing of the *Goonch* in the Ganges between Bijnore and Meerut. It is stated that

'When the bridge is "up", in the cold weather under the oldest boats, the "gonch" may be seen clinging on by feelers to the bottom. It struck me they could be speared, so a friend and myself sent down our canoes, armed ourselves with barbed spears, made so that the heads should *slip off* the handles, and drove down to the Ghat. The spear heads had about 20 yards of stout cotton string attached, and to the end of the rope an inflated (bullock's) bladder. When we saw the gonch, the spear was sent "home", and the shaft withdrawn. The fish at once went off, and the bladder keeping on the surface showed his course. We followed in canoes, and taking extra spears, gained the bladder and pulled up our prey, finishing him as best as we could. One morning my friend and myself killed three gonch thus, all but 80 lbs. If this sport can be got at one bridge, I see no reason why not at every one on the Ganges and Jumna, and other streams too, for gonch abounds down country, but I must say I have never tried it anywhere else but at that one bridge.'

In the cold season the *Goonch* probably hibernates as there are few records of the fish being caught at this time of the year. It takes spoon and spinning bait, and also live bait when big. On being hooked, it generally sulks, but the young provide fairly good sport.

For anglers a good account of the species is given by Thomas (**13**) in his *Rod in India* from which a few extracts are given below.

Once Mr. Cyril Kirkpatrick and Mr. Aldwell wanted to clear the *Goonch* out and for this purpose 'they used the strongest tackle, a male bamboo or ringol, on which they played them till they sulked, and then they simply hauled them out, hand over hand, on a cord as thick as a pencil.'

'Mr. Cyril Kirkpatrick also prefers the shallow at the head of the white water for these fish, where, letting the bait down the white water, the Goonch takes it for some exhausted fish that has failed to get past the shutters and is falling back. He also has a preference for a good stout cord that you can haul on to, so as not to waste time or try tackle over their sulking.'

The tackle recommended is the same as dressed for *Mahseer* on wire gimp No. 2/0. When it is intended to haul them out hand over hand a stronger gimp should be used.

Beavan (**1**) quotes from an article in the *Pioneer* to the effect that the best bait for the *Goonch* is the Spiny Eel or 'Bahm' (*Mastacembelus armatus*). 'Like most Siluroids this fish will only bite from dark till about two hours after dark, when if taken his maw will invariably be found empty; and then again from dawn

till 8 o'clock. It seems to feed on the young of a species of herring,' (probably *Clupea chapra*).

In 1920, while collecting the fauna of the Manipur Valley in Assam, I was informed of a fish locally known as *Nga-len*, but I could not obtain any specimen during the period of my visit in February-March. The local name implies that the fish rarely moves but mainly lies at the bottom. The following remarkable account of the method of its capture was given to me (8).

'The Mohammedan fishermen who alone capture and eat this fish dive and search for it under water. On discovering a fish, they come out and take a rope with them and dive again to the same place. They tie the rope round the tail of the fish being always careful not to touch its belly as this immediately disturbs it. The rope is now taken on shore and two or three people drag the fish out. It is said to be the most powerful fish in the valley.'

At the time I was unable to identify the fish from the above account but from Thomas's description of the habits of the *Goonch* I am inclined to believe that the *Nga-len* of the Manipur Valley is *B. bagarius*.

ACKNOWLEDGMENTS.

As in the case of the previous articles in this series I have to express my sincere thanks to the authorities of the Bombay Natural History Society for making a grant towards the cost of the illustrations. Mr. K. S. Misra helped me with the preparation of the table of measurements, and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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Explanation of Plate.

Colour sketches of *Bagarius bagarius* (Hamilton), showing variation in colouration in different localities and after the removal of specimens from water.

Fig. 1.—Colour sketch of a fresh specimen from Southern Shan States, Burma.
Fig. 2.—Colour sketch of a fresh specimen from Calcutta Corporation Water-works at Pulta, near Calcutta.
Fig. 3.—Same as above, but after the specimen had been out of water for an hour or so.
Fig. 4.—Colour sketch of a dead specimen brought to the Indian Museum and stated to have been collected in a canal near Calcutta.

The outlines of the figs. 2—4 are of a specimen from North Assam.

THE TWO-HORNED ASIATIC RHINOCEROS.

(*DICERORHINUS SUMATRENSIS*).

BY

THEODORE HUBBACK.

(*With 8 plates*).

The Sumatran or Two-horned Rhinoceros (*Dicerorhinus sumatrensis*), of Asia, now regarded as a distinct genus, *Dicerorhinus*, the generic title *Rhinoceros* being reserved for the Indian and Java species, was once widely distributed, but owing to continual persecution for the sake of its horn and other parts of its anatomy it has been brought to the verge of extinction.

It is on observations made on this mammal in British Malaya that this monograph is based, but *sumatrensis* has been recorded from India, Burma, Indo-China, Siam, Sumatra and Borneo. Except in Sumatra, where its incidence has not been completely investigated, it appears that in these countries this species of rhinoceros is rapidly disappearing.

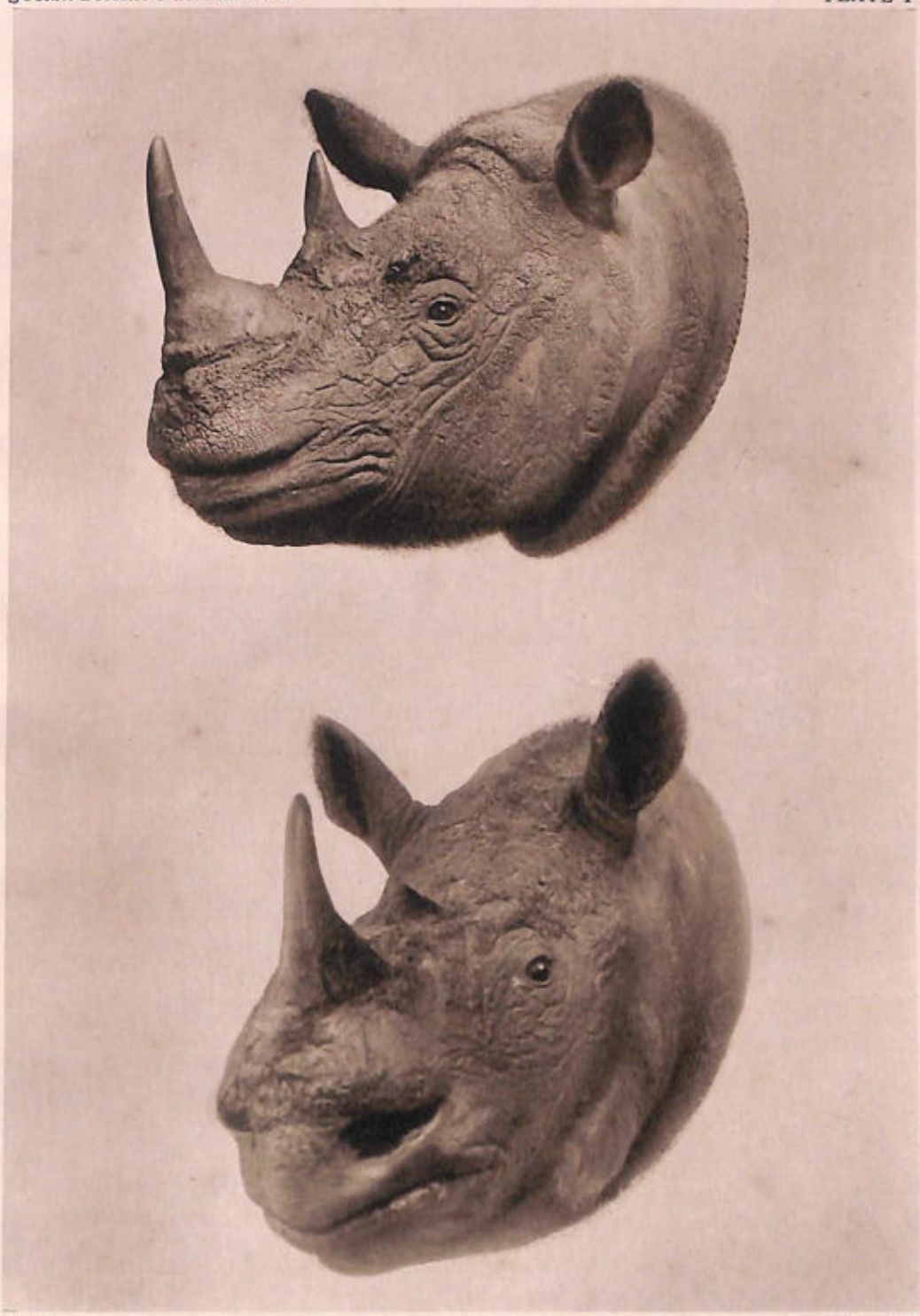
No doubt the habits of the Sumatran rhinoceros with local adaptations to different environments, would be much the same in all the above countries; still my ecological remarks must not be taken as applying to other countries than Malaya.

HISTORICAL.

The Asiatic two-horned rhinoceros was, according to Blanford, in his 'Mammalia' in the *Fauna of British India*, first named *Rhinoceros sumatrensis* by Cuvier in 1817. (See *Cuv. Règne An.* 1, page 240, 1817.) I have been unable to ascertain when the first record was made establishing the fact that there was a two-horned rhinoceros in Asia.

Greek writers described certain animals bearing a single horn and designated one as the Indian Ass. The first Greek writer to mention the rhinoceros was Strabo who wrote just before and after the beginning of the Christian era.

Rhinoceroses were seen in Europe for the first time in 61 B.C. when Pompey the Great introduced them to the games of the Roman circus. Pliny (23-79 A.D.), the Latin writer, mentions the rhinoceros and describes its fights with elephants. But these were probably African animals because those represented on the coins and sculpture of the Romans are shown with two horns and there is nothing to justify us in believing that these may have represented the *sumatrensis*. Marco Polo (1298) appears to have seen rhinoceroses in Java, probably *Rhinoceros sondaicus*, and presently I shall quote what he said about the rhinoceros which provides us with a link between the unicorn and the rhinoceros.



Copyright] [*T. Hubback*

Mounted heads of the Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (*Cuv.*)—Pahang, Federated Malay States. *Above*, old male: *Below*, old female.

It is well established that rhinoceroses have been known for centuries. The incidents of the unicorn as the animal of fable and the rhinoceros as the animal of fact may have some bearing on the superstitions attached to the rhinoceros. At least one legend associated with the unicorn has been passed on to the rhinoceros. The horn of the unicorn when made into and used as a drinking cup, was supposed to be able to detect poison and we find that even at the present time the same wonderful properties are assigned to the horn of the rhinoceros.

The idea of an animal's horn when used as a drinking cup detecting poison in any liquid placed in the cup is as old as Ctesias, who attributed this virtue to the horn of the Indian Ass, which, I think, must have been some species of Asiatic rhinoceros.

In a note in the 1840 Edition, published by Blackie & Son, Glasgow, of Oliver Goldsmith's *History of the Earth and Animated Nature*, which book, without the notes, was first published in 1774, we find the following in relation to rhinoceroses' horns.

'Thurnberg says, "It is generally believed that goblets made of the horns in a turner's lathe, will discover any poisonous draught that is put into them by making the liquor ferment until it runs quite out of the goblet. Such goblets are frequently set in gold and silver, and are regarded as suitable presents to kings, persons of distinction, or particular friends; or else they are sold at a high price, sometimes at the rate of fifty rix-dollars a goblet. When I tried these horns, both wrought and unwrought,—both old and young horns,—with several sorts of poison,—weak as well as strong,—I observed not the least motion or effervescence; and when a solution of corrosive sublimate, or other similar substance, was poured into one of these horns, there arose only a few bubbles, produced by the air which had been enclosed in the pores of the horn, and which was now disengaged from it."'

'Besides the use of its horns for goblets and handles of swords and daggers, there is scarcely any part of the animal which is not employed medicinally in the countries it inhabits.'

Another legend which long persisted in relation to the unicorn and was apparently also passed on to the rhinoceros was that this normally fierce animal was wonderfully gentle in the mating season, and from that evolved the idea that it became docile in the presence of a maiden and was lulled to sleep with its head on her breast. This fancy appears in the *Physiologus* which states:—'They send to it a pure virgin all robed. And the unicorn springs into the lap of the maiden and she subdues him and he follows her.'

But Marco Polo would have none of this in relation to the rhinoceros and when describing that animal wrote:—'It is a hideous beast to look at and in no way like what we think and say in our countries, namely a beast that lets itself be taken in the lap of a virgin. Indeed I assure you that it is quite the opposite of what we say it is.'

These superstitions attached to the mythical unicorn and bestowed on the substantial rhinoceros have been responsible for conferring on the rhinoceroses' horns and other parts magical properties resulting in its continual persecution which has brought all species of the Asiatic rhinoceros to the verge of extinction. The two-horned variety has in no way escaped the baleful influences of these illusions.

To come down to more modern times Prince Henri d'Orléans in his book *From Tonkin to India,* being an account of a journey made by him in 1895, records seeing the head of a two-horned rhinoceros in a druggist's shop at Mong-le, a small Chinese town in Yunnan, close to the Tonkin border, in, approximately, latitude 22.30N., and longitude 102E. The rhinoceros was alleged to have been killed about four miles away.

Again in the same book Prince Henri records that they found plenty of the spoor of rhinoceroses in the valley of the Nam-Tsai, near Assam. The rhinoceroses' trails must have been numerous because Prince Henri writes, 'We had to thank the latter (rhinoceros) for many an enlarged path and flattened bank.' He also stated that their guide Poulanghing explained that these were the tracks of the two-horned rhinoceros and that their flesh was good. This was in the Singpo country, approximately latitude 27.30N., and longitude 97E.

In view of what R. Lydekker wrote in his book *The Game Animals of India, Burma, Malaya and Tibet*, 1907 edition, regarding an unidentified species of two-horned rhinoceros which he suggested might be found in the Singpo country, this record is interesting. These two notes by so accurate an observer as Prince Henri show that the two-horned rhinoceros extended over a large area of country directly south of the Chinese and Tibetan borders, and as we know it is still to be found in Sumatra and Borneo no doubt in days gone by its distribution was very wide.

Henri Mouhot, the distinguished French Naturalist, in his book *Travels in Indo-China,* published in 1864, refers in Volume II to a rhinoceros hunt at which he was present in the Laos country, somewhere east of Luang Prabang, approximately in latitude 21N. and longitude 103E. There is an illustration accompanying this account which was drawn by M. Janet Lange from a sketch by M. Mouhot, but the animal depicted is obviously a *Rhinoceros sondaicus* and not a *Dicerorhinus sumatrensis*, the single horn and the fold across the back of the neck being clearly depicted. This is not very far from where Prince Henri d'Orléans recorded having seen the head of a two-horned rhinoceros in a druggist shop, and approximately six degrees of longitude east of the Singpo country. This indicates that at the time of M. Mouhot's journeys there were probably two species of rhinoceroses to be found in Indo-China and Northern Siam and this also may have a bearing on Lydekker's 'Singpo' rhinoceros.

The Asiatic two-horned rhinoceros has from time to time been divided into two or more species, *sumatrensis* and *lasiotis* being amongst them. Blanford in his 'Mammalia' in the *Fauna of British India* discusses these species and gives the reasons for their designation. He inclines to believe, however, that there is only one species but possibly more than one variety. This is supported by modern nomenclature. In the latest edition of Rowland Ward's *Records of Big Game* it is suggested that there are two local races, one *lasiotis*, embracing Assam to Borneo, and the other *blythi*, the race found in Tenasserim. It is doubtful whether the latter race would vary from that found in Malaya although the Malay



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The Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (*Cuv.*)—shot in steep country in Ulu Benus, Pahang, Federated Malay States.—(For details see text).

[*T. Hubbuck*

Peninsula, if *Records of Big Game* is to be followed, holds *lasiotis*.

Lydekker, in his *Game Animals of India, etc.*, 1907 edition, refers to even more than two varieties and suggests that the Malayan animal should be known as *R. sumatrensis niger*, but his premises are, to my mind, incorrect so far as the colour of the Malay animal is concerned. This I will refer to later on.

In *The Field* of the 23rd October 1915, R. I. Pocock wrote a note on the two-horned Asiatic Rhinoceros after having seen two recently mounted heads of this rhinoceros in Messrs. Rowland Ward's showrooms in London.

In this note Mr. Pocock remarks on the difference in the shape of the skulls and states that it would be important to ascertain if the difference is sexual as it was obviously not geographically racial the two specimens having been obtained in the same district. It was not sexual both the animals being mature males. In fact I think it extremely unlikely that the female of the *Dicerorhinus sumatrensis* would ever have such massive horns as are shown on these specimens.

Mr. Pocock refers also to the absence of fringes on the ears of these animals. I do not think that any rhinoceros which reaches maturity and lives in the dense thorny jungle of Malaya could hope to save the fringes on its ears, even if it ever had them. I have seen, in Malaya, a specimen of a baby *sumatrensis*, and it had much hair on its body and ears.

Physical Attributes.

The *Dicerorhinus sumatrensis* is not a very large animal. I think the maximum height for a male would be about 4 ft. 6½ in. at the shoulder this being the measurement of an old male I obtained in Ulu Benus, Pahang. This beast which was stocky and bulky measured 96 in. in girth directly behind the shoulder and 102 in. in length from the end of his nose to the rump, as near as I could measure it. These measurements were taken on a steep hill side so cannot be considered as very accurate. But I have measured other rhinoceroses and the mature animal, whether male or female, has invariably measured more than 4 ft. at the shoulder. One very old female whose molars were worn right down almost to the gum measured 4 ft. 3 in. in height at the shoulder. The measurements of the horns of this animal are given under No. 4 in the table below.

The colour of the *sumatrensis* which has been mentioned as differing from the variety called *lasiotis* and which Lydekker thought was blacker than the northern variety does not, in my opinion, entitle the subspecies *niger* to be recognized. The colour of the hide of the Malayan variety is a dark grey and the underside of the skin, on the belly, under the forelegs, and in the groin, distinctly shades towards pink. The blackest part of the rhinoceros is the horn; even the head is not so dark as the horn. The tail is bare and short, tufted with sparse hairs. The ears, which have been taken as one of the parts which show a difference from

the more northern variety, have a very short fringe and a few hairs on the inside, but no mature rhinoceros living in the dense jungles of Malaya, behaving in the way they do, could possibly save long hairs on the edges of its ears. The young rhinoceros is hairy but this hair disappears as the animal ages and only very short hairs, almost bristles, are found on most of the exposed parts of the mature body. A young rhino following its mother passed on one occasion very close to some of my men as recounted later, and it was noticed as being hairy. It was not a baby by any means.

There are two very long horns in the British Museum which are labelled as having been produced by *sumatrensis*. These horns, according to Rowland Ward's *Records of Big Game* measure 32⅛ in. and 27⅛ in. in length, but the next horn recorded only reaches a length of 15 in. That horn came from the Malay Peninsula. The Datok Raja Kiah of Jelebu in Malaya, who is mentioned later on, told me that he had once obtained a *sumatrensis* whose front horn measured about 20 in. in length, but I am afraid I cannot attach much importance to the measurement although it was probably an abnormally long horn. I think that any anterior horn of a *sumatrensis* which measured over 10 in., and any posterior horn which measured over 5 in. should be considered as above the average. The females have smaller and less rugged horns than the males, and seldom show anything but a small development of the posterior horn. In an old male the whole of the top of the nose both around and in front of the horns becomes a mass of horn and at times may develop small lumps which might almost be called subsidiary horns. I have seen two heads with what were almost third horns, and the illustration of the mounted head of a male *sumatrensis* clearly shows a small horny protuberance over the left eye. The horn is merely agglutinated hair and as the *sumatrensis* is very fond of rubbing his horn against trees one can quite imagine that rough surfaces may easily become enlarged into embryo horns? The horn never appears to be used as a weapon, the large incisors in the lower jaw being the weapon of defence and offence.

The following are the measurements of the horns of four mounted heads of *Dicerorhinus sumatrensis* obtained in Malaya. Numbers 1 and 4 are illustrated.

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Numbers 1, 2 and 3 are those of males, number 4 that of a very old female with teeth worn right down to the gums.

These measurements can be taken, I think, as typical of the class of horn that was obtainable in Malaya.

The *sumatrensis*, for his height, has a fairly large foot. The greatest measurement of the track of a fore foot that I have recorded was 9½ in. across the widest part which would be to the outer edges of the two lateral toe nails. Measurement of the centre toe nail, in this case, was 3½ in. wide. Another track that I measured of what was a slightly smaller beast was 8½ in. across with a centre toe nail measuring 2¾ in. These were all measurements of fore feet. The hind feet are narrower and the toe nails generally slightly longer. The older the rhinoceros the more he digs his toes in when going up hill, which I believe he must do every day of his life! Anyway he always did whenever I followed him! The result is that his toe nails get shorter as he gets older. The impression of a short but wide toe nail indicates old age. This is in contradiction to the wild elephant which gets down on his heels the older he gets so that his toe nails are inclined to grow longer. The most extraordinary portion of the rhinoceros's external anatomy is his sheath and penis. The sheath points backwards and the result is that when the male urinates he does so behind. This is the only definite clue that can be obtained as to what is the sex of the animal one is following.

The illustration Plate IV shows the sheath and although not very clear it can be seen to hang down like a scrotum. If the male urinates when he is walking or even running he appears to throw his penis backwards and his urine shoots up into the air between his legs. The result is that, when following a track, splashes and drops of urine can be seen on leaves of the bush he has passed through, even up to a height of six feet. One's attention is sometimes drawn to the fact that the animal has urinated, because of the smell which is thus brought so close to one's face. In an article in the *Journal* of the Bombay Natural History Society, volume xxxviii, No. 1 published in Aguust 1935, written by Mr. W. S. Thom on Rhinoceros Shooting in Burma, he states that this phenomenon of urinating on the bushes is done by the female, but I do not think that this is so. I have followed rhinoceroses for too many miles to be mistaken in what I have written above. Several other peculiarities mentioned by Mr. Thom in his article do not correspond with my experience, but I do not wish to criticise further the writings of a very experienced shikari, so I will merely record the deductions I have made from my own observations.

Habits and Terrain.

In the Malay Peninsula the *Dicerorhinus sumatrensis* was to be found in many parts of the mountainous country and sometimes in the coast belts. The *sumatrensis* is now almost entirely a mountain animal due, I think, to having been driven back from the lower lands. It is, however, very occasionally found someway

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from the mountains in foot hills or dense low-lying jungle. It lives in the thickest and roughest jungle terrain it can find and that alone, up to this time, has saved it from extermination.

The two-horned rhinoceros seldom travels except alone, it being most unusual to find two of them together.

The Datok Rajah Kiah of Jelebu, an old and experienced rhinoceros hunter, who belonged to a type now passed from Malaya, informed me many years ago that he thought when two rhinoceroses were seen together that they were probably mother and calf except on the rare occasions when two came together for propagation purposes. I have on four occasions followed two rhinoceroses. In one case they were mating but on the other occasions when I came across two they may have been mother and calf, because apparently the calf runs with the mother until nearly full grown. The evidence that I have on the latter point is not very convincing, but taken cumulatively it does seem to point to slow maturity and long association with the parent.

The 'To Raja Kiah caught a baby male rhinoceros which he carefully tended and kept for seven years. I did not see it when it was very young but the 'To Raja told me that it was still hairy when he got it. He shot the mother and found the baby near by. At the end of seven years the rhino had grown to a little over three feet in height: obviously not full grown. It was just showing the anterior horn, but there was no sign of the posterior horn. It foraged in the jungle during the day as it got older, had its own wallows, and returned to the 'To Raja's house in the evening for a feed of rice. When the rice was ready one of the household would call with a loud and shrill, Hoh! Hoh! Hoh! and the rhino would answer from the jungle and come back at full speed for his evening meal. He slept under the house.

I have frequently seen tracks of rhinoceros at least as big as this one following a larger one and I think one may presume that they were mother and calf and that the calf was no longer extremely young. This tends to show that the rhinoceros is a long-lived animal although there is insufficient evidence to be dogmatic about it.

The 'To Raja learnt two lessons in connexion with his rhinoceros. He had an offer from another Malay for the rhinoceros but with the usual financial jugglings of such people the 'To Raja was persuaded to part with the young rhino by promises of payment so soon as the purchaser was able to get in touch with his principal who lived some 50 miles away. Foolishly the old man allowed the animal to be taken away. About a week afterwards the would-be purchaser returned with the rhino to the 'To Raja and told him that it was sick and could not proceed any further on the journey. The poor little beast had been dragged along a jungle path, had never been given a chance to wallow, and its skin was cracked in dozens of places. It died shortly afterwards and the 'To Raja had neither his rhino, to which he had been very much attached, nor the money which he expected for it. The two lessons were:—(1) avoid greed, (2) a rhino cannot exist unless allowed to wallow.

As I have written above rhinoceroses have a poor development of the herd instinct and are extremely unsociable. I have followed



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The Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (Cuv.)—passing through a ' salt lick ' in Ulu, Pahang, Federated Malay States.

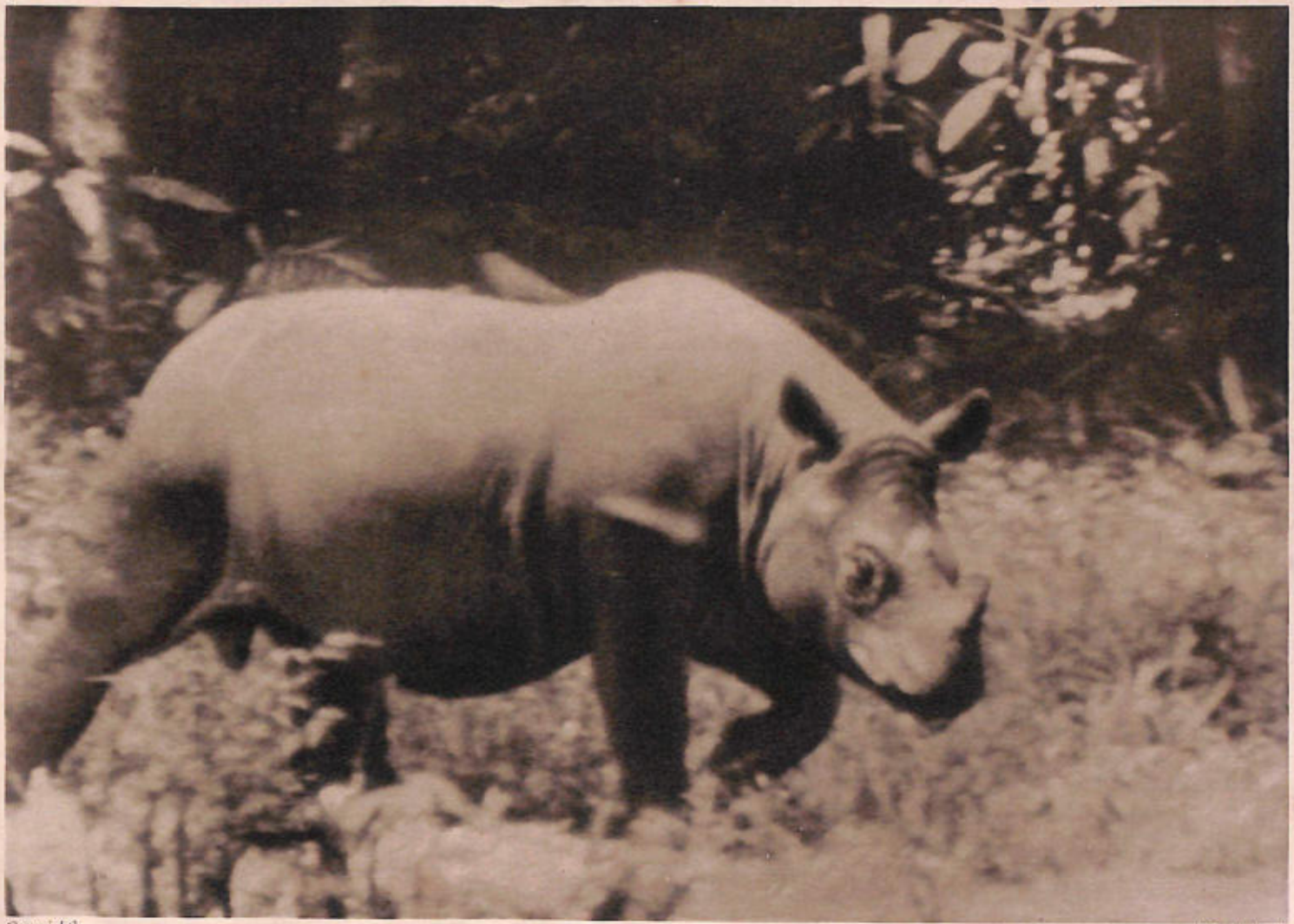
[*T. Hubback*

rhinoceroses on foot through dense jungles for days and days but have seldom come across more than one animal. Although at times I have followed fresh tracks which crossed the fresh tracks of another animal I have seldom known them to join up. On one occasion when following the tracks of two big beasts another one crossed their trail and followed them. So then there were three. But the reason was obvious, because presently we came to a place where two of them had had a tussle and the third had laid down close by, no doubt wondering which of the two was to be her future lord and master. I hoped I was going to see a rhino fight and followed up the tracks but I was disappointed. I came upon some more traces of struggles and then one of them went away and left the two to continue their honeymoon. Perhaps it was the lone male which had intruded into the party and which now took up the running? I do not know, but I do know that the solitary one which I went after, it being easier to deal with one animal than two, was a very old male with his posterior horn broken off. This animal is mentioned on page 598 and is No. 2 in the list.

Of all the difficult and exasperating animals to follow through dense jungle the rhinoceros easily takes first place. They invariably go through the thickest undergrowth they can find and deliberately leave a game path to go through, or under, or over, some fallen tree which appeals to their sense of humour, I suppose. They do this normally as recreation when going about their lawful occasions, but when once wise to the fact that they are being followed they excel themselves in ingenuity. Nothing is too difficult for them. I remember once tracking a rhinoceros up a steep hill side in very rough country with many rocks about. We came up to him almost on the top of the hill. He heard us, I suppose, and turned round to face the direction we were coming from, but carefully put a large fallen tree and a dense thicket of rattan between himself and the line of our approach. We could see nothing, but were suddenly brought up standing by a tremendous snort just in front of us. Then a short rush away from us—cessation of all sound, and another magnificent snort, more like an engine blowing off steam than anything else. This was followed by a shrill squeal, denoting that he had smelt us and away he went crashing through everything. We saw nothing at all. He rushed down a dry gully and when we followed painfully in his rear—by that time he was far away—we found that, when tearing down this dry water course which was full of granite boulders, he had come to a place where the formation broke away to a sheer drop of twenty feet. This did not bother him, he just took it in his stride, nor did the flat slab of granite at the bottom on which he landed check him in any way, he had continued his rush as if nothing out of the ordinary had happened. The drop to this granite bed would have seriously injured if not killed any other heavy animal, but a rhino is the toughest animal on earth. His short leg bones enable him to do these things without much inconvenience. We followed him up for some miles before he stopped, apparently to amuse himself by rubbing his horn against a tree, taking off rather more bark than

usual, and kicking up a greater amount of earth at the foot of the tree than is customary. That was the only indication that he remembered that granite bed rock. And so it is always with them. They seem impervious to any physical feeling of discomfort. Their walking powers in bad country are phenomenal. I have often followed up a rhino which has laboriously climbed—I should say we have laboriously climbed—a high mountain merely to go down the other side. A rhino that has been scared may do this two or three times during a day without stopping, except to take a quick wallow if he comes across a mud hole, and, at the end of the day, the unfortunate people following him will be perhaps far enough behind him to take two or three days to catch him up. The hunting of rhinoceros by tracking is a very difficult business and, if that was the only way to get them, then the rhino would have been in no danger of extinction. But unfortunately the rhinoceros with all his highly developed senses will continually follow the same game trails, especially near wallows or near salt licks, and it is due to this habit that they have been so persecuted. Even to this day, one finds rhinoceroses' game paths passing alongside some long disused and partially filled-up pit, showing their extraordinary obsession for keeping to and following almost the exact paths which generations of rhinoceroses have used. This has resulted in pits being dug on their accustomed trails by poachers anxious to obtain their horns. I have described the procedure later on.

When travelling through the jungle on their ordinary rounds rhinoceroses move slowly and steadily covering a great deal of ground during the twenty-four hours. But occasionally finding some particular patch of jungle that he likes, a rhinoceros may hang about in the vicinity for some days. They particularly favour the heads of narrow valleys, where they generally have well used wallows, plenty of thick undergrowth and nice precipitous sides to the valley to give them plenty of exercise. An ideal place for a rhinoceros to frequent is jungle so dense, that a man can see nothing within five yards except a wall of forest, and so steep that he cannot walk without holding on to something, which something will almost certainly be thorny. Another delightful type of jungle favoured by rhinos is one interspersed with the large bamboo known to Malays as *buloh semeliang* (*Dendrocalamus giganteus*). This bamboo grows quickly and to a great height. Not having much rigidity, much of this bamboo leans towards the ground while still alive and, on steep hill sides, thus presents an almost impenetrable tangle. But the rhinoceros does not bother about this; he goes under the bamboo letting the tangled mass pass over his back. This bamboo fractures easily leaving an edge as sharp as a razor which will cut to the bone with ease. To follow a rhinoceros along a steep hill side where he has passed under *buloh semeliang* is a very ticklish business and if your party gets through without casualties you will have done well. I have seen an elephant's trunk cut very severely by one of these bamboos when he was rushing down a hill after getting a taint of human scent. But they do not bother the rhinoceros; in fact, nothing, except human scent, seems to worry them. They go about their business without fuss or haste.



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The Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (*Cuv.*). A side view of the same animal shown in plate III.

[*T. Hubback*

To follow rhinoceroses with the hope of making observations or watching their movements is extremely difficult and few opportunities ever come one's way.

There was an old rhinoceros in a very remote part of the Malayan jungle of which I wanted to make an intensive study. I tried to. I followed on his fresh tracks for an accumulative period of forty days, spread over five separate expeditions after him. I heard him three times, was very close to him several times but saw him never. His habits were fairly regular until he became alarmed and then he was the cunningest thing in the jungle. The country he frequented was not high but extremely steep and covered with thorns of many sorts. The worst obstruction was a palm called by Malays *chuchor* (*Calamus castaneus*). It grows in dense clumps to a height of about ten feet, and is very thorny. This palm jungle was interspersed with rattans of several varieties and most of the terrain followed by this rhino, when he was alarmed, was along steep hill sides heavily wooded and covered with *chuchor*. Directly he knew he was being followed he tried every trick known to rhinos to give us the slip. He never stayed for any time in his wallows—to make up for that he wallowed frequently—and he continually made huge circles coming back on tracks about once in two days. One day he came close to a camp which had been used by us two days previously. Some way off, he became aware of the proximity of the old camp and stopped before he came to the banks of the river which separated him from our camping place. He then turned back and went in another direction. His habits seemed to indicate that he was very old. He had a track which measured 9½ in. across, exceptionally wide for a *sumatrensis*, with short toe nails. He also had little control over his urine, when alarmed he had an almost continual dribble for a mile or two. But I have noticed, on other occasions, that rhinos when alarmed and panicky would do the same thing, but they did not go on for half an hour as this old fellow did. He never ran far but he never seemed to stop. A fast walk which he could keep up for miles defeated us. When we did get up to him and he got away without our seeing him—that was always—we knew that it would be two or three days before we would have a chance of getting close to him again. We used to track him all day, camp on his tracks at night, and off again early next morning; still he defeated us.

His food consisted chiefly of twigs of the trees sought by rhinoceroses, which indicated that his teeth were much worn. Generally they chew up more of the trees they push down than just the slender twigs. He found and demolished large quantities of jungle fruits which were easy to swallow, which he did stones and all, but his digestion was all right because they never seemed to upset him. A favourite trick of his was to get into a river and follow it for half a mile or more; he would then find a place well concealed on the bank and leave the river by climbing over stones or roots or something which would be difficult for us to spot a day or two afterwards. I remember following a rhinoceros which went down to a river and first walked about half a mile upstream,

then about a mile down stream, then back again for about a quarter of a mile upstream to the mouth of a small stream which was full of large stones; he walked on these stones until he was well away from the main river, climbed the bank and disappeared into the jungle. This manœuvre delayed us the best part of a day. The account of following the old rhinoceros has not been an exception to the rule, it is merely a good instance of what the rhinoceros can do when it really tries to get away from the nasty smell of man.

All rhino are very fond of wallowing. As I have already written it is essential for their very existence that they should be able to wallow. Their hides are extremely thick but the epidermis is thin and sensitive and the number of flies that follow them no doubt irritate them and make their habit of wallowing a very natural one. Normally the rhinoceros wallows once or twice in the twenty-four hours, more in hot, dry weather. It is also fond of walking and swimming in the rivers. I have never seen any evidence of them lying down in the rivers although they invariably lie down in their wallows. The wallows are generally situated under a bank, sometimes in a swamp. Wallows under banks are made in such a position, I believe, because the rhinoceros likes to dig into the bank with his horn. This is done, I presume, to make the mud in the wallow of the right consistency, because after heavy rain the mud would be very thin and would probably not stick sufficiently to his hide; so he thickens it up a little by breaking down the bank with his horn or with his fore feet, but more usually his horn. The banks become hollowed out as the illustration shows (Plate V).

Before the days of intensive rhinoceros destruction in Malaya it was possible to find a regular battery of rhinoceroses' wallows in one place, as many as seven or eight would be found under a bank and all in use. At one salt lick in Ulu Pahang, a salt lick well patronized by rhinoceroses in their palmy days, I found no less than five large wallows in a series, almost touching each other. Near another lick were eight. They are no longer used. To adapt two lines of Tom Moore's poetry one might well say:—

The pits are still there
But the rhino have gone.

I have known a rhinoceros which had been disturbed, to wallow as many as six times during the day, remaining only a few minutes in each wallow, rolling about to get himself thoroughly covered with mud and then going on again. In one place, he had obviously thrown himself into the wallow, probably hot and bothered, because the mud was splashed everywhere in the vicinity. On another occasion when following a rhinoceros in very rough country, too rough even for him to find a wallow, he actually tried to wallow in a little stony gully with about two inches of water at the bottom. As a wallow it was not a success. I think that their necessity to wallow must be very great otherwise alarmed animals would not be so anxious to perform the rite. Possibly the sensitiveness of their skin demands a coating of mud, although that is scarcely consistent with their fondness of going through all the thickest and thorniest jungle they can find. Flies certainly



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A wallow of the Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (Cuv.)—near a 'salt lick.'

[*T. Hubback*

bother them, especially a large unidentified kind of *Tabanus*, with a blue abdomen. They are also attacked by a special type of tick which is the only jungle tick that I have come across which will with ease drive its mandible through thick shikar cloth. Of course compared with rhino hide this feat must be nothing to it, but the ticks which attach themselves to the wild cattle of the Malayan jungles cannot do it. The ticks appear to fall off the rhino long before they are gorged, in fact at times I have seen rhino ticks on the trail followed by a rhino which had evidently not had a meal at all, and yet I believe that they must have come from the rhino's body.

Most of the salt licks affected by rhinos are sulphur springs which are generally situated amongst rocks. These rocks are polished quite smoothly by the animals using these licks. For many years I thought that these polishings were the result of the licking of the rocks for some inherent benefit in the rock itself. I subsequently found out that the rocks are licked to remove from the lips or mouth of the animal a peculiar type of small leech, akin to the horse leech, which lies in the slime of the sulphur water. When an animal puts his muzzle down to drink the leech secures its hold. I first noticed this fact whilst watching a tapir in a sulphur lick and subsequently often saw sambhur deer do the same trick. I have a cine film showing quite clearly a sambhur stag rubbing his lips on the rocks after taking a long drink at the sulphur water. The rocks are also polished by the animals' bodies, as well as in the process of removing leeches from their mouths and lips. It is not surprising that centuries of such contacts have smoothed over all the rocks in the vicinity of a lick.

Rhinoceroses also visit mud-licks which show no exudation of sulphur but probably contain some trace of sulphur or possibly a saline which attracts them. There is I think no doubt but that wild animals visit salt licks for the purpose of cleansing their stomachs and intestines of parasites. Wild cattle droppings will be almost pure mud after a visit to a mud-lick, and I have often come across the dung of elephants slimy and covered with mucus after a visit to a salt lick.

Senses.

The senses of hearing and smelling in *Dicerorhinus sumatrensis* are extraordinarily acute. The enormous nasal cavities surely enhance its power of scent. The habit that this rhinoceros has of curling up its pointed upper lip when testing the wind is no doubt an effort to utilize more of the inner surface of the nostrils in trying to discover the direct line of scent. A rhinoceros, once he has decided that the wind is tainted, wastes no time in getting away and, as I have described elsewhere, he voices his fear in no uncertain manner. I have no doubt but that the rhinoceros relies more on his nose than any other organ to give him warning of danger. His hearing is also very acute, despite the fact that he has small ears which do not look as if they would be capable of catching much sound. The Datok Raja told me that, when

approaching a rhinoceros, on no account to break anything along the side of the trail, except the smallest twig, if it was necessary to mark the route, because a rhinoceros could hear so extraordinarily well that he would be put on guard and would immediately start to test the wind in every direction. This is sound advice although a little difficult to follow along a steep hill side with a thorny rattan holding one back by the lobe of one's ear!

In the dense jungles favoured by rhinos there is little movement in the air, except during a storm, and I have no doubt but that the rhinoceros with his extraordinary powers of smell would detect human scent from almost any direction if sufficiently close to him even on the stillest day. Their sight is poor, in fact probably of little use to them for detection purposes and can be ignored when stalking them.

The rhinoceros has several distinct methods of expressing pleasure, annoyance or alarm and uses both his throat and his nose to give vent to his feelings. It is interesting to know that a rhinoceros when alarmed has a very distinct way of showing his fear as against an extremely truculent demonstration when only suspicious. As I have written already, a suspicious rhinoceros will face the direction where he thinks there is something out of the normal and then give vent to a terrific blast from his nostrils. He may then turn round and trot away a few yards and repeat the performance. It is merely bluff. When he gets a taint of your wind his attitude immediately changes into one of abject fear. Of all animals I think the rhinoceros must hate the scent of man most. Possibly it is due to his being so seldom confronted with it, that to him it is the most horrible smell on earth! Occasionally a rhinoceros when suspicious will turn round and run away without any vocal display, stopping in a short distance to listen intently. It is then very difficult to approach him because he will keep absolutely still and one is liable to almost run into him. But when he gets one's wind .the procedure is very different. The animal immediately goes off at full speed in any direction—if facing you he is liable to run straight in your direction—making a noise something between the bark of a dog and the quack of a duck. It is not exactly a squeal but a noise peculiar to a thoroughly alarmed rhinoceros. The intensity of the quacking will generally indicate the distance he will go before he slows up. When hunting in the mountains, I used to despair when I heard a rhino rush away making a series of long and plaintive quacks, knowing perfectly well that it would be days before we would be able to catch him up. On the other hand, if alarmed, he snorts violently and then rushes off; but he will nearly certainly pull up within a hundred yards or so, probably wondering what had disturbed him.

When feeding and quite undisturbed a rhino will continually squeak and talk to himself making some of the noises through his mouth and some with his nose. These noises can be heard for some distance. I have never heard them after a rhino has been disturbed, although followed all day. Apparently he only makes these noises when he is completely at peace with everything. There is a peculiar noise that a rhinoceros makes when in a wallow,



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A disused wallow of the Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (Cuv) [*T. Hubback*

This is a quite distinctive sound and not at all like a rhinoceros. The first time I heard it I was with the old Datok Raja and we could hear a rhino splashing about in a wallow but could see nothing. Presently I heard a noise which I took to be made by a monkey, probably a gibbon I thought. I whispered to the Datok that there was a monkey evidently close to the wallow who had spotted the rhino and that we must be careful that he did not spot us too. The old man smiled and shook his head. 'That is the rhino; they make that noise when enjoying themselves in a wallow.'

I often heard that noise on other occasions and was often hard put to it to believe that it really was the rhino and not a gibbon. The sound was low and rather plaintive, something like the low note of a white-handed gibbon, but also with a faint resemblance to a bird. A noise impossible to describe accurately. Finally a rhinoceros will squeal terribly when dying a violent death, not unlike the screaming of the sambhur deer under similar circumstances, but an even more distressing sound.

In addition to noises which present some sort of endeavour to express its feelings there is a complete series of snorts and grunts and blowings which the rhinoceros sometimes gives vent to when wallowing, probably due to trying to get the mud out of his nose and eyes. But generally speaking, they do not make much noise when settled down in a wallow for a good rest. When lying down on the ground, and probably also in a wallow, they never, I believe, lie on their sides, but fold themselves up with their legs tucked under them.

Food.

I do not think that *Dicerorhinus sumatrensis* ever graze; I have never seen any evidence of them doing anything of the sort. They eat fallen fruit and so far as that goes do take food off the ground but do not appear to eat grass or roots of any sort. Their principal food is the small branches of certain trees, and bitter or astringent fruits. I have once seen a rhinoceros eating lichen, or possibly some fungus off a fallen tree, but their main food supply is from young trees that they break down. Whereas the other species of large wild life in Malaya will often find food in secondary jungle, the *sumatrensis* invariably feeds only in virgin forest or very old regenerated jungle. They seem to feed indiscriminately, that is to say they do not appear to have any regular hours, although they do frequently sleep during the heat of the day. They may however wallow at any time.

Rhinoceros are particularly fond of trees of the Sapotaceæ family, some of which are enumerated below. Other trees and fruits which they eat are included in the following list. The native name is given in brackets.

Trees and Fruit eaten by *Dicerorhinus sumatrensis*.

Anacardiaceæ. *Mangifera* sp. (Machang berlawin) fruit eaten,
Apocynaceæ. *Dyera* spp. (Jelutong).



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Apocynaceæ. *Dyera* spp. (Jelutong).

EUPHORBIACEÆ. *Sapium baccatum*....(Memaya).
GUTTIFERÆ. *Garcinia* spp. (Kandis); *Kayea Kunstleri* (Gaha).
LEGUMINOSÆ. *Pithecolobium* sp. (Keredas); *Saraca* sp. (Tengelan), flowers eaten.
MYRISTICACEÆ. *Myristica* spp. (Penarah).
MYRTACEÆ. *Eugenia* sp. (Kelat merah, kelat kuning, etc. etc.).
RUBIACEÆ. *Urophyllum* spp. (Manai badak, manai pahit, manai rumpah).
SAPOTACEÆ. *Palaquium* and *Payena* spp. (Nyatoh, several varieties); *Payena costata* (Mengelut or Salut), fruit eaten; *Palaquium Gutta* (Taban merah, etc.).

Of the many species of *Eugenia*, which are common in the virgin forests of Malaya, young trees are often broken down and the smaller branches and leaves eaten. Many trees containing gum or getah are favoured by rhinoceroses. *Jelutong* seedlings they are fond of. The gum from large *jelutong* trees is the principal ingredient of chewing gum. The several species of the shrub *Manai* which grow in patches on hill sides are often eaten down by rhinoceroses which are very fond of the bitter leaves.

The principal jungle fruits that they are fond of belong to the genus *Mangifera*, as well as the fruit of a tree called *Mengelut* or *Salut* which has a thick sticky creamy juice, no doubt palatable to the rhinoceros. Once when following a *Rhinoceros sondaicus* on the coast of Tenasserim, Lower Burma, I found that the animal had eaten large quantities of the bark of a tree, *Ceriops Candolleana* which grows in mangrove swamps and in tidal water. It has a bright orange inner bark and it is, I believe, used for tanning. The urine of this rhinoceros was stained bright orange by the juices in the bark and dried on the leaves like small discs of gelatine.

The rhinoceros obtains most of his food by breaking down small trees, pushing against them with his forehead or chest until the tree is sufficiently bent over to enable him to walk it down by pressing the tree under his belly. Sometimes when the tree is fairly large he puts his fore feet on it to bring more weight into play. He may even hold a tree down by standing on it with his fore feet; I have often seen the marks of his toe nails on the trees that have been broken down.

Having defeated the tree, the rhinoceros proceeds to eat the twigs and small branches. He will move round and round the end of the tree continually altering his position during the process of demolishing the leaves and ends of the branches.

A favourite trick of the rhinoceros when feeding is to get a sapling behind his front horn and twist it round and round until it is thoroughly decorticated and covered with mud from his head. I do not know exactly how this is done never having caught a rhino *flagrante delicto*; but it is generally supposed that this is only done by a rhinoceros which has sufficiently long horns to enable it to twist the saplings between the two horns. I found that this was not the case. In one instance I was following a rhinoceros which had twisted a number of saplings but discovered

later that it had a very poor and stumpy posterior horn. Also, I believed, for the same reason, that a female rhinoceros could not twist saplings and, when following rhino's spoor and finding twisted saplings, I concluded that I was on the track of a male which had a good horn. I disproved this by finding saplings twisted in approved style by a cow rhinoceros which was accompanied by a calf. I do not now believe that the length of the horns has anything to do with the thoroughness of the twistings and such indications are no guide either to the sex of the animal being followed or the size of the horns.

Another favourite trick of the rhinoceros is to rub his horn against smallish trees and take the bark off. This is frequently accompanied by pawing up of the earth at the foot of the tree and the sprinkling of the surrounding shrubs with urine. In this case there is generally some indication of the type of horn possessed by the rhinoceros: an old rugged horn will knock large chunks of bark off; a young horn will merely plane the bark off. Much disturbance in this way to the tree and the ground around it will almost certainly indicate a male rhinoceros. I think that the pawing up of the ground may show that there is some sexual connexion between the rubbing of the horn and the disturbed earth which is spread about in all directions, no doubt some of it being directed against his sheath. Female rhinos do rub their horns against trees in a similar fashion but I have never noticed that it has been accompanied by pawing.

General Observations.

Rhinoceros frequently defecate into water but also on land. I have only once seen a place where a rhino had returned to a particular spot to defecate. Their droppings consist of round balls rather larger than a cricket ball in the case of a mature beast. It is impossible to tell the female from the male fæces. The fæces of an old animal will contain coarse and only partly digested twigs, no doubt due to defective or much worn teeth. Often during the fruit season their fæces are full of the stones of jungle fruits, unbroken but clean of all fibre. Thus does the rhinoceros spread trees, useful to himself and other animals, throughout the jungle. I have often seen young *Mangifera* seedlings growing out of an old accumulation of rhinoceros dung.

A rhinoceros will never defecate in a wallow or a salt lick; at least I have never seen any signs of one having done so. An elephant will defecate in a salt lick and foul the whole place for any other animals, and even seladang (*Bibos gaurus*) are known to occasionally offend in this way.

I am afraid I cannot write much about the young of rhinoceros. I have sometimes come across their tracks but have only once been very close to a rhinoceros calf. All my men saw it but I did not.

We were looking for the tracks of the old rhinoceros mentioned earlier and had been following along a game trail on the top of a narrow ridge. The ridge dipped and then climbed again. I was

EUPHORBIACEÆ. *Sapium baccatum*....(Memaya).

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Having defeated the tree, the rhinoceros proceeds to eat the twigs and small branches. He will move round and round the end of the tree continually altering his position during the process of demolishing the leaves and ends of the branches.

A favourite trick of the rhinoceros when feeding is to get a sapling behind his front horn and twist it round and round until it is thoroughly decorticated and covered with mud from his head. I do not know exactly how this is done never having caught a rhino *flagrante delicto*; but it is generally supposed that this is only done by a rhinoceros which has sufficiently long horns to enable it to twist the saplings between the two horns. I found that this was not the case. In one instance I was following a rhinoceros which had twisted a number of saplings but discovered

later that it had a very poor and stumpy posterior horn. Also, I believed, for the same reason, that a female rhinoceros could not twist saplings and, when following rhino's spoor and finding twisted saplings, I concluded that I was on the track of a male which had a good horn. I disproved this by finding saplings twisted in approved style by a cow rhinoceros which was accompanied by a calf. I do not now believe that the length of the horns has anything to do with the thoroughness of the twistings and such indications are no guide either to the sex of the animal being followed or the size of the horns.

Another favourite trick of the rhinoceros is to rub his horn against smallish trees and take the bark off. This is frequently accompanied by pawing up of the earth at the foot of the tree and the sprinkling of the surrounding shrubs with urine. In this case there is generally some indication of the type of horn possessed by the rhinoceros: an old rugged horn will knock large chunks of bark off; a young horn will merely plane the bark off. Much disturbance in this way to the tree and the ground around it will almost certainly indicate a male rhinoceros. I think that the pawing up of the ground may show that there is some sexual connexion between the rubbing of the horn and the disturbed earth which is spread about in all directions, no doubt some of it being directed against his sheath. Female rhinos do rub their horns against trees in a similar fashion but I have never noticed that it has been accompanied by pawing.

General Observations.

Rhinoceros frequently defecate into water but also on land. I have only once seen a place where a rhino had returned to a particular spot to defecate. Their droppings consist of round balls rather larger than a cricket ball in the case of a mature beast. It is impossible to tell the female from the male fæces. The fæces of an old animal will contain coarse and only partly digested twigs, no doubt due to defective or much worn teeth. Often during the fruit season their fæces are full of the stones of jungle fruits, unbroken but clean of all fibre. Thus does the rhinoceros spread trees, useful to himself and other animals, throughout the jungle. I have often seen young *Mangifera* seedlings growing out of an old accumulation of rhinoceros dung.

A rhinoceros will never defecate in a wallow or a salt lick; at least I have never seen any signs of one having done so. An elephant will defecate in a salt lick and foul the whole place for any other animals, and even seladang (*Bibos gaurus*) are known to occasionally offend in this way.

I am afraid I cannot write much about the young of rhinoceros. I have sometimes come across their tracks but have only once been very close to a rhinoceros calf. All my men saw it but I did not.

We were looking for the tracks of the old rhinoceros mentioned earlier and had been following along a game trail on the top of a narrow ridge. The ridge dipped and then climbed again. I was

ahead with one man, and some way behind were six Malay carriers and behind them six Sakai, the aboriginals of the Malay Peninsula. Presently we crossed a fresh track of what was obviously a large rhino. The lateral toe nails were far apart and I mistook the track for that of the old male. The wide spreading toe nails of this rhinoceros should have indicated to me that they were the tracks of a big female and not those of the old male I was looking for. I had noticed this trait before and think that it is due to the result of an ageing body and flabby muscles of the foot, which may not be so pronounced in the male. I think the track of a large splayed foot may be taken as an indication, but only an indication, when following the spoor of a *Dicerorhinus*, that the animal is a female. The tracks were very new and I sent my companion back along the trail to stop the carriers, natives cannot restrain their chattering and I did not want them to upset the whole business. While my man was on his way back, I heard directly below me the breaking of a tree and then the swishing of some branches. That was the rhino. I started to move nearer the edge of the ridge but before I had gone five yards the rhino became aware of my presence and rushed off. I was well above it and the wind should not have played me such a dirty trick. The animal made a low squeaking noise and ran back towards where my men were. Soon I heard weird noises and then cries of alarm from the Sakai. It all happened too quickly for any of the men to realize what was happening. I had not far to go to find them. The rhinoceros, which was a female followed by a calf, had run right between them. I heard stories of bravery which, knowing their characters, astonished me!

Apparently the rhinoceros having got my scent rushed back more or less on the level until it came out on the game path just in front of my Malays who were plodding along the narrow ridge. The rhino had nowhere else to go so just carried on. The men who had stopped, having heard something coming towards them through the jungle, scattered to each side of the ridge, no doubt looking for suitable trees to climb, but before they could do anything the rhino had passed. The same thing had happened to the Sakai who had rather more time being a hundred yards in the rear and some of them were up trees when the rhino passed them.

What interested me was the calf. I questioned the Malays and Sakai very closely regarding the position of the calf, and those that observed anything more than the bole of a tree told me that the calf was so close to its mother that its head was almost entirely hidden between her hind legs. I extracted this information when inquiring if they had seen whether the calf had any signs of a horn. One of the men said that he distinctly noticed that the calf showed a good deal of hair on it and they all said that the cow proceeded at a slow trot and was blowing hard. They also said, which I confirmed afterwards by examining the tracks, that the calf was not a very small animal.

The route taken by the rhino was a perfectly natural one and was more or less in the direction it was moving when I disturbed



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The Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (*Cuv.*).
The same animal shown in plate III.

[*T. Hubback*

it. But had this incident occurred when I was not there it would have been described as a desperate charge and still another story of the ferocity of the rhinoceros would have come into being. The track of the rhino along the ridge showed that she had followed more or less the centre of the path and, for all she cared, the men might not have been there at all. Her main object was to get away from my smell!

I examined the place where the rhinoceros with her calf had been when I disturbed it. There was a wallow there which was very nearly dry but they had been stamping about in the mud. Here the cow had twisted up a small sapling in approved style. My men had noticed merely a small anterior horn on the cow and no signs of a second horn at all.

The tracks of the calf which were very faint on the ridge were very visible in the drying mud of the wallow and were those of a young, but not very young rhino. It is very difficult to spot the tracks of a calf, when with its mother, as generally it keeps either just in front and so has its tracks covered by those of the larger animals or follows close behind stepping into the depressions made by the mother's feet. The dung of a calf is hardly ever seen; I saw some on this single occasion. It was near the wallow. Datok Raja told me that the mother covers up the dung of the calf with her own dung, and the only way to find the calf's droppings is by moving those of the cow very carefully to see if there are any small-sized fæces underneath. I give this for what it is worth; native observations of this sort are not of much value.

The rhinoceros has three toes on each foot. The only other animal in the Malayan jungle that has three toes on its hind foot is the tapir. But the tapir has four toes on his fore foot, so its tracks should not be confused with those of a rhinoceros, but when tracking is difficult, and the fourth toe of a tapir obliterated by the track of its hind feet, mistakes can be made except by experienced trackers. The tracks made by a rhinoceros are not easy to follow. Its large spongy feet press down leaves which spring back to their original level and only faint indications may be left by the toe nails. An old track of a day or two may easily be confused with a new track, especially during dry weather. Heavy rain will almost completely obliterate rhinoceros's tracks at times, and it is often terribly disappointing after a long day's tracking to have a night of heavy rain and know that a long, difficult and tiring day is ahead of one until such time as the rhinoceros has reached some spot, probably miles away, when the rain had ceased.

There is one great help to the tracker and that is the rhinoceros's habit of wallowing. His hide is always dirty. As I have written, the only other animal whose tracks in any way resemble a rhino's is the tapir and an oldish track of a large tapir which had been perhaps partially washed out by rain might easily be mistaken for that of a rhinoceros. Since the tapir never wallows a careful examination of the saplings or trees that the animal has rubbed against will soon show traces of mud or a mud smear if the animal is a rhinoceros.

Poaching.

If salt licks have been a benefit to the rhinoceros they have also spelt his doom. Their habit of making periodical visits to salt licks has enabled poachers to set traps for them along the many game trails which lead to these licks. In Malaya, there is little trapping of rhinoceroses done now for the simple reason that rhinoceroses are very few and far between. But a few decades ago there was a regular business done in pitting for rhinos and hundreds must have been destroyed.

I have travelled a great deal through what was once rhinoceros country and have found dozens and dozens of old disused pits. Most of them were in the vicinity of salt licks, but some in places where there were well defined trails.

At one lick I found no less than 18 of these pits and I certainly did not find all the pits that had been dug. They were twenty to thirty years old. So many pits indicate a large rhinoceros population. There are none there now at all, although this is in an entirely unopened part of the country. At another well known salt lick I found eleven old pits, but on one side of the lick I did not make a careful investigation. This lick is still very occasionally visited by rhinoceroses, but every year their visits become less. In this lick I found, a few years ago, a shooting platform recently constructed, no doubt with the hope of getting a pot shot at a rhinoceros. At another lick, in quite a different part of the country, about twenty years ago, I found that a fence had been made covering each game trail into the lick and a spring bamboo spear placed so as to command a small opening left in each piece of fence. This was the work of Sakai, an aboriginal predatory tribe who do much damage to wild life in some places.

These pits, of which I give an illustration (Plate VI), were made with much care, every trace of the activity of man being removed. There was no difficulty in finding where to make a pit, because there were numerous game trails leading to these salt licks and, in the old days, these trails were regularly used. Such a pit is about seven feet deep, nine to ten feet long, and three to four feet wide. It is so constructed that when a rhinoceros falls into it he is wedged between the slightly sloping sides of the pit and thus kept from reaching the bottom with its feet. A big animal would thus be tightly held by its own weight and entirely helpless. The chances of its getting out are very small, unless it fell so that it could get its head into the sides of the pit, when it would probably be able to dig itself out. In the north of the Malay Peninsula, I understand, that the pits used were lined with round jungle rollers of hardish timber so that there could be no question of an animal being able to dig himself out, but I have never seen any signs of any lining to any pit in Pahang where most of the pitting took place. In selecting the locality for a pit hard soil was searched for, and generally the pit was made on the side of a hill along which ran a game path. Every particle of earth removed from the pit is carried away for some distance and no trace of it was left near the spot. I think that this was more to remove the

scent from the earth in which the poachers had been working than to avoid the chance of the rhinoceros noticing a change in the landscape, because the rhinoceros has very poor eyesight. A fascine of jungle saplings would then be made and placed over the pit, the entire place being covered up with earth and leaves until it looked exactly like any other part of the game trail. I do not think that the poachers visited the pits very often, the extreme sensitiveness of the rhino's nose making it imperative that as few visits should be made as possible. But, so long as the poacher was satisfied that his work had been good enough to assure the capture of an animal falling into the pit, that was all he cared about. What did he care for the sufferings of the unfortunate animal? From what I have gathered these wretched animals very often starved to death. Under such circumstances only the horn would be taken and if the animal was an immature one quite possibly there was nothing to take at all.

Although the pit was the commonest and the most deadly way of obtaining rhinoceroses other methods were adopted. A platform made in a salt lick was one, but this was, I believe, a not very satisfactory business because in those days there were no electric torches and a rhinoceros would seldom come into a lick during the day time. The *belantek*, the spring bamboo or steel spear, was sometimes used as I have already mentioned, but the device was not so certain as the pit, although other animals,—a deer or a seladang might be thus added to the bag.

The tracking of rhinoceroses was seldom undertaken by poachers, although an experienced hunter, like the Datok Raja, used no other method. In fact he told me that, when persons started pitting in the Negri Sembilan where he lived, he gave up hunting rhino in disgust. He complained bitterly that pits very soon drove all the rhinos out of the district and described with scorn the methods of people who were only capable of getting a rhinoceros by digging a pit for it.

The tragedy of the whole thing lies in the fact that the *Dicerorhinus sumatrensis*, one of the cleverest, cunningest, sturdiest and most harmless of jungle animals should be driven from the face of this earth by superstition and greed. For years, in Malaya, this rare animal has been protected by laws which being ineffective are merely marks on pieces of paper, with the result that nothing practical has been done to try to save it from extermination.

Commercialized Superstitions.

There has been for many decades in Malaya a demand for horns and other parts of the rhinoceros due to the fact that Chinese shop-keepers and others have always been willing to pay big prices for such articles. In fact, I have known of Chinese who financed poachers, or at any rate would be willing to give them credit for provisions for a horn not yet obtained.

This stimulated the business and it went on steadily for many years until the *Dicerorhinus* has been brought to the verge of extermination.

In Northern Pahang, the largest of the Federated Malay States, and the least developed, a tremendous amount of destruction was done to the rhinoceros population at the beginning of this century, despite the fact that from 1896 there was a law in Pahang making it a punishable offence for any person, who was not licensed so to do, to capture, kill or wound any rhinoceros. Not that anyone was either licensed or punished. These poachers were not hampered in any way by an enforcement of the law and the inertness of the Government must be considered as a contributory cause for the disappearance of the rhinoceros.

Many years ago, I had the following conversation with an old Malay on the disappearance of rhinoceros from much of the country where we were at the time. I had been for some weeks trying to locate rhinoceroses but without success.

'What,' I said, 'has become of all the rhinos?'

'I do not know,' he answered.

'Do you remember if there were many here during your youth, because there must have been many at some time or other according to the number of game trails I have seen which were obviously made by rhinoceroses?'

'Yes, there were very many when I was a boy. I remember a man, who devoted all his time catching rhinos in pits, coming here with a sack full of rhino's horns. I have not seen a rhino horn now for years, nor do I know where all the animals can have gone to.'

I had my answer.

That the number of rhinoceroses must have been large, if the old man's story is to be believed, is confirmed to some extent by the numerous trails made by them over the country we were talking about. A rhinoceros game path is different from that of an elephant —sometimes of course they use the same paths—being narrower, as the rhino's footprints continually overlap. Thus they wear a deep furrow down the middle of the path when the track is in steep country. I have seen a trail leading down to a wallow which was six to seven feet deep and much too narrow for an elephant to pass along. But the most astonishing trail I ever came across was in limestone country, where the 'sack full of rhino's horns' came from. Here there is a huge limestone massif, 2,000 feet high, which was often circled by rhinoceroses when travelling that way. In this case a trail passed between two large limestone boulders, both of which were well polished for a height of about three feet. These boulders rested on bed rock,—limestone—and in this bed rock the trail had been worn down a few inches! How many thousands, nay! tens of thousands, of rhino's feet must have passed along that trail?

None pass now, because there are none to pass.

As I have shown in an earlier part of this article, parts of the rhinoceros's body have been used since ancient times for magical rites or as medicine. This has been the main incentive to the hunting and killing of these animals in Asia so as to bring them to the point of extermination. Killing for profit, and large



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The Asiatic two-horned Rhinoceros—*Dicerorhinus sumatrensis* (*Cuv.*).
The same animal shown in plate III.

[*T. Hubback*

profits in the case of rhinoceroses, will always be fatal to rare species.

In Malaya the rhinoceros's horn is the chief attraction, Chinese being willing to pay as much as £2 (U.S. $10) or even more per ounce for the horn or part thereof. The dried blood is also a marketable commodity, fetching 5*sh.* (U.S. $1) a pound. It is collected and dried on paper, brown paper for preference—it weighs more—then dried over a fire, the resulting blood-soaked paper fetching the above price. But almost all parts of the body are considered valuable medicine of one sort or another, even the contents of the small intestines before they have been evacuated have a value to the medicine seller. The skin, roasted like pork cracknel, is considered a great delicacy. The horn is purchased by Chinese almost solely as an aphrodisiac. I cannot trace when this was first discovered but it is undoubtedly considered now as an infallible stimulant. Whether the effect of taking powdered rhinoceros horn in your tea or other vehicle is psychological or physiological it is difficult to determine, although it is quite possible that the powdered horn has some irritant effect on the generative glands and so produces a sense of virility which is normally not there. On the other hand, substitutes have been used as the following incidents show. Some years ago throughout Malaya imitation rhinoceros horns were hawked around the country by Chinese vendors who sold them to the Chinese medicine shops which are to be found in every small village. These imitations were good efforts to represent a rhinoceros's horn to anyone who had never seen the real thing, and went like hot cakes. The Chinese medicine shopkeepers knew, of course, that they were not rhinoceros's horns, but the ignorant Chinese labourer who felt the want of something to stimulate his desire, did not.

These imitations were made from buffalo horn and shaped like a rhino's horn.

There was one instance where one of these imitation horns was found in a Chinese medicine shop and displayed alongside a genuine rhinoceros's toe nail; just to show that there was no deception! These were seized by the Police who did not realize the difference between a real and a genuine horn. I saw the Chinese medicine man and asked him what he meant by having in his possession a rhinoceros's horn without a permit. The law requires one to have a permit. He immediately said that it was not a rhinoceros's horn at all. I explained that such was no news to me but he had apparently been selling shavings from this horn as rhinoceros horn and what was he going to do about it? That rather puzzled him. However I switched off on to the rhino's toe nail and he had a perfectly satisfactory explanation for that. However I warned him that he might still be prosecuted for cheating and the nail and horn would be held as exhibits.

Now, to finish this story I should have a string of satisfied or dissatisfied witnesses who testified to the efficiency or otherwise of the false horn. Unfortunately they were not forthcoming so the conclusion is incomplete. But the fact remains that this faked horn business was for some time quite a good line for the medicine



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shop-keepers, so possibly the superstition may be founded and supported on psychology only.

Malays attach all sorts of qualities to the rhinoceroses' horns which are merely childish. One is that a deep seated thorn can be extracted by rubbing the sore part with a rhinoceros's horn; another is that a severe stomach ache or any other ache can be relieved immediately by the application of a rhino's horn to the affected part, and so on. They are never willing to substantiate their claims by a demonstration—the horn is never forthcoming.

Still, these legends persist and so long as they persist and so long as there is no serious attempt to tackle the problem of how to preserve the rhinoceros for posterity, the *Dicerorhinus sumatrensis* is doomed.

In Malaya the *Rhinoceros sondaicus* is on the verge of complete extinction due to these superstitions and the failure of poor efforts to conserve it.

Posterity.

What will Posterity say of the present generation which is allowing, in many parts of the world, the fatal progress of the extermination of species, while professing an anxiety to save such species for future generations?

Unfortunately in the present state of our civilization those who have most to say are frequently those who know the least about their subject. Wild Life Conservation is no exception to this unfortunate state of affairs as all true conservationists will agree.

Dicerorhinus sumatrensis is on the threshold of a position that will inevitably cause it to disappear. I do not suggest that the last of its race will necessarily die a violent death but, due to disturbance and lack of proper facilities to enable them to exist under congenial and natural conditions, they will not breed.

The *sumatrensis* is, I believe, a long-lived species, and as such there will be for many years a solitary one or two left in remote places, which the opponents of proper conservation, and there are many of them, will point to as evidence of the adequateness of the futile arangements, mostly on paper, that have been made for their salvation.

In the new Wild Life Protection Act, 1936, Burma, which might be considered as the last word on Wild Life Protection, the killing, taking, importation or exportation of rhinoceroses or any part thereof, is prohibited, although there is a provision to enable the Local Government to give special licences to do some of these acts for scientific purposes.

This sounds as if the rhinoceros was very well protected but unfortunately a proviso has been inserted in the Act which reads as follows:—

'Provided that it shall not be an offence for any physician or druggist to possess or sell or for any person to possess for private medical purposes rhinoceros blood or any preparation thereof: . . .'

How anyone can become possessed of any part of a rhinoceros when all killing and hunting of that animal is prohibited, when all

import of the animal or any part thereof is prohibited, and still keep within the law, seems problematic. Why therefore insert a clause which seems to provide a very large loophole for illicit dealings in rhinoceroses' blood which means dead rhinoceroses?

Possibly the Local Government anticipates the giving of licences to such persons as those mentioned above to possess 'for scientific purposes', and if so the trade in these objects will not be stopped.

Possibly the difficulty will be overcome by substituting buffalo's blood for rhinoceroses' blood and so placate Public Opinion which appears to have been responsible for the loophole in this Act.

But it does not help the preservation of rhinoceroses which are now far too rare to be dealt with in any other way than by complete and adequate protection.

To save them from complete extinction, the only hope that remains for the rhinoceros in Malaya, and I think I may add in Burma, is to constitute inviolable sanctuaries in their own habitat where a suitable environment is known to exist. These sanctuaries must be properly guarded and freed from human interference and severe penalties should be provided for any breaches of such laws as are enacted to make these places real refuges for the rhinoceroses in them.

There must be no loophole in the Act such as there is in the Burma Act. Whatever superstitions there may be connected with the rhinoceros, it must be recognized that these superstitions have brought all species of the Asiatic rhinoceros to the verge of complete disappearance, and, unless steps are taken to make it practically impossible to continue to commercialize these superstitions, then we must realize that we are impotent to save the *Dicerorhinus sumatrensis* from extinction.

ADDITIONAL NOTES ON THE ASIATIC TWO-HORNED RHINOCEROS.

BY

S. H. PRATER, C.M.Z.S.

SPECIES AND RACES OF THE ASIATIC TWO-HORNED RHINOCEROS.

The Asiatic Two-horned Rhinoceros was first made known in scientific literature by Bell (*Phil. Trans.*, p. 3, t. 2, 1793) who described an animal killed in Sumatra under the name of the Double-horned Rhinoceros of Sumatra. It was on Bell's decription that Cuvier (*Règne An.* i, p. 240, 1817) founded the name *Rhinoceros sumatrensis*. Three years later Raffles (*Trans. Linn. Soc.*, vol. xiii, p. 208, 1820) described the same animal under the name *Rhinoceros sumatranus*. Raffles' name is however antedated by Cuvier's. Later, as skulls, horns, skeletons and even live examples of this rhinoceros became available in England and the Continent, attempts were made by naturalists to distinguish various species of Asiatic Two-horned Rhinoceros from the different areas of its wide range.

Thus in addition to the species originally described by Bell, four other species of Asiatic Two-horned Rhinoceros were distinguished. *R. crossii* was established by Gray (*P.Z.S.*, p. 250, 1854) on a single horn of unknown origin presented to the British Museum by Mr. Cross in 1854. *Ceratorhinus niger* was the name given by Gray (*Ann. Mag. Nat. Hist.*, ser. 4, vol. xi, p. 359, 1873) to a Malaccan Rhinoceros acquired by the Zoological Society of London in 1872. Gray distinguished it from the typical Sumatran animal, (as described by Bell), by its broader skull, wider lower jaw and black colouring. *C. blythii* was established by Gray (*Ann. Mag. Nat. Hist.*, ser. 4, vol. xi, 366, 1873) on three skulls of Two-horned Rhinoceroses from Tenasserim, figured by Blyth (*Journ. As. Soc. Bengal*, vol. xxxi, t. iii, figs. 1, 2, 3). It is difficult to discover from Gray's description which of the skulls served as his type, but he indicated that two skulls representing younger animals revealed certain differences in structure of the lower jaw sufficient for recognition as distinct species, to which he gave the name *blythii*, to differentiate them from his Malaccan species *niger*.

Rhinoceros lasiotis was established by Sclater (*P.Z.S.*, p. 493, pl. xxiii, 1872). His type was a young Two-horned Rhinoceros which was captured in Chittagong in 1869, and purchased by the Zoological Society of London in 1871. Anderson (*P.Z.S.*, p. 129, 1872) saw the animal at Calcutta and wrote an account of it under the name *R. sumatranus*. Sclater (*loc. cit.*) described and figured the animal, and in a foot note to his account assigned to it the name *lasiotis*, amplifying his reasons in a subsequent paper (*P.Z. S.*, p. 790, 1872). He was led to his conclusions by a comparison of the Chittagong animal with the Malaccan Rhinoceros, referred to

above, which was acquired in the same year by the Society. He differentiated the Chittagong rhinoceros by its larger size, pale browner colouring, smoother skin, longer, finer and more rufescent hair, shorter, more tufted tail, and by the ears having a drooping fringe of hair, some 5 in. long, and above all by the much greater breadth of the head as indicated by the great width of the skull between the ears.

In the year 1876, Flower (*P.Z.S.*, p. 443, 1876) on examination of the considerable accretion of material by then available in the British Museum and in the Museum of the Royal College of Surgeons came to the conclusion that there were no more than three distinct types of Asiatic Rhinoceros :—the Great One-horned Rhinoceros (*R. unicornis*), the Lesser One-horned Rhinoceros (*R. sondaicus*), and the Asiatic Two-horned Rhinoceros (*R. sumatrensis*). As to the existence of more than one species of Asiatic Two-horned Rhinoceros he remarked that the distinctive characters indicated in the skull of the Malaccan Rhinoceros, which provided the type of Gray's *niger*, were individual characters due to age. The animal was an old female. He was unable to examine the skulls which formed the type of Gray's *blythii*. These were in the Indian Museum. As regards *lasiotis* of Sclater, he had the opportunity in the following year of examining the skull of a rhinoceros killed at Comillah in Tipperah, i.e. from the province from which the type of *lasiotis* originated. He could find in the skull no characters which would justify its recognition as a separate species (*P.Z.S.*, p. 636, 1878). He showed that the skulls of Two-horned Rhinoceros present considerable individual variation in general conformation: proportionate breadth to length, the development of the nasal bones, number and position of lachrymal foramina, and other details. Blyth (*J.A.S.B.*, vol. xxxi, p. 862, 1861) from an examination of an extensive series of skulls, had previously indicated the considerable individual variations exhibited in the skulls of all three species of Asiatic Rhinoceros. He showed that skulls of *unicornis*, *sondaicus* and *sumatrensis* all exhibited a short and broad type with a high occiput and considerable width between the orbits and a second type which exhibited exactly the opposite characters, while other skulls showed an intergradation between these extremes. A similar variation is seen in the skulls of the Indian Wild Boar (*Sus cristatus*). The variation occurs in both sexes, and is not confined to particular areas of distribution. As regards the external characters by which the various species were distinguished, these again were shown to be individual in nature.

Subsequent authors have regarded the various so-called species of the Two-horned Rhinoceros as forms of the typical race *sumatrensis*. The famous Rhinoceros from Chittagong which provided the type of Sclater's *lasiotis* died in the Zoological Gardens in 1901. Oldfield Thomas (*P.Z.S.*, p. 154, 1901) who examined the specimen indicated that none of the external characters relative to colour, development of hair, etc., which were so distinctive in the animal when it was young, remained at the time of its death. They had disappeared with advancing age. Even the lengthy hair fringes, which formed so distinctive an adornment to the ears of

the animal, were at the time of its death reduced to the short bristles customary in adults. Anderson (*loc. cit.*) had commented upon this particular character when he first saw the animal at Calcutta, and attributed the great development of its ear fringes to its age. He remarked that lengthy ear fringes were not in evidence in adult male and female Two-horned Rhinoceroses which he had seen in Burma. Nor did Thomas discover in the skull of Sclater's *lasiotis* any tangible character by which it could be distinguished from the typical *sumatrensis*. None except size. Of the 12 skulls examined by Thomas, the skull from Chittagong was easily the largest. The skull measurements recorded by him are 23 5/8 in. in a straight line from the occipital crest to the end of the nasal; zygomatic breadth 12 7/8 in.; interorbital breadth 8 in. A skull in the British Museum, presented by Sir Stanford Raffles, which is believed to have come from Sumatra, approached the Chittagong skull in measurements. Thomas indicated that if the locality was correct, the existence of an equally large form in Sumatra would dispose of the last claim of *lasiotis* to distinction as a separate race. He however doubted the correctness of the locality and therefore provisionally retained *lasiotis* as a northern form or race of the Two-horned Rhinoceros, distinguishable alone by its greater size. The Two-horned Rhinoceros is probably now extinct in Bengal, and whether animals from this province were in fact consistently larger than those inhabiting Sumatra can probably no longer be ascertained. Measurements of skulls available in the British Museum, indicate that skulls from Sumatra, Borneo and Malacca are smaller than the skulls from Bengal. While skulls from Pegu and Arracan are intermediate. Size is then the only character by which this supposed northern race is distinguishable.

Lydekker (*Cat. Ung. Mam., B.M.*, vol. v, p. 50), in addition to *lasiotis* from Bengal, recognises *blythii* as a distinct race occurring in the Malay Peninsula and Tenasserim. He differentiates *blythii* from typical *sumatrensis* as a smaller, blacker, less hairy form. There is no evidence to indicate that the Two-horned Rhinoceros inhabiting Tenasserim are smaller than those from Malacca or Sumatra. The colour of the body and hairiness are, as has been indicated, individual characters. Wroughton in his 'Summary of the Results of the Mammal Survey' (*J.B.N.H.S.*, vol. xxvii, p. 311, 1921) dismisses the race *blythii* and recognises only the northern form *lasiotis*, limiting its distribution to Eastern Bengal. He gives the distribution of the typical race *sumatrensis* as Pegu, the Malay Peninsula, Sumatra and Borneo.

The Asiatic Two-Horned Rhinoceros as a Distinct Genus.

The question has also been raised as to whether the various species of Rhinoceroses now included under the single Linnaean genus *Rhinoceros* are not really separable into different genera. Between the year 1738 when Linnaeus made the Great Indian One-horned Rhinoceros the type of his genus *Rhinoceros* and the year 1904, when Palmer published his great work, *Index Genera Mammalium*—no less than 42 generic names were proposed for the

various kinds of Rhinoceros, many receiving generic names which were synonyms of one another. The earliest attempt to distribute the Rhinoceros into different genera was made by Gloger (*Naturg.* p. 125, 1841) who among other genera established a separate genus *Dicerorhinus* for the Asiatic Two-horned Rhinoceros. He was followed by Gray (*P.Z.S.*, p. 1003, 1867) who revised the classification of the *Rhinocerotidae*, and assigned the Asiatic Two-horned species to a separate genus *Ceratorhinus*, distinguishing it from the genus *Rhinoceros*, by the presence of two horns, by the well developed lumbar neck folds and by certain characters of the skull.

Flower (*P.Z.S.*, p. 44, 1876) supported Gray's classification and indicated certain distinctive characters in the skull of the Asiatic Two-horned Rhinoceros. In this species the long downward processes of the squamosal bone, called respectively the post glenoid and the post tympanic, do not unite below the auditory meatus, whereas fusion of these processes is exhibited both in the Great Indian One-horned Rhinoceros (*R. unicornis*) and in the Lesser One-horned Rhinoceros (*R. sondaicus*). Apart from distinctions in the skeletal structure of the Two-horned Rhinoceros, studies of the visceral anatomy of *R. unicornis* by Professor Owen (*Trans. Zool. Soc. London.*, vol. vi, p. 31), of *sondaicus* by Sir E. Horne (*Phil. Soc. Trans.*, 1821), of *sumatrensis* by Garrod (*P.Z.S.*, p. 707, 1877), also indicate considerable structural differences in the anatomy of the small intestine. In *R. unicornis* the gut is provided with numerous long cylindrical narrow outgrowths 'like tags of worsted', in *sondaicus* these tags are present, but are flatter and broader; while in the Two-horned Rhinoceros these tags are absent. Further, both *unicornis* and *sondaicus* have so called 'foot glands' embedded in the integument of the foot, in *sumatrensis* these glands are absent.

Apart from distinctions in the anatomy of these animals, palaeontological evidence of their distinctive origin and character has been provided by Professor Fairfield Osborn in his paper on the Phylogeny of the Rhinoceros of Europe (*Bull. Amer. Mus. Nat. Hist.*, xiii, p. 229, 1900).

In his paper Osborn recognises 6 distinct groups or sub-families of Rhinoceros, each forming distinct branches of the great Rhinoceros family. Discoveries subsequent to the publication of his paper which include the *Baluchitherium*, a gigantic hornless extinct form of Rhinoceros, whose fossil remains were first unearthed at Chur Lando, Baluchistan, in the year 1911, have led Prof. Osborn to add to the number of known groups. He now indicates 8 groups or lines of descent. All the herbivorous quadrupeds tend to spread and migrate into different habitats and climates and into new feeding grounds to which they become adapted through a principle, which Osborn calls *adaptive radiation*. According to Osborn, the 8 lines of Rhinoceros separated from each other at a very ancient period and, although externally similar in certain cases, they are very far apart in their history and anatomy. The Great One-horned Indian Rhinoceros (*R. unicornis*) and its relative the Smaller One-horned Rhinoceros (*R. sondaicus*) have an obscure geological history. No

representatives of this group of Rhinoceros have been found anywhere but in South Eastern Asia. Their remains are not found in the more ancient Siwalik beds but they appear with relative suddenness in the uppermost and more recent beds in the form of two species—the Siwalik Rhinoceros (*R. sivalensis*) and the ancient Rhinoceros of India (*R. palaeindicus*). The Two-horned Rhinoceros had a much wider distribution. No fossil species allied to the Sumatran Rhinoceros has ever been obtained from the Tertiary deposits of India. In Tertiary times however a number of species allied to the Sumatran Rhinoceros inhabited the forests of Central and Western Europe. Their remains are abundant in the Miocene and Lower Pliocene deposits of France and Germany. From which it is concluded that the Two-horned Rhinoceros is a comparatively recent immigrant into Southern Asia, the type having probably originated in Western Europe. The earliest representative of the group in Southern Asia is the flat-nosed *Rhinoceros platyrhinus* of the Lower Pleistocene beds of India. They were quite abundant in the Siwalik Hills in the late Pliocene or early Pleistocene times. The Upper Pliocene is indicated as a geological period when these animals, favoured by a genial climate lived in a broad forest belt which extended from the East Coast of England and southwards and eastwards across southern France and northern Italy into India. Like their descendants of today, the primitive two-horned forms probably lived in the deepest recesses of the forest. The survival of the type through long epochs of time is traced to the protected environment in which they habitually lived—an enviornment which, while it does not favour rapid evolution, tends on the other hand to persistence of type.

From all this it will be seen that the various species of Rhinoceros though externally similar are very far apart in their history and anatomy. The question arises as to whether these distinctions entitle them to be grouped in separate genera or whether they merely represent natural divisions of the Linnaean genus *Rhinoceros*, to which most naturalists have hitherto assigned them. Oldfield Thomas (*P.Z.S.*, p. 112, 1901) indicated that if there is to be any uniformity in the value of genera as recognised among Mammals, it is impossible to include such essentially different animals in one genus *Rhinoceros*. He considered that the generic groups as proposed by Osborn (*loc. cit.*) should be accepted. He however indicated that the name *Ceratorhinus* Gray (*P.Z.S.*, p. 1021, 1867) used by Osborn for the Asiatic Two-horned Rhinoceros was antedated by Gloger's name *Dicerorhinus* (*Naturg.*, p. 125, 1841) which therefore by technical priority is the correct generic name.

Supplementary Notes on the Asiatic Two-Horned Rhinoceros.

Measurements.

Young. The measurements of a newly born *R. sumatrensis* which was born on the Steamship *Orchis* in Victoria Docks, London, on December 7th, 1872, have been recorded by Bartlett (*P.Z.S.*, p. 104, 1873): length 3 ft., height at shoulder 2 ft., weight estimated at about 50 lbs. Bartlett remarks that with its long legs, long head

and meagre body, and in its movements it was rather like a young ass.

Adult. The young female Rhinoceros from Chittagong to which reference has been made at the time of its arrival in the Zoo (1872) measured 4 ft. 4 in. at the shoulder. The aged female from Malacca which was a contemporary at the Zoo of the Chittagong animal, was according to Bartlett 3 ft. 8 in. high at the shoulder. Evans (*Journ. B.N.H.S.*, vol. xvi, p. 161 and 455) records the measurements of a male and a female from Burma:

	Length Muzzle to root of tail	*Girth behind shoulder*	*Height at shoulder*	
♂	8′ 2″	7′ 2″	4′ 4½″	(measured between uprights.)
♀	7′ 9″	6′ 6″	4′ 6″	

Colour and Development of Hair.

Newly Born. Bartlett (*P.Z.S.* 1872, p. 104) describes the colour of the newly born rhinoceros referred to above as being nearly black, covered with short crisp black hairs; the ears very hairy inside as well as outside. (His illustration shows the margins of the ears heavily fringed with hair). Tail quite like a brush at the tip.

Young. The rhinoceros captured at Chittagong in February 1869 and subsequently acquired for the London Zoo, was described by Anderson who saw it at Calcutta in 1870. He describes it as a young female. It died in London in 1901, 32 years after its capture. The general colour of the skin, according to Anderson *P.Z.S.*, p. 129, 1872), was ashy grey becoming light brown when moist, the arm pits and under surface of the groin and the skin within the creases formed by the folds of the body had a flesh pink tint. The face, anterior to the eyes, was nude of hair except for the pendulous lip which had strong bristles set wide apart. The outer margins of the ears were heavily fringed with drooping hairs nearly 5 in. long and the insides were covered with short bristles. The body was covered with bristles about 1 in. in length; on the head and neck they were shorter and on the sides of the belly and over the wrists and heels, the hairs were adpressed and somewhat curly; the upper two-third of the tail was covered with bristles. The hairs on the margins of the lower third of the tail, increased in length towards the tip, the apical hairs being about 6 in. long.

The colour of the body hairs varied; on the head and neck the bristles were almost white, on the upper half of the trunk, the bristles anterior to the shoulder fold were dark brown, posterior to the shoulder fold, they were almost white in some lights and showed a rufous tint in others. On the lower half of the trunk they were black. The rufescent tint of the body bristles is also remarked upon by Sclater, who says that it gave the animal a brownish appearance in certain lights. Anderson's description of the colour of the Chittagong rhinoceros coincides with Bell's original description of a male from Sumatra in which the general colour

is described by him as brownish ash; under the belly and between the legs, and, within the folds of the skin—dirty flesh.

Old. The Rhinoceros from Malacca acquired by the London Zoo, an aged female, is described as being black. Garrod who described the anatomy of the animal, refers to the colour as dark slaty. The hairs covering the body were shorter, coarser and more bristly than in the young animal from Chittagong in which the hair is described as being softer tending to lie flatter on the skin. The body hairs were more sparse than in the young animal, and were most in evidence in the middle line of the back and on the outer sides of the limb. The tail, though covered with black straggling bristles, had no terminal tuft. The inside of the ears had a covering of short black hairs and the outer margins were similarly lined with short bristles. Anderson remarks that adult animals of both sexes seen by him in Burma, had the ears fringed with strong erect black hairs tipped with brown. He suggests that the delicate terminals of the hairy ear fringes are worn off as the animal increases in age, probably by the friction to which the ears are subjected in the creatures wanderings through the dense jungle. This explanation does not quite meet the case of the Chittagong Rhinoceros, which spent the greater part of its life in an open paddock, and nevertheless exhibited, when old, the same loss of its drooping ear fringes, which at the time of its death were reduced to short bristles.

Development of Horns.

The newly born rhinoceros described by Bartlett (*loc. cit.*) had a front horn on its nose about $\frac{3}{4}$ of an inch in length. The posterior horn was not developed, but a smooth, spot indicated its position. As regards the length of horns—the horn presented to the British Museum in 1854 by Mr. Cross, on which Gray established his species *R. crossi*, measured according to Gray (*P.Z.S.*, p. 250, 1854) $31\frac{1}{2}$ in. along the curve with a girth of $17\frac{1}{2}$ in. at the base. Probably this is the horn mentioned in Rowland Ward's *Records of Big Game*; though its present measurements are given as length $32\frac{1}{2}$ in., circumference $17\frac{3}{8}$ in. In his Memoir on Asiatic Rhinoceros, Blyth (*J.A.S.B.*, xxxi, p. 156, 1862) figures a splendid head then in the possession of Col. Fytche, Commissioner of Martaban and Tenasserim. This was an animal killed in Tavoy. The span of curvature from base to tip is 24 in. Col. Fytche informed him that he had in his possession a head with still finer horns, some 5 or 6 in. longer. In a letter to Blyth he speaks of a Rhinoceros which he tracked up a mountain 4000 ft. high; near the summit he came suddenly upon the beast whose anterior horn was at least 10 or 12 in. larger than the one he had got. Unfortunately, the gun bearer on seeing this giant fell down on his face in fright and rolled down the hill. Blyth's observations indicate that even so far back as 1862, fine horns of *R. sumatrensis* were extremely difficult to obtain and were bought up at high price by Chinamen, who not only valued them as medicine but carved them into wonderful ornaments. The comparatively poor development of horns in these animals at the present time is

probably due to the persistent persecution and the killing off of better horned animals and the breeding of poorer stock. Similar deterioration is seen in the horns of Sambar and other deer in areas where they are subjected to constant harassment.

Development of Hoofs.

Bartlett (*P.Z.S.*, p. 106, 1873) records the condition of the hoofs in a newly born Rhinoceros. At birth the hoofs or nails are long and pointed; the points are soft and turn inwards so as to fold over and cover part of the sole of the foot. From the manner of their turning under it is evident that the turned in parts of the horny nails covering the sole are worn through by continuous contact with the ground, and the frontal portion is all that remains to provide the blunt nail.

Habits.

Mr. Hubback refers to the peculiar habits of the male when urinating, the urine being shot upwards and backwards between the legs for some distance so that leaves of the surrounding trees and bushes are sprinkled. He expresses doubt as to whether this habit is exhibited by the female also. Anderson who recorded his observations on the habits of the female rhinoceros, captured in Chittagong, writes: 'She has a peculiar habit of squirting out her urine to a great distance, sending it out behind her for nearly 20 feet, a habit by which the male is made aware of her presence in the dense recesses of his native forests where smell is probably the sole guide by which the sexes become aware of each other's presence'. It is evident from the above that both sexes share the habit. Major G. H. Evans' observation on the habits of *R. sumatrensis* in Burma (*Journ. B.N.H.S.*, vol. xvi, p. 555) agrees with Mr. Hubback's that this rhinoceros does not repeatedly visit the same spots for the deposition of its faeces. He writes: 'Small heaps or mounds, perhaps the droppings of a week may be found on the hill sides where they lie up. But as a general rule I do not think that they can be particular in this matter as one habitually finds single droppings on the tracks on the sides of hill ridges and an abundance of them scattered in the beds of streams.' The Great Indian One-horned Rhinoceros (*R. unicornis*) on the other hand is known to revisit particular places for the evacuation of excreta which accumulate in mounds. The habit facilitates the work of the poacher who lies in wait for the Rhinoceros in the neighbourhood of these spots; his task is simplified by the animal's habit of approaching the place backwards. Other animals, besides the great One-horned Rhinoceros, display this particular habit, notably the Indian Porcupine (*Hystrix leucura*) and the Four-horned Antelope. In the case of the porcupine enormous mounds of ordure, the product of one or more animals, are commonly found.

Food.

Further information regarding the plants and fruits eaten by *R. sumatrensis* has been given by G. H. Evans (*Journ.*

B.N.H.S., vol. xvi, p. 555) and by Mr. W. S. Thom (*Journ. B.N.H.S.*, vol. xxxviii, p. 137). In the matter of food, Evans does not differentiate between *R. sumatrensis* and the Lesser One-horned Rhinoceros (*R. sondaicus*). Both species appear to have the same feeding habits; neither feeds much on grass. Both subsist mainly on leaves, fruits and twigs. The conformity in feeding habits is evidenced in the similarity in structure of the molar teeth of both these animals. Their teeth differ materially in the form and in the pattern presented by wear from those of the Great Indian One-horned Rhinoceros, a species which is by habit a grazer, feeding almost exclusively on grass. The feeding habits of *R. sumatrensis* and *R. sondaicus* have profoundly influenced their distribution. Finding their subsistence on a great variety of forest trees and shrubs, these two species have extended their range through the great forest tracts reaching from the confines of Assam and Bengal, through Burma and the Malay Countries. The Great Indian One-horned Rhinoceros on the other hand is limited by the nature of its food to a range confined to the grass jungles of the North Indian alluvial plains. Similar factors have limited the range of the grass-eating White Rhinoceros, and facilitated the wider distribution of the 'browsing' Black Rhinoceros on the African Continent.

Beliefs and Legends.

Many beliefs and legends attach to the Rhinoceros and are generally applicable to all species. Writing of the Rhinoceros in Nepal, General Sir Kaiser Shumshere Jung Bahadur says 'The flesh and blood of the Rhinoceros are considered acceptable to the *Manes* to whom high caste Hindus and most Gurkhas offer libation of its blood after entering the disembowelled body'. Rhinoceros blood is efficacious to the dying as it is believed to ensure for the soul both a peaceful departure and a happy release on the other side. It should be mentioned that the power of ensuring peace for the departed soul is retained by the 'Shell' of the beast for years after its decease. Continuing, General Kaiser says 'The urine is considered antiseptic, and is hung in a vessel at the principal door as a charm against ghosts, evil spirits and diseases'. In the Calcutta Zoo there is always a brisk demand for this product of the Rhinoceros. The above beliefs are in no way confined to Nepal as the Chinese, Burmese, Siamese preserve practically every part of the Rhinoceros. The horns, blood, urine and hide and even the intestines are converted into medicine. The belief in the virtues of Rhinoceros Horn, persisted in Europe even to the end of the eighteenth century. So recently as 1763, it was asserted that a cup made of Rhinoceros horn would fall to pieces if poison were poured into it. 'When wine is poured into it', wrote Dr. Brookes, 'it will rise and ferment, but when mixed with poison it cleaves in two, which experiment has been seen by thousands of people'. The belief is probably of eastern origin where it was prevalent long before it grew current in the West. Apollonius, whose travels to India in the first century have been recorded by his biographer Philostratus, speaking of a cup of

Rhinoceros horn said: 'On the day they drink from the cup they cannot fall sick; nor suffer if wounded, nor be injured though they pass through fire; wherefore these cups belong to the king alone; nor might any other hunt this animal'. Asked by his friend Damidius whether he believed in this tale, the sage replied 'I believe it if I find the king of this country immortal. For if any one gave to me, or to another, such a health bearing cup, is it not likely that I should use it daily to drink it to the dregs? Nor could any one blame me for getting drunk under such circumstances.'

It has been indicated how the Rhinoceros inherited many of the vaunted virtues of the Unicorn. Among them, its weakness in the presence of virgins, and the efficacy of its horn against poison. The origin of the belief in the Unicorn is lost in the mists of antiquity. Various explanations have been given as to its origin and various animals have been suggested as its counterpart; among them the Oryx, the Wild Ass and the Rhinoceros. But a less usual explanation traces the origin of the Unicorn not to a four-footed beast, but to a reptile. None other than the Horned Viper, *Cerastes*, which bears above each eye a projecting scale, shaped somewhat like a horn. The origin of the belief in the Dragon is traced to the Python, which poetic fervour and imagination endowed with wings, limbs, claws; and in a similar way this common and dreaded horned viper, which figures prominently in Assyrian and Hebrew Religion and Art, took unto itself in legend and story the form of a powerful four-footed beast. If the horned *Cerastes* gave origin to the Unicorn, it is easy to understand the attributes legend gives to this fabled animal. To the poisonous nature of *Cerastes* is due the supposed efficacy of the horn of the Unicorn as a protection against poison. For the belief that poison counteracts poison goes back to the earliest times. Is there not current even today in India the ancient belief that the 'stones' or jewels supposed to be derived from the head of the cobra and other snakes are efficacious against their venoms? And the belief in the virgin's power over the Unicorn is perhaps traceable to the Woman's domination over the Serpent, of which mention is made in the Bible—these wondrous attributes passing subsequently from the Serpent to the Unicorn and from the fabled Unicorn to the Rhinoceros.

THE BIRDS OF BOMBAY AND SALSETTE.

BY

SALIM ALI AND HUMAYUN ABDULALI.

PART VI.

(Continued from p. 381 of this Volume).

The Indian Blue-breasted Banded Rail : *Hypotaenidia striata striata* (Horsf.).

Field identification: Slightly smaller than the Partridge. A stub-tailed, long-legged marsh bird skulking about singly among reeds, etc. on the edge of tanks or water-logged paddy cultivation. Dark brown and olive-brown above, with white markings, ashy-grey and brown below with the abdomen and undertail barred white. Chin and throat white; crown rufous. Twitches its stub-tail up and down at every step. Flushed with difficulty. Slow laboured flight with legs trailing behind.

Noted and/or shot: Gōrēgāon and Powāi Lake. Also at Kihim (Kolāba Dist.) across the Harbour, in a mangrove swamp.

Doubtless resident, though as yet we have no breeding records from our area.

The Spotted Crake: *Porzana porzana* (Linn.).

Field identification: Size between the Quail and the Partridge. Reddish olive-brown above with black streaks; grey below. Speckled with white on breast, neck and upper back. Lower back, rump and upper tail coverts streaked narrowly with white. Similar in general effect and habits to the foregoing species. Singly, in reed-beds, etc. on the margins of tanks. A confirmed skulker.

Specimens: *B.N.H.S.*: ♀ 23-12-08 Malabar Hill, Bombay (J. C. G. Bowen); [o? Novem. 1893 Panwēl, Kolāba Dist. (W. S. Millard)].

Noted: Powāi Lake.

Winter visitor. Latest date 12 April. We have come across it only rarely, but Inverarity (*J.B.N.H.S.*, ii, 45—1887) says it is common round Bombay. It may well have been commoner before the low-lying marshy areas on the outskirts of the city and in the suburbs were reclaimed.

The Little Crake: *Porzana parva* (Scopoli).

Specimens: *B.N.H.S.*: o? Malabār Hill, Bombay (A. H. A. Simcox).

We have not seen this specimen, but it is listed in the old Card Catalogue of the Society's Collection prepared by Mr. N. B. Kinnear. It may have been an aberrant cold weather straggler. We have not come across it in Salsette.

The Eastern Baillon's Crake: *Porzana pusilla pusilla* (Pall.).

Field identification: Size about that of the Quail. General effect and colouration as of the Spotted Crake but lacking the white speckles on neck, breast and back. Breast grey, belly barred black and white. White edge to first primary quill conspicuous and diagnostic. Singly, in marshy reed-beds. Same skulking habits.

No specimens. Noted at Powāi, Tūlsi and Vihār Lakes, Vilé Parlé.

Status? Common, at least in the cold weather. A great skulker, flushed only when almost trod upon, flying quail-like for a few yards before dropping into the reeds again.

So far we have no evidence of its breeding in our area.

The Ruddy Crake: *Amaurornis fuscus fuscus* (Linn.).

Field identification: Like the Waterhen in general effect but somewhat smaller and predominantly chestnut and olive-brown with no white in face or

breast. The bright red legs are conspicuous even in flight. Singly, among reeds and thickets of rank vegetation about marshy ground and paddy-fields.

Specimen: *St. X. C.*: 266 ♂ 21-11-36 Powāi Lake (H. A.)

Resident (presumably). Rare. We cannot trace any records of its breeding within our limits.

The White-breasted Waterhen: *Amaurornis phoenicurus chinensis* (Boddaert).

Local name: *Kuku-komri.*

Field identification: Size about that of the Partridge. Upper parts slaty-grey with olive tinge. Face, neck and breast white. Abdomen and under tail rusty red. Long yellowish-green legs with long toes. The stub tail is held cocked up and is constantly flicked. Singly or pairs, in and about reeds and thickets by marshes and water-logged fields. Often seen on roads near tanks and lakes.

Specimens: *B.N.H.S.*: ♂ July '24 Kūrla; 3 downy chicks 10-9-24 Kūrla (near Mohili River—D. A. Baretto).

Resident. Common. Silent except during the monsoon when it breeds and is very noisy. The calls begin with loud raucous grunts, croaks and chuckles suggestive of a much larger animal (EHA compares it to 'a bear being roasted over a slow fire'!), and settle down to a monotonous metallic *ku-wak ku-wak ku-wak*, etc. somewhat like that of the Coppersmith but in a higher key and repeated more quickly. This is often kept up for over 15 minutes at a stretch on cloudy overcast days. The calling continues more or less throughout the night. The food consists of insects, molluscs, seeds and vetgetable matter.

Breeding: Barnes (*J.B.N.H.S.*, vi, 39) found it breeding at Vihār Lake in August. In Salsette we have observed nests at Sion, Kūrla, Vilé Parlé, Andhēri, Pāli Hill (Bandra) and Trombay in August and September, though it probably begins laying in July. The nest is placed in the interior of a hedge or small tree—up to about 15 ft. from the ground—on the margin of a pond, tank or water-logged paddy field. Sometimes it is well hidden by monsoon creepers, at other times fairly open and conspicuous. It is a shallow cup-shaped structure something like a crow's nest, composed of twigs, grass and flags of reeds and bulrushes. In days gone by, EHA found a nest at Girgaum built in the top of a date palm. There used to be some marshy land there devoted to paddy cultivation. We have taken a grass-lined nest built on the ground near water at Powāi with c/6. The normal clutch consists of 4 or 5 eggs. They are some shade of buff with longitudinal blotches of reddish-brown and pale purplish-grey. The birds (both sexes?) are close sitters and may sometimes be almost caught with the hand when brooding. The young are able to run as soon as hatched and follow the mother about. They look very like domestic chickens and are covered with uniform black down. Their bill and legs are blackish.

The Indian Moorhen: *Gallinula chloropus indicus* Blyth.

Mahrātti name: *Likeer.*

Field identification: Size about that of the Partridge. General effect of a waterhen on land, of a small duck on water. Slaty-grey and brown with white border to wing and white undertail. Singly or gregariously, among partially submerged rushes, etc. often swimming out into open water with floating vegetation. It swims well with a characteristic jerky motion of the head and stub tail.

Specimen: *B.N.H.S.*: ♀ 7-3-21 Thāna (B. C. Ellison).

Noted: Vilé Parlé, Santa Cruz, Powāi Lake.

Resident. Fairly common on Powāi Lake and in smaller numbers at most ponds and village tanks with floating or marginal vegetation. No breeding record for our area.

The Kora or Water-cock: *Gallicrex cinerea* (Gmelin).

Field identification: Rather larger than the Partridge. Male in breeding plumage: Head, neck and lower parts chiefly black; above blackish-brown and slaty-grey. Covering the forehead and sticking up as a sort of casque or horn above the crown is a horny, red shield which is the most characteristic feature of the male watercock at this season. At other seasons the male is coloured like the female, brown and buff with wavy brown lines on the underparts. Singly, skulking amongst reedy marshes,

Specimens: *B.N.H.S.*: o? June 1895 'Bombay' (A. Francke); *St. X. C.*: 265 ♀ 21-11-36 Powāi Lake (H. A.).

Noted by us in Salsette only at Powāi Lake.

Resident. Not common. Shy. We have no records of nests in our area; but a male shot by H. A. at Powāi Lake on 16 July (1933) was evidently breeding. Its testes measured 21×13 mm.

The Indian Purple Moorhen: *Porphyrio poliocephalus poliocephalus* (Lath.).

Field identification: A leggy bird the size of our domestic hen with long red legs, heavy red bill and a red horny shield covering the forehead. General effect of plumage purplish-blue. In swampy reeds and rushes on tank margins, etc., singly or gregariously.

Specimens: *B.N.H.S.*: o? 12-4-26 Kūrla (D. A. Baretto); [♀ 20-7-11 Panwēl, Kolāba Dist. (Mamlatdar, Penn.)].

Noted: Vihār and Powāi Lakes. In about 1887 Inverarity (*J.B.N.H.S.*, ii, 45) found large noumbers on Bhiwandi tank on the adjacent mainland (beyond Thāna).

Resident, in small numbers. Navarro has taken nests with eggs at Talegaon in September along with Waterhens and birds of this kind, much persecuted by local gunners who consider it good eating.

The Coot: *Fulica atra* Linn.

Local name: *Poonār; Kām.*

Field identification: A slaty-black duck-like bird with ivory-white pointed bill and a white horny shield covering forehead. Gregariously—loose flocks—on tanks, swimming about like duck and pattering along the surface of the water when alarmed and trying to take wing.

Specimens: *B.N.H.S.*: ♀ 16-11-25 Kūrla (D. A. Baretto); [♀ 2-12-12 Bassein (R. dos Remedios)]; ♂ 6-12-18 Kolāba Cove, Bombay Harbour (J. A. D. MacBain).

Noted: Powāi and Vihār Lakes. Mahaluxmi (1938). This is one of the birds that is being shot out of the Bombay District by enthusiastic 'sportsmen'. It used to be not uncommon on every small village tank in Salsette about 25 years ago when S. A. shot it frequently at Santa Cruz, Vilé Parlé and Andhēri, but is now rarely seen. Inverarity (*J.B.N.H.S.*, ii, 45—1887) always found it on Vihār Lake and other tanks during the cold weather. EHA (*C.B.B.*, 176) also writes of it as very common everywhere in the neighbourhood of Bombay. In some years it is not uncommon on Powāi Lake even now.

Status? Mainly at least a winter visitor. We have only come across it here during the cold weather months. Strangely enough this bird, which often covers enormous distances on migration, can be caught by hand on a small tank. The procedure is to surround it and keep it on the move with stones, shouts, etc. After a while it usually sneaks into cover on land, whence it is easily beaten out and captured. There is a common belief that a coot cannot fly when its wings dry up!

Breeding: Not recorded in Salsette, but Major R. M. Betham (*J.B.N.H.S.*, xiv, 176) found several nests near Poona between 14 July and 17 August 1901.

The Bronze-winged Jacana: *Metopidius indicus* (Latham).

Field identification: Size about that of the Partridge. A leggy bird with shiny greenish-bronze wings, chestnut lower back, rump and stub-tail. Head and lower plumage glistening black. A conspicuous white stripe from eye to nape. Young birds are very different being chiefly whitish, rufous and brown. The most characteristic feature of the Jacanas—this and the next species—is their enormously elongated and slender toes which enable them to trip along gingerly over lotus leaves and other floating vegetation. Singly or gregariously, on ponds and tanks with waterlilies, Singāra (*Trapa bispinosa*) and other aquatic vegetation.

Specimens: *B.N.H.S.*: ♂ imm., ♂ imm. 7-3-21 Thāna (B. C. Ellison); [♂ 7-12-09 Daman Road, Bombay (R. L. Sinclair)]; *St. X. C.*: 90 ♂—Powāi (H. A.).

Noted: Powāi and Tūlsi Lakes.

Resident. Fairly common.

Breeding: The nesting season is in the rains—July and August. The nests are partly submerged pads of rush-stems and weeds placed on floating vegetation

on tanks and ponds. The normal clutch is of 4 eggs. In colour these are buff or olive intricately pencilled with fine black lines. We have taken numerous nests at Powai. H. Bulkley found two nests at Thana H. Wenden (*N. & E.*, iii, 357) found it breeding freely at Kalyan, 32 miles from Bombay, in August.

The Pheasant-tailed Jacana: *Hydrophasianus chirurgus* (Scop.).

Field identification: Size about that of the Partridge. A striking chocolate-brown bird with white head, foreneck, throat and wings. Golden-yellow hind-neck. The long, pointed blackish sickle-shaped tail gives it its name. In non-breeding plumage the colour is chiefly pale brown and white; a black line runs through the eye down the side of neck and expands into a necklace on upper breast; the pheasant-tail is missing. In non-breeding season—gregarious, often in large flocks—on waterlily- and Singara-covered tanks. H. A. has observed one in Bandra Creek, and Sinclair (*J.B.N.H.S.*, i, 164) one on a rock on the seashore in Konkan!

Specimens: *B.N.H.S.*: ♂? 20-5-28 Malād (E. Henricks).

Noted: Bandra; Andhēri; Powai, Tulsi and Vihar Lakes.

Resident. Common. It has a peculiar nasal mewing call *tewn, tewn*, etc. commonly uttered in flight.

Breeding: The nest is a pad of rushes, etc. as of the Bronze-winged Jacana, placed on floating vegetation. We have seen eggs laid directly upon lotus and Singāra (*Trapa*) leaves in a seemingly precarious situation. The eggs are peg-top shaped, usually olive-brown in colour, and match to perfection the decaying sodden leaves on which they rest. Brother Navarro found 2 nests with c/3 and c/4 on the lotus-covered tank near Bandra railway station on 18 September 1937. One of the owners took alarm at the thermometer fixed to determine the temperature of the sodden nest and next morning the eggs were found on another lotus leaf 5 feet away. On the thermometer being shifted to this site the eggs were found to have been removed to a newer position about 2 feet away on the following day. How are the eggs moved?

The Painted Snipe: *Rostratula benghalensis benghalensis* (Linn.).

Field identification: Slightly larger than the Quail. A leggy typical rail. Above chiefly metallic olive-green with buff and blackish streaks and markings; lower plumage chiefly brown and white. A long slender snipe-like bill. The female is more showily coloured than the male. As with the Bustard Quail, she does all the courting and leaves the male to incubate the eggs and rear the young. Flushed singly or in wisps in swampy reed-beds and salt marshes by our creeks. Feeble, laboured flight, legs trailing behind.

Specimens: *B.N.H.S.*: ♀ 7-3-21 Thāna (B. C. Ellison), ♂ Decr. 1893, ♀ Decr. 1890 Bombay (E. L. Barton), ♀ 7-12-24 Kūrla (D. A. Baretto) juv. 29-10-14 Thāna (Counsel), juv. (in down) 15-10-24 Kūrla (S. A.) ♂? 8-12-25 Vilé Parlé (S. A.); *St. X. C.*: 101 ♀, 102 ♂ 3-10-33 Andhēri (H. A.).

Noted: Powai and Tulsi Lakes, Gōdhbunder, Mulund.

Resident. Common. Stomachs of specimens examined by us contained remains of snails and orthopterous insects, and paddy grains.

E. Henricks, the Society's skinner, reported to us in June 1930 that he had caught at Malād an adult specimen which was unable to fly well due to some heavy weight attached to one of its feet. Examination showed a large Ampullaria shell adhering firmly to the middle toe of one foot. The operculum had closed when accidentally trod upon by the bird.

Breeding: It is not unlikely that the Painted Snipe breeds in Salsette throughout the year. We have not actually found any nests here but have taken ovarian eggs from a female shot on 12 April. The gonads of specimens were in breeding condition from the end of September to early May and we also found young in all stages during these months. *Stray Feathers* (vii, 526) records that on 1 December 1878 J. D. Inverarity caught two half-grown chicks, unable to fly, at Gōdhbunder. The nest is a pad of grass or rushes with a slight depression in the centre in which normally 3 or 4 eggs are laid. They are some shade of yellowish-stone colour, blotched and streaked with brown. The nest is usually placed on the ground in grass on the edge of a marsh, on bunds, etc.

The Indian Sarus Crane: *Antigone antigone antigone* (Linn.).

Field identification: A large grey stork-like bird with long bare red legs and naked red head and neck. Usually pairs, stalking about cultivation and marsh land.

Aberrant straggler. Owing to the severe drought in Gujerat and the Deccan, several of these birds were seen in and near Bombay during the cold weather of 1900. H. S. Symons (*J.B.N.H.S.*, xix, 261) records seeing a solitary bird at Santa Cruz on 9-12-08. A few days previous to this he had seen a dead Sarus near Bandra railway station and conjectures that this may be the other of the pair. He mentions that once before he had seen this species at Panwēl (Kolāba Dist.) in 1897 which was also a famine year upcountry. We have no more recent records from Salsette.

The Sarus is common in Gujerat where it is clothed in sanctity and protected by the inhabitants.

The Demoiselle Crane: *Anthropoides virgo* (Linn.).

Aberrant straggler. Following the severe drought in Gujerat and the Deccan, several birds were seen in Bombay during the cold weather of 1900. Not recorded since.

The Lesser Florican or Likh: *Sypheotides indica* (Miller).

Field identification: Slightly larger than the Red-wattled Lapwing and somewhat similar to it in general effect. Male black and white with curious black ear-plumes sticking out behind head. Female brown above finely stippled and pencilled with black; buffy-white below. In stretches of tall grassland.

Specimen: *B.N.H.S.*: ♂ imm.—Bombay (N. C. Macleod).

Rare straggler? Kinnear calls it 'an uncommon cold weather visitor', but as will be seen, the records are not confined to that season. Single birds have been observed from time to time, the records for our area and the adjacent mainland being as follows:

Bombay and Salsette:

Mahaluxmi, ca. 1889 (H. S. Symons, *J.B.N.H.S.*, xix, 261).

Between Andhēri and Malād, December 1912 (M. F. Suter, *ibid.*, xxii, 631).

♀ Catholic Gymkhana Grounds, Kennedy Sea Face 4-9-18 (N. Marryat, *ibid.*, xxvi, 674).

Near Churchgate Railway Station, 8-6-13 (*Times of India* of 10-6-13).

Mainland:

Panwēl 17-1-09 (H. S. Symons, *J.B.N.H.S.*, xix, 261).

♀ Between Māndwa and Alibāg, 16-12-12 (C. D. Baker, *ibid.*, xxii, 202).

♀ Karjat (foot of Bhōr Ghat) 20-1-35 (J. Stokoe, *ibid.*, xxxviii, 191).

♀ Chinchavli near Neral, Nov. 1908 (M. F. Suter, *ibid.*, xxii, 631).

Kalyan, December 1912 (H. A. W. Brent, *Times of India* of 11-6-13).

H. A. saw a single bird near Chōndi (Alibāg Taluka) on 30-5-38.

[**The Great Stone Plover:** *Esacus recurvirostris* (Cuvier).

Field identification: Size about that of the domestic hen with long bare yellowish-green legs. Pale greyish-sandy above, white below. Some black in wings and a conspicuous black streak through eye. Largish head, thick, pointed somewhat upturned bill and round greenish-yellow goggle eyes. Singly or pairs, near rivers and tanks.

Specimen: *B.N.H.S.*: ♀ 22-11-21 Panwēl, Kolāba Dist. (E. L. Barton).

Status? Rare. We have only come across a solitary example on the mangrove marsh bordering Dharamtar Creek, near Rewās Pier (12-3-30). J. D. Inverarity (*J.B.N.H.S.*, ii, 45, 1887) shot a specimen at Panwēl, this being the only occasion on which he saw one. Not recorded in Salsette.]

The Indian Stone Plover, *Burhinus oedicnemus* ssp.

Field identification: Size slightly larger than the Partridge, and much more leggy. Singly or in small flocks essentially in dry, open scrub country.

Status? We have few definite records from Salsette. An enthusiastic 'shikari' once claimed to have shot some 'wood-cock' near Powāi and his description fitted this species beautifully! Mr. McCann caught one of these birds in Bombay City some years ago, and recently saw one at Marōl (December).

Breeding: Brother Navarro took several nests at Khandala (W. Ghats ca. 2,000 ft.) in April and May. The usual clutch is of 2 eggs, laid on the bare stony ground.

The Indian Courser: *Cursorius coromandelicus* (Gmelin).

Field identification: Size about that of the Partridge. General appearance somewhat like the Red-wattled Lapwing. Long, bare china-white legs. Upper plumage sandy brown with some black in the wings. Crown rich rufous. A black band through eye running down neck. A broad white stripe parallel to this band above the eye continuing down neck. These black and white bands are a conspicuous feature. Chin and throat white, breast chestnut, abdomen black. Singly, pairs or small parties, on open dry fallow land or ploughed fields. Running along at speed, stopping abruptly and erect and then resuming the run.

Specimens: *St. X. C.*: 2 ♀ juv., 3 ♀ juv., 3-6-33 Andhēri (H. A.).

Resident? Not common. H. A. observed a flock of some 40 birds about the base of Gilbert Hill, Andhēri (23-4-30). The next day there was only a single pair at that spot. The birds may be seen occasionally at the 'Kutcherpatti' on Trombay Island.

Breeding: That they breed in Salsette, occasionally at least, is evidenced by the juvenile specimens obtained on 3 June. The young birds are buff-coloured, barred on the upper parts with black presenting a mottled appearance. Iris dark grey. They had fed on small coleoptera and green caterpillars.

We have no other record for Salsette. Brother Navarro has taken nests at Khandala and Lonavla in June.

The Large Indian Pratincole or Swallow-Plover: *Glareola maldivarum maldivarum* (Forster).

Sinclair (*J.B.N.H.S.*, iii, 69) records shooting this species at Rewādanda. At Kihim (also in Kolāba Dist.) H. A. observed a flock of pratincoles, presumably this species, flying South over the sea along the coast at sunset (29-12-31). He noted the birds again on 30 December and 1 January (1932).

[**The Crab Plover:** *Dromas ardeola* Paykull.

Field identification: A lonely black and white bird, about the size of a domestic hen, with heavy crow-like beak, on seashore or tidal mudflats.

H. A. shot an example on the seashore near the fishing village of Thal, Kolāba Dist., on 26-10-30. He observed another near Rewās Pier (Dharamtar Creek) on the same date 5 years later.]

The Great Black-headed Gull: *Larus ichthyaëtus* Pallas.

Field identification: A large sea bird, in size between a duck and a goose. Pale grey above with black head and neck, white underparts and short orange-yellow legs. The toes are webbed like a duck's. In winter plumage which is mostly while the birds are with us, the head and neck are white, much streaked with black. Large size distinguishes it unmistakably from other gulls. Usually singly, about the Harbour and sea-coast, flying majestically or perched on the buoys.

Specimen: *B.N.H.S.*: ♂ 12-3-99 Trombay Island, Bombay Harbour (H. J. Walton).

Noted: About the docks, and Pir Pao (Salsette); Alibāg, Janjira, Rewādanda.

Winter visitor. Not common but frequent.

The Black-headed Gull: *Larus ridibundus* Linn.

Field identification: Similar to above but smaller. Size somewhat less than the domestic duck. The so-called black head is in fact chocolate-brown deepening to blackish on hindneck and lower throat. While with us the birds are mostly in winter plumage when the head is greyish-white. A vertical crescent-shaped black patch is conspicuous about the ear-coverts. Gregariously, often large numbers in association with the next species, about the docks and in the Harbour picking up floating refuse from ships. Also about fishing villages or following fishing boats returning from the catch.

Specimens: *B.N.H.S.*: 11 collected in Bombay Harbour between 28 December and 12 March.

Noted: Mahim and Sion Creeks.

Winter visitor. Fairly common. Latest date 4 April.

The Brown-headed Gull: *Larus brunnicephalus* Jerdon.

Field identification: Practically indistinguishable in size and colour from the above, especially in winter plumage. Doubtless often confused with it. In full summer dress the head is more greyish-brown than chocolate. In *ridibundus* the first primary is white with black edges and tip: in this species it is black with a white subterminal band. Habits, etc. as above.

Specimens: *B.N.H.S.*: ♂ 10-3-25 Bombay Harbour (C. McCann); [♀ 4-4-30 Alibāg (S.A.)].

Winter visitor. Bearing in mind the everpresent possibility of confusion it is our impression that this species is less common round Bombay than the Black-headed Gull. On the South Konkan Coast, however, Vidal (*S.F.*, ix, 94) considered it abundant and *ridibundus* very rare. Hume also definitely asserts (*S.F.*, iv, 414, 1875) that *brunnicephalus* is commoner in Bombay Harbour than *ridibundus*.

The Sooty Gull: *Larus hemprichii* Bruch.

Aberrant straggler. The only record for Bombay we know of is the solitary specimen seen by Hume on some rocks in the Harbour in January 1875 (*S.F.*, iv, 414).

The Eastern Herring Gull: *Larus fuscus taimyrensis* Buturlin.

Field identification: Rather larger than the three foregoing. In adult plumage dark slaty-grey above, white below with black in the flight feathers. In winter the head and neck are streaked brown; in summer they are white. Immature birds are dark brown with white streaks above and the white lower parts are mottled and streaked with pale brown. Gregariously, about docks and in the Harbour, and around fishing villages.

Specimens: *B.N.H.S.*: ♂♀ 9-3-14, ♀ 2-2-17, ♀♀ 23-1-10, ♂♂ 21-2-17 Bombay Harbour (S. H. Prater); ♂ 26-3-99 Bombay Harbour (Major H. J. Walton).

Winter visitor. Fairly common. Large numbers are occasionally seen about the fishing village of Dānda—near Bandra.

The Yellow-legged Herring Gull. *Larus argentatus cachinnans* Pallas.

Field identification: Very similar in size and colouring to the last and difficult to differentiate from it in the field. Somewhat paler grey above. Habits, etc. same as with other gulls.

Specimen: *B.N.H.S.*: ♀ 21-2-17 Bombay Harbour (S. H. Prater).

Winter visitor. Fairly common. Latest date 29 March.

The Indian Whiskered Tern: *Chlidonias hybrida indica* (Stevens).

Field identification: Size about that of the pigeon. A slender, graceful bird with long, pointed wings and an exceptionally square tail. In summer, plumage pale ashy grey above, white below gradually shading into black on abdomen and under tail. A velvety black cap. In winter, i.e. mostly while the birds are with us, the crown is white as are the entire lower parts. Only the hindcrown and nape are black-streaked or wholly black. Bill, legs and feet red. Gregariously, about tanks, marshes and creeks either flying back and forth at moderate heights scanning the water below for food or resting on some mudbank on their ridiculously short legs. They hurl themselves down on a fish or tadpole swimming near the surface or swoop gracefully on sand crabs, etc. and bear them away in their bills.

Specimens: *B.N.H.S.*: ♂ 22-9-24 Kūrla (D. B. Baretto); *St. X. C.*: [120 o?, 121 o? 13-10-33 Bassein, Thāna Dist. (H. A.)].

Noted: Powāi Lake, Gōdhbunder and Sion Creeks.

Status? Mainly winter visitor. Fairly common. We have noted individuals as early as 4 August and as late as 11 June. Do occasional birds or pairs stay with us throughout the year? And breed? A large flock at Powāi Lake

on 4 May was evidently on passage. A female shot from this showed no gonadal development.

The Gull-billed Tern: *Gelochelidon nilotica nilotica* (Gmelin).

Field identification: Somewhat larger than the Whiskered Tern. Same general effect and habits but can usually be distinguished at a distance from other grey-and-white terns by its black bill, legs and feet.

Specimens: *B.N.H.S.*: ♀ 8-12-99 Bombay Harbour (E. Comber); ♀ 28-12-13 Bombay Harbour (N. B. Kinnear); ♂ 19-11-17 Kūrla (S. H. Prater); ♂ 1-9-18 Bhyandar (A. P. Kinloch).

Noted: Bandra, Vilé Parlé, Andhēri, Sion, Gōdhbunder—about creeks and mudflats.

Winter visitor. One of our commonest terns. By about the end of August the birds are well in. Numbers may still be met with at the end of May, while we have records of individual birds on 16 June, 23 and 24 July.

The Indian Lesser Crested Tern: *Thalasseus bengalensis bengalensis* (Lesson).

Field identification: Size and general effect that of the Gull-billed Tern. Distinguishable by its yellow bill and black legs and feet. Usually met at sea some distance from the shore, and also on the larger tidal creeks. The call *cher-ruk* while fishing in the manner of a Pied Kingfisher is characteristic.

Specimens: *B.N.H.S.*: ♂ 20-6-11 Bombay Harbour (S. H. Prater); ♀♀ 5-3-99 Bombay Harbour (Major H. J. Walton).

Winter visitor, principally. Not common. We have observed it when crossing the Harbour by the ferry service, and the bird becomes quite common as one goes further south.

The Little Tern or **Ternlet**: *Sterna albifrons albifrons* Vroeg.

Field identification: Differentiated from all our other terns by its small size which is about that of the Ring-Dove though the long wings and forked tail make it appear bigger in flight. Bill, legs and feet orange-yellow.

Specimens: *B.N.H.S.*: 3 ♀ and 1 ♂ 25-5-37 (H. A. and McCann).

Resident or breeding visitor? It is surprising that no specimens of the Little Tern had been taken, or the birds met with on our shores until the remarkable discovery recently of a nesting colony by Brother Navarro of St. Xavier's College. On 25 May 1936 Br. Navarro was rowed out by fishermen from Gorai, north of Manori Creek in Salsette, to a small rocky islet some 2-3 miles from the shore. This islet was crowded with Little Terns, the ground being covered with their nests mostly containing 3 eggs each. The fishermen collected close on 200 eggs. According to their testimony the birds had been breeding on this islet for years.

On 28 May of the following year H. A. visited this island again with Mr. McCann and Br. Navarro. The approach is extraordinarily difficult at this season, as the coast is rocky and a third of the island, which is less than 200 yards square, was covered by the tide. We anchored a couple of hundred yards off the rock, and waited for the tide to go down. Large flocks of these terns could be seen flying over the rock, and occasionally, they would cover some distance out to sea. No birds however came within gunshot, and we decided to swim the last hundred yards. The shore is extremely rocky, but there were two or three patches of level ground covered with a straggly growth of grass. The birds were not wild, and sat on their eggs 2 to 3 feet from one another. There must have been over a hundred nests. The eggs, 2 to 3 in number, were laid on the bare shingle, and one had to walk cautiously, to avoid stepping on them. They were all fresh. We shot a few specimens, and the birds became much wilder, and it was with some difficulty that we secured photographs of the birds at their nests. We saw no other birds except a *Thalasseus bergii* which just flew over the island.

On our return from the islet, a special watch for these Ternlets was kept, but we saw only a few stragglers, beating up and down the shore at evening. As there are no other records of this bird from our area it would appear that the species is possibly a breeding visitor only.

The Red Sea Brown-winged Tern: *Sterna anaetheta fuligula* Licht.

Field identification: Size about that of the Whiskered Tern, but with upper parts dark brown instead of grey. The black crown of the summer

plumage is brown in winter with white edging to the feathers. The bill, legs and feet are black as in the Gull-billed Tern.

Specimens: *B.N.H.S.*: o? 23-9-18 Colāba, Bombay (Lieut. Tebbut); *St. X. C.*: 83 ♂, 84 ♀, 85 ♂ 17-9-33 Bandra.

Winter visitor. Not common. The St. Xavier's College specimens were captured by hand during the monsoon. They apparently were stragglers blown in by a gale. One was shot at Bandra on 15-11-38. The birds that Hume found breeding on the Vengurla rocks belong to the southern race *S. a. antarctia*.

[The Indian Sooty Tern: *Sterna fuscata infuscata* Licht.

Field identification: Size about that of the Gull-billed Tern. Upper parts deep chocolate brown. The black crown of the summer plumage is streaked with white in winter. Bill, legs and feet black.

Specimen: *B.N.H.S.*: o?—Alibāg, Kolāba Dist. (W. F. Sinclair).

Straggler. No other records.]

[The Indian Skimmer: *Rhynchops albicollis* Swains.

Field identification: A tern-like black, white and brown water bird chiefly remarkable for its orange-red scissor-shaped bill with the lower mandible compressed like a knife-blade and projecting much beyond the upper.

Specimen: *B.N.H.S.*: o? March 1890 Alibāg, Kolāba Dist. (E. L. Barton).

Straggler. The only record from our neighbourhood.]

Hume records (*S.F.*, iv, 414) meeting a single Caspian Tern (*Hydroprogne caspia*) and the Crested Terns (*Thalasseus bergii*) evidently in some numbers, near the Prongs Lighthouse and Colāba Point in January 1875. *T. bergii* is common further south.

The Turnstone: *Arenaria interpres interpres* (Linn.).

Hume (*S.F.*, iv, 414) found the Turnstone 'pretty abundant' all round Bombay Island and other islands in the Harbour in January 1875. We have no more recent records.

The Western Grey Plover: *Squatarola squatarola squatarola* (Linn.).

Field identification: A little larger than the Golden Plover, and much paler. In the hand, the presence of a tiny hind toe distinguishes it from that species.

Noted and/or shot: Malād (Salsette); Kihim (across Bombay Harbour).

Winter visitor. Not uncommon. Small parties—never large flocks—on seashore or by mangrove-fringed creeks and tidal mudflats.

The Oyster-Catcher or Sea-Pie: *Haematopus ostralegus longipes* Buturlin.

Field identification: Somewhat larger than the Partridge. A striking black and white wading bird with longish bare red legs and long, straight, moderately slender orange-red bill. Usually small flocks amongst rocks on the seashore and tidal mudflats.

Specimens: *B.N.H.S.*: o? October 1893 Alibāg, Kolāba Dist., *St. X. C.*: 178 o? 22-10-33 Alibāg (H. A.).

Winter visitor. Common. Usually extremely wary. We have observed the birds here as early as 28 September and as late as 29 May. EHA (*C.B.B.*, 165) even saw a flock of about 15 not far from Bombay on 29 June. Hume (*S.F.*, iv, 414) noted several in Back Bay in January 1875. Their call notes resemble those of the Whistling Teal and in fading light when the birds are flying towards or away from one the effect is very teal-like.

The European Little Ringed Plover: *Charadrius dubius curonicus* Gmelin.

Field identification: Somewhat smaller than the Quail. A sandy-brown shore bird with a white forehead, black forecrown, earcoverts, around eye and a black collar round the white neck. Underparts white. Legs yellowish- or greenish-grey. A typical plover with a thick head, large eyes and short stout bill. Small flocks on the seashore and tidal mudflats.

Specimens: *B.N.H.S.*: oo 6-4-24 Sion Causeway (S. A.); ♀ 25-10-24 Kūrla (D. B. Baretto); ♀ 26-1-14 Colāba (S. H. Prater); *St. X. C.*: 36 ♀ 1-8-33. 105 ♀ 8-10-33 Andhēri (H. A.).

Noted: Mahāluxmi, Worli, Māhim, Dānda, Bhyandar, Trombay, Kihim, etc. EHA (*C.B.B.*, 164) mentions flocks frequenting the Esplanade Maidan.

Winter visitor. Common. Earliest date 11 August; latest 6 April. Flocks are commonly to be seen about the mudflats and salt pans in Salsette running along swiftly, feeding in company with Stints and other waders. In this environment their colouration is remarkably obliterative and it is often quite impossible to pick out a bird, even at close range until it moves.

We have no authentic record of the very similar Jerdon's Little Ring Plover (*C. d. jerdoni*) from our area. This race, as a rule, prefers the shingly banks and beds of rivers, streams and tanks inland.

Navarro has several records of this bird breeding at Khandala in June.

The Pamirs Lesser Sand-Plover: *Charadrius mongolus atrifrons* Wagler.

Field identification: Slightly larger than the foregoing. Ashy brown above pale rufous and white below. Head markings more or less like the Ring-Plover's, but lacking the white collar on hindneck. In winter plumage, while with us, the forehead, etc. are fulvous instead of black and the rufous of breast and flanks lesser in extent. Legs and feet greenish-grey, bill black. Flocks, running about feeding on sandy seashore especially between the tide marks. Also frequents tidal mudflats by creeks, etc.

Specimens: *B.N.H.S.*: oo 14-3-26 Bhyandar (S. A.); ♀ 25-10-24 Kūrla (D. B. Baretto); ♀ 28-9-13 Manori Creek (Dr. F. M. Suter); *St. X. C.*: 79 ♀, 80 ♂ 20-9-33 Versova mudflats (H. A.).

Winter visitor. Common and abundant. Earliest date 13 September; latest 14 March. Usually seen on the sea beach in mixed flocks with the Large Sand-Plover and other shore birds. The two species are in the proportion of something like 2 of *mongolus* to 1 of *leschenaulti*. They fly swiftly in close orderly formation all turning and twisting on the wing together with their white undersides glistening from time to time as the sun strikes them. When the flocks first arrive from their breeding grounds the birds have evidently not quite got over their 'territorial' instinct. Much rivalry is apparent and skirmishes are frequent. Their combats are as innocuous as amusing to watch. Two birds will run parallel to each other, heads lowered. Of a sudden one will turn on the other, rush at him with open wings and jump clean over him. Sometimes they vary these tactics and diverge as if oblivious of their adversary's proximity. Suddenly however they will wheel on each other and repeat the 'clinch'.

The Large Sand-Plover: *Charadrius leschenaulti* Lesson.

Field identification: Appreciably bigger than the Pamirs Sand-Plover and more rufous-sandy above, but otherwise the two are alike.

Specimens: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lieut. Tebbut).

Noted: Near Gōdhbunder, Kihim, Alibāg, Karanja, Rewās, Rewādanda, Mūrūd (Janjira), etc.

Winter visitor. Common. Habits same as of the Lesser Sand-Plover. In the stomach of a specimen several of the beetles *Sphenoptera aenea* (Fam: Buprestidae) were found.

The Eastern Golden Plover: *Pluvialis dominicus fulvus* (Gmelin).

Field identification: Size about that of the Partridge. A typical plover with thick head, large eyes and short straight moderately stout bill. Mottled white, brown and golden-yellow above; black below. In winter the black is absent. Small parties or flocks on mudflats, etc. covered with short rank grass—moist lark country.

Specimens: *B.N.H.S.*: ♂♂ 2-11-08 Bhyandar (N. B. Kinnear).

Noted: Andhēri, Malād, Gōdhbunder, Bassein, Rewās, Kihim, Alibāg (Sākar Creek), Dharamtar Creek. J. D. Inverarity observed it on the Mahāluxmi mudflats in October 1877 and shot a couple on the Race Course. In March 1883 he saw a flock of a dozen near the Race Course (*J.B.N.H.S.*, ii. 44).

Winter visitor. Not uncommon. We have observed a flock of about 25 and a party of 4 (in summer plumage) on 24 August and 17 July respectively. They are frequently seen in our neighbourhood as late as the first half of May. The stomach of a specimen contained tiny snails and slugs.

The Sociable Lapwing: *Chettusia gregaria* (Pallas).

Field identification: Slightly larger than the Partridge. A greyish brown plover with wings and tail partly white and partly black. Black crown, white forehead, the white continuing in a broad stripe above eye down almost to nape.

Specimen: *B.N.H.S.*: ♀ 7-12-99 Esplanade, Bombay (J. M. Mason).

Aberrant straggler. EHA (*C.B.B.*, 164) writes that in December 1899 when the famine in Gujerat and the Deccan drove many strange birds to Bombay for a living, a flock of 40 or 50 of these plovers appeared on the Esplanade and remained for some weeks. They attracted much attention and were productive of letters in the newspapers.

The Indian Red-wattled Lapwing: *Lobivanellus indicus indicus* (Bodd.).

Mahrātti: *Hoot-toot-ti*; Hindūstāni: *Titori, Titwi.*

Field identification: Slightly larger than the Partridge and with longer legs and neck. Bronze-brown above, white below. Crown, throat and breast black. Lower back and tail white, the latter with a broad black cross-band. A crimson wattle or fleshy projection above and in front of each eye. Usually pairs or small parties, in open country near water. Familiar *Did-he-do-it?* calls.

Specimens: *B.N.H.S.*: ♂ 8-9-19 Bhyandar (A. P. Kinloch); [♀ 31-5-08 Vasind (S. H. Prater)].

Resident. Common.

Breeding: The earliest nest we have record of was on 29 March (Tūlsi Lake). The season is at its height between April and July. The nest is merely a natural depression or scrape in the ground, unlined, sometimes margined with pebbles or 'kankar'. It is usually situated on waste or fallow land more or less water-logged in the rains, and with deep imprints of cattle hoofs. The drying-up beds of village tanks also offer suitable sites. The normal clutch consists of 4 eggs, rather pointed at one end. In colour they are some shade of stone or grey-brown, blotched with blackish and match the ground to perfection. Indeed it is difficult to locate a nest even in a circumscribed area except by patiently watching the behaviour and movements of the owners. A successful method is to scan a likely patch from a distance with binoculars when the white on the head of the brooding bird will show up conspicuously. When suspicious the bird quietly slinks away from the nest with head held low between the shoulders only straightening itself up or flying off when some distance away. The colouration and markings of the newly hatched downy chicks of this Lapwing provide a very good example of Nature's camouflage. They are quite invisible at a couple of feet's distance when squatting or lying 'doggo' with neck outstreched. They run about freely picking up insects, etc., by themselves, to all appearances perfectly oblivious of possible danger, but respond mechanically to the alarm notes of their parents, squatting low beside a stone or clod and becoming completely invisible. When danger is past and immediately upon the signal from the parents—a series of high-pitched *clucks* as they wheel frantically overhead—they are up again and busy running about feeding with no semblance of caution on their own part. The parent birds launch fierce aerial attacks on crows, mynahs, king-fishers and even dogs and jackals that intrude into the proximity of their nest or young.

The Yellow-wattled Lapwing: *Lobipluvia malabarica* (Bodd.).

Field identification: Size about that of the Partridge, more leggy. Sandy brown above, white below with a black cap and bright yellow lappets above and in front of the eyes. Chin and throat black. Neck and breast paler than upper plumage. Tail white with a broad black subterminal band conspicuous in flight. Legs and feet bright yellow. Pairs or small parties, on waste and fallow land—usually drier facies than the Red-Wattled Lapwing.

Specimens. *B.N.H.S.*: ♂ 6-4-11 Santa Cruz (N. B. Kinnear); [♂ 24-12-00 Revdanda, Kolāba Dist. (E. Comber)].

Noted: Andhēri: Kihim (Kolāba Dist.).

Resident. Uncommon. Its call is very different from that of the Red-wattled Lapwing. It is a plaintive *Ti-ee, ti-ee*, etc., punctuated by high-pitched quick-repeated titters *twit-twit-twit*, etc.

Breeding: We have no record from Salsette, but at Kihim (Kolāba Dist.) across the Harbour—S. A. found downy chicks about 3 days old, on 24-6-30 on the same stretch of hoof-pitted waste land as was being used by the Red-wattled species. The chicks were stippled black and rufous and harmonised with the soil so completely that after roughly marking down the spot it took fully 10 minutes to locate one within 2 feet of his boot! The chicks were lying 'doggo' on the bare uneven ground without stone or clod as shelter. When a chick is once spotted, the broad white collar on its hindneck is prominent thereafter.

The parent birds demonstrate in the same frantically vocal manner as the foregoing species when their nest or young are approached, flying in circles close overhead often making as if to strike the intruder.

Navarro has taken nests at Khañdala in May.

The Black-winged Stilt: *Himantopus himantopus himantopus* (Linn.).

Field identification: Size about that of the Partridge. A striking wading bird of black and white plumage chiefly remarkable for the length of its thin pink or red legs—about 10 inches—which enable it to wade into fairly deep water and which trail behind conspicuously in flight. Its bill is black, straight and slender. Singly, pairs or small parties on salt pans and mudflats by tidal creeks.

Specimen: *B.N.H.S.*: ♀? 29-9-24 Kūral (D. B. Baretto).

Noted: Bhyandar, Bassein, Alibāg (Sakar Creek), Naugaon and Nagotna (Kolāba Dist.).

Local migrant? All our records are between 29 September and 6 November only. Not uncommon but patchy.

The Avocet: *Recurvirostra avocetta avocetta* Linn.

Field identification: Size of the Stilt. Black and white plumage, long bare bluish legs and slender, black upcurved bill make its identity unmistakable. Singly or pairs—occasionally parties—by creeks and on tidal mudflats usually in company with 'snippets'.

Specimens: *B.N.H.S.*: ♂ 12-11-25, ♀ 25-11-25 Kūrla (D. B. Baretto); ♀ 11-3-04 Bombay (John Wallace); ♂♂ 27-2-15 Uran (A. H. A. Simcox); ♀ 6-12-18 Bombay Harbour (J. A. D. McBain); ♂ 23-9-18 Bhyandar (Lieut. Tebbut).

Noted: Bassein Creek (Thāna Dist.), Rewās mudflats, Sākar and Rewdanda Creeks (Kolāba Dist.).

Winter visitor. Sparingly but not uncommon. The feeding with the curiously shaped bill is effected as follows: The bill is directed against the ground obliquely so that the curved part skims the squelchy semi-liquid mud. The bill is then moved with a back and fore rotatory motion taking in small crustaceans, etc.

The Eastern Curlew: *Numenius arquata lineatus* Cuvier.

Field identification: Size about that of the domestic hen. A darkish sandy-brown bird streaked with black and fulvous to produce a game bird pattern, with white lower back and rump. Its most characteristic feature, however, is the curved slender bill 5 or 6 inches in length. The call, when once heard, is also characteristic—a shrill *coorlee* usually uttered in flight. Singly or parties on the seashore between tide marks. Also on mudflats and marshy land by tidal creeks. Extremely wary.

Specimens: *B.N.H.S.*: ♂ 6-12-18 Colāba Cove, Bombay Harbour (J. A. D. McBain); [♂ 1-9-11 Panvēl, Kolāba Dist., ♀? 25-12-10 Rewdanda (P. M. D. Sanderson)].

Noted and/or shot: Gōrēgāon Creek; Bassein (Thāna Dist.) Inverarity (*J.B.N.H.S.*, ii, 45) saw a Curlew on Mahaluxmi Race Course on 26 September 1886, and EHA (*C.B.B.*, 170) writes that 'when the tide has run far out and bared the black rocks round Colāba and Breach Candy its wild and plaintive scream often comes in on the breeze'. Conditions have altered greatly, however, and we are aware of no recent record of the Curlew anywhere within town limits.

Winter visitor. Earliest date 20 August. Not uncommon across the Harbour and down the coast. Do some remain with us throughout the

year? Sinclair (*J.B.N.H.S.*, i, 164) found them on the Konkan Coast all the year round.

[At Bedi Bunder in Kathiawar H. A. observed a Curlew on 12 June. At Rozi Bunder he found both Curlew and Whimbrel common on 16 June (*J.B.N.H.S.*, xl. 122).]

The Whimbrel: *Numenius phaeopus phaeopus* (Linn.).

Field identification: Rather smaller than the Curlew but very like it in colouration, general effect and habits. 'The call, uttered in flight, is a musical *tetti, tetti, tetti, tet* with rapid intonation. The dark crown with median whitish streak are often visible with the naked eye and obvious through glasses' (Meinertzhagen).

Specimens: *B.N.H.S.* ♂ 23-9-18 Bhyandar (Lt. Tebbut); [♂♂ 1-9-11 Panvēl, Kolāba Dist.]; *St. X. C.*: 81 o 20-9-33 Versōva Flats (H. A.).

Noted: Vasora (near Andhēri), Gōdhbunder; Kihim, Alibāg, Colāba Reclamation.

Winter visitor. Earliest date 20 July; latest 23 May. Commoner than the Curlew and usually in bigger flocks. We have seen several of nearly 100 birds each. They are very fond of the stretches of mangrove marshes along our tidal creeks, and may also be seen running about feeding on the seashore by the water's edge at low tide.

Both this species and the Curlew—as indeed are most of our migratory waders provided they are large enough to be worth powder and shot—are much persecuted by local shikaries.

The Black-tailed Godwit: *Limosa limosa* ssp.

Inverarity (*J.B.N.H.S.*, ii, 45) shot one among the salt pans at Penn (Kolāba Dist.) in February 1884.

H. A. obtained one from a party of 3 in tidal mud at Rewās (Kolāba Dist.) on 22-11-32.

The Bar-tailed Godwit: *Limosa lapponica lapponica* (Linn.).

Field identification: Size, colouration and general effect approximately that of the Whimbrel but with a straight, not curved, bill. Occurring in the same surroundings.

Specimen: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lieut. Tebbut).

Noted only near Rewās Pier—Dharamtar Creek—12-3-30; a solitary example probing the mud near the jetty. On page 319 of vol. iv. of the *Journal* 2 Bar-tailed Godwits are recorded as received by the Society from Mr. Sinclair, Alibāg.

Straggler? As pointed out by S. A. in a note on the Bhyandar specimen (*J.B.N.H.S.*, xxxiii, 716) Bombay is considerably south of its hitherto known range in the Indian Empire.

The Terek or **Avocet Sandpiper**: *Xenus cinereus cinereus* (Gulden).

Field identification: Size about that of the Quail, brown above, white below in winter plumage while with us. Its most diagnostic feature is the long slender black bill noticeably upcurved like the Avocet's. Legs and feet orange-yellow which is unusual among Sandpipers. Parties or flocks on the seashore and tidal mudflats about the estuaries, usually in association with other small waders.

Specimens: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lt. Tebbut); *St. X. Co*: o? Thāna (Nunes).

Noted: Malād; Rewās, Kihim.

Winter visitor. Earliest date 15 September: latest 12 April.

The Green Sandpiper: *Tringa ochropus* Linn.

Field identification: Size about that of the Snipe or the Quail. Head and neck greyish-brown. Upper parts dark brown with a bronze-green gloss. Lower parts, rump and tail white. The white rump, especially, distinguishes it in zig-zag flight from the somewhat similar looking but smaller and less dark Wood Sandpiper. The bill is slender, straight and snipe-like, but shorter than the Snipe's. Its call notes *twee-twee-twee* uttered when flushed and as the bird goes off are distinctive when once heard.

Singly or couples at puddles and village tanks.
Specimens: *B.N.H.S.*: o? 2-1-11 Kheneri (Salsette); ♂ 16-12-18 Kūrla (S. H. Prater); *St. X. C.*: 77 ♀ 12-9-33 Andhēri, 52 ♀ 6-8-33 Gōrēgāon (H. A.).
Winter visitor. Common. Earliest date 5 August; latest 9 May.

The Marsh Sandpiper: *Tringa stagnatilis* (Bechstein).

Field identification: Rather smaller than the Green Sandpiper, but like the Greenshank in general effect. Its brown upper parts are more greyish than bronze-green. Lower back and rump white; tail brownish. Bill slightly recurved, this feature being obvious only at short range and through binoculars. Usually singly by tanks and flooded fields, standing in shallow water and probing the mud often with head submerged.
Specimens: *B.N.H.S.*: [♀ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear)]; *St. X. C.*: o?—Trombay.
Noted and/ or shot: Gōdhbunder Creek.
Winter visitor. Not common.

The Common Sandpiper: *Tringa hypoleucos* Linn.

Field identification: Slightly smaller than the Quail. Upper parts brown tinged with olive. Lower back and rump not white. White conspicuous only in outer feathers of tail. Lower parts white except breast which is suffused with pale ashy-brownish. A white wing-bar conspicuous in flight. Utters *tee-tee- tee* when flushed and going off. Singly, by tanks, puddles, creeks and about rocks on the sea beach.
Specimens: *B.N.H.S.*: ♀ 6-4-01 Bombay (J. M. Mason); ♂ 12-1-08 Andhēri (N. B. Kinnear?); ♀ 19-11-17 Kūrla (S. H. Prater); o? 16-11-25 Gōdhbunder (S. H. Prater); ♀ 16-12-18 Bombay (S. H. Prater); ♂ 1-9-18 Bhyandar (A. P. Kinloch); ♂ 2-10-24 Kūrla (D. B. Baretto); *St. X. C.*: 174 ♀ 1-8-33 Andhēri (H. A.)
Winter visitor. Common. Birds already begin to arrive in some numbers in the first week of August and may be commonly seen till about the middle of May. Occasional individuals, however, remain in our midst throughout the year but they do not breed at this latitude.

The Wood or Spotted Sandpiper: *Tringa glareola* Linn.

Field identification: Size about that of the Green Sandpiper. Sepia brown above indistinctly spotted and marked with white. Back and rump white. Breast pale brownish. Whitish stripe above eye. Singly or small parties—larger flocks later in the season prior to emigration—by flooded fields, tanks, shallow vegetation-covered jheels, etc.
Specimens: *St. X. C.*: 123 o Bassein, Thāna Dist. (H. A.).
Noted: Andhēri, Bhandūp, Powāi Lake.
Winter visitor. Not uncommon. Earliest date 14 September; latest 9 May. H. A. observed a solitary example on 20 July (35).

The Redshank: *Tringa totanus eurhinus* (Oberholser).

Mahrātti: *Maater.*
Field identification: Larger than the Green Sandpiper, and unmistakably of the tribe in general effect. Greyish-brown above, streaked and spotted with white. Back white, specially conspicuous in flight when the long slender red legs trail behind. A white bar in wings. Utters a sharp *tiwee-tiwee-tiwee* or *tew-tew-tew* as it flies off. Singly or small parties at tanks, about mangrove-lined creeks, tidal mudflats and salt pans.
Specimens: *B.N.H.S.*: ♀ 27-11-09 Hog Island, Bombay Harbour (E. Comber); ♂ 8-9-18 Bhyandar (A. P. Kinloch); ♂ 2-11-08 Bhyandar (N. B. Kinnear); [♀ 25-12-09 Panvēl, Kolāba Dist. (N. B. K.)]; *St. X. C.*: 124 ♀ 13-10-33 Bassein, Thāna Dist. (H. A.).
Winter visitor. Fairly common, but not abundant. Earliest dates 29 July and 19 August; latest 25 May. On the latter date a flock flying abreast in a ribbon at about 3-400 feet in N. direction, apparently emigrating.

The Greenshank: *Glottis nebularia* (Gunnerus).

Field identification: Size about the same as or slightly larger than the Redshank. Darker greyish-brown above, with white rump. White below.

Distinguishable from the foregoing by absence of white wing-bar, by its olive green instead of red legs and by its long slender bill being slightly upcurved. Its call *tew-tew-tew* is very like that of the Redshank. Usually singly in the same surroundings as last.

Specimen: *B.N.H.S.*: ♂ 2-11-08 Bhyandar (N. B. Kinnear).

Noted: Andhēri, Malād, Mahūl, Trombay, Gōrēgāon, Gōdhbunder; Kihim, Alibāg, Dharamtar.

Winter visitor. Fairly common, but not abundant. Earliest date 8 August; latest 18 June. At 6-30 p.m. on 2 May (1930) a flock of about 100 Greenshanks was observed at Sākar Creek (Alibāg) hugging the coast and flying strongly due North in ribbon formation—all abreast—at a height of about 500-600 feet.

Almost all sandpipers and allied waders, big and small, pass locally under the name of *Timbla*.

The Ruff and Reeve: *Philomachus pugnax* (Linn.).

Field identification: Male slightly larger than the Redshank: female appreciably smaller. A wader with noticeably short sandpiper-like bill. Upper plumage in winter, while with us, brown mottled with black and buff; white below, the breast suffused with brown or buff. Small flocks, mixed with other waders on tidal mudflats and paddy stubble by creeks, etc.

Specimens: *B.N.H.S.*: ♀ 23-9-18 Bhyandar (Lt. Tebbut); *St. X. C.*: ♀ 19-10-33 Alibāg (H. A.).

Noted: Bassein (Thāna Dist.): Naugaon (Kolāba Dist.).

Winter visitor. Uncommon but possibly often overlooked or confused with other species.

The Little Stint: *Erolia minuta minuta* (Leisler).

Field identification: A diminutive wader slightly bigger than the Sparrow. Mottled greyish-brown above, white below. Outer tail-feathers brownish. Flocks on mudflats and the sea beach in association with other stints and shore birds. When disturbed the flock flies off swiftly in orderly mass formation turning and wheeling in unison and uttering a musical *wit-wit-wit* or low *tr-rr*. The black legs distinguish this bird from Temminck's Stint, the legs of which are olive green.

Specimens: *B.N.H.S.*: ♀ 21-11-08 Bhyandar (N. B. Kinnear); oo 6-4-24 Sion Causeway (S. A.); o? 26-11-25 Kūrla (D. B. Baretto).

Noted: Andhēri, Māndwa, Rewās, Alibāg (Kolāba Dist.).

Winter visitor. Common. Earliest date 25 Sept. latest 6 April.

Temminck's Stint: *Erolia temminckii* (Leisler).

Field identification difficult. Size and general effect same as of the Little Stint, but with the outer tail-feathers white. In the hand distinguishable by the shaft of the first primary being white, the others brown. In *minuta* all shafts of primaries are more or less white. Habits same as last, though in smaller flocks and perhaps more often by fresh water tanks, etc.

Specimens: *B.N.H.S.*: ♀ 23-3-85, o? 25-3-85 Bombay (EHA); *St. X. C.*: 112 ♀ Salsette, 207 ♀ Decr. 34 Andhēri (H. A.).

Winter visitor. Less common than the Little Stint. Often in association with it and with mixed flocks of other waders.

The Curlew-Stint or **Pigmy Sandpiper**: *Erolia testacea* (Pallas).

Field identification: Size about that of the Common Sandpiper. Upper parts grey-brown with a good deal of white streaks and mottling. Upper tail coverts mostly white. Lower parts white with brownish wash on breast. Its diagnostic feature is the slender curlew-like bill decurved towards the tip. Parties amongst mixed flocks of small shore birds on tidal mudflats, etc.

Specimen: *St. X. C.*: 216 o? 7-10-35 Bassein, Thāna Dist. (H. A.)

Winter visitor. Common, but overlooked as a 'kūch-nai'.

The Dunlin: *Erolia alpina alpina* (Linn.).

Field identification: Size about that of the Common Sandpiper. Colouration and general effect as the last but with upper tail coverts blackish brown, clearly noticeable in flight. The bill is decurved but to a lesser extent than in the Curlew-Stint. The proportionately longer bill is a characteristic feature

of the Dunlin as is also the rounded 'hunch back' profile when at rest. Small flocks in company with other waders on tidal mudflats and the seashore.

Specimens: 00 Decr. 1932 Trombay (Rev. Palacios): 137 ♀ 20-10-33 Rewās Kolaba Dist. (H. A.).

Noted: Andhēri.

Winter visitor. Uncommon.

The Broad-billed Sandpiper: *Limicola falcinellus* subspecies?

Field identification: Size about that of the Common Sandpiper. General effect as of the Dunlin. Upper parts ashy-brown, lower white. Breast finely streaked with brown. Its diagnostic feature is the bill which is depressed and broad. Singly or small parties, by puddles, etc. on tidal mudflats and seashore, frequently in mixed flocks of waders.

Specimens: *B.N.H.S.*: o? 23-9-18 Bhyandar (Lt. Tebbut); *St. X. C.*: [135 ♀, 136 ♂ Rewās, Kolāba Dist. (H. A.)].

Noted about Rewādanda Creek—1st week of November 1933 (Rev. Palacios).

Winter visitor. Not common. The races cannot be differentiated in winter plumage.

The Woodcock: *Scolopax rusticola rusticola* Linn.

Field identification: Size about that of the Pigeon. General effect that of an overgrown Snipe.

In *Stray Feathers* (vol. vii, p. 525) J. D. Inverarity records one shot by R. D. Cairns of the Oriental Bank 2 miles from Thāna on Christmas Day, 1878. It was flushed in bushes at the foot of some low hills near marshy ground.

This individual was obviously an exhausted passenger. Some Woodcock regularly winter in the Nilgiris and adjacent hills, but if this is their usual route they must pass over without stopping for there is no other record of their occurring in our area.

The Wood Snipe: *Capella nemoricola* (Hodgs.).

Field identification: This and the two following, namely the Common and the Pintail Snipe are difficult to differentiate in the field except with constant practice. Size slightly larger than the Quail. Dark brown above streaked with black, rufous and buff. Very obliterative colouration, blending admirably with the surroundings. Paler or whitish below. Long, straight slender bill about 2½ inches. Singly or wisps on grass-covered marshes, squelchy paddy stubble and also on tidal mudflats along creeks with rank grass cover, mangroves or other bushes. Rising with a harsh note *pench* or *scape* like the squelching of a sodden shoe, and flying off swiftly in zig-zags.

Specimen: *B.N.H.S.*: ♀ 18-1-17 near Thāna (Major M. L. Ferrar).

One was shot near Bombay by T. H. Moore in January 1896 (*J.B.N.H.S.*, xxv, 149).

Winter visitor. Rare, but perhaps not always identified even in sportsmen's bags.

The Common or **Fantail Snipe**: *Capella gallinago gallinago* (Linn.)

Field identification: See *supra*.

Specimens: *B.N.H.S.*: o? 13-1-95 Thāna (W. J. Pringle); ♀ 20-1-09 Thāna (N. B. Kinnear); ♀ 6-2-19 'Near Bombay' (H. A. W. Brent); ♀ 7-3-21 Thāna (B. C. Ellison); ♀ 3-12-23 Thāna (R. A. Spence); *St. X. C.*: [126 ♀ 15-10-33 Kihim, Kolāba Dist. (H. A.)].

Noted and/ or shot: Gōdhbunder, Tūlsi Lake, Irla, Vilé Parlé.

Winter visitor. Common. Earliest date 18 September; latest 4 May.

EHA (*C.B.B.*, 167) mentions that snipe were shot on the Flats (meaning chiefly about Mahāluxmi and Tārdeo) every year. Conditions have altered greatly since that time and suitable marshes no longer exist within town limits. The snipe have gone the way of the malarial mosquito.

The Pintail Snipe: *Capella stenura* (Bonaparte).

Field identification: See *supra*. In the hand it may readily be distinguished from the Fantail by the 26 or 28 attenuated pin feathers in the tail as against 12 to 14 normal ones in the Fantail.

Specimens: *B.N.H.S.*: ♂? December 1890 Bombay (E. L. Barton); ♀ 27-12-10 Bhāndūp (J. L. Symons); ♂ 25-1-13 Santa Cruz (N. B. Kinnear).

Noted and/or shot: Gōdhbunder, Vilé Parlé, Powāi Lake.

Winter visitor. Earliest date 24 September; latest 3 April. We agree with Inverarity who wrote in 1879 (*S.F.*, vii, 526) that about Thāna and on the snipe grounds across the Bombay Harbour the Pintail forms the majority in bags.

The Jack Snipe: *Lymnocryptes minima* Brunnich.

Field identification: Smaller than the Quail. Like the Common Snipe but with a metallic green and purple sheen on the back visible in the hand. Bill shorter than the Common Snipe's. Singly or wisps on marshy ground. Requires heavier cover in the nature of reeds and bulrushes than the Fantail or Pintail Snipe. Rises silently. Zig-zag flight less swift.

Specimens: *B.N.H.S.*: ♂ ♀ 25-1-05 Thāna (W. S. Millard); ♂ 8-1-10 Thāna (N. B. Kinnear); ♂ 3-12-23 Panvēl, Kolāba Dist. (P. M. D. Sanderson).

Noted and/or shot; Gōdhbunder, Vilé Parlé.

Winter visitor. Common.

The Little Cormorant: *Phalacrocorax niger* (Vieillot).

Mahrātti: *Pan-kaula.*

Field identification: Size about that of the Jungle Crow. All black. Long neck, stiff tail, slender bill sharply hooked at end. A water bird usually seen swimming, perched on a tree near water or sunning itself with open wings on some rock or stake. Singly or gregariously on tanks and lakes.

Specimen: *St. X. C.*: [132 ♀ 20-10-33 Rewās, Kolāba Dist. (H. A.)]

Noted: Tūlsi and Tānsa Lakes.

Resident. Not common.

Breeding: On 1 September (1935) H. A. found several pairs nesting on large trees in company with Night Herons in the midst of Thāna town. Most of the nests contained half fledged young. The nests are made of twigs and resemble those of the Crow. A normal clutch consists of 3 to 5 eggs, dirty chalky white, narrow and pointed at both ends.

The Indian Shag (*Phalacrocorax fuscicollis*) may also occur in our area. H. A. has doubtfully observed it at Kihim across the Harbour.

The Indian Darter or **Snake Bird**: *Anhinga melanogaster* Pennant.

Field identification: Size that of a small duck. A black bird with silver-grey streaks on the back, and brown head and neck. Chin and throat white, speckled with brown. Tail long and stiff. The long slender S-shaped neck, narrow head and pointed dagger-like bill are characteristic features of the Darter. When on the water only the snake-like neck and head are visible. In flight—attained by rapid wing beats as in the Cormorant—the thin neck is held outstretched. Perches in branches above water whence it tumbles down into it on alarm, diving and swimming away swiftly below the surface. Singly or small loose parties at tanks and lakes.

Resident? Not common. We have only observed occasional examples at Tūlsi and Powāi Lakes in Salsette. Also at Tānsa. Its food consists of fish which are chased and captured below the surface.

The Red Sea Masked Booby or **Gannet**: *Sula dactylatra melanops* Heuglin.

Field identification: Size that of a large duck. White all over except wings and tail which are chocolate brown. Naked skin of face dark slaty blue. Heavy pointed bill greenish yellow.

Specimens: *B.N.H.S.*: ♂? 25-7-02 Bombay Coast; ♂? 28-7-27 Parel, Bombay (C. Wood).

Straggler. Blown in periodically by gales of the South-west Monsoon. Other records from Bombay are:

2 specimens captured by E. R. H. Jackson of the Bombay Port Trust in 1909 and 1912 respectively (*J.B.N.H.S.*, xxi, 1334).

1 Uran 10-8-1914.

The Persian Shearwater: *Puffinus persicus* Hume.

In the B.N.H.S. Collection there is a specimen (♂?) obtained at Alibāg in July 1885 by W. F. Sinclair, presumably blown in by monsoon gales.

The Indian Spoonbill : *Platalea leucorodia major* (Temm. & Schlegel).

Field identification : A large snow-white egret-like bird with a distinctive flat spatula-shaped bill. Singly or flocks, by tanks, jheels and marshes.

Local visitor? Rare. H. A. observed it on the tidal mudflats near Avās (Kolāba Dist.) across the Harbour, on 21-10-32. It is not uncommon in Nasik District.

The White Stork : *Ciconia ciconia ciconia* (Linn.).

Field identification : A large long-necked, long-legged egret-like bird standing about 4 feet to the top of its head. White—with black wing-quills. Legs and the heavy pointed bill red. Singly, pairs or small parties on and about marshes.

Specimen : *B.N.H.S.* : ♂? 11-11-25 Kūrla (D. B. Baretto).

Noted : Sion mudflats (a solitary example 10-11-27). One seen from the train at Bassein (on mudflats).

Winter visitor. Rare.

The White-necked Stork : *Dissoura episcopa episcopa* (Bodd.).

Field identification : Similar to but smaller than the White Stork—standing about 3 ft. to top of head. Black except neck, abdomen and undertail which are white. The crown is black and looks like a padre's skull cap. Singly, by water or marsh.

S. A. observed a solitary example on the edge of Vihār Lake 16-3-24 and a pair on Sākar Creek, near Alibāg, in April 1930.

Local migrant. (Straggler?) Rare.

The Painted Stork : *Ibis leucocephala leucocephala* (Pennant).

Field identification : Size about that of the White Stork. White, closely barred and marked with metallic black above, and a black band across breast. Striking rose-pink about the shoulders. Long, pointed, heavy yellow bill slightly decurved near tip. Unfeathered yellow face. Pairs or parties, by tanks and marshes.

Specimen : *B.N.H.S.* : ♂?—Bombay Harbour (W. S. Millard).

Straggler. There are no other records and we have not come across this stork in our neighbourhood.

[**The Open-billed Stork** : *Anastomus oscitans* (Bodd.).

Field identification : Size small for stork. Greyish-white with black in wings. Distinctive reddish-black bill with the mandibles not fitting closely but leaving a narrow gap between them. Pairs or flocks, about tanks and marshes.

S. A. noted a couple at Vaishwi Tank near Alibāg town on 19 May 1930, and H. A. observed a large flock at Wassin (opposite Rewās) in Dharamtar Creek on 23-11-32. The birds were on a soft squelchy tidal mudflat in association with numerous ducks and waders.

Local migrant. Rare.]

The Eastern Purple Heron : *Ardea purpurea manillensis* Meyen.

Field identification : A large slender egret-like bird about the size of the Open-bill, with long thin S-shaped neck and pointed dagger bill. Bluish-grey and slaty with neck and head chiefly rufous. Breast and abdomen black and chestnut. A long black crest. Typical heron flight with neck drawn in and legs trailing behind, unlike storks and cranes which fly with neck extended. Solitary, usually standing in water at edge of reed-covered tank or on mudbank in creek, etc. Stalks along the edge of reed-beds in knee-deep water, peering intently into it with poised bill, 'freezes' suddenly and jabs its bill to snap up some fish or frog with lightning rapidity.

Specimen : *B.N.H.S.* : [♀ 2-12-12 Bassein, Thāna Dist. (R. dos Remedios)].

Noted : Powāi and Tūlsi Lakes.

Resident? Not common. No breeding record from our area.

The Common Grey Heron : *Ardea cinerea cinerea* (Linn.).

Field identification : Size and general effect as above but ashy-grey with whitish crown, neck and abdomen. Long black crest. A conspicuous black

and white line down middle of foreneck. Habits, etc. same as of the Purple Heron.

Noted: Powāi Lake (on reedy shallow margin); Gōdhbunder Creek (in mangroves and tidal mud along banks); Kihim (on rocky seashore).

Resident? Not common. No breeding record from our area.

The Large Egret: *Egretta alba* subspecies?

Field identification: Size about that of the Heron. Pure white, with black bill, legs and feet. Solitary, at edge of tanks and creeks.

Noted: Powāi Lake: Rewās (Kolāba Dist.).

Status? Rare. The note, usually uttered in flight, is a harsh *Kraa-krr*. Navarro found this bird breeding with *E. intermedia*, *A. grayii* and *E. garzetta* at Karjat in July.

The Indian Smaller Egret: *Egretta intermedia intermedia* (Wagler).

Field identification: Like the Large Egret but smaller. Usually gregariously in same biotope as last.

Noted: Powāi and Tūlsi Lakes. Rewas (Dharamtar Creek) Kolāba Dist.

Resident. Fairly common.

Breeding: By the middle of May the birds have commenced putting on their dainty ornamental breeding plumes on the head, breast and back. We have no breeding record in our area, but Barnes (*J.B.N.H.S.*, vi, 142) found nests on a tree near 'Wassind' (Vāsind) Station on the G.I.P. Railway, about 50 miles from Bombay, in July. The birds nest in colonies, building crow-like twig nests in trees, either by themselves or in association with herons and storks. The normal clutch consists of 4 pale bluish-green eggs.

The Little Egret: *Egretta garzetta garzetta* (Linn.).

Field identification: Smallest of the three. Size that of the more familiar Cattle Egret. Pure white in colour and a small replica of the preceding two in all respects. Usually flocks in same biotope and often in association with the Smaller Egret.

Specimen: *B.N.H.S.*: [♂ 12-5-18 Kihim (S. H. Prater)].

Noted: Powāi and Tūlsi Lakes, Gōdhbunder; Rewās.

Resident. Fairly common.

Breeding: Barnes (*J.B.N.H.S.*, vi, 144) records a large colony nesting in a tree near Vāsind village (G.I.P. Railway—ca 50 miles from Bombay) in July. In the same tree were also nesting Cattle Egrets and Paddy Birds. The nests are similar to those of the foregoing species, the eggs differing only in being smaller. There are several mixed egret colonies round Bombay, e.g. Vajrabai Hot Spring, Karjat; and further observation might produce interesting information. Some years ago these egrets used to be extensively and lucratively farmed in Sind for the sake of their ornamental breeding plumes. With the change in women's fashions, egret feathers no longer carry the same demand, and prices have also dwindled accordingly. But some small farms exist even to this day. Egret farming could still become a profitable cottage industry if export of farm produced feathers to foreign countries were licensed and their production properly organised and controlled. A good account of Egret Farming in Sind will be found on pages 748-749 of vol. xxviii of this *Journal*.

The Cattle Egret: *Bubulcus ibis coromandus* (Bodd.).

Mahrātī: *Gochandi-khao*; Hind.: *Gāi-bagla*.

Field identification: A familiar lanky bird about the size of a country hen with longish, pointed yellow bill. In young birds the bills are black and they are then easily confused with the Little Egret. Pure white and very like the Little Egret except in the breeding season when it acquires golden buff plumes on head, neck and back. Gregarious; usually in attendance on grazing cattle, snapping up grasshoppers, etc. disturbed in the animals' progress. Often far from water.

Specimen: *B.N.H.S.*: ♀? 8-9-18 Bhyandar (A. P. Kinloch).

Noted: *City*: Bhūleshwar, Khētwadi (1912), Chowpāti, Malabār Hill, Mahāluxmi; *Suburbs and Salsette*: Bandra, Khār, Chembūr, Powāi Lake, Gōdhbunder, etc.

Resident. Common. S. A. has observed an individual for days at Bhūleshwar, in the heart of the bustling bazaar, on a tree partly overhanging a half dry temple tank and partly a halwai's shop. The bird spent its time picking off the flies disturbed off the sweetmeats in the stall beneath from time to time and alighting on the tree for respite! Flies appear to be greatly relished. We have noted another individual at Chowpāti who was in the regular habit of eating flies off a toddy pot hung on a tapped cocoanut palm for collecting the juice.

Breeding: By the first week in May, many birds have already donned their golden breeding dress, and by the end of that month this is general. Building operations commence by about the middle of May and nesting continues till August. The birds nest in colonies selecting some large tamarind or other tree, in or near a village, for the purpose. This tree is usually shared by Paddy Birds and Little Egrets. We have noted such nest colonies opposite Bandra railway station, in Andhēri bazaar, in Borivli village, and at Mahāluxmi. The same trees are used for several years in succession. 15 to 25 nests is not an unusual number for a colony. The nests are untidy twig structures like those of the Crow. Three to five eggs form a normal clutch. They are a pale skim milk blue in colour.

The stomach of a fledgling examined was packed with grasshopper remains, a small crab and about 200 Blue-bottle flies (*Musca vomitoria*).

Barnes (*J.B.N.H.S.*, vi, 142) found the Cattle Egret nesting at Vāsind (G.I.P. Railway) in July.

The Indian Reef Heron: *Demiegretta asha* (Sykes).

Field identification: Size about the same as, or slightly larger than the Cattle Egret. Very similar in general effect to the Small Egret but found in 2 colour phases: (1) White, (2) Slaty-grey. Occasional birds are intermediate being partly white and partly grey. Singly or pairs about rocky seashore, mangrove-lined creeks and tidal mudflats.

Specimen: *B.N.H.S.*: [21-11-10 Panvēl, Kolāba Dist. (N. B. Kinnear)]

Noted: Mahim, Andhēri, Bhyandar, Mahūl, Kihim, Rewās, Hornby Vellard.

Status? Our records are only between 18 October and 20 May. Not uncommon but sparingly.

The Indian Pond Heron or **Paddy-Bird**: *Ardeola grayii* (Sykes).

Field identification: Size about the same as or slightly less than the Cattle Egret. Most of the plumage white, concealed by an earth-brown mantle so that when at rest on the edge of a tank the bird is almost invisible. As soon as it rises, however,—usually with a croak—the white wings, back and underparts flash into prominence. Singly or gregariously at every piece of water-pool, puddle or tank, inundated paddy-field, creek or on the seashore. Especially fond of village tanks in the process of drying up.

Specimen: *B.N.H.S.*: ♂ juv. 14-7-13 Colāba, Bombay (S. H. Prater).

Resident. Very common. Its food consists for the most part of frogs. Its normal method of hunting is to wade into water or stand poised on the edge as still as a dummy and dart at any prey coming within striking range.

Breeding: By about the middle of April the birds commence to don their nuptial plumage. The back becomes rich maroon. A long white occipital crest is developed and the legs and feet—normally greenish-yellow—assume a beautiful salmon-pink tint. By the middle of June the majority of birds are in full breeding dress. Most nests are found between July and September. Paddy-birds breed in colonies in association with other egrets and Night-Herons. Their nests are untidy platforms of twigs like those of the Crow, built in large trees such as tamarind or mango. We have observed nest colonies at Bandra (opposite railway station), Victoria Gardens (Byculla), and in the midst of Thana town. Barnes (*J.B.N.H.S.*, vi, 142) found nests at Vāsind (about 50 miles from Bombay) in July. A normal clutch consists of 3 or 4—rarely 5—pale greenish-blue eggs.

The Indian Little Green Heron: *Butorides striatus javanicus* (Horsf.).

Field identification: Slightly smaller than the Paddy-bird. Above slaty or blackish-grey glossed with bronze green; below paler grey. Singly by rocky

or mangrove-lined tidal creeks, pools, etc. Occasionally found at rocky hill streams.

Specimens: *B.N.H.S.*: ♂ 3-11-20 Kennery Island, Bombay Harbour (V. S. La Personne); 3 nestlings 30-5-37 Gōdhbunder (C. McCann).

Noted: Mahūl, Andhēri, Powāi and Tūlsi Lakes.

Resident. Fairly common, but unobtrusive. The stomach of a specimen contained shrimps and mudfish (*newtas*).

Breeding: On 30 May Mr. C. McCann found a nest in a mangrove bush near Gōdhbunder Creek. In structure it was like that of the Paddy-bird. It contained 3 young in down—with the wing quills sprouting—which were able to clamber about the branches.

The Night Heron: *Nycticorax nycticorax nycticorax* Linn.

Mahrātti: *Raat-baggal* or *Raat-koku*.

Field identification: Larger than the Paddy-bird. Of the same general effect, but with an appreciably stouter bill. An ashy-grey bird with black crown, nape and long crest at back of head, the last with some white feathers in it. Lower parts chiefly whitish. Young birds are brown, streaked with rufous. Their underparts are white broadly streaked with dark brown. Colonies, roosting in favourite large trees during the day and flying out in parties at sunset with loud raucous *kwaaks* to feed at tanks and creeks.

Specimens: *B.N.H.S.*: ♂ 28-7-14 Carnac Bunder, Bombay (Counsell); ♀ 27-11-99 Hog Island, Bombay Harbour (E. Comber).

Hume (*S.F.*, iv, 415) disturbed a large colony on Elephanta Island and shot a few in January 1875.

Resident. Common. Considered finest 'game bird' in Salsette and much persecuted by local 'sportsmen'!

Breeding: The Night Heron nests in colonies which often extend over several adjacent trees, between June and September. They build the usual twig nests of the Crow pattern often sparsely lined with leaves. We have records of large colonies on *Pithecolobium* trees in Victoria Gardens, Bombay, and in Thāna town where almost every available Banyan and Peepal tree is utilised. The eggs—usually 3 or 4—are pale greenish-blue in colour. The young birds soon leave the nest and clamber about the neighbouring branches keeping up an incessant *click, click, click*, etc. The din which a nesting colony at this stage produces can be heard fully half a mile away.

Stomachs of fledgling Night Herons examined by us contained among other things a fresh unbroken Night Heron egg, a leg of embryo of same, remains of *Gerardia praevestiana* and shrimps, etc.

Barnes (*J.B.N.H.S.*, vi, 415) found the Night Heron breeding on islets in the Vihār Lake, and at Elephanta, in August.

The Yellow Bittern: *Ixobrychus sinensis sinensis* (Gmelin).

Field identification: Somewhat smaller and slenderer than the Paddy-bird but of the same general effect. Yellow, brown, rufous and chestnut predominating in plumage. Black crest. Singly, by edge or reedy swamps and occasionally mangrove-lined creeks. Unobtrusive, creeping away surreptitiously when suspicious.

Specimens: *B.N.H.S.*: ♂ 25-1-09 Thāna (N. B. Kinnear); *St X. C.*: 268 ♂ juv. 21-11-36 Powāi Lake (H. A.).

Resident. Not common.

The Chestnut Bittern: *Ixobrychus cinnamomeus* (Gmelin).

Field identification: Similar to above, but with upper parts chestnut-cinnamon, lower pale chestnut. Habits, etc. same as of the Yellow Bittern.

Noted: Powāi Lake; Kihim (Kolāba Dist.).

Fairly common among the reeds at Powāi Lake. Inverarity (*J.B.N.H.S.*, ii, 45) shot them at Gōdhbunder and also one near Pemm (Kolāba Dist.) on 28-11-1886.

Breeding: H. A. observed a bird carrying twigs on two consecutive days in August, near Powāi but failed to find the nest. Navarro has found several nests at Khandala and Karjat during May, June and July.

The Bittern : *Botaurus stellaris stellaris* (Linn.).

Field identification : Considerably larger than the Paddy-bird. Short, stout, pointed bill and large feet. A buff coloured bird of the general effect of the Paddy-bird with black back and blackish streaks and barring on rump and in the lower plumage. Singly, in reed beds and shrubbery on marshes.

Specimen : *B.N.H.S.* : ♀ 4-12-16 near Thāna (A. F. Forbes).

Winter visitor. Rare. We have not come across the Bittern in our area, but J. D. Inverarity (*S.F.*, vii, 526, 1879) believed it to be not uncommon, though seldom seen. In 8 years he had only seen three. One he shot on 22-10-1877 on the 'Flats' half a mile from Byculla Club, close to the railway and 'within 200 yards of the Foras Road which crosses the flat from Bombay to Worlee'. The second he saw on 12-1-1878 on Bhiwandi Tank and the third he shot on 24-2-1878 at Panvēl. He also saw several others subsequently (*J.B.N.H.S.*, ii, 44). Mr. Kotwal shot a specimen at Parle on the 3rd January 1939.

The Flamingo : *Phoenicopterus ruber antiquorum* Temm.

Marāthi : *Rohi*.

EHA (*C.B.B.*, 167) records seeing an example not far from Hog Island in Bombay Harbour. In April and May 1930 two flocks (or the same flock?) of about 12 birds were observed at Alibāg and Kihim (Kolāba Dist.), respectively flying along the seashore in a northerly direction. There are several other records for May and this bird is probably a common passage migrant.

The Lesser Flamingo : *Phoeniconaias minor* (Geoffr.).

In the old card catalogue of birds in the B.N.H.S. Collection, prepared by Mr. N. B. Kinnear, there is listed a specimen ♀ 2-1-1898 Thāna (J. Mason). We have not seen the specimen and have no further details.

The Nukta or **Comb Duck** : *Sarkidiornis melanotus* (Pennant).

Field identification : Larger than the domestic duck. Black above glossed with green and blue; white below. Head and neck white speckled with black. A comb or knob at forehead near base of bill in the male.

Inverarity (*J.B.N.H.S.*, ii, 45) records the shooting of a solitary young of the year at Penn (Kolāba Dist.) on 28-11-1887. We know of one other shot at Kihim (Kolāba Dist.) in May a few years ago.

Local straggler.

The Cotton Teal : *Nettapus coromandelianus* (Gmelin).

Field identification : The smallest of our ducks. Size between the Pigeon and the Jungle Crow. Rather similar in colouration to the Nukta. Bill goose-like, not as flat as the duck's. In flight whitish edge of wing conspicuous in male.

Specimens : [♂ ♀ 7-12-09 Daman Road, B.B. & C.I. Rly. (R. L. Sinclair)].

Noted : A pair on Powāi Lake 30-11-34 (H. A.). Inverarity (*J.B.N.H.S.*, ii, 46—1887) saw large flocks at Neral below Matheran. One shot near Karjat.

Status? Probably local straggler. Rare.

The Lesser or **Common Whistling Teal** : *Dendrocygna javanica* (Horsf.).

Field identification : Smaller than the domestic duck. A chestnut coloured duck confusable with no other of the same size. Small flocks. Shrill whistling notes constantly uttered on the wing distinctive. Flight rather feeble and unducklike, reminiscent of the Jacanas.

Specimens : *B.N.H.S.* : ♂? 22-5-26 Mahadalla Tank, Malād (E. Henricks); [♂ 29-11-15 Kalyan (W. S. Millard)].

Noted : Powāi Lake, Irla; Kihim (Kolāba Dist.) on rocks on seashore! A flight of about 40 birds was seen at Hornby Vellārd on 6-11-38. They settled out in the bay well out of range, but passing the same way a couple of hours later, we saw a swimmer trying to retrieve two winged birds, and a man with a gun watching the proceedings. It may be an achievement to shoot wild duck in Bombay City, but unless some sanctuary is allowed to game birds (especially a resident species) we shall soon be exterminating them.

Resident? Uncommon and in small numbers. Possibly breeds around Powāi Lake.

The Sheldrake : *Tadorna tadorna* (Linn.).

Mr. C. McCann observed a small party on Tūlsi Lake some years ago. Other records from the Deccan show that this bird occasionally straggles further south.

The Ruddy Sheldrake or **Brahminy Duck :** *Casarca ferruginea* (Voeg.).

Hindustāni : *Chakwa.*

Field identification : Larger than the domestic duck. Orange brown with a shiny green patch on the predominatingly black and white wings. Head and neck buff. Pairs or small parties.

W. F. Sinclair (*J.B.N.H.S.*, i, 166) observed a pair in Bombay Harbour (ca. 1886). H. A. noted a party of 4 at a brackish pool on a tidal mudflat near Rewās (Kolāba Dist.) on 22-11-32.

Winter visitor. Straggler? It is common round Nasik and in the Deccan.

The Mallard : *Anas platyrhyncha* Linn.

Field identification : The ancestor of our domestic duck, equal to it in size and same in colouration as the green-headed plumage often seen. The female is dark brown with buff streaks producing a game bird pattern.

The only records of its occurrence we have are (1) that of E. H. Aitken (*J.B.N.H.S.*, xiii, 398) who says that owing to the severe drought in Gujerat and the Deccan a few were seen about Bombay in the winter of 1900 (2) Sinclair (*J.B.N.H.S.*, iii, 71) has recorded one from Nagotna in Dharamtar Creek (3) One was shot near Panvēl on 17 November (*J.B.N.H.S.*, xxix, 1052).

The Spot-bill or Grey Duck : *Anas poecilorhyncha poecilorhyncha* Forster.

Field identification : Size that of the domestic duck. Rather like the female Mallard in colouration with some white in the wings and two orange-red spots at base of bill on either side of forehead.

Specimen : *B.N.H.S.* : [o? 7-12-09 Daman Road, B.B. & C.I. Rly. (R. L. Sinclair).].

Straggler. Aitken (*J.B.N.H.S.*, xiii, 398) mentions the Spotbill occurring in or near Bombay in the winter of 1900 due to the drought in Gujerat and the Deccan. S. A. observed a party of 4 birds flying over Kihim (Kolāba Dist.) on 1-10-30.

The Gadwall : *Chaulelasmus streperus* (Linn.).

Field identification : Smaller than the domestic duck. General aspect of plumage pale brownish-grey with rufous head and neck. A black-and-white wing-bar particularly conspicuous in flight, and a chestnut patch on wing. Underside white. Female : mottled dark and light brown with whitish underparts and wing-bar as in male.

Specimens : *B.N.H.S.* : [♂ ♀ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear); ♀ 15-6-90 Alībāg (W. F. Sinclair).]

Noted and/ or shot : Andhēri, Chembūr ('kutchra-patti'), Trombay ; Kihim

Winter visitor, in small numbers. Not uncommon. Of bags of 14 and 7 ducks made near Chembūr, two and three respectively were Gadwall.

The Wigeon : *Mareca penelope* (Linn.).

Field identification : Smaller than the domestic duck. General aspect pencilled grey. Chestnut head with cream coloured patch on its forepart, combined with the brownish-pink breast and the blue-grey bill suffices to identify the male. Female rather like the female Gadwall but lacks the wing-bar. The blue-grey bill is a diagnostic character in both sexes.

Specimen : *B.N.H.S.* : [♂ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear).]

Noted and/ or shot : Santa Cruz ; Kihim.

Winter visitor. Uncommon.

The Common Teal : *Nettion crecca crecca* (Linn.).

Field identification : Our second smallest duck, only slightly bigger than the Cotton Teal. Male : pencilled greyish colour. Chestnut head with a broad

metallic green band running through the eye, lined on either side with whitish. A tri-coloured wing-bar—black, green and buff—especially conspicuous in flight. Female rather like female Gadwall with a metallic green and black wing-bar.

Specimen: *B.N.H.S.*: ♀ 7-10-24 Lamzai, near Kūrla (D. B. Baretto).

Noted and/ or shot; Andhēri, Santa Cruz, Bassein, Thāna, Gōdhbunder, Tūlsi Lake; Naugaon (Kolāba Dist.).

Winter visitor, in small numbers. Not uncommon.

The Pintail: *Dafila acuta* (Linn.).

Field identification: Slightly smaller than the domestic duck. Male; upper plumage pencilled greyish. Head brown with a white band on either side running down into the white neck and underparts. Its chief characteristic is the long, pointed pin-like central tail feathers which extend beyond the tail. The elongated body, the long slender neck and pointed tail usually help to recognise the drake. Female: mottled brown and buff. In general rather like the females of the Gadwall and Wigeon but slenderer in build.

Specimens: *B.N.H.S.*: [♀ 26-12-09 Panvēl, Kolāba Dist. (N. B. Kinnear).]

Noted and/ or shot: Bassein (Thāna Dist.), Chembūr, Trombay ('Kutchra-patti'), Kihim.

Winter visitor in small numbers. H. A. has observed a small flock among the rocks on the seashore at Kihim (Kolāba Dist.).

The Garganey or **Blue-winged Teal**: *Querquedula querquedula* (Linn.).

Field identification: Slightly larger than the Common Teal. Male recognisable by his pink-brown white-speckled head with the broad conspicuous white eyebrow and by the bluish-grey on his wing shoulders. The female resembles the females of so many ducks of the same size that without some practice it is difficult to recognise her by herself.

Specimen: *B.N.H.S.*: ♂ 7-12-09 Daman Road, B.B. & C.I. Railway. (R. L. Sinclair).

Noted and/ or shot: Naugaon and Rewās (Kolāba Dist.).

Winter visitor. Not common.

The Shoveller: *Spatula clypeata* (Linn.).

Field identification: Somewhat smaller than the domestic duck. More characteristic than its plumage and unfailing as a recognition mark is its peculiar flat shovel-shaped bill, considerably broader at tip than at base. This is possessed by both sexes though they differ considerably in colouration.

Specimen: *B.N.H.S.*: ♂ 5-12-99 'Thāna' (purchased).

Noted and/ or shot: Trombay ('Kutchra-patti'), Rewās (Dharamtar Creek), Waklan (near Mumbra), Alibāg (Vaishwi Tank).

Winter visitor in small numbers. Not uncommon. Latest date 19 May.

The Red-headed Pochard or **Dun Bird**: *Nyroca ferina ferina* (Linn.).

Field identification: A squat duck, somewhat smaller than the domestic bird, recognisable by its rotund shape and the conspicuous tri-coloured plumage of the male—head chestnut; breast, rump and hind parts black; body pencilled grey. The female is predominantly dirty grey-brown.

Specimen: *B.N.H.S.*: ♀ 8-10-93 Bombay Harbour (W. S. Millard).

Noted and/ or shot: Bassein, Chembūr, Powāi Lake.

Winter visitor in small numbers. Not uncommon. Out of 2 bags of 7 and 14 duck, one and 2 respectively were of this species.

The White-eyed Pochard: *Nyroca rufa rufa* Linn.

Field identification: Smaller than the domestic duck. General aspect of plumage rufous-brown and blackish-brown with a whitish wing-bar. Abdomen white. Female duller coloured.

Specimen: *B.N.H.S.*: ♀ 17-11-08 Andhēri (N. B. Kinnear).

Noted and/ or shot: Kihim and Alibāg (Kolāba Dist.).

Winter visitor. Not uncommon as wildfowl go in our area. In the cold weather of 1931 we observed fairly large flocks floating on the sea not far from the shore (at Kihim) but always well out of gunshot. At dusk—often

after it was quite dark—the birds regularly flighted inland in parties and in twos and threes taking the same route every evening. Similarly, W. F. Sinclair (*J.B.N.H.S.*, xiii, 191) writes: 'This is *the* sea duck of Alibāg Coast, where flocks not exceeding 50 were constantly to be observed in winter. They generally rode just outside the surf where they were safe from disturbance from passing boats. It is likely that they used the sea as refuge during the day and fed inland at night.'

The Scaup : *Nyroca marila marila* (Linn.).

Aberrant straggler. J. D. Inverarity (*J.B.N.H.S.*, ii, 45) shot a female on a small tank near Panvēl on 13-1-1884. No other record.

The Tufted Pochard : *Nyroca fuligula fuligula* (Linn.).

Field identification : Size and rotund shape of the Red-headed Pochard. Male black and white with a conspicuous black tuft at back of head of same colour. Female like male but brown where he is black and lacking the crest.

Specimen : *B.N.H.S.* : ♂ 5-12-99 Thāna.

Noted : Alibāg (Vaishwi Tank). Inverarity (*J.B.N.H.S.*, ii, 45) records it near Penn, Kolāba Dist., on 28-11-1887.

Winter visitor. Scarce. Latest date 14 March. Most duck visiting or passing over Bombay and the surrounding neighbourhood, take refuge on the sea during day time, and flight in to feed in the evening. Even the essentially fresh water duck like Wigeon and Pintail are often seen beyond the surf during the day.

The Goosander : *Mergus merganser merganser* Linn.

Aberrant straggler. E. H. Aitken (*J.B.N.H.S.*, ii, 56) shot one (either ♀ or immature ♂) on 2-12-1886 at Shewa on the east side of, and across Bombay Harbour. It was playing along in a shallow sheet of water forming a reservoir of the salt works. No other record.

The Little Grebe or Dabchick : *Podiceps ruficollis capensis* Salvadori.

Mahrātti : *Pān-būrki.*

Field identification : Size about that of the Pigeon. A drab coloured water bird with short pointed bill and practically no tail. Gregariously, on village tanks, etc. swimming about in open water or among the floating weeds, and diving at the least suspicion.

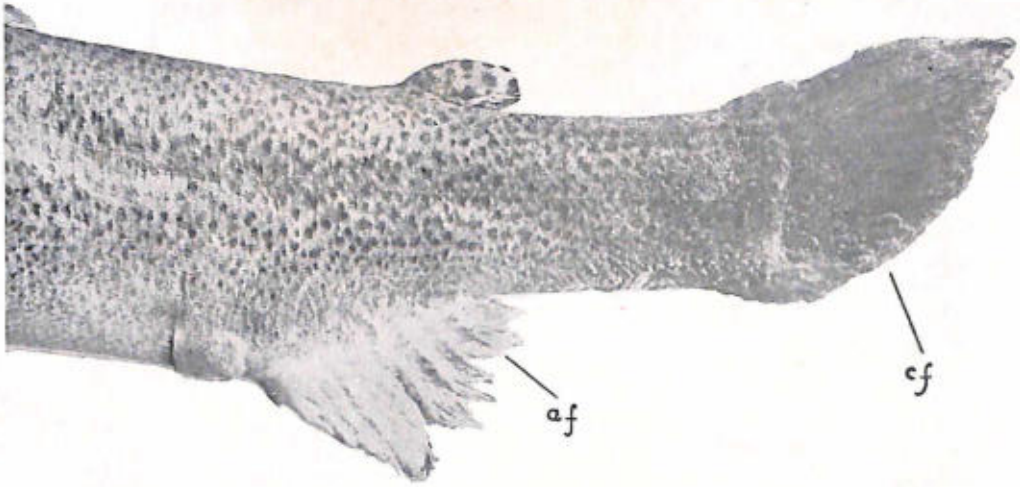
Specimens : *B.N.H.S.* : ♂ 12-3-93 Thāna (J. M. Mason); ♀ 19-11-17 Kūrla (S. H. Prater); ♂ 6-12-18 Colāba Cove, Bombay Harbour (J. A. D. McBain).

Noted : Dhobi Talao, Gwālia Tank and Babulla Tank (Mazagon) before they were filled up; Mahāluxmi, Parēl, Andhēri, Chembūr, Powāi Lake, etc.

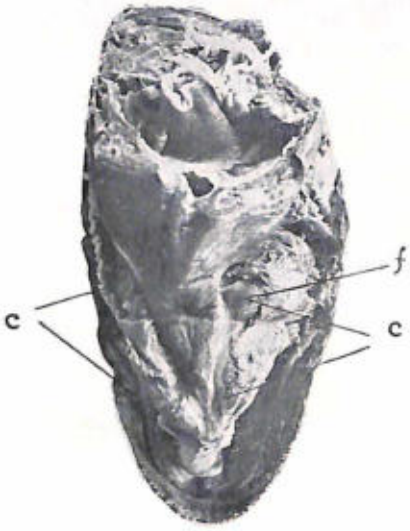
Resident. Common. Present on practically every village tank and congregating on larger sheets of water as the former gradually dry up in the hot weather. Thus on Vaishwi Tank, which provides the water supply to Alibāg town, S. A. counted 132 individuals on 19 May (1930) when most of the smaller tanks in the neighbourhood were quite or almost dry. A couple of months previously the number of Dabchicks on this tank had been considerably smaller. The call is a sharp tittering often heard when the birds are disporting themselves of an evening. They can seldom be induced to fly. On taking alarm they either dive below or patter along the surface for some distance vibrating their diminutive wings rapidly. When once started on the wing, however, they fly well and often for considerable distances. Their food consists of water insects and their larvae, tadpoles and small crustaceans.

Breeding : The season is not sharply defined. H. A. found a nest in a mill pond at Mahaluxmi in September, and another on the village tank at Kihim (Kolāba Dist.) in October. Fry (*J.B.N.H.S.*, xxi, 275) took 3 clutches of eggs from the 'Mahaluxmi Pond' between 16 November and 31 March. On 22-11-34 H. A. observed a juvenile in downy striped plumage with red beak on Konkan Tank, not far from Mumbra (Thāna Dist.). The nest is a rough pad of sodden weeds placed on floating vegetation. A normal clutch consists of 3 to 5 eggs. These are white at first but soon get discoloured to dirty brownish by the constant soaking and contact wih the sodden weeds.

THE END.



1.



2.



3.

Fig. 1.—Rainbow Trout showing Fin-rot on the caudal and anal fins. Stumpy caudal fin (*cf*) and frayed anal fin (*af*) are noteworthy.

Fig. 2.—Rainbow Trout with Carcinoma of Thyroid. Atrophied gill filaments (*f*) are seen attached to the tumours (*c*).

Fig. 3.—Brown Trout with Carcinoma of Thyroid (*c*).

NOTES ON THE DISEASES OF TROUT AT THE MAHILI HATCHERY—KULU (PUNJAB).

BY

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(*With a plate*).

Little attention has so far been given to the diseases of trout in its Indian habitats. The control of parasitic and other diseases is a problem of considerable importance. Under domestication, i.e. when herded together and fed on artificial food, trout, like all other animals, fall victims to parasites and contract diseases.

Gaschott (1931) has given an account of the various diseases, to which trout are susceptible, and has dealt with their diagnosis and treatment. Davis (1936) has dealt with internal and external parasites of trout and such other diseases as Fungus, Pop-eye, Thyroid tumour, Intestinal inflammation, White spot disease, Blue sac disease and Soft egg disease. Moore (1923, 1924) has made a study of diseases of fish in State Hatcheries in New York. Carcinoma of Thyroid in the Salmonoid Fish has received an exhaustive treatment in the well illustrated paper by Gaylord and Marsh (1914). Several other investigators, both in Europe and America, have made a study of the various parasites and diseases of trout and other fish and dealt with their control and treatment.

A systematic study of the diseases of trout, it is regretted, has not been made on account of lack of facilities, and in the present paper an account of such diseases as have come to our notice at the Punjab Government Trout Hatchery at Mahili (Kulu) is presented.

The diseased trout were obtained from the Hatchery and most of this material was received preserved in 5 per cent formalin. In a few cases alive sick fish were also examined. Of the two species, Rainbow Trout and Brown Trout cultivated at the Mahili Hatchery, the former has suffered far more acutely from parasites and other diseases than the latter.

The commoner diseases at the Mahili Hatchery have been Fin-rot, Carcinoma of Thyroid, Inflammation of Intestine, and Fungus.

Fin-rot or Tail-rot or Fin-disease was first noticed at the Hatchery in August 1929 among Rainbow Trout, and it appeared in an epidemic form. The diseased fish had grown sluggish and dark in colour. The dying fish came to the surface, gasped for air, turned upside down and after a few hours died. Both in the adult and in the fingerlings the caudal fin had lost its rays and had been reduced to a stump (Fig. 1). In most of the cases dorsal,

pectoral and anal fins had also been affected and showed naked fin rays without any covering of epidermis.[1]

Fin-rot is caused by a rod-shaped bacterium which can usually be found in large numbers in the infected fins (Davis 1936). The infection usually starts from the outer margin of the fin, where the epidermis becomes thickened and forms a white line, visible externally across the fin. The fin rays are also attacked and soon become frayed and broken. Sometimes only a portion of the fin is destroyed, and in other cases the outer half or two-thirds is destroyed.

The young fingerlings usually die before the infection has spread to the underlying tissues; while in the adults the tissues at the base of the fins are also affected. The disease varies greatly in its intensity. Among the fry the mortality is always heavy. Among adults recovery is possible though the fins retain their stumpy appearance. According to Davis (1936) 'the fins regenerate more or less completely'. No such regeneration of the fins, however, has so far been noticed among the fish which have recovered at the Mahili Hatchery.

According to Davis (1936) 'little information has been obtained regarding the factors that tend to bring an outbreak of the disease'. At the Mahili Hatchery, however, it has been definitely observed that fish and fry reared in clear spring water remain unaffected; while those reared in ponds fed by river water, which brings in silt during the floods, always suffer from an attack of Fin-rot soon after the monsoon rains. At Madhopur Farm, too, flood water in July was directly responsible for the outbreak of this disease among Rainbow Trout fry.

Control.—A salt bath instead of producing any healing effect, seemed to hasten the death of the sick fish at the hatchery. Davis (1936) recommends baths of a solution of copper sulphate, 1 : 2,000, for one or two minutes. But it is too strong a solution to be administered by unskilled hands either to adult fish or to fingerlings. A bath of 1 : 20,000 solution of copper sulphate for 10 to 15 minutes however, proved efficacious in early stages of the disease. The bath was repeated daily and healed the fins within a fortnight. The fish in which the disease had advanced did not survive. The warm water bath, recommended by Taplin (1932), proved beneficial during winter. The fish from the hatchery pond, where the range of temperature was 38°F. to 48°F., were transferred to a spring fed pond with a temperature ranging from 55°F. to 58°F. and were cured of the disease completely.

Carcinoma, Thyroid tumour or *Goitre* in trout is said to be analogous to goitre in man (Davis 1936). It is, therefore, interesting to note that in the Kangra District, where Mahili Trout Hatchery is located, human beings, too, suffer from goitre.

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[1] Dr. W. Rushton (Fishmongers Hall, London), to whom the diseased Rainbow Trout were sent for examination, reported that 'No external lesions could be found or any features, which point to, or suggest, that the fish had died from "furunculosis" . . .'

Note.—Furunculosis is another bacterial disease, the most characteristic symptom of which is the presence of open sores on the body (Davis 1936).

The disease has not so far been noticed in an epidemic form at the Hatchery. Only occasionally one or two fish have suffered. The tumours of thyroid, in the diseased fish examined (Figs. 2 and 3), were located at the junction of the first and second pair of gill arches, on either side, and also between the third and the fourth gill arches. The former pair of tumours were visible internally too, on the floor of the mouth. Atrophied gill filaments were seen attached to the tumours.

The primary cause of thyroid tumour is now generally considered to be a deficiency of iodine, which is essential to the proper functioning of the thyroid gland (Davis 1936). Overcrowding, a limited supply of water, and insanitary condition in the ponds also appear to be important contributing factors.

The diseased fish linger on for months and months, and it is only when the tumour has enlarged to such an extent that it has spread into the gill arches, that the blood vessels cease to function and in portions the circulation is stopped and the fish dies.

Control.—At the Mahili Hatchery the fish in which the disease was noticed in an advanced stage were always killed. In the early stages of the disease a weak bath of iodine (potassium iodide) in 1 : 1,000,000 strength has given satisfactory results, and the fish recovered. Gaylord and Marsh (1914) recommend the administration of the following chemical baths: iodine (potassium iodide) 1 : 1,000,000; arsenic (arsenic oxide) 1 : 3,000,000, and mercury (mercuric chloride) 1 : 5,000,000. Davis recommends (1936) addition of iodine directly to the food: a table-spoonful of 1 per cent iodine dissolved in 1 per cent solution of potassium iodide 'thoroughly mixed with about 50 pounds of ground food is sufficient to keep the fish from showing any trace of thyroid tumour'.

Intestinal Inflammation: Most of the Rainbow Trout attacked by Fin-rot at the Hatchery suffered from inflammation of the intestine as well. In 1929 when the epidemic of Fin-rot appeared, the fish, as an economical measure, were being fed on 75 per cent oat flour and 25 per cent dried fish. It was rather expecting too much from these carnivorous fish to maintain their vitality on such a poor diet. The diseased fish had grown dark in colour, refused to take any food and sought the corners of the pond. The intestine was inflamed and contained only mucus. One Brown Trout that died in February 1930 had a large tumour in the intestine which filled up the entire lumen.

The disease is apparently caused by unsuitable food. Change of diet, recourse to natural food, such as aquatic insect larvae, worms, snails, slugs and a large proportion of meat in their diet improves the condition of the fish.

Fungus or *Saprolegnia* has so far not caused any serious damage at the Hatchery. *Saprolegnia* readily attacks dead eggs, dead fry or any dead organic matter lying in the rearing or hatching boxes. Adults are attacked by the fungus when they have been handled roughly, especially after the stripping season. It appears as tuft of white threads—mycelial filaments—on any part of the fish after

some physical injury, and its filaments soon spread into the underlying tissues.

Control.—A 3 per cent solution of common salt for 5 to 10 minutes or until fish show signs of distress, has so far proved very efficacious. Patches of skin overgrown with fungus, when rubbed gently with cotton soaked in a 1 : 2,000 copper sulphate solution or solution of common salt in vinegar or iodine, have effected speedy recovery. The most effective remedy to prevent an attack of fungus is to remove the root cause of the disease. Daily picking of dead eggs, cleaning all the troughs and hatching trays, regular salt baths for the fish, after they have been handled, have always proved effective against an attack of fungus.

The writer had an experience of a very striking example of *Saprolegnia* growth on Carp. In a Carp Farm in the Punjab the fish were confined to a portion of tank with a wire netting screen as a partition. Whenever fresh water was let into the tank, the fish rubbed their heads against the wire netting attempting to escape towards the inflowing current. They consequently received injuries on their lips, mouth and head, where fungus appeared in profusion and the fish began to die in large numbers. The wire netting screen was at once removed, the diseased fish were given salt baths and in a very short time recovered.

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NOTES ON BUTTERFLIES OF THE SHAN STATES, BURMA.

BY

CAPT. W. C. CARROTT.

I have recently been reading through the back numbers of the *Journal* from vol. x, 1895, and to my surprise I have not noticed any account or list of the butterflies of this very interesting part of Burma.

While I have not covered all of the Shan States during my fifteen years of collecting I think I may claim to have a fairly good representative collection of butterflies from this area.

The Shan States covers a large amount of the hilly country in Upper Burma. The highest elevation reaches about 6,000 feet above sea level. Both the Southern and Northern sections are reached either by rail or road. The railway terminates at Lashio in the North and Shwenyaung in the South. Beyond these railheads are fairly good second class roads up to the Chinese border. It is not advisable, however, to travel by car far beyond the railheads in the rainy season. In the dry season the roads are in good condition in so far as second class roads can be made good and one can motor through what I consider to be one of the most interesting countries in the world. The scenery is beautiful beyond description and the different tribes vary as does the scenery. The motorist passes through rolling downs, dense jungle and lovely pine woods with a lake dotted here and there in the course of one morning's drive.

In the *Identification of Indian Butterflies* the author, referring to Burma, says that 'in many ways the Thandaung ghat is one of the best collecting places in the Indian Empire; it is the meeting place of the Chinese and the Malayan elements and possesses a number of species or well defined races that do not appear to be found elsewhere.' This section referred to is on the same range of hills as the Shan States but geographically not in the Shan States.

I might go farther than the above-mentioned author and say that the whole of the Shan States is one of the best collecting grounds in the Indian Empire. I feel sure readers will agree when they notice the long list of butterflies to be found therein, many of which are very rare and not found elsewhere.

Maymyo, the writer's headquarters, while not in the Shan States proper is on the plateau at the beginning of the Northern section and is an excellent locality for many rare and interesting varieties. During my twelve years of residence here and eight at Kalaw in the Southern section, I have built up a good collection of butterflies from important places. In addition to Maymyo and Kalaw I have toured the States extensively and collected butterflies wherever I travelled.

Before giving the list of butterflies to be found in the Shan States I would mention I should be very glad to exchange with any collectors in India and Ceylon. I have many hundreds of duplicates and would be glad to get into touch with fellow collectors all over India especially Southern India and Ceylon.

The names given in the following list are taken from the 1st edition of the *Identification of Indian Butterflies* by Brigadier Evans, which I believe in some cases differ a little from the names given in the 2nd edition.

As I am not an expert there may be mistakes in the names especially in the Lycaenidae. This family together with the Hesperidae I find most difficult to name as there are so very many varieties.

PAPILIONIDÆ.

TROIDES

aeacus. Fairly common in all parts of the Shan States. Very fond of feeding on flowers of lantana.

helena cerberus. Common and as above. The variety *eumages* is very rare and I have only seen one male during the many years I have been collecting.

BYASA

aidoneus. Rare but if one knows the time of flight which is during September one can collect a few specimens in and around Maymyo. This year I caught four males and two females. The colour of the female given by Col. Evans is brown. Those caught by me are not in any way brown but a distinct slaty black.

zaleucus. Very rare in the Shan States. I have only seen two males during my 15 years of collecting, one in Kalaw in the South and the other at Maymyo in the North.

aristolochiae goniopeltis. Very common all over the country.

philoxenus polyeuctes. Fairly plentiful during May and September. Evidently it is double brooded as they are not seen between the above two months.

crassipes. Very rare indeed. I have only seen one from Kalaw in the South during my many years of collecting.

CHILASA

agestor agestor. I generally get half a dozen of these each summer during April. Evidently feeds on the camphor tree as I have caught a number round this tree in my garden. It is a good mimic of *Danais tytia tytia* and can easily be taken for it.

slateri marginata. I have not found this butterfly in the Shan States proper but it is found at the foot of the Thandaung ghat adjoining the Shan States.

clytia clytia. Common all over the country.

clytia onpape. Also fairly common especially in the North beyond Lashio and up to the Chinese border.

PAPILIO

memnon agenor. Males of this variety are to be found eight months of the year. Females however of all three forms are scarce.

rhetenor. Rare. I have only one in my collection; a female caught on 11-5-35 at Maymyo.

protenor euprotenor. Very rare in the Shan States but common in other parts of Upper Burma.

bianor gladiator. Found at Kalaw in the South only this year. During my eight years' residence there I did not see a single specimen. In September of this year a friend caught several in his garden. It may be I had taken it for *paris* as it flies with it and looks very much like it on the wing.

polyctor ganesa. Fairly plentiful at Kalaw in the South but I have not found it in the North. This flies also with *paris paris* and is difficult to tell from it on the wing.

paris paris. Very common all over the country. I noticed the specimens taken from the Shan States are much larger than those I have seen in other parts of Burma and those from India.

arcturus arcturus. Rare in the Shan States.

mahadeva. Rare, does not appear to fly about 2,000 feet and is found at Nan-Pan-Det at the foot of the Kalaw Hills and at low altitudes round about Taungoo towards the Karen Hills.

castor castor. Rare. Also does not appear to fly above 2,000 feet. I have caught it at Lebin in the South Shan States. Males are filth eaters and can be found feeding on excreta of animals.

helenus helenus. Common all over the Shan States.

chaon chaon. Also very common especially at Maymyo.

noblei. I have heard that this is found in the Shan States but have not come across it. I understand it is more common in the North of Burma around Myitkyina.

polytes romulus. One of our commonest butterflies. I have not come across the 3rd form of female, the one like *hector*. The other two female forms are fairly common.

demoleus demoleus. Very common everywhere.

machaon verityi. Fairly plentiful in the Southern Shan States but rare in the North. It appears to fly at 5,000 feet and above. I have caught them at Kalaw and Taunggyi and I understand they are fairly common at a place called Pindaya.

xuthus. I have not heard of this being found in the Shan States but it may be found in the South towards the Chinese and Siamese borders.

PATHYSA

glycerion. I have only caught one male of this in the Shan States although it is fairly common on the plains of Upper Burma.

agetes agetes. Rare at altitudes of above 2,000. More common at the foot of the hills.

nomius swinhoei. Common at between two and three thousand feet. Males can be found by the hundreds taking moisture from the beds of streams. Females are fairly difficult to get.

aristeus hermocrates. Flies with the above and not distinguishable from *swinhoei* until one has it in the net. Fairly common.

antiphates pompilius. Common at low altitudes. Very rarely seen above 3,000 feet.

ZETIDES

cloanthus. Rare in the Shan States. Caught one in Kalaw some years ago but seen none since.

sarpedon sarpedon Very common all over the country and most parts of the year.

doson axion. Fairly plentiful all over the country. Flies along with *s. sarpedon*.

eurypylus cheronus. Plentiful, especially during April and May in the hills.

bathycles chiron Common and flies with the former three varieties.

agammemnon agammemnoa. Common but not so plentiful as the above four.

PARANTICOPSIS

macareus gyadæs. Males are fairly common during April and May. Feed on moisture in stream beds and easily caught. Females appear to be rare.

xenocles kephisos. Not at all common. Fly during April and May and like *agestor* appear to feed on camphor trees. I generally collect about two pairs of this each year. Evidently single brooded.

megarus similis. I have caught males of this at 2,000 feet on the hills to Maymyo. No females caught as yet, but no doubt they could be found by getting into the jungle on the roadside where the males are found. Like others of this family the males are fond of moisture on roads and stream beds.

MEANDRUSA

gyas aribbas. A very rare butterfly. I secured a male in Kalaw at 4,500 feet during the summer of 1923. Commoner at 6,000 feet near Mogok.

payeni amphis. I have not seen this butterfly in the Shan States but believe it is to be found at Mogok 6,000 feet along with the above *gyas*.

TEINOPALPUS

imperialis imperatrix. There is one place only in Burma where this beautiful butterny is to be found and that is at Thandaung, Karen Hills, adjoining the Southern Shan States. Evans says in his *Identification*, N. Burma to Ataran. The late Mr. Cooper said he saw a wing of one in the Ataran but I don't think this is sufficient proof to say they are to be found there. I have not heard of any of these butterflies being caught outside of Thandaung, on the hill there known as Thandaunggyi. The butterflies are very difficult to catch and fly very early in the morning between 7 and 10 o'clock. After that time they seem to disappear down in the valleys. Perhaps if one followed them down to the valleys they could be beaten up. Mr. Sparks of the Burma Railways informed me he has caught as many as half a dozen in one morning. I doubt if this number could be seen now apart from caught in one morning. They fly during April. I propose going up there next April to try my luck and if possible shall follow them down to the valleys when they disappear at about 10 a.m.

LEPTOCIRCUS

curius. Common at low altitudes but I have not seen them at above 3,000 feet.

meges indistincta. Common and as above.

PIERIDÆ.

LEPTOSIA

nina nina. Not at all common in the Shan States. One sees an occasional one during April and May.

PIERIS

napi montana. Not too plentiful. I have not seen any in the Northern Shan States but have seen odd ones at Kalaw in the South.

canidia indica. Very common all over the country.

brassicae, Common in Maymyo in the summer months. I noticed this is not listed as being found in Burma.

APORIA

agathon agathon. Rare. I have only seen this in the South Shan States.

DELIAS

singhapura agostina. Fairly plentiful all over the country.

eucharis. Common both South and North.

hyparete hierte. Fairly plentiful at different times of the year.

belladonna burmana. Rare. I only collected one of this from the South, Kalaw, many years ago. Seen none in the North.

descombesi leucacantha. Not rare and can be found most all over the country.

aglaia. Common during summer months.

thysbe pyramus. Very common around Maymyo in the North and not scarce in the South.

PRIONERIS

thestylis. Rare. Only found one male at Kalaw many years ago.

clemanthe. Rare. Not seen in the North, odd specimens found at Kalaw in the South.

HUPHINA

lea. Not at all common in the Shan States. Can be found more plentifully at low elevations.

nerissa dapha. Rare at high altitudes. More plentiful at foot of hills.

APPIAS

lalassis. Rare in the South but not found in the North by me.

lalage lalage. Not too plentiful in any part of the country.

libythea oiferna. Rare and I have not found this fly at higher than 3,000 feet.

lyncida hippoides Common at low altitudes.

albina darada. Common at low altitudes, rare higher up.

paulina adamsoni. Very seldom seen it in the Shan States.

nero galba. I caught a couple of these in the Katha District not far from the Shan States but evidently it prefers the plains and does not fly to higher altitudes.

CATOPSILIA

crocale. Common all over the country and most of the year.

pomona. Common.

pyranthe minna. Common.

florella gnoma. Common.

GANDACA

harina burmana. Rather scarce, an occasional one can be seen in the summer months.

DERCAS

verhuelli doubledayi. Maymyo seems to be the headquarters of this butterfly as it is exceedingly common about six months of the year.

GONEPTERYX

rhamni nepalensis While Maymyo is the headquarters of the above, Taunggyi in the S.S.S. would appear to be the home of this butterfly. Hundreds of males are to be seen on the hills feeding on duranta flowers. Females however are very scarce.

TERIAS

libythea. Common.

laeta. Ditto.

blanda silhetana. Common but not so numerous as the above two.

hecabe hecabe. Very common.

COLIAS

None of this family in the Shan States; but I understand *croceus fieldii* is to be found in N. Burma. However, I have not come across it during my various tours in Upper Burma so I should think it either very local or rare.

IXIAS

pyrene latifasciata. Common at below 3,000 feet but very seldom seen at above this altitude.

HEBOMOIA

glaucippe glaucippe. Common at low altitudes but rather scarce at 4,000 and above.

PARERONIA

avatar avatar Not too plentiful in the Shan States.

valeria hippia. Fairly common in the South but not too common in the North. The variety *philomela* is very rare and I have not seen it in the Shan States but have caught it on the plains of Lower Burma.

DANAIDÆ.

HESTIA

lynceus hadeni. While this is not found in the Shan States I would mention that it is fairly common in the Myaungmya District in Lower Burma. Bassein is given in the *Identification* by Evans but I think this is misleading. During my trips to Bassein especially for this butterfly I never came across a single one. On the other hand a friend living in the Myaungmya District sent me several good specimens and said it was plentiful there. I should think it flies only within a radius of 50 miles, and so is very local.

aglea melanoides. Common all over the Shan States.

melaneus plateniston. Fairly plentiful but not so common as the above.

tytia tytia. Quite a number can be caught during six months of the year. April to September.

limniace mutina. Very common all over the country.

melissa septentrionis. Common and flies with the above.

gautama gautama. I have not come across this in the Shan States.

plexippus. Very common indeed.

chrysippus. Ditto.

EUPLOEA

mulciber mulciber. Very common.

alcathoe doubledayi. Rare in the Shan States. I have only caught one male during a long period of collecting.

alcathoe oesatia. Rare. One female only in my collection.

diocletiana diocletiana. Common at the foot of the hills but very seldom seen at above 2,000 feet.

klugii macclellandi. Rare in the Shan States.

klugi crassa. Rare in the Shan States.

midamus splendens. Very seldom seen in the Shan States.

midamus brahma. I have not come across this as yet not even in the Karens. It is probably very local.

godarte. Very common all over the country and at all altitudes.

deione deione. Rare in the Shan States proper but not so at the foot of the Karen Hills.

harrisi hopei. Very seldom seen; but I understand it is to be found up towards Lashio in the North.

SATYRIDÆ.

This is a family that I have not been able to do much with. In my early days as a collector I was not interested in the common browns. When I did get an interest I found my cabinets were too full to allow room for *Mycalesis*. However I have a few noted which I give below but which is nothing like a complete list of this butterfly found in the Shan States. At a later date I hope to be able to compile a more representative list.

MYCALESIS

francisca.

gotama charaka.

perseus blasius.

mineus mineus.

visala neovisala.

suavolens.

nicotia.

mamerta mamerta.

LETHE

sidonis sidonis. Not at all common in the Shan States. One male only in my collection.

sura. Not common in the Shan States but more plentiful in Northern Burma towards the Chinese frontier.

europa niladana. Quite common all over the country.

rohria rohria. Common.

confusa gambara. Very common indeed all over the country and at all altitudes.

verma stenopa. Common in and around Maymyo. I have not noticed it in the South.

latiaris. Rare. One male only in my collection.

mekara zuchara. Not common at high altitudes.

chandica flamona. Rare. Only one male caught by me.

distans. Not too rare. A few specimens caught by me. The few specimens I have caught have been in my garden in Maymyo in the middle of Cantonments.

vindhya. Rare, only one male caught by me.

kansa. Common, especially in the North.

sinorix. Rare. One female only in my collection.

pulaha pulahoides. Rare. One male only secured by me.

bhadra. Very rare. I have only seen one of these in the Shan States and that was at Kalaw in company with Dr. Haynes when we both did a scramble for this prize which luckily fell to me.

muirheadi bhima. Rare and only at lower altitudes.

ORINOMA

damaris. It used to be fairly common at Kalaw in the South and I had not noticed it in the North before this year during September when I caught six males. I had been over the same ground every year and the same month for the last twelve years but never saw it before this year. I did not come across any females.

YPTHIMA

hubneri hubneri. Common.

baldus baldus. Very common.

savara. Not common in the Shan States.

sakra austeni. Common at foot of Karen Hills.

ZIPOETIS

scylax. I have only found one male during my many years of collecting and I should call it rare in this part of Burma.

ORSOTRIOENA

medus medus. Very common indeed.

ERITES

I have not come across any of these although I notice they are listed as found in the Shan States.

NEORINA

westwoodi. One specimen, male, only from the foot of the Shan States near Mogok.

ANADEBIS

himachala. I found plenty of this at the bottom of the Goteik Bridge in the North. It was quite common there. Not seen elsewhere. Perhaps very local.

diademoides. One male caught only at the foot of the Karen Hills near Taungoo.

MELANITIS

leda ismene. Very common all over the Shan States. Very variable on the underside.

zitenius zitenius. Not rare in and around Maymyo. Flies with the above.

ELYMNIAS

hypermnestra undularis. Common in the North.

nesoea timandra. One specimen only from Kalaw in the South.

AMATHUSIIDÆ.

AEMONA

lena. Caught a few in Kalaw. Appeared to be very local.

lena haynei. Common near Maymyo and very variable. I don't find any difference in the sexes except that the female is much larger than the male. It is double brooded and flies during April and September.

FAUNIS

arcesilaus Not found at high altitudes. Very common at foot of hills.

STICOPTHALMA

louisa tytleri. This large butterfly is also found at the foot of the hills. Rare in the Shan States.

louisa louisa. Fairly common at the foot of the Karen Hills. I have not noticed it higher up in the Shan States proper.

THAUMANTIS

diores. Rare in the Shan States. One male only sent me from Momeik State near Mogok.

THAURIA

lathyi amplifascia. Fairly common in Maymyo but very local. Double brooded May and September. Unless one is on the spot when this emerges it is difficult to get perfect specimens. They fly so low and slow that they are the prey of birds and reptiles.

aliris pseudaliris. Common at the foot of the Karen Hills. Very rare in other parts.

AMATHUSIA

phidippus friderici. Very rare and only found at the foot of the Karen Hills. One damaged male only in my collection.

AMATHUXIDIA

amythaon. I have found this also at the foot of the Karen Hills and in no other part of the Shan States. Very difficult to get perfect specimens no doubt owing to its great size.

ZEUXIDIA

amethytus masoni. This is another butterfly of this large family that is found only at the foot of the Karen Hills. It would appear that Pathichaung where these butterflies are caught is the home of the *Amathusiidae*.

DISCOPHORA

tullia zal. Very common all over the Shan States. The variety *spiloptera* is very rare and I have not been fortunate in getting this. The other variety *indica* is not so rare.

continentalis continentalis Nothing near so common as the above. Only one male in my collection.

ENISPE

euthymius. Rare in the Shan States but common at the foot of the hills. A number of these were sent me from the Upper Chindwin District and are apparently very common there.

(To be continued).

BIRD PHOTOGRAPHY IN INDIA.

BY

MAJOR R. S. P. BATES, M.B.O.U.

(*With 6 plates*).

It has been suggested that I should write an article for the *Journal* on how I get my photographs of Indian Birds, giving all relevant details of cameras, lenses, exposures, distances from the subject, hides, and apparatus and methods generally. This I will endeavour to do, but be it remembered that in India there are as yet far too few bird photographers, and in a country of this size our paths seldom seem to cross. My methods therefore are methods evolved largely from my own experience and may consequently be in a number of respects as antiquated as parts of my apparatus.

With the rapid evolution of miniature and small cameras, the continual speeding up of emulsions, the introduction of fine-grain developers, and the increasing popularity of colour photography, methods in all branches of photography are bound to undergo almost perpetual modification if not indeed considerable alteration. I do however venture to assert that the methods of the bird photographer have not altered appreciably but that these modern improvements have merely rendered their application easier. In other words, once you get your bird where you want it, nowadays, with any luck at all, you should be able to take a successful picture of it under almost any conditions of terrain and climate.

To generalize, bird photographs can be obtained in four ways:

(1) From the hide.

(2) By concealing the camera and releasing its shutter from a distance by electrical or other means.

(3) By stalking.

(4) By flashlight.

Of flashlight photography I am quite ignorant, and have never even attempted it, so on that subject I have exactly nothing to say.

Stalking is generally, to put it vulgarly, a mug's game. By that I do not mean to imply that it should not be attempted at all. I have seen some excellent photographs achieved by stalking, but to walk about the countryside with a reflex camera at the ready and an eye on every bird you see sitting on a bush is a complete waste of both time and energy.

But, and it is a big but, there is one division of the breeding birds of this country to the obtaining of whose photographs the stalking method can be most successfully applied. Practically every negative I possess of Herons, Egrets, Storks, Cormorants, Spoon-bills, and Ibises, and I have a few hundred, were taken paddling myself about their breeding grounds in a boat with a reflex between my knees, gradually on successive visits accustoming the birds to my presence until I was able to work up the boat, or let it drift



The Hide, uncamouflaged and with one side raised to show its construction. It is pitched on a sloping bank.

on a favourable breeze, close up to the subject I wanted. These birds have a habit of breeding in colonies; colonies sometimes of great size and complexity, containing every one of the species enumerated. When the trees they use stand in a village or on dry land, the nests for safety's sake will be confined to the summits of the tallest, but where they stand in water, nests may be quite low down from a few inches above its surface up to the crests of the half-submerged trees.

Two points of great importance emerge above all others in this work: the boat must be easy to manœuvre but stable so that noisy or jerky movements can be avoided; and the camera, preferably a reflex, should be capable of accommodating a lens of comparatively long focus. For years I have used a 12 inch focus Dallmeyer Tele-anastigmat. I have heard of longer focus lenses being used on birds and animals, such as those of 17 inch focal length, but the danger of getting blurred images through camera shake and movement is much increased, and very large images from which direct prints can be made are by no means a necessity.

I have not laid down the reflex as being the one and only type of camera for this purpose as the rangefinder-coupled small camera obviously has great possibilities but I have as yet had no chance of trying one out in a Heronry. The first boat I used, a light canoe, was definitely unsuitable, and after very nearly precipitating myself and my camera into the water I had to abandon all thoughts of climbing from it into the trees or taking photographs standing up to obtain a higher viewpoint. The rather broad collapsible punt evolved later proved much more useful. The illustration of the Openbills was taken from it. Big enlargements from this negative show no signs of camera shake or movement whatsoever and although stalked these birds very definitely are not in the least afraid. On the contrary, they are entirely engrossed in their own affairs.

I cannot remember how far distant I was from these Openbills but not more than 25 feet and probably less. The images on the negative are approximately half an inch in height. I remember on one occasion in this same Heronry a kindly breeze wafting me imperceptibly towards a Spoonbill until I was so close to the old gentleman that I could have prodded him with the end of the paddle. It was impossible to include all of him on the plate and eventually I found his head and neck taking up the whole of the focussing screen.

As for stalking what might be termed land birds, I have always found it extremely difficult, except on occasions in the case of nesting birds which rely for protection on immobility and obliterative colour pattern,—such for instance as Nightjars and Sandgrouse. Most birds seem to have an uncanny intuition and take to flight in that split second in which the photographer decides it is time to expose his plate. Actually what happens is that you stop or slow up for a fraction of time to press the release and the already suspicious bird is off the mark quicker than you are. And with that profound statement I think we will leave stalking to look after itself.

The other two methods have of course a great deal in common, but to my mind you miss more than half the fun by merely camouflaging the camera close to a bird's nest when you might just as well conceal yourself along with the camera. One of the greatest joys of bird photography from the hide is that you have the chance of studying a bird and its habits at the closest range. When it is most surprising how very different a bird looks really near engaged in its normal day's work. The texture of every feather, the intricacies of its colour pattern, its little idiosyncrasies and habits, become apparent; whereas at the distances you normally look at birds in your daily rambles, only their general ways and appearance are discernible.

Another great disadvantage in concealing the camera only is the necessity of approaching it and so disturbing the bird after every exposure. And a bird which is continually interrupted during incubation or in its visits to the nest with food and material is not likely to act in a normal manner for long. No, all things considered, photographs taken from the hide are bound to be the most satisfying both to the taker and the viewer, and also the least upsetting to the bird if due care be exercised.

I wonder if I might digress for a moment to get a grouse off my chest. If there is one type of photograph which I abhor, it is the type not infrequently seen in the daily press of some half-fledged terrified young bird with its useless toes at all angles obviously on the point of falling off the perch to which it has been made to adhere through sheer fright. Such photographs are in reality nothing but unnatural fakes. Yet apparently there are people who see something in such misleading pictures. By no stretch of the imagination can they be termed nature pictures anyway. In fact I cannot imagine anyone taking up bird photography seriously ever producing such worthless stuff. True bird photography is the art of portraying birds and their lives as they live them, so young birds incapable of leaving their nests should not be taken out of them to produce improbable photographs.

The less the contents of a nest are interfered with the better. Young ones I never touch, and eggs only when I am taking a nest and egg photograph. Then in deep nests I push the eggs towards the back of the cup inserting a pebble or short twig to keep them there. To tilt a nest to show its contents is a great mistake and straightway introduces an unnatural look into the picture. It is the camera which should be tilted, never the nest. Besides, pulling the nest about may lead to desertion. And if a bird deserts a nest upon which I am working, I consider a very black mark has been chalked up against me.

As an instance of where a distant release would have proved useful, here is an amusing incident which happened to me this year when photographing a Brooks' Nuthatch. With the hide scarcely 7 feet from the old Woodpecker's hole which they had cemented up until its entrance might just have accommodated a halfpenny, I had obtained half a dozen negatives with very little trouble. On development I was dissatisfied with the lot, so the following day I went back to try my luck again. The birds were



A photograph of Openbills obtained from a punt while cruising about the Vedan Thangal Heronry in Southern India.

now so tame that they actually visited the nest while I stood motionless on the very spot on which I intended to erect the tent. I therefore put up the camera as close to the hole as I could and retreated some thirty yards to see results. Both birds made disagreeable noises from the next pine tree so after a short time I decorated the camera with hazel twigs. This move immediately had the desired effect, and the huge lens was ignored. But I had no distant release so took up my position just behind the camera. This obviously met with disapproval so my wife proceeded to stuff leafy twigs into my hat, down my neck, into my pockets, the tops of my stockings; in short she made me thoroughly uncomfortable. Every time I moved I rustled like a rattlesnake and shed bits of foliage. Nevertheless by the time I gave up trying to balance most of a bush on a large prominence accentuated by my stooping posture, I had obtained the pictures I required. It was an interesting experiment, but the day's work would have been accomplished more comfortably and just as quickly from my tent. And this at last brings us to photography from the hide.

In the first place what is meant by a hide? Every bird photographer probably has his own ideas on the subject. Some seem to consider a wigwam affair of a drab-coloured sheet thrown over a few sticks tied together at the top to be sufficient. In England where the photographer is most likely to be his own porter, such a sketchy affair may be indicated, but personally I put down comfort in the hide to be one of the first essentials. Nothing can be more tiring and disheartening, and consequently conducive of bad work, than sitting hunched up in a cramped position unable to move without fear of bumping into the sides of the tent, particularly on a sticky day in the monsoon. Remember that birds resent movement much more than they do noise so the tent must be roomy enough to permit a certain amount of freedom. This does not mean that it must be large, but it should be so constructed that it retains its symmetrical shape when erected on the most sloping and uneven ground, or anchored in a tree. Not only will such construction be conducive to comfort but the possibility of frightening away the bird through inadvertently sticking a knee or an elbow into a portion of the tent wall which you had not realized to be so close, will be greatly minimized.

I described my original tent in *Bird Life in India*. My present one is a great improvement upon it and is constructed as follows. I bought four lengths of ¾ inch iron piping (as used for encasing electric wiring) each four feet long and had 2 inch spikes fixed into one end of each. The bore of this piping is such that ½ inch diameter brass covered curtain rod slides into it very comfortably. These tubular curtain rods can be bought in any bazaar at about 2 annas a foot and are extremely light. On to these are fitted collars provided with a wing nut by which the amount of rod protruding from the iron piping may be easily adjusted. So much for the legs of the framework.

The top consists of three more lengths of the iron piping, two being side pieces 2 ft. 9 in. long, and the third, one of the ends, 2 ft. 2 in. in length. These rods are threaded at both ends to

screw into three-way angle pieces, the down-pointing socket of the three being to accommodate the top of a leg. The fourth rod, to complete the rectangle, is a wooden unthreaded one which fits easily into place in its sockets by slightly forcing the side bars apart. When complete the roof frame measures 3 ft. by 2 ft. 6 in. The tent therefore is 3 ft. long by 2 ft. 6 in. wide and adjustable in height from 4 ft. up to more than 7 ft. Not that I have ever had occasion to use it so attenuated, as firstly six or eight inches of the legs will probably be embedded in the earth, in marshy or sandy ground perhaps a good 2 ft. Secondly the excessive permissible length of each leg is to allow of the roof remaining level when the tent is pitched on an abrupt slope, where the outer legs of course have to be considerably longer than the upper ones. If the roof is not kept level with the tent walls vertical then you are in for trouble with the drill cover which will not 'hang' but ruckles up and cannot be clipped together without gaps forming at the upper corners of the tent.

I once threw away a good chance of photographing a Chukar through neglecting to check up on this point. I had waited patiently for nearly two hours while both the birds cackled incessantly from amongst some rocks fifty yards above the hide. At length complete silence reigned as a pair of hawks responsible for the disturbance betook themselves further afield. A few minutes later I turned to look through a peep-hole in the side of the tent at the same time raising my hand. With a startling whirr of wings and much abusive language a Chukar hurtled down the hill side. It had been within a few feet of the back of the tent paddling along the goat track which led straight past the nest and had obviously seen my hand through the gap a few inches wide which I had failed to notice.

I consider it necessary to have the cover rather tight fitting so that it cannot flap about in a high wind. The last time I was at home I saw a photographer working upon a Golden Plover's nest on a Yorkshire moor. His tent was almost white, or appeared so against the dark heather; its sides were so loose that in the blustery wind then blowing they were flapping in and out with considerable force, and lastly there had been no attempt at camouflaging this tent so alien in its sombre surroundings. Some distance away I picked out the disconsolate Plover making no attempt whatsoever to go near its nest.

An added disadvantage of loose tent walls comes to light in this question of camouflage. If the cloth can blow about in a wind, not only may the bird be frightened away but grass, leafy branches, and other materials used for concealment, are apt to be dislodged.

The fabric of my tent consists of khaki drill, a rectangular strip 3 ft. by 2½ ft. forming the top on to which the sides and ends each 4½ ft. in length are stitched. Inside the top are 8 tabs which clip round the bars of the roof frame with large press studs to keep the roof taught. At one time I had a flap in this roof which I could turn back for ventilation. The first time it rained I got a stream of water on my head and into the focussing hood of the reflex. I now depend on the fresh air which gets in at the edges.

Each of the sides has an overlap of 2 inches and on this overlap are large press studs at 8 inch intervals. Across the roof and on all four sides about a foot apart are thin ropes caught to the drill at intervals. Into the loops thus formed the camouflaging material can be stuffed with a good chance of its remaining in place.

For peep-holes I am afraid I mutilate the walls with a pen-knife. Specially prepared holes always seem to be in the wrong place, but after a few short slits have been made here and there, one or other will turn out to be right and the mutilation may cease. Some photographers, I believe, use a periscope, but I have never availed myself of this device, perhaps to my loss.

For the lens apertures I have found Zipp fasteners most useful. In the front panel I have two, each a foot long opening up and down from the centre. I have now added long ones in each of the side panels since finding myself incapable of dealing with a Himalayan Pied Kingfisher which contented itself with sitting on guard 8 feet to the left of the tent, never once flying up to the nest-hole upon which I had trained the lens.

I always carry four short iron pegs and a length of rope wrapped up in the tent in case the ground should prove too hard to drive in the legs and for use when the tent has to be raised from the ground in a tree or on a platform. For local use I also substitute ⅝ inch curtain rods for the iron ones as the latter are so much heavier. I prefer however to take the stronger legs when out on trek to avoid any possibility of a breakdown.

Unfortunately birds seem to have an absolute flair for putting their nests in awkward situations. On occasion the only possible advice is 'find another nest', but if time permits and the necessary materials are procurable, the majority of nests can be dealt with. Ground-breeding birds of course prove the easiest victims, although in reed-beds and even on marshy ground it may be necessary to sink four posts into the mud and lash on to them just above water-level a plank platform on which to erect the tent. I have used a boat on occasion in deep water but the slightest movement is apt to make a boat sway; so a fixed platform is definitely preferable. It is when we come up against birds which nest in tall trees and on ledges on cliff faces that real difficulties crop up. A nest in a pine tree for instance is likely to be particularly difficult to cope with, as a thousand to one no position for the tent exists at the requisite distance.

In dealing with a Blue Magpie's nest, which was approximately 30 feet from the ground in an attenuated maple, I once had to transport five 35 ft. pines from where they were lying two miles away in the debris of an avalanche and sink each one well into the ground in order to form a scaffolding for the tent 15 ft. from the maple. Incidentally I also moved my camp back three miles to be on the scene of action. The priceless part about this effort was that by far the best negatives I now possess of the birds in question were obtained by concealing the tent in a nearby clump of viburnum bushes when the scaffolding was in process of erection, as I noticed that both birds in their agitated comings and goings frequently alighted on a particular perch not 6 feet from the ground

about thirty yards from the site of our labours. Still, I was not sorry that I had gone to so much trouble as I procured a further series of the bird at and on the nest.

As I discovered eventually that this perch was at all times a great favourite with both birds, the tale certainly points a moral, and that is, study the actions of the birds you want to photograph. If you can, it pays every time to spy on your intended subjects from afar, to study their lines of approach to the nest, and to take a good look round to see what alternative routes they may use or where they may stand or perch in the vicinity of the nest. It may be with certain birds that the discovery of a nest is not essential. Some birds which feed round the margins of ponds, on the banks of rivers, or on the sea-shore, such for instance as members of the Sandpiper family, can be photographed by putting the tent close to a favoured mud spit or inlet. But whatever your intended approach to the bird may be, your study of its habits will enable you to form in your mind's eye an idea of the composition of your picture and so to select the position of the tent accordingly. Birds are often very set in their ways so that the rather sudden appearance of the tent in most cases will not cause them to alter their routes.

The actual position for the tent of course depends on a number of other conditions as well. You have to take into consideration the size of the bird and the focal length of the lens in use; on these depend the size of the image on the plate. Other factors are the conformation of the ground or tree in which it has to be anchored, the background, the immediate surroundings of the nest, the direction of the sun, and the object you are out to attain, by which I mean whether you are after a close-up of the bird only or wish to show its habitat as well.

Depth of focus is naturally bound up with the size of the bird. It is no use getting so close to a large bird that if it happens to sit facing the camera its tail is going to be out of focus. Make sure that the entire bird and all its surroundings you want shown up will be within the field of focus at the largest stop you may have to use, as any defects in focus will naturally be exaggerated in subsequent enlargements. It is really impossible to lay down hard and fast rules as to the distance of the hide from the subject so I have included a couple of illustrations from direct contact prints to show the actual size of the image obtained. In point of fact, with the 12 inch tele-anastigmat lens most of my photographs of birds varying in size from the tiny Warblers up to the size of a domestic hen have been taken at distances between 6 and 15 feet.

The conformation of the ground is naturally of importance. It may be quite impossible to put the tent just where you would most like it. Or again for purposes of concealment, it may be advisable to put it a couple of feet further away, say to conform with the line of some bushes on either side of it. This may entail a somewhat smaller image, but better a small image than a nervous bird loath to approach its nest. This of course introduces the subject of camouflage. I sometimes think I err on the side of overcaution in this respect, but I am sure a few extra minutes



A Brown Hill-Warbler about to enter its nest. Taken at F4 with an exposure of only 1/15 second on an overcast day while rain was actually falling.

spent on making the tent blend in with its surroundings will never be wasted. As a general rule the smaller the bird, the less its fear of the tent and consequently the lesser the need of elaborate concealment. Nevertheless, I always contrive to make the tent tone in with its background as much as I can.

To hide the lens is decidedly important. The hood of my large lens, which incidentally is four inches in diameter, is black. I have had a small bird refuse absolutely to face this uncovered and yet that same bird has come quite happily as soon as the black rim has disappeared under a ring of green leaves. I have now had it painted green but I still take the precaution of twisting some grass or large leaves around it.

The question of representing the lens when the camera is not in position is also a matter of concern. As far as possible, even with a bird I expect to be far from timid, I put up and camouflage the tent at least the evening before I intend to use it, as near dusk as possible. I have found that a bird will more readily return to its nest in a failing light and by the following day be quite used to the hide's proximity, consequently saving one a tiring wait as well as being more natural in its behaviour. So far I have never once had my tent tampered with except on occasion by ravenous goats and cattle out for an easy meal provided by the camouflaging material. But it is obviously unwise to leave the camera and lens out all night if it can be avoided, so I hang a black disc over the lens aperture to represent the absent lens.

A couple of years ago now I tried my luck on a Dabchick in front of whose nest a shikari I thought I had trained in my ways, had put up my hide two days previously. When I arrived I at once had occasion to find fault with him for forgetting the disc. His reply was that the bird was quite tame and had been sitting all morning.

Once the camera was in place that bird did everything conceivable except venture in front of the lens. For an hour I could have stretched out my hand and have touched it as it lay on the water in the shelter of the tent wall. Time and time again it swam round the nest under water but only on one occasion did it come to the surface for a fraction of a second to give the water a terrific slap nearly frightening the life out of a Reed-Warbler which had unwisely landed on the nest.

As I have only the one tent but may at times wish to work on two or even more birds on the same day, I often put up dummy hides of leafy branches or grass and then substitute the real tent for these when occasion arises. In each case I invariably add something, the lid of a tin, a piece of paper, the end of a bottle, to represent the lens.

I have now mentioned all the essential points I can think of in connection with the erection of the hide[1] so we can proceed to get inside it so to speak. In many ways birds seem to be rather

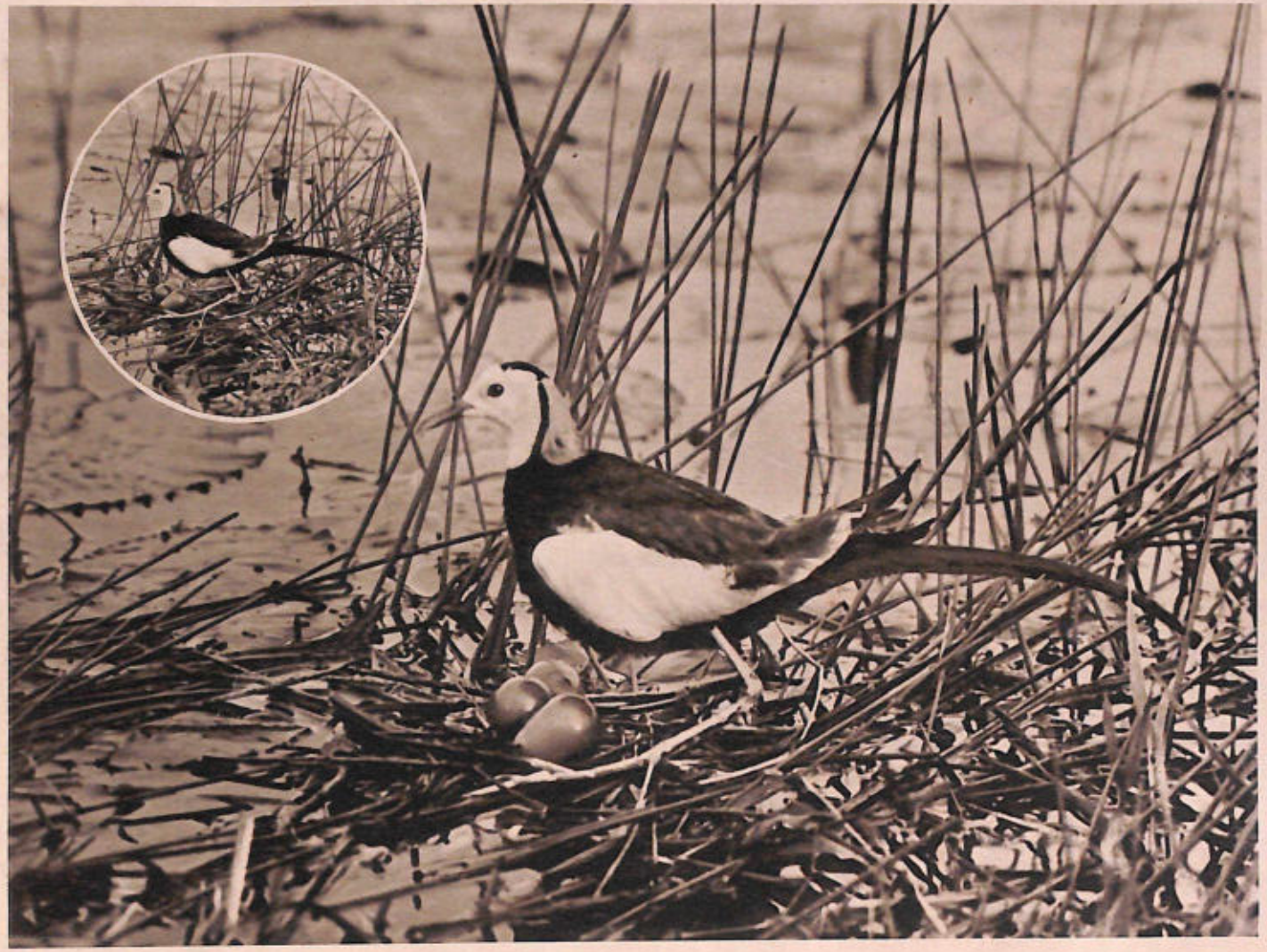
[1] It may at times be necessary, when dealing with very shy birds, to put up the tent or dummy hide some distance away, moving it up gradually to its final position.

unintelligent creatures but it does not do to imagine that they are altogether void of intellect. Any bird is certainly capable of deducing the fact that you must be in the hide if you walk up to it quite alone and suddenly disappear from view. But fortunately for us most of them seem quite incapable of distinguishing between one and two persons. It is therefore essential to have a helper to see you into the hide. Not only is his presence necessary in deceiving the birds, but he can assist in the final closing up of the hide, see that no foliage is likely to droop over the lens as it withers, and stay in the immediate vicinity until you have finished making disturbing noises moving slides and accessories into more handy positions, testing and setting the shutter, and settling in generally. Another of his duties in a populated area is to keep other people and animals at a respectful distance. It is more than annoying to have to leave the tent without photographs only to find the cause to have been due to an admiring audience sitting far to close and in full view of the nest. On one occasion this year the undesirable audience was a Cuckoo. It was really very silly of the birds to be so suspicious of it, especially as they were already feeding a large young Cuckoo, no doubt the intruder's offspring, in their own nest. But there it was; until I had signalled up the shikari to shoo the Cuckoo away from its observation post, those Redstarts were not going to visit their home.

As it is quite on the cards that a bird on its arrival at the nest will do the unexpected, it may be necessary to call up the helper to cope with the situation to save getting out of the hide yourself and thereby giving the show away that you are concealed there. I arrange with him to return at stated intervals to a distant viewpoint from which he can see my S.O.S. I wait till I think the bird is out of the way or at any rate in such a position that it cannot see the movement and then push a corner of a handkerchief out of the back of the tent.

Nearly all my work in the hide for the last twelve years has been carried out with the aforementioned Dallmeyer Tele-Anastigmat lens on a series of reflex cameras. I believe that this particular lens of 12 inch focal length working at an aperture of F3.5 is no longer made. It is certainly responsible for the rather 'soft' character of most of my photographs. Whether this softness is an advantage or a disadvantage in nature photography I leave to others to judge, but I do know that I hope to use that lens for many more years. Certainly when I see some of the very beautiful and amazingly sharp photographs in *Country Life* and *The Field* I occasionally have misgivings: they are obviously so capable of enlargement to any degree. But whatever the lens used, I consider its focal length should lie between 8 and 12 inches, preferably nearer the latter. Lenses of the combinable type, which by using the separate components give a choice of focal lengths, are most useful but seem to be somewhat out of favour these days.

I have possessed a number of reflex cameras, partly because they get treated rather roughly and partly through searching for the ideal. These have varied from 5 by 4 ins., 9 by 12 cm., to



The Pheasant-tailed Jacana. The insets in this and the previous plate indicate the actual size of the image on the negative.

¼ plate, the best size probably being the last. I would however like to experiment with a 3½ by 2½ which in these days of small cameras and fine grain would probably be just as effective and certainly cheaper in operational costs. Plates, tanks, and all other accessories too would be less bulky and more convenient in all ways.

The ideal does not exist, but the points to look for when purchasing a reflex camera for bird or nature work generally are a not too noisy shutter which can also be reset speedily with a minimum of noise—some make an appalling prolonged series of clicks. It must be possible to alter the shutter speed with the shutter wound, and the figures should be easily readable at an angle and in a dim light. The focussing hood should be detachable. It should have a reasonably long extension and a firm lens panel not given to sagging when fully extended.

The tent is generally quite dark enough for the image to show up quite clearly on the screen without the hood, and headroom in the hide is often a problem. Without it too, it is possible to fix a mirror at such an angle just above the screen that you can sit at ease and without strain behind the camera and yet see at a glance what is in the field of view. I have fixed up the discarded mirror of my old car on my present reflex so that I can adjust its angle to suit my position behind the camera. I believe there is a special naturalist's reflex which has a monocular finder set for the purpose of viewing the screen from behind. To my mind there is one great objection to this: you cannot keep your eye glued to a small eye-piece without strain, whereas to glance every few seconds without leaning forward into a comparatively large mirror is no strain whatsoever. A periscope is perhaps the real answer to the problem.

At one time I had difficulty in altering the stops, but by fitting a long lever to the iris diaphragm's edge and screwing a notched wooden strip to the side of the camera as a guide I can now readjust the aperture of the lens in a moment with quite sufficient accuracy for all practical purposes.

In the hide the camera may often have to be quite low down, within eighteen inches or so of the ground, so a short tripod is a necessity. I have never seen a really suitable one on the market so far, but it is not difficult to adapt any of the wooden ones. It is however essential that the camera tripod and turntable should be sufficiently strong to prevent vibration. When the camera front is fully extended with a heavy lens on it, vibration set up by the movement of the mirror or focal plane shutter can be serious. The turn and tilt tops sold for small cine cameras are no good for this purpose. Something of robust construction is required, both the movements of which can be worked smoothly and quickly with one hand.

As a rule it is very unwise to chase a bird about with the lens. If it notices the movement, which ten to one it will, it is quite on the cards that you will have to pack up and go home. On the other hand it may be really worth while to take the risk. Possessing already a number of photographs of Stone Plover on the nest, I thought the risk quite worth while when I saw both birds standing close together a few feet to one side of their eggs. As it happened

they spotted the lens as soon as I started to move it. I never got another photograph of either of that pair but I still think the attempt was justifiable.

On occasions two hands seem quite insufficient to cope with all there is to do. A fairly long antinous release is a help on these occasions which can be kept in the hand while working other gadgets. Most reflexes can be fitted with this type of release. It may sound rather idiotic but I seriously contemplated making use of an electric release in the hide, intending to work it by means of a bell-push under my foot so as to leave my hands free. I still think it would be well worth a trial. The 'Electrolease', as the one I contemplated buying is called, unfortunately had not come into production when I went to Kashmir last year so I have not followed up the idea.

As regards the question of exposure, I do not find it easy to proffer advice. I have been rather lax in keeping records, as I consider a bald statement of exposures and stops is of little use since there are so many varying factors to consider. Naturally there is a great tendency to cut exposure to stop movement, a tendency which must be resisted. If you are uncertain of the correct exposure, it is better to overdo it. Modern emulsions can stand great over-exposure but under-exposure cannot satisfactorily be compensated for. It is surprising what long exposures are often given in bird photography. It is a matter of choosing, or hitting upon, the right moment to release the shutter. You cannot expect every exposure to be successful. You must often work on the idea of making a number of exposures on a restless bird in the hopes that one or two of them will not show movement. I reckon that round about 80 per cent of my negatives have been obtained with exposures in the neighbourhood of 1/20th second; a number with exposures far longer than that. Two excellent plates of the Turtle Dove which illustrated my article in the *Journal* last September were each exposed for 10 seconds.

I strongly advise the purchase of a good photo-electric exposure meter. It will of course be necessary to allow somewhat for different types of subject, but within those limits, which you can only learn by experience, stick to what the meter says and you will not go far wrong. As a second string I kept my optical meter —a Biwi—which has definitely proved its worth, as twice, thanks to India's climate, my electric meter has ceased to function. On the whole exposures in bird photography need to be rather longer than for other subjects, as more often than not you will require to bring out considerable detail in the deeper shade and you are working at very close quarters.

There are two other articles of furniture which I now always take into the hide with me; one a strong folding stool which I bought at Boots' for a shilling, and the other an acquisition which I invested in two years ago and now wonder how on earth I ever did without, namely a changing bag. It is infuriating to find you have used up your last plate just as the birds are affording opportunities for better photographs than any you have obtained. Just after I had taken the photograph of the Paddy-field Warbler



The Yellow-billed Blue Magpie of the North-West Himalayas: a picture obtained through observing that the birds when disturbed at the nest often made use of this perch within 6 feet of the ground.

which also appeared in the September number of the *Journal*, the other bird arrived and sat a couple of inches below the nest for some considerable time. The two birds together would have made a delightful picture.

A large number of double plate-holders—I much prefer plates to films—take up space, besides being expensive to buy, but it is quite simple to slip a spare box of plates and the changing bag into your pocket for use in emergency. I have used the bag in the hide a number of times now. Besides, it simplifies filling the plate-holders and transferring the plates to the developing tank at any time of day when you are out in camp. For this purpose a large bag is convenient. I find the whole-plate size the most useful for my 9 by 12 cm. plates.

Every bird photographer should do his own developing and do it on the spot. It does not mean a tremendous increase in the gear to be transported. All you need in camp is the changing bag, a reliable developing tank, a thermometer, a small set of scales, an ounce measure, two or three bottles, and a limited supply of chemicals. Actually I carry a second tank for washing purposes into which the developing tank slips for packing, so that if necessary I can develop two batches of plates one after the other and so economize in solutions and time.

There are numerous advantages in doing your own developing immediately. It gives you a chance of revisiting the scene of your labours if your first efforts turn out to have been failures, and secondly you can develop for the type of negative you require. Most D. & P. firms are inclined to send out strong contrasty negatives which look lovely but are difficult or even impossible to enlarge from. It is not necessarily their fault. They mostly have to work on mass production principles, treating all plates and films alike as they have no idea of the subjects with which they are dealing. In the rains exposed plates are apt to deteriorate rather quickly, so the sooner they are dealt with the better. While yet another advantage lies in the fact that you learn of any faults in exposure at once and can apply the knowledge gained the next time you enter the hide.

Ever since they came into being I have used Ilford Hypersensitive Panchromatic plates—for the small camera for views the fine-grain version of the same films. A panchromatic emulsion is undoubtedly necessary for bird-photography. It is almost unbelievable how many brightly coloured birds can be faithfully portrayed on these materials without the use of a filter. I once hurriedly snapped a Black and Yellow Grosbeak when it was cracking pine seeds a few feet behind our tents. This however was by no means a success so the correct filter—a 'beta' is generally sufficient—is on occasion very necessary.

I am afraid I still remain faithful to the well-tried pyro developer, the formula for which is given on every box of Ilford plates. It has few ingredients and is so delightfully simple to compound. Into the bargain it produces an exceedingly good printing image. A great deal is heard these days about fine grain developers, and quite rightly so. Few direct prints are ever seen in nature

photography so a negative free from objectional grain is a necessity as enlargements will greatly emphasize the mealy appearance of a coarse-grained image. For bird photography, for which the real miniature cameras are not suitable, the I.D. II or D. 76 developers are quite capable of producing a sufficiently fine-grained image without increase in exposure, but with due care the pyro developer will not unduly emphasize grain. See that both the developing and fixing solutions are at the same temperature, not too warm, do not over-develop, and all should be well. I have spoilt a number of negatives through insufficient attention to these points, and reproduce the Rubythroat photograph to show how an otherwise good negative can be reduced to mediocrity by careless processing. In this case I grossly over-developed a whole batch of 6 plates. In development as in exposure you must resist that tendency to carry it too far in a misguided effort to bring up shadow detail. Stick to the time and temperature chart for the particular plates and developer you are using and do not develop for excessive contrast which in India usually already exists to add to your difficulties.

This year I took to Kashmir all the ingredients for making up a metol-hydroquinone borax fine grain developer (I.D. II). The formula for this is as follows :—

Metol	20 grs.
Sodium sulphite (anhydrous) ...	880 grs.
Hydroquinone	50 grs.
Borax	20 grs.
Water to	20 ozs.

It has good keeping qualities, is not laborious to make up, is economical, and to develop about 250 ¼ plates—the number I used last leave—in a tank requiring 20 ozs. of solution approximately the following quantities of chemicals will suffice:—

Metol	1 oz.
Sodium sulphite (anhydrous)	3 lbs.
Hydroquinone	2½ ozs.
Borax	1 oz.

These you will admit do not take up a great deal of room and compared with what you would have to pay a firm for processing this number of plates, not to mention the outlay on postage and packing, the cost of these materials, working out at under Rs. 9 is ludicrously small. If you choose to employ the pyro developer, both the bulk and cost of the chemicals will be considerably less.

Having developed your negatives it follows that you might just as well go a stage further and make your own enlargements and slides from them. Except when I am on leave, I take very few photographs of birds. I find that all my spare time in between is fully employed with the enlarging and slide making from the negatives I have accumulated. Enlarging can be very interesting as well as very simple. The greatest advantage accruing from doing your own work is that you can produce just the result you



A Himalayan Rubythroat enlarged from a negative taken and developed at 12,000 feet in Kashmir. The obvious grain detracts from the picture and was due to overdevelopment and insufficient attention to the temperature of the different solutions.

desire. In ninety-nine negatives out of a hundred only a comparatively small portion makes the picture and after all you should be the best judge of what those limits are and how the photograph should be reproduced. No amount of correspondence with a distant firm is going to produce quite the same result, besides which if special enlargements are to be made from every negative you send away it is going to come in very expensive.

All my enlarging is done with a vertical enlarger which I constructed from two derelict ½-plate 'Triple-Victos' which you can buy for a few shillings each, and a 6½ inch condenser mounted complete with carrier stage which I obtained from Messrs. J. J. Lancaster & Sons of Birmingham. For the lens I was lucky enough to be already in possession of a Ross Xpres salvaged from a former Reflex. The firm just mentioned sell all the parts separately for making up enlargers as well as complete instruments.

I keep a stock of Ilford glossy bromide paper, whole-plate size in soft, normal, and contrasty grades, so that employing an amidol developer I can turn out good black and white enlargements from any of my negatives eminently suitable for reproduction. Enlargements of various sizes on other grades and surfaces of paper I also turn out when the fit takes me.

I believe I also mentioned that I am in the habit of making lantern slides. They are a tremendous asset and are very easy to make with a little practice. I seldom make these slides by contact but use the enlarger to project the image the most suitable size on to the slide, sometimes slightly enlarging from the original, more often reducing it. I find it is easier to produce a good slide from a mediocre negative than it is to produce a satisfactory enlargement from it. If amidol is used no additional chemicals are required, but I prefer a hydroquinone caustic-soda developer to the amidol as I like the blacker tones it produces. For the sake of convenience I append the formulae of the amidol and hydroquinone caustic-soda developers which are as follows:—

Amidol for Bromide Papers (I.D. 22)

Sodium sulphite (anhydrous) ...	... 220 grs.
Amidol	... 60 grs.
Potassium bromide	... 8 grs.
Water to	... 20 ozs.

This developer does not keep for more than two or three days.

Hydroquinone Developer (I.D. 16)

No. 1. Hydroquinone Solution.

Hydroquinone	... 160 grs.
Sodium sulphite (anhydrous) ...	... 1 oz.
Water to	... 20 ozs.

No. 2. Alkali Solution.

Sodium hydrate (caustic-soda stick)	... 90 grs.
Potassium bromide	... 35 grs.
Water to	... 20 ozs.

For use take equal parts of each.

Although I have allowed myself to wander off into formulae, may I hasten to add that I have no intention of turning this article into a discourse on photography in general, about which in any case I am incompetent to write, so for any of the actual processes of developing, enlarging, printing, slide making, and general tittivating of faulty negatives, may I commend you to any of the excellent manuals on these subjects produced by the makers of the plates and papers you will be using.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART II.

(*Continued from page 408 of this volume*).

SPHINGIDÆ (*continued*).

Theretra oldenlandiae F.

Moore, *Lep. Ceyl.*, ii, 17, pl. 85, fig. 1a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 87. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 567.

Bell and Scott, *Fauna Brit. Ind.*, Moths, v, 448, pl. 6, figs. 4 and 5. 1937.

Ovum—Usual Sphingid type, pale green in colour. Deposited evening 22-vii-36. Hatched morning 25-vii-36.

1st instar—Head round, pale green. When newly hatched the ground colour is pale green and the larva is unmarked. Later the ground colour darkens and a series of seven subdorsal spots appears, from the 4th to 10th somite. Under a lens these spots have the upper half red and the lower yellow. Horn black. Moulted 27-vii-36.

2nd instar—Head and body black. A subdorsal yellow speck between the 1st-2nd and 2nd-3rd somites. A series of seven subdorsal yellow spots ringed with black from the 4th to 10th somite. Horn black with the base yellow. Legs yellow. Moulted 29-vii-36.

3rd instar—Similar to preceding. Instead of the two specks on the thoracic somites, there is now a subdorsal line consisting of a number of yellow and white dots. In most examples the spots on the 4th and 5th somites are centred with black and those from the 6th to 10th with orange. Sublateral area sprinkled with minute white dots. Moulted 31-vii-36.

4th instar—Similar to preceding. The first two ocelli with black pupils and with the black ring edged internally at top and bottom with a white and a black line. The other five ocelli with an orange horizonal stripe edged above and below with whitish. A few yellow specks at the base of the horn forming a continuation of the series of subdorsal ocelli and extending along each side of the anal somite. Horn black tipped with white. Moulted 2-viii-36.

Final instar—Head dull black. Legs pinkish. Ground colour blackish, the abdominal somites marbled with darker and with a black dorsal line. Thoracic somites with a subdorsal line of yellow and white dots and with a cream sublateral stripe merging into the sublateral white speckling of the abdominal somites. The ocelli on the 4th and 5th somites consist of a black ring edged above

and below internally with a white and a black line, this encloses a yellow area with a large black pupil sprinkled with white specks. On the 6th to 10th somites the ocelli consist of a black ring, edged internally at the top and bottom with white, and enclosing a purplish spot, just below the middle of which is a paler horizontal line with yellow ends. One specimen had this line entirely yellow. A transverse dorsal stripe along the anterior edge of each of the abdominal somites formed of a series of short longitudinal cream lines. A line of yellow specks from the base of the horn extending to the anterior and posterior edges of the 11th somite. Horn black and long, the base yellow and the tip white. In all stages it is very mobile and can be moved backwards and forwards. At the beginning of each instar the ground colour is very black and the rings surrounding the ocelli are difficult to detect, later the ground colour becomes greyer and the rings are then clearly visible. Ceased feeding 5-viii-36 and pupated 7-viii-36.

Pupa—In a loose cocoon spun among litter on the surface of the ground. Bone colour with blackish shading. Abdominal somites with a dark olive green dorsal stripe. A subdorsal black dot on each somite. Spiracles set in a black spot. Intersegmental areas darker in colour. Ventrum with an interrupted black median line. The black shading more pronounced sublaterally. Thorax with two subdorsal black dots. Wing cases with a line of black specks along the costa coalescing into a blotch at the centre. Proboscis sheath forming a slight keel in front of and below the head. A male emerged 17-viii-36.

Food-plant—Garden Balsam (*Impatiens* sp.)

Described from a number of larvae; some bred from ova and others found in the 2nd and 3rd instars in Calcutta in July 1936.

Hampson's description is as follows:—'Larva pale purplish brown; a subdorsal line of yellow and white spots with a pale lateral line below them on the thoracic somites; black ringed ocelli on 4th to 10th somites, the first two centred with blue, the posterior with purple. In the early stages these posterior ocelli are centred with crimson and there are dorsal bands of yellow specks.' Seitz is no better and writes 'Larva deep dark brown, almost black, peculiarly dotted light, particularly on the sides. On the rings 4 and 5 there are lateral fictitious eyes, on the following rings only yellowish lateral spots. Horn very long and thin. On species of *Vitis, Arum decurrens, Caladium, Colocasia*, on Balsaminae and other plants. The caudal horn is very agile and may be raised and lowered (Semper). Pupa brown marked with black; it has no projecting proboscis-case but a coniform snout.'

Rhyncholaba acteus Cr.

Moore, *Lep. Ceyl.*, ii, 23, pl. 88, fig. 1a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 100. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 568.

(Bell and Scott, *Fauna Brit. Ind.*, Moths, v, 462, pl. 6, figs. 8-10. 1937.)

Ovum—Yellow green, ovoid and small for the size of the insect. Hatched 25-ix-31.

1st instar—Head yellow green, body blue green. Horn thin, about half the length of the body, black with a yellow base. Moulted 27-ix-31.

2nd instar—Head yellow green, body blue green. A large white subdorsal spot on the 4th somite and a series of smaller oval white spots outlined in dark blue from the 5th to the 10th somite, the posterior spots being less conspicuous than the anterior. Horn as in previous instar. The thoracic somites begin to assume the typical tapering Choerocampid shape. Moulted 29-ix-31.

3rd instar—Very similar to the previous one. The spot on the 4th somite develops a dark pupil. The base of the horn orange. Moulted 1-x-31.

4th instar—Head blue green. True legs orange pink. Body blue green. Thoracic somites tapered, with a dark dorsal and a pale subdorsal line. 4th somite bearing a subdorsal ocellus consisting of a yellow green ring, edged internally and externally with white, containing an indigo blue spot anteriorly, the posterior portion being bright green dotted with white. A series of seven indistinct oblique white lateral stripes. A series of six elongated yellow subdorsal spots outlined with dark blue from the 5th to the 10th somite. Horn about half an inch long, the base orange followed by a narrow black, a wide white and a wide black ring, the tip white. The whole carried erect and curved slightly forward. Moulted 3-x-31.

Final instar—Similar to the previous one except that the horn is orange pink, short, thick and curved downwards. Pupated in a slight web among leaves on the surface of the ground 8-x-31.

Pupa—Brown with a dark dorsal line and lateral stripes. Ventral surface white, a black central and two dark brown lateral stripes. Wing cases pinkish brown, the edges darker. Tongue case free and circular. A male emerged 20-x-31.

Food-plant—*Caladium*.

Described from a batch of six larvae from ova found in Calcutta. Of these, one assumed a pinkish ground colour after the first ecdysis, another after the second and three after the third, these all produced the brown form of larva described below. The sixth remained green throughout. All wild larvae that I have seen have been of the green form.

Final instar—Brown form—Head and ground colour tobacco brown. The subdorsal thoracic lines yellow. The ring of the ocellus on the 4th somite very dark brown edged internally with white and externally with yellow. The spots on the 5th to 10th somites very conspicuous, the centres bright yellow green. Other markings the same as the green form.

Hampson described the horn as yellow and does not mention the brown form. He also appears to have been ignorant of the shape of the pupa as one of the characteristics given for the Choerocampinae is 'Pupa without external sheath for the proboscis'. Seitz's description is 'Young larva green, later on often dark brown, in front very pointed; on the 4th ring a very large expressive fictitious eye, surrounded by yellow and often shaded with dark;

on the other rings lateral light ovals and below them dark oblique patches. Horn very small.'

CYMATOPHORIDÆ.

Thyatira batis L.

Hamps., *Fauna Brit. Ind.*, Moths, i, 180. 1892.

Head lobed, brown marked with rufous. Body dark purplish brown, the dorsum slightly paler. 1st somite with a slight and 2nd with a very pronounced double dorsal hump. 5th to 9th and 11th and 12th somites each with a single dorsal hump. Legs rufous. The prolegs marked externally with orange. The larva rests with the head and thoracic somites curved along the abdomen and the posterior somites held up. When small somewhat resembles the excreta of a snail.

Pupa was formed in a leaf spun to the bottom of the box. Pale fuscous brown irrorated with darker specks. The intersegmental areas darker. Head rather obtuse.

Food-plant—*Rubus* sp.

The imagines emerge about 9 p.m.

Described from a full fed larva found in Darjeeling 21-v-35, pupated 26-v-35, and a male emerged 11-vi-35.

Hampson reproduces a figure from Buckler's *Larvae Brit. Butterflies and Moths*, which shows a larva with more pronounced humps than mine, and gives the following description:—'Larva brown; the 1st somite purplish, the 2nd and 3rd yellowish; paired dorsal hump on 2nd and 5th to terminal somites; oblique lateral dark stripes on 4th to 10th somites.'

LIMACODIDÆ.

Parasa lepida Cr.

Moore, *Lep. Ceyl.*, ii, 127, pl. 128, fig. 2b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 388. 1892.

Hamps., *Ill. Het.*, ix, 72, pl. 175, figs. 4, 4a. 1893.

Hering Seitz, *Indo-Austr. Bombyces*, x, 694.

Head brown and retractile. 1st somite retractile with a double black dorsal spot. Ground colour green. A blue dorsal stripe edged with dark olive green and then with whitish. A similar lateral stripe. A sublateral series of ten scoli tufted with urticating bristles, these are very short and mossy in appearance, the posterior two pairs with a black basal spot. A subdorsal series of ten scoli increasing in size to the 3rd, which is large and with a few red bristles in addition to the green ones, the next five very small, the 9th large and red tufted, the 10th smaller. Ventral surface whitish outlined in yellow. Some larvae have the ground colour between the dorsal and lateral stripes whitish.

Penultimate instar—Similar to the final but the area between the dorsal and lateral stripes whitish with a blue subdorsal stripe. No black basal spot on the posterior scoli. The lateral scoli themselves much longer and not so mossy in appearance. The first three and last two of the subdorsal series very much larger and tufted with black bristles, the 4th to 8th practically invisible.

Cocoon hard and dark brown, oval in shape and with some of the larval bristles, which turn black, woven into each end. In nature the cocoon is spun on the trunk of the tree on which the larva has fed and is completely covered by a web into which bits of bark are spun. Several cocoons are spun close together and they are extremely difficult to detect until the covering web has weathered away. The imago escapes by cutting a circular lid out of one end of the cocoon.

Food-plant—Mango (*Mangifera indica* Linn.), Gardenia and many others.

Described from a number of full fed larvae found in Calcutta 9-vii-36, one of which pupated 11-vii-36 and a male emerged 4-viii-36.

The larva is evidently very variable but none of the descriptions I can find applies to my examples. Hampson, in the *Fauna of British India*, describes it as 'pale green, whitish or bright yellowish green above; three dorsal mauve or green bands; subdorsal and sublateral series of short spinous tubercles, the spines of the anterior and posterior tubercles tipped with red.' In the *Illustrations of Heterocera* he writes 'The larva differs considerably in colour according to the plants upon which it has been feeding—two well marked varieties feeding on coffee and tea. The former usually have a pale greyish white ground colour, with three bright green dorsal stripes; whilst those living on the tea plant are more brilliantly coloured, having brilliant mauve stripes on a rich yellowish green ground.' The plate clearly shews the basal black spots on the posterior scoli but they are not mentioned in the text. The description in Seitz is 'Larva light green with three dorsal yellow or green bands, with subdorsal and lateral spined appendages, the spines of the anterior ones being spotted red.'

Natada suffusa Moore (=*Macroplectra nararia* Moore f. *cosmiana* Swinh. (=*suffusa* Moore)).

Hamps., *Fauna Brit. Ind.*, Moths, i, 381. 1892.

Moore, *Lep. E.I. Co.*, 415, pl. 21, figs. 8, 8a. 1857-1859.

Head brown and retractile. Ground colour green. A purple brown dorsal stripe, broad anteriorly and narrowing to a line on the 7th somite, from which it again broadens posteriorly. A yellow spot on each side of the dorsal stripe on the 7th somite. A series of 11 lateral projections with urticating bristles, the 1st and 2nd short, red and directed forwards, the 3rd red, long and directed sideways, the 4th to 10th short, green and directed sideways and the 11th long, green and directed backwards. A double dorsal row of tufts of very short urticating bristles. In some examples the dorsal stripe is almost obsolete.

Cocoon—Spherical, purplish brown.

Food-plant—*Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 25-xii-31, pupated 28-xii-31, and a male emerged 19-i-32.

Hampson describes the larva of *N. nararia* Moore, which he makes conspecific with *suffusa*, as 'yellowish green above, pink below; a yellow or pinkish dorsal band; a subdorsal series of red

tipped spinous tubercles; a sublateral series of larger whitish tubercles with very short spines, the tubercles at each end being long, those at the posterior end longest.'

NOCTUIDÆ.

Polytela gloriosae F.
Moore, *Lep. Ceyl.*, iii, 13, pl. 145, fig. 1a. 1884-87.
(Hamps., *Fauna Brit. Ind.*, Moths, ii, 168. 1894.)
(Warren Seitz, *Indo-Austr. Noctuidae*, xi, 86.)

Head brown. Legs brown with black tarsi. Prolegs orange. Ground colour purplish black. 1st somite with an orange dorsal blotch edged anteriorly with six black and posteriorly with two white spots. 2nd and 3rd somites each with an ovate orange subdorsal blotch containing a black dot and with a white spot on the outer edge. 1st to 12th somites with a white dorsal spot on the posterior edge of each somite, the 6th to 12th somites with a smaller white spot on the anterior edge as well. 4th to 9th somites each with two subdorsal white spots. 10th to 12th somites each with an orange subdorsal blotch. A lateral white spot between each somite from the 1st to 11th. 3rd to 11th somites with a sublateral white spot on the anterior portion of each somite. The dorsal and lateral spots largest.

Pupa reddish brown, subterranean.

Food-plant—Various kinds of Lily, particularly *Gloriosa superba*, and *Amaryllis*.

Described from a full fed larva found in Calcutta 31-vii-32, buried itself 2-viii-32 and a male emerged 14-viii-32.

Seitz gives the ground colour as 'purplish brown irrorated with silvery blue' and describes the white spots as yellow. Hampson describes the larva as 'smooth, purple black with dorsal, lateral and sublateral series of white spots; purplish lateral blotches on thoracic and two terminal somites; head, legs and a dorsal spot on 1st somite red'. (Hampson's description seems to be based on that of Moore, whose figure shews a larva with dull brownish lateral blotches on the 2nd, 3rd, 11th and 12th somites.)

Prodenia littoralis Boisd F.
Moore, *Lep. Ceyl.*, iii, 19, pl. 146, fig. 1b. 1884-87.
Hamps., *Fauna Brit. Ind.*, Moths, ii, 247. 1894.
Warren Seitz, *Indo-Austr. Noctuidae*, xi, 320.

Head black with an inverted yellow V. Legs black. Ground colour purplish black, a subdorsal series of triangular black marks, the apices directed towards the dorsum. 2nd and 3rd somites each with a subdorsal yellow spot; 4th to 9th somites each with a dull reddish subdorsal spot. Ventral surface paler. Claspers brown.

Pupa subterranean, of typical Noctuid shape. Colour bright chestnut brown, the skin between the somites and a dorsal line darker. Spiracles surrounded by a dark ring.

Food-plant—Very varied. I have found it on *Antirrhinum*, *Zinnia*, Spinach, Lettuce, Castor and *Caladium*, whilst Moore records *Lantana* as a food-plant. In captivity it will eat almost anything.

Described from a full fed larva found in Calcutta, 27-ii-35, buried itself 1-iii-35 and a male emerged 13-iii-35.

Hampson's description, which is copied almost word for word from Moore, is 'Pale violet brown, with a subdorsal series of narrow yellow spots with black lunules above them; a lateral series of purplish black spots centred by a white dot; a sublateral white line.'

Spodoptera mauritia Bsd.

Warren Seitz, *Indo-Austr. Noctuidae*, xi, 321.

Head olive brown with an inverted pale Y. Ground colour dark grey. 1st somite with a white dorsal line, which is continued along the dorsum as a more or less well pronounced purplish stripe. A subdorsal pale stripe, edged above with a black lunule on each somite. A sublateral pale stripe edged above with purplish. Ventral surface greenish.

In the 1st instar the larva is green with a black head. The head becomes brown after the first ecdysis. Some larvae become brown in the 4th instar, whilst others remain green with a brown lateral stripe, a few having a brown dorsal stripe in addition. All become brownish grey in the 5th instar with the adult markings more or less pronounced.

Pupa in a slight earthen cocoon just below the surface of the soil. The pupae vary considerably in colour, most of them are mahogany with the abdominal somites paler but a few are unicolorous yellow brown.

Food-plant—Grasses.

Described from a number of larvae bred from ova in Calcutta, one of which pupated 12-iii-38 and a male emerged 20-iii-38.

Seitz's description is 'Larva dark brown marbled with whitish; dorsal line white edged; subdorsal and lateral lines white; head red brown; venter greenish; feeding on cereals, reported to be injurious to rice in the Punjab.'

Sphetta apicalis Wlk.

Moore, *Lep. Ceyl.*, ii, 114, pl. 121, fig. 2a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 167. 1894.

Head pale yellow with a few coarse hairs. Ground colour grey. A white subdorsal line, straight on the thoracic somites but forming a series of Vs with their apices directed backwards on the abdominal. A white lateral line and a yellow sublateral stripe. Each somite with a black lateral and a yellow sublateral setiferous tubercle. 3rd to 12th somites each with four subdorsal setiferous tubercles, those on the 3rd black, on the 4th, 5th and 6th red, on the 7th, 8th and 9th the inner black and the outer red, on the 10th black, on the 11th red and on the 12th the inner black and the outer red. Anal plate marked with red. Ventral surface pale greenish.

Pupa dark mahogany brown. A slight projection between the eyes. The cremaster a bunch of hooked spines. In a slight cocoon between two leaves.

Described from a full fed larva found at Peshoke (2,500 ft. Darjeeling District) 21-xii-36, pupated 5-i-37, and a male emerged 24-i-37.

Moore's description, most of which is copied by Hampson, is 'Larva greyish blue above, green below, with a longitudinal waved darker greyish blue lateral band dividing the two colours; a dorsal row of blunt tubercles from fifth segment, and a subdorsal row of small black spots, one on each segment, the dorsal tubercles and anterior segments with a few short blackish hairs, and a single hair from each segment below the lateral line. Pupa purple brown.' In the figure the shape is distorted but the red tubercles are clearly shewn.

Chloridea obsoleta F. (=*Heliothis armigera* Hbn.).
Moore, *Lep. Ceyl.*, iii, 51, pl. 150, fig. 1a. 1884-87.
Hamps., *Ill. Het.*, ix, 92, pl. 176, fig. 22. 1893.
Hamps., *Fauna Brit. Ind.*, Moths, ii, 174. 1894.
Warren Seitz, *Indo-Austr. Noctuidae*, xi, 308.

Head small, colour very variable. Body with a few hairs, the colour very variable, the only constant feature being a white line along the anterior edge of each proleg.

Form 1. Head green. Body green with a darker dorsal line due to the contents of the intestines. A darker lateral line above the spiracles and a white sub-spiracular line. Ventral surface brighter green.

Form 2. Head very pale brown. Body yellow green with a paler sub-spiracular line. The 4th to 10th somites each with an indistinct rust coloured subdorsal blotch, that on the 4th somite largest. Ventral surface darker green.

Form 3. Head very pale brown. Body pinkish grey, the 1st somite less tinged with pink. A grey dorsal and lateral stripe. A pink spiracular stripe edged above and below with a white line. 4th to 11th somites each with a darker grey subdorsal blotch joining the lateral stripe and, on the 4th and 11th somites, joining the dorsal stripe as well. 5th to 10th somites each with a pair of black dorsal spots. Ventral surface paler.

Form 4. Head pale olive brown. Body putty colour tinged with pink. A greyish dorsal stripe rather more pronounced on the 11th somite. A whitish sub-spiracular line. Ventral surface tinged with green.

Form 5. Head honey colour. Body pale olive brown. A darker dorsal stripe more pronounced on the 11th somite. A darker subdorsal stripe and a whitish sub-spiracular stripe. Ventral surface whitish tinged with green.

Food-plant—Carnation, *Antirrhinum* and other cultivated plants, the larvae preferring the flowers. They are semi-nocturnal and cannibalistic.

Pupa subterranean in an earthen cocoon. Noctuid in shape but long and slender. Abdomen yellowish brown with a dark dorsal line, the intersegmental areas darker brown. Thorax tinged with olive green. Wing cases anteriorly olive green shading into yellowsh brown posteriorly. Cremaster a very long double spine.

Described from a series of full fed larvae found in Calcutta, one of which pupated 16-iii-34 and a male emerged 28-iii-34.

Hampson's description is 'Dorsal area pale brown; a lateral whitish band; ventral area pale green; each segment with some black specks; head red brown. Or green with a dark dorsal and two yellow lateral lines; the thoracic somites speckled brown and black, 5th to 10th somites with lateral brown blotches, anal somite with an irregular black dorsal mark. Feeds on rose buds.' Moore's figure shews a pale green larva with a subdorsal series of large pear-shaped black blotches.

Anua (*Ophiusa*) *coronata* F.

Moore, *Lep. Ceyl.*, iii, 158, pl. 166, fig. 5. 1884-87.

(Hamps., *Fauna Brit. Ind.*, Moths, ii, 502. 1894.)

Head brown, a yellow stripe along the median suture, a submedian yellow line and a pink stripe edged anteriorly with yellow and posteriorly with black. Body sienna brown, a double dorsal, a double subdorsal and a lateral line of somewhat paler brown. The dorsal lines touch twice on the 8th somite enclosing a dark spot. A pair of subdorsal yellow tubercles on the 11th somite. Ventral surface light brown with darker specks. Claspers externally very dark brown with a transverse yellow stripe, orange internally. A velvety black spot between the first and another anterior to the second pair of prolegs. I found one example in which the ground colour was flesh pink.

Pupa dark purple and enclosed in a slight cocoon of gummy silk spun, in captivity, between leaves.

Food-plant—*Quisqualis indica* Linn.

Described from a full fed larva found in Calcutta 19-x-31, pupated 26-x-31, and a male emerged 9-xi-31.

Hampson's description appears to have been made from an immature, preserved specimen. The yellow edged lateral spot on the 5th somite is only present in immature examples. The brown stripes of the head darken to black in preserved specimens. The mention of paired black tubercles on the 10th and 11th somites must be a mistake, the pair on the 11th somite is the only one present and that is yellow. (Hampson's description is based on that of Moore, whose figure shews a considerably shorter and stouter larva than mine.)

Parallelia (*Ophiusa*) *algira* L.

Head reddish brown with a pair of triangular pale yellow spots on the vertex. Body long and thin. Ground colour pinkish brown. A pale double dorsal line, edged on each side by a narrow blackish stripe. A narrow lateral stripe slightly darker than the ground colour and a blackish sublateral stripe. A reddish brown subdorsal dot on the anterior portion of the 4th somite. None of the stripes is of solid colour but each is composed of minute dots superimposed on the ground colour. Ventral surface pale with a black median stripe expanding slightly between each pair of prolegs. Legs reddish brown. Claspers marked internally with carmine, externally the base with a few minute blackish dots, the apex marked with

carmine. 1st pair obsolescent. A pair of red dorsal tubercles on the 11th somite.

Pupa between two spun together leaves. Purplish black covered with a white bloom. Spiracles very noticeable.

Food-plant—Castor (*Ricinus communis* Linn.).

Described from a full fed larva found in Calcutta 20-vi-38, pupated 23-vi-38, and a male emerged 2-vii-38.

Phytometra jessica Btlr.

Head and legs pale green. Ground colour pale green. A double white dorsal line, a double white subdorsal line and a white lateral line. A few short white hairs springing from white freckles. 1st and 2nd pairs of prolegs obsolete. Body narrow anteriorly, broadening posteriorly. One example had the head and legs marked with black and a black lateral dot in the middle of each somite.

Pupa pale green with a brown subdorsal spot on the posterior edge of the thorax and with the skin of the dorsum between the 1st, 2nd, 3rd, 4th, 5th, 6th and 7th abdominal somites brown. Proboscis sheath slightly longer than the wing cases. Enclosed in a hammock shaped cocoon of thin white silk, in nature presumably spun on the underside of a leaf.

Food-plant—*Antirrhinum* flowers.

Out of five larvae, two died from the attacks of a fungoid disease and one was killed by hymenopterous parasites.

Described from a full fed larva found in Calcutta 9-iii-35, pupated 11-iii-35, and a female emerged 17-iii-35.

Cosmophila erosa Hbn.

Moore, *Lep. Ceyl.*, iii, 84, pl. 155, fig. 1b. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 411. 1894.

Head green. Body green with a dorsal, subdorsal, lateral and sublateral line of minute white dots. Shape long and slender, the first pair of prolegs aborted, the second partially so. Some examples with a darker dorsal stripe.

Pupa in a spun together leaf. Rather slender with a small tooth projecting forward from between the eyes. Colour dark purple brown, the thorax darker than the rest.

Food-plant—Garden Hollyhock (*Malvaceae*).

Described from a full fed larva found in Calcutta 8-ii-38, pupated 11-ii-38, and a male emerged 21-ii-38.

Moore's figure shews a plain green larva with red prolegs and this feature is mentioned in his description and also in Hampson's, who more or less copies him. Both give *Hibiscus*, also *Malvaceae*, as the food-plant.

GEOMETRIDÆ.

Agathia laetata F.

Moore, *Lep. Ceyl.*, iii, 437, pl. 197, fig. 1b. 1884-87.

(Hamps., *Fauna Brit. Ind.*, Moths, iii, 487. 1895.)

(Prout Seitz, *Indo-Austr. Geometridae*, xii, 69.)

Head brownish. Ground colour dark green dorsally suffused with dull reddish purple. 1st somite divided into two lobes and

posterior somites slightly swollen. Very like the new growth of *Oleander*, on which it feeds.

Pupa in a spun together leaf. Buff coloured with dark dorsal markings.

Food-plant—Oleander (*Nerium odorum* Soland).

Hampson's description is 'larva green with dorsal prominences on 1st and 11th somites. Pupa yellowish green above, green below, the abdominal somites black-speckled' and this is copied by Seitz, except that the dorsal prominences are said to be on the 'prothorax and 8th (?) abdominal somite.'

Photoscotosia miniosata Wlk.

Head small, pale olive green. Ground colour pale green, 1st to 3rd. somites with a rufous dorsal stripe with a dark median line. 4th to 8th somites each with a rufous triangular dorsal mark, the apex directed forwards, 9th to 11th somites with a similar, but much fainter, mark. Last somite and anal claspers dark olive brown.

Pupa very dark purplish brown with the intersegmental areas paler. Pupated in a spun together leaf.

Food-plant—*Rubus* sp.

Described from a full fed larva found in Darjeeling 11-v-35, pupated 14-v-35, and a female emerged 2-vi-35.

Percnia ductaria Wlk.

Head and the dorsum of the 1st somite yellow brown, the latter with two black spots. Ground colour black, the skin shining as if oiled, with a yellow dorsal and sublateral and a white subdorsal and lateral stripe. Venter with a white median and lateral stripe. Legs yellow, claspers yellow marked with black. The skin is extremely thick and tough.

Pupa slender, very dark mahogany brown. In captivity in a slight earthen cocoon just below the surface of the soil.

The larvae are semi-gregarious, several being found on the same bush of the food-plant (name unknown) but it is rare to find more than two on one leaf.

Described from a number of full fed larvae found at Peshoke (2,500 ft. Darjeeling District) 23-xii-36, one of which pupated 3-i-37 and a male emerged 19-i-37.

Buzura (*Biston*) *suppressaria* Guen.

Moore, *Lep. Ceyl.*, iii, 407, pl. 188, fig. 1b, 1c. 1884-87.

(Hamps., *Fauna Brit. Ind.*, Moths, iii, 247. 1895.)

Head lobed, mottled brown. Ground colour mottled brown. 1st somite lobed. 2nd to 11th somites with a pair of pale dorsal spots. 11th somite with a transverse black stripe. Pale lateral tubercles on 7th and 8th somites. Spiracles red. Anal plate and claspers reddish.

Another form has the ground colour dark green with a darker dorsal stripe and dark suffusion between the somites. A lateral patch on the 3rd somite, a transverse stripe on the 11th and the anal claspers black.

Pupa very dark purple, almost black. Abdomen ending in a long anal spike. Subterranean.

Food-plant—*Cassia* sp. and *Lagerstroemia indica* Linn. (Crape Myrtle).

Described from a full fed larva found in Calcutta 9-xi-31, buried itself 11-xi-31 and a female emerged 11-i-32.

Hampson describes the green form only and says that the larva of the female is paler than that of the male. I have not observed this.

PYRALIDÆ

Sylepta derogata F.

Fletcher, *Some South Indian Insects*, pl. xxxv, figs. 2, 3 and 4.

Head brown, legs black. Ground colour green; 1st somite with two black dorsal spots. A white spiracular line. Clothed with sparse hair. Lives in a spun together leaf. Before pupating the larva turns pink.

Pupa reddish brown in a spun together leaf.

Food-plant—Hollyhock.

Described from a full fed larva found in Calcutta 6-iv-32, pupated 9-iv-32, and a male emerged 15-iv-32.

Correction

NYMPHALIDÆ.

Euthalia garuda Moore, *suddhodana Fruhs.*

On page 398 of vol. xl of this *Journal*, I described this larva as having a series of *eleven* feathery scoli. This should, of course, be *ten*. The '2nd to 10th' and the '11th' in the following lines should be corrected to '2nd to 9th' and '10th'.

ARCTIDÆ.

Utetheisa pulchella L.

The description appearing under this name on page 402 of vol. xl of this *Journal* is really of the larva of *Utetheisa lotrix* Cr. and the heading should be read accordingly. Specimens bred this year have been determined by the British Museum (Natural History) and I understand that this species has not been bred before. The reference originally quoted apply to true *pulchella*.

(To be continued).

THE MEDICINAL AND POISONOUS CRUCIFERS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The CRUCIFERÆ are a very important Natural Order, and one which includes many esculents and few poisonous or medicinal plants. They are annual, biennial, or perennial herbs without milky juice. They are dispersed all over the world; reaching, in the polar regions and on the highest mountains, the limits of flowering-plant vegetation. The family consists of 220 genera and 1,900 species; most of these inhabit the South of Europe and Asia Minor; they are rarer in the tropics, in extra-tropical and temperate South America. Several species are cultivated in numberless varieties and forms as vegetables.

The members of the Order are acrid, stimulant, and anti-scorbutic; seeds oleaginous, frequently pungent.

The following have been isolated from different parts of the plants:—(1) *alkaloids*—cheirinine, sinapine—; (2) *aromatic alcohols*—inositol—; (3) *enzymes*—myrosin—; (4) *glucosides*—cheirolin, glucocheirolin, glucotropocolin, sinalbin, sinigrin—; (5) *acids*—behenic, erucic, fumaric, myronic, oleic, stearic—; (6) *pigments*—quercetin—; (7) *mustard oils*—allyl, benzyl, phenyl ethyl.

The medicinal and poisonous crucifers of the world belong to 45 genera:—ALLIARIA (temperate Europe; Asia); ALYSSUM (Mediterranean; Europe); ARABIDOPSIS (Europe; Western Asia); ARABIS (northern temperate regions; south America); BARBAREA (northern temperate regions); BERTEROA (northern temperate regions of the Old World); BRASSICA (Mediterranean; Europe, Asia); BUNIAS (Mediterranean; Asia); CAKILE (northern temperate regions); CAMELINA (Mediterranean; Europe); CAPSELLA (temperate and sub-tropical regions); CARDAMINE (cosmopolitan; chiefly temperate regions); CHEIRANTHUS (Mediterranean; northern temperate regions); CLYPEOLA (Mediterranean); COCHLEARIA (Europe, Asia Minor); CRAMBE (Mediterranean; Europe, Asia, Polynesia, Patagonia); DENTARIA (northern temperate regions); DESCURAINIA (northern temperate regions; South America); DIPLOTAXIS (Mediterranean; Europe); DRABA (northern temperate and arctic regions; south-western North America); EROPHILA (Mediterranean; Europe); ERUCA (Mediterranean); ERYSIMUM (Mediterranean; Europe; Asia); FARSETIA (Mediterranean); HELIOPHILA (South Africa); HESPERIS (Mediterranean; Europe); IBERIS (Europe, Asia); IODANTHUS (Atlantic North America); ISATIS (Mediterranean; Europe; Asia); LEPIDIUM (cosmopolitan); LUNARIA (Europe); MATTHIOLA (Mediterranean; Europe, South Africa); MORICANDIA (Mediterranean); NASTURTIUM (cosmopolitan); RADICULA (North America); RAPHANUS (Mediterranean; Europe; Java); RAPISTRUM (Mediterranean; central Europe); RORIPA (northern hemisphere); SENEBIERA (subtropical regions; Europe); SESELI (Europe, Africa, Asia, Australia); SISYMBRIUM

(northern temperate regions); THLASPI (northern temperate [illegible]); THYSANOCARPUS (California); VESICARIA (Europe); WASABIA (Japan).

The medicinal and poisonous crucifers of India belong to 24 genera :—ALLIARIA, ALYSSUM, ARABIDOPSIS, BARBAREA, BRASSICA, CAPSELLA, CARDAMINE, CHEIRANTHUS, COCHLEARIA, CRAMBE, DESCURAINIA, DRABA, EROPHILA, ERUCA, ERYSIMUM, FARSETIA, ISATIS, LEPIDIUM, MATTHIOLA, MORICANDIA, NASTURTIUM, RAPHANUS, SISYMBRIUM, THLASPI.

A. Pods narrow, long. Seeds usually uniseriate (pods sometimes short in *Nasturtium*)
  I. Sepals narrow, erect; valves without horns or appendages; stigmas erect, connate or decurrent on the style ... ... MATTHIOLA.
  II. Sepals broad or narrow; stigma undivided or shortly bilobed
    a. Sepals erect, lateral saccate.—Hoary, leafy erect herbs ... ... CHEIRANTHUS.
    b. Sepals spreading, not saccate; pods tumid; seeds minute, biseriate. Flowers usually yellow ... NASTURTIUM.
    c. Sepals not saccate; pods 4-angled; seeds uniseriate. Flowers yellow ... ... BARBAREA.
    d. Sepals not saccate; pods hardly nerved, usually acute; stamens simple. Flowers white or purple ... ... CARDAMINE.

B. Pods short, broad. Seeds usually biseriate (pods sometimes long and seeds uniseriate in *Farsetia*)
  I. Pods 2-celled; sessile, many-seeded. Seeds compressed, often winged, uniseriate ... ... FARSETIA.
  II. Pods 1-2-celled, 2-many-seeded, valves often tumid. Seeds biseriate (sepals never saccate). Flowers white or yellow .....
    a. Sepals, short, spreading. Glabrous herbs ... COCHLEARIA.
    b. Stamens often appendaged; pods usually orbicular and 4-seeded.—Hoary herbs ... ... ALYSSUM.
    c. Stamens not appendaged; pods longer than broad, many-seeded.—Hoary herbs
      + Petals entire ... ... DRABA.
      ++ Petals bifid ... ... EROPHILA.

C. Pods usually sessile, long, narrow. Seeds usually 1-seriate. Stigma capitate, emarginate or shortly bilobed
  I. Flowers yellow, pedicelled, ebracteate. Pods terete, valves 3-nerved ... ... SISYMBRIUM.
  II. Flowers white. Pods terete, valves 1-3-nerved. Seeds smooth or striate ... ... ALLIARIA.
  III. Flowers yellow, pedicelled, ebracteate. Pods cylindric or flat, valves 1-nerved ... ... DESCURAINIA.
  IV. Flowers white, purple or rose-coloured. Valves of the terete or compressed pod 1-nerved or nerveless ... ARABIDOPSIS.
  V. Flowers yellow, rarely purple, ebracteate. Pods elongate, narrow, compressed tetragonal or terete; valves linear, 1-nerved, frequently keeled ... ERYSIMUM.

D. Pods short or long, cotyledons longitudinally folded or deeply grooved
  I. Stigma capitate, truncate or 2-lobed
    a. Pods long. Seeds uniseriate ... ... BRASSICA.
    b. Pods short, turgid, beaked. Seeds biseriate ... ERUCA.
  II. Stigmas connate, forming an erect cone. Pods long. A glaucous large herb or undershrub .... MORICANDIA.

E. Pods short, dehiscing throughout their length, compressed laterally at right angles to the septum
  I. Cotyledons incumbent, straight, curved or longitudinally folded
    a. Pods many-seeded, valves not winged ... CAPSELLA.
    b. Pods few-seeded, valves winged or not ... LEPIDIUM.
  II. Cotyledons accumbent, straight. Pods compressed notched; valves winged or keeled ... ... THLASPI.

F. Pods short, indehiscent, not jointed, usually hard Pods 1-celled, oblong or linear, wing thick.—Glaucous herbs ... ... ISATIS.

G. Pods long or short, transversely jointed; joints indehiscent or the lower 2-valved or reduced to a pedicel for the upper
  Lower joint of pods a seedless pedicel, upper globose 1-seeded ... ... CRAMBE.

H. Pods long, not jointed, indehiscent, either 1-celled and many-seeded or breaking up into many 1-celled, 1-seeded indehiscent fragments
  Pods long, terete, hollow or septate; seeds globose 2-3-celled ... ... RAPHANUS.

ALLIARIA.

The two species of this genus inhabit Western Asia, Europe, and North Africa.

Alliaria officinalis Andrzej. is found in the Western Himalaya from Kumaon to Kashmir, at 6,000-10,000 feet. From Afghanistan it extends westwards to the Mediterranean, Central and subarctic Europe.

The herb and seeds are esteemed diuretic, diaphoretic, and expectorant, and are used as external application in gangrenous affections, and to promote suppuration, healing of cuts, bruises and ulcers.

In England the leaves used to be taken internally as a sudorific and deobstruent, and externally were applied antiseptically in gangrenes and ulcers. The juice of the leaves taken alone or boiled into a syrup with honey is found serviceable in dropsy.

The plant is to be used fresh, for it loses its properties on drying.

Dutch: Lookkruid, Look zonder look—; *English*: Beggarman's Oatmeal, Cardiacke, Caspere, Eileber, English Treacle, Garlick-roast, Hedge-garlick, Jack-by-the-hedge, Leek-cress, Garlick Mustard, Penny Hedge, Poor Man's Garlic, Poor Man's Mustard, Poor Man's Treacle, Sauce-alone, Swarms—; *French*: Alliaire, Herbe aux ailles, Herbe aux aillets, Herbe aux aulx, Julienne alliaire—; *German*: Knoblauchhederich, Knoblauchkraut, Knoblauchsrauke—; *Greek*: Skordion—; *Italian*: Erba alliaria—; *Pacific Coast*: English Treacle, Garlic Mustard, Garlicwort, Hedge Garlic, Hedge Mustard, Leek Cress, Poor Man's Mustard—; *Portuguese*: Alliaria—; *North America*: Hedge Garlic—; *Russian*: Chessnovitsa—; *Spanish*: Aliaria—.

ALYSSUM.

The genus includes 120 species, natives of Europe, the Mediterranean region as far as Central Asia, the Canary Islands, Madeira; naturalised elsewhere.

Alyssum maritimum Lam. is cultivated in gardens in North-western India.

(northern temperate regions); THLASPI (northern temperate regions); THYSANOCARPUS (California); VESICARIA (Europe); WASABIA (Japan).

The medicinal and poisonous crucifers of India belong to 24 genera :—ALLIARIA, ALYSSUM, ARABIDOPSIS, BARBAREA, BRASSICA, CAPSELLA, CARDAMINE, CHEIRANTHUS, COCHLEARIA, CRAMBE, DESCURAINIA, DRABA, EROPHILA, ERUCA, ERYSIMUM, FARSETIA, ISATIS, LEPIDIUM, MATTHIOLA, MORICANDIA, NASTURTIUM, RAPHANUS, SISYMBRIUM, THLASPI.

A. Pods narrow, long. Seeds usually uniseriate (pods sometimes short in *Nasturtium*)
   - I. Sepals narrow, erect; valves without horns or appendages; stigmas erect, connate or decurrent on the style ... ... MATTHIOLA.
   - II. Sepals broad or narrow; stigma undivided or shortly bilobed
     - a. Sepals erect, lateral saccate.—Hoary, leafy erect herbs ... ... CHEIRANTHUS.
     - b. Sepals spreading, not saccate; pods tumid; seeds minute, biseriate. Flowers usually yellow ... NASTURTIUM.
     - c. Sepals not saccate; pods 4-angled; seeds uniseriate. Flowers yellow ... ... BARBAREA.
     - d. Sepals not saccate; pods hardly nerved, usually acute; stamens simple. Flowers white or purple ... ... CARDAMINE.

B. Pods short, broad. Seeds usually biseriate (pods sometimes long and seeds uniseriate in *Farsetia*)
   - I. Pods 2-celled; sessile, many-seeded. Seeds compressed, often winged, uniseriate ... ... FARSETIA.
   - II. Pods 1-2-celled, 2-many-seeded, valves often tumid. Seeds biseriate (sepals never saccate). Flowers white or yellow .....
     - a. Sepals, short, spreading. Glabrous herbs ... COCHLEARIA.
     - b. Stamens often appendaged; pods usually orbicular and 4-seeded.—Hoary herbs ... ... ALYSSUM.
     - c. Stamens not appendaged; pods longer than broad, many-seeded.—Hoary herbs
       - † Petals entire ... ... DRABA.
       - †† Petals bifid ... ... EROPHILA.

C. Pods usually sessile, long, narrow. Seeds usually 1-seriate. Stigma capitate, emarginate or shortly bilobed
   - I. Flowers yellow, pedicelled, ebracteate. Pods terete, valves 3-nerved ... ... SISYMBRIUM.
   - II. Flowers white. Pods terete, valves 1-3-nerved. Seeds smooth or striate ... ... ALLIARIA.
   - III. Flowers yellow, pedicelled, ebracteate. Pods cylindric or flat, valves 1-nerved ... ... DESCURAINIA.
   - IV. Flowers white, purple or rose-coloured. Valves of the terete or compressed pod 1-nerved or nerveless ... ARABIDOPSIS.
   - V. Flowers yellow, rarely purple, ebracteate. Pods elongate, narrow, compressed tetragonal or terete; valves linear, 1-nerved, frequently keeled ... ERYSIMUM.

D. Pods short or long, cotyledons longitudinally folded or deeply grooved
   - I. Stigma capitate, truncate or 2-lobed
     - a. Pods long. Seeds uniseriate ... ... BRASSICA.
     - b. Pods short, turgid, beaked. Seeds biseriate ... ERUCA.
   - II. Stigmas connate, forming an erect cone. Pods long. A glaucous large herb or undershrub ... ... MORICANDIA.

E. Pods short, dehiscing throughout their length, compressed laterally at right angles to the septum
  I. Cotyledons incumbent, straight, curved or longitudinally folded
    a. Pods many-seeded, valves not winged ... CAPSELLA.
    b. Pods few-seeded, valves winged or not ... LEPIDIUM.
  II. Cotyledons accumbent, straight. Pods compressed notched; valves winged or keeled ... ... THLASPI.

F. Pods short, indehiscent, not jointed, usually hard Pods 1-celled, oblong or linear, wing thick.—Glaucous herbs ... ... ISATIS.

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Alyssum maritimum Lam. is cultivated in gardens in North-western India.

The plant is commonly used in Spain as an antiscorbutic and diuretic. In Barcelona it is highly esteemed as an astringent for gonorrhoea.

Catalan: Caps blancs, Herba blanca, Sempre en flor—; *English*: Sweet Madwort—; *French*: Alysse, Alysse maritime, Alysse odorant, Alysson, Corbeille d'argent, Corbeille d'or—; *German*: Steinkraut—; *Malta*: Allison, Sweet Alysson, Buttuniera—; *Roumanian*: Galbenus, Lubit—; *Russian*: Taritsa—; *Spanish*: Aliso de mar, Bosqueletes anchos, Bosqueletes de dama, Bosqueletes de plata, Mastuerzo maritimo—.

Arabidopsis.

The genus consists of 11 species distributed over Europe, Asia, and Africa.

Arabidopsis thaliana (Linn.) Heynh. is found in Kashmir at 5,000-10,000 feet, and in Kumaon. It extends to Afghanistan, Western Asia, Central Europe, and the Mediterranean region; it has become naturalized in North and South America, South Africa and Australia.

It is used in Spain and other parts of Europe to cure sores in the mouth.

English: Thale Cress—.

Barbarea.

The genus consists of 15 species of the northern temperate regions, chiefly European.

Barbarea vulgaris Br. is found in the temperate and subalpine Himalaya and Western Tibet at 6,000-10,000 feet. It is distributed to Western Asia, Europe, North and South Africa, and Australia.

In Spain the leaves are a reputed vulnerary.

In La Reunion the plant is used as a stimulant and antiscorbutic.

Catalan: Herba barbara, Herba barbera, Herba de Santa Barbara—; *English*: Winter Cress, Yellow Rocket—; *French*: Barbarée, Barbarée vulgaire, Cresson de terre, Cresson vivace, Girarde jaune, Herbe aux charpentiers, Herbe de sainte Barbe, Herbe de saint Julien, Herbe de sainte Marguerite, Julienne jaune, Rondote—; *German*: Barbarakraut, Erdkresse—; *La Reunion*: Cresson de terre—; *Pacific Coast*: Bitter Cree, French Cress, Hedge Mustard, Land Cress, Normany Cress, Rocket Cree, St. Barbara's Cress, Winter Cress, Winter Rocket, Yellow Rocket—; *Spanish*: Yerba de los carpinteros, Yerba de Santa Barbara—.

Brassica.

The genus numbers 33 species, often polymorphic, chiefly Mediterranean.

The seeds of most of them are stimulant and laxative.

The following species are used medicinally in Europe—*B. campestris* Linn., *B. Napus* Linn., *B. nigra* Koch., *B. oleracea* Linn., *B. Rapa* Linn.—; in Japan—*B. campestris* Linn.—; in China—*B. campestris* Linn., *B. cernua* Thunb., *B. Napus* Linn. var. *chinensis* (Linn.) O. E. Schulz, *B. oleracea* Linn., *B. Rapa* Linn.—; in Indo-China—*B. campestris* Linn., *B. integrifolia* (West.) O. E. Schulz, *B. Napus* Linn. var. *chinensis* (Linn.) O. E. Schulz, *B. oleracea*

Linn.—; in the Philippine Islands—*B. integrifolia* (West.) O. E. Schulz.—.

A. Ovary multi-ovulate (9-45). Pods 1.5-10 cm. long. Beak distinctly conical, sometimes as thick as the pod, often 1- or 2-seeded
  I. Stem-leaves amplexicaul
    1. Flowers not surpassing the buds at flowering
      a. Calyx closed. Petals pale yellow, 1.8-2 cm. long. Pods with undulate margins. Leaves more or less fleshy ... ... 1. *B. oleracea.*
      b. Calyx half-opened. Petals intensely yellow, 0.9-1.8 cm. long. Pods with straight margins. Leaves membranous ... ... 2. *B. Napus.*
    2. Flowers surpassing the buds at flowering ... 3. *B. campestris.*
  II. Stem-leaves sessile or petiolate
    1. Leaves with a plane margin ... ... 4. *B. integrifolia.*
    2. Leaves with a crisp margin ... ... 5. *B. cernua.*

B. Ovary few-ovulate (5-11). Pods 0.8-3 cm. long. Beak very thin, always seedless ... ... 6. *B. nigra.*

1. **Brassica oleracea** Linn. is cultivated in all its numerous varieties all over India. The typical plant is indigenous in Central Europe.

The Cabbage has entered into the Ayurvedic Materia Medica, and is very often prescribed by vaids for a variety of ailments.

The cabbage and its numerous associates are well-known household remedies.

The seeds are diuretic, laxative, stomachic, and anthelmintic. The leaves form a good application in gout and rheumatism. An Irish cure for a sore throat is to tie cabbage leaves round it; and the same remedy is applied in England with hot cabbage leaves for a swollen face.

The red cabbage is most emollient and pectoral. The juice made into syrup, without any condiments, is useful in chronic coughs, and in bronchial asthma. It is considered in France to be highly antiscorbutic.

The leaves of the common white cabbage, when gently bruised and applied to a blistered surface, will promote a free discharge, as also when laid next the skin in dropsy of the ankles. Its juice will cure warts.

Bengal: Kopi—; *Catalan*: Col—; *Chinese*: Kan Lan, Pe Ts'ai, Pao Pao Ts'ai—; *Deccan*: Karam—; *Dutch*: Kool—; *Egypt*: Krumb—; *English*: Cabbage, Colewort, Collet, Sea Cabbage, Wild Cabbage—; *French*: Chou, Navette d'hiver, Rabette—; *German*: Gartenkohl, Kohl—; *Greek*: Krambi—; *Gujerat*: Kobia—; *Hindi*: Band gobi, Karamkalla, Kobi, Kopi—; *Hova*: Laisoa, Laisoamasombika—; *Indo-China*: Cam lam—; *Iraq*: Lahanoh—; *Italian*: Cavolo—; *Kurdish*: Kalam—; *Marathi*: Kholkhol—; *Moldavian*: Curechiu—; *Mundari*: Arakubi, Kubiara, Potomkubi—; *Polish*: Iarmuz, Kapusta—; *Portuguese*: Cauve, Repolho—; *Punjabi*: Band gobi—; *Roumanian*: Varza—; *Russian*: Kapusta—; *Sanskrit*: Dalamalini, Dalasarini, Kebuka, Kechuka, Keluta, Kembu, Kembuka, Pechuka, Pichuni, Polini, Supatra, Swadukanda, Swalpavitapa—; *Spanish*: Berza, Col—; *Swedish*: Kahl—; *Sze-Chwan*: Lien Hoa Pe—; *Tamil*: Gos, Kos—; *Telugu*: Gos.

2. **Brassica Napus** Linn., indigenous in the South Mediterranean region, is cultivated in India.

The root is emollient and diuretic. Its juice is useful in chronic coughs and bronchial catarrh.

The Chinese use the seeds to cure coughs complicated with dyspnoea, and to subdue expectoration due to cold.

Afrikaans: Raap—; *Catalan*: Nap—; *Chinese*: La Pa Tzeu, Lo Pou Tse—; *Danish*: Stekroe—; *Dutch*: Steekraap—; *English*: Coleseed, Navew, Rape—; *French*: Arbi, Chou navet, Navau, Navet—; *German*: Raps, Reps, Ruebsen, Stechruebe—; *Greek*: Bunias—; *Hindi*: Kali sarson, Tori—; *Iraq*: Saljam—; *Italian*: Napo, Navone—; *Malta*: Navone, Neveu—; *Mundari*: Huringmani, Mani, Turimani—; *Persian*: Saljam—; *Polish*: Rzepnica—; *Portuguese*: Nabo—; *Roumanian*: Broajba—; *Russian*: Briukoa, Dikayia Repa, Nyemetskayia Repa—; *Sadani*: Lutumani, Turimani—; *Spanish*: Nabo, Nabo común, Nabo largo—; *Swedish*: Stickrave—; *Uruguay*: Colza, Nabo—.

var. **chinensis** (Linn.) O. E. Schulz is cultivated in India, China, Korea, Japan and Java.

The entire plant is antiscorbutic, arthritic, and resolvent.

The seeds are considered stimulant, stomachic, and laxative.

In Indo-China the leaves and stems are considered to be anti-dysenteric. The seeds are used in gleet and in difficult parturition.

In Chinese drug shops the plant is represented as dry, round, light-coloured cakes of vegetable matter made from the broken leaves. The cakes have been found to contain a large amount of various vitamins (Hsien Wu).

Annam: Cai—; *China*: Sung—; *English*: Chinese Cabbage—; *Indo-China*: Van dai—; *Japan*: Onuma—; *Malaya*: Pak chai piang—; *Mundari*: Kubi, Risakubi—.

3. **Bassica campestris** Linn. is naturalized in India. In all probability it is indigenous in the mountainous region of the Mediterranean.

The tuberous roots and the seeds are said to be antiscorbutic.

The seeds yield Oil of Colza, which is officinal in Sweden as *Oleum Rapae*.

Arabic: Chardal—; *Betsileo*: Anambe—; *Brahui*: Mashna muli—; *Catalan*: Colinap—; *Danish*: Raps—; *Dehra Dun*: Banga sarson, Sarson—; *Dutch*: Koolzaad—; *English*: Coleseed, Colza, Field Cabbage, Navette, Swedish Turnip, Wild Navew—; *French*: Chou des champs, Chou colza, Navette—; *German*: Rape—; *Hova*: Ananomby, Anantsonga, Nave—; *Italian*: Colza—; *Malta*: Summer Rape, Wild Cabbage, Rapa selvatica, Caulicelli, Liftia—; *Meerut*: Banga sarson, Sarson—; *Mundari*: Piramani—; *Oudh*: Pila sarson—; *Pacific Coast*: Bargeman's Cabbage, Common Navew, Nape, Rutabaga, Summer Rape, Turnip, Wild Navette, Wild Navew—; *Rohilkhand*: Pila sarson—; *Roumanian*: Rapita—; *Russian*: Colza, Surepitsa—; *Sadani*: Sarso—; *Spanish*: Colinabo, Colza, Nabicol, Nabina—; *Uruguay*: Colza, Nabiza, Nabo—.

var. **rapa** (Linn.) Hartm. is cultivated throughout India. The Ayurvedists distinguish two varieties, the red and the white, and consider the white the better of the two.

The seeds mixed with hot water form an efficient counter-irritant poultice. The oil, combined with camphor, forms an efficacious embrocation in muscular rheumatism, stiff neck, etc.; it is used in dengue fever with benefit, and it is rubbed on the chest in bronchitis.

In Indo-China the roots and the leaves are considered stomachic; the ground fresh leaves are applied to abscesses; the seeds are given in colic.

Afrikaans: Raap—; *Annam*: Lu bu, Tron cu—; *Arabic*: Khardaleasvad—; *Bengal*: Kalisarson, Sadarai, Sanshi, Shalgram, Shurshi, Schwetrai, Sursha,

Sursi—; *Burma*: Amemniyenzi—; *Canarese*: Kappusasoe, Sarsive—; *Catalan*: Nap de bou, Nap rodo—; *China*: Yun T'ai—; *Cutch*: Surah—; *Deccan*: Kalerayan, Pilerayan—; *English*: Rape, Wild Turnip—; *German*: Reps, Ruebe, Ruebsen, Rurnips—; *Gujerat*: Kalarai, Raira, Sarashire, Sarsawa—; *Hasara*: Dakubi—; *Hindi*: Bangasarson, Baralai, Dain, Dainlai, Jadiya, Jariya, Kalerai, Kalisarson, Khetiya, Lahi, Lahota, Lai, Laita, Pilasarson, Pilirai, Rararada, Rarasarson, Sarson, Sarsonzard, Shalgham, Shetashirsha, Sursi, Tori, Toriya—; *Indo-China*: Man thanh, Vu than—; *Iraq*: Shalghan—; *Kurdish*: Shailam—; *Lepcha*: Kanyang—; *Malayalam*: Karupakatuka—; *Malta*: Swede—; *Marathi*: Kalamohare, Sherasa—; *Mundari*: Dakobi, Piramani—; *Nagpuri*: Dahakobi, Dahakubi—; *Persian*: Sipandanesiyah—; *Punjab*: Gonglu—; *Quetta-Pishin*: Jamboi—; *Rajputana*: Sarson, Sarsu—; *Sanskrit*: Bhutaghna, Bimbata, Duradharsha, Grahagna, Kadamba, Kadambada, Kadambaka, Kalasarshapa, Katukasveha, Katusveha, Rajakshavaka, Rajika, Rakshitaphala, Sarishapa, Sarshapa, Sidhaprayojana, Sidhartha, Tantubha, Tantuka, Tuverika, Ugragandha—; *Sinhalese*: Kaluabbe, Wal-aba—; *Spanish*: Nabo gallego, Turnep—; *Tamil*: Karuppukkadugu—; *Telugu*: Nallaavalu—; *Uthal*: Sarih—.

4. **Brassica integrifolla** (West) O. E. Schulz is much cultivated in India. It is distributed over the Indo-Malayan region, temperate Eastern Asia, Africa, Madagascar, the West Indies, and South America.

The seeds are warming, sudorific, and a well-known aid to digestion. They are much used in internal congestions, in spasmodic, neuralgic, and rheumatic affections, and in morbid states of the cerebro-spinal system.

In medicine the oil is used as an embrocation and is applied to the skin in eruptions and ulcers.

Bengal: Raisarasha—; *Bombay*: Rai, Rajika, Sarson—; *Canarese*: Sasive—; *China*: Pai Chieh—; *Cutch*: Rai—; *English*: Indian Mustard, Rai—; *French*: Moutarde de l'Inde, Moutarde rouge—; *Gujerati*: Rai—; *Hindi*: Badshahirai, Barirai, Barlai, Gohnasarson, Khasrai, Rai, Sarson, Sarsonlahi, Shahzadarai—; *Indo-China*: Ben, Rau cai, Rau mo, Spey top, Thuy thai—; *Kashmir*: Asur—; *Konkani*: Samsvel—; *Malaya*: Pak kai—; *Marathi*: Mohari, Rayan—; *Mundari*: Rai, Raimani—; *Pacific Coast*: Chinese Mustard, Cosson, Indian Mustard, Russian Mustard—; *Philippines*: Mostaza—; *Portuguese*: Mostarda de India, Mostarda vermelha—; *Sadani*: Rai—; *Sanskrit*: Rajika—; *Sinhalese*: Abba—; *Tamil*: Kadugu—.

5. **Brassica cernua** (Thunb.) Forbes and Hemsley is cultivated in India. It is found in China, Japan, and the West Indies.

The leaves are used in Indo-China as an antidysenteric. They are powerfully diaphoretic.

A decoction of the seeds is given in lumbago, cough, and indigestion.

China: Chieh—; *English*: Black Mustard—; *Indo-China*: Gioi—.

6. **Brassica nigra** (Linn.) Koch is cultivated in India and many other countries.

The leaves and seeds are much used by Hindu and Mahommedan practitioners, who credit them with valuable therapeutical properties.

The dried ripe seed is rubefacient, vesicant, emetic, stimulant, tonic and revulsive.

The seeds act as a digestive condiment, if taken moderately. If swallowed whole they operate as a laxative, and for this purpose are sometimes prescribed in dyspepsia and other complaints attended with torpid bowels.

The flour of the seeds is used in the form of a poultice being a useful and simple rubefacient and vesicant. Mustard poultices prove highly serviceable in cases of febrile and inflammatory diseases, internal congestions, spasmodic, neuralgic, and rheumatic affections. Mustard flour in water is highly recommended as a speedy and safe emetic. It is reckoned as a medicine of great value by the Javanese and the Chinese.

The Meskwaki Indians of Wisconsin grind the seed and use the powder as a snuff to cure cold in the head.

The pure fresh oil is a stimulant and mild counter-irritant when applied externally. As such, it is very useful in mild attacks of sore-throat, internal congestion, and chronic muscular rheumatism.

Mûstard seed has been recommended by Sanskrit authors as a cure for snake bite and scorpion sting; but Caius and Mhaskar have shown that it has no antidotal value against snake or scorpion venom.

An alkaloid, sinapine, has been isolated from the seeds; also myrosin, sinigrin, inosite, albumins, gums, and colouring matters.

Arabic: Khardal, Khirdal, Khurdal—; *Bengal*: Baisarisha—; *Bogotá*: Rábano, Rábano de canarios—; *Bombay*: Rai, Sarsan—; *Canarese*: Bilesasive, Karisasive, Sasive—; *Danish*: Senep—; *Deccan*: Raiee, Suroo, Sursoo—; *Dutch*: Mosterd, Zwart mosterd—; *Egypt*: Kabar, Khardal, Khodar, Lifsan—; *English*: Black Mustard, Mustard, True Mustard—; *French*: Chou noir, Moutarde, Moutarde grise, Moutarde noire, Navuce rouge, Sénevé, Sénevé noir—; *German*: Gruener Senf, Hollaendischer Senf, Mustert, Schwarzer Senf, Senf—; *Greek*: Napi, Napia, Sinapi, Sinipi—; *Gujerat*: Kalirai, Rai—; *Hindi*: Aslra, Banarasirai, Ghorrai, Jagrai, Kalirai, Lahi, Makrarai, Rai, Sursu, Suru, Taramira, Tira—; *Iraq*: Khardal—; *Italian*: Senapa, Senapa nera, Senapa vera—; *Konkani*: Sansonv—; *Lepcha*: Kun-rang nok—; *Malta*: Black Mustard, Senapa, Senapa nera, Sinapa, Mustarda seuna—; *Meskwaki*: Fitciko, makani—; *Pacific Coast*: Black Mustard, Brown Mustard, Kerlock, Red Mustard—; *Persian*: Sarshaf—; *Polish*: Gorczyka—; *Portuguese*: Mostarda, Mostardeira—; *Potenza*: Lassand—; *Prairie Potawatomi*: Tcotca'mosikûn—; *Reggio*: Senva—; *Roumanian*: Mustar—; *Russian*: Gortchiza ; *Sanskrit*: Asuri, Aritikshva, Jwalanti, Jwalatprabha, Katuasuri, Krimika, Krishnasarshapa, Krishnika, Kshava, Kshavaka, Kshudhabhijanana, Kshuijanika, Kshutabhijanaka, Kshutaka, Madhurika, Raji, Rajika, Raktasarshapa, Raktika, Sarshapa, Tikshnagandha—; *Sind*: Ahor, Kali sursoon, Suraj—; *Sinhalese*: Ganaba, Kalu-aba—; *Spanish*: Mostaza—; *Swedish*: Senap—; *Tamil*: Chirukadugu, Kadugu—; *Telugu*: Avalu—; *Treviso*: Colzat—; *Urdu*: Rai—; *Uruguay*: Mostacilla negra, Mostaza negra—; *Verona*: Ravenele—.

Cardamine.

The genus includes 100 cosmopolitan species, natives of temperate and cold regions, especially of Europe and Western and Central Asia.

The plant is bitter and antiscorbutic. The flowers are diuretic, useful in chorea and asthma.

The following are used medicinally in Europe—*C. alpina* Willd., *C. amara* Linn., *C. asarifolia* Linn., *C. gelida* Schott., *C. hirsuta* Linn., *C. impatiens* Linn., *C. parviflora* Linn., *C. pratensis* Linn., *C. resedifolia* Linn., *C. sylvatica* Linn., *C. trifolia* Linn.—; in Indo-China—; *C. hirsuta* Linn.—; in Northern America—*C. pratensis* Linn.—.

A. Petals linear, erect, very minute, white, often absent ... 2. *C. impatiens.*
B. Petals spreading, 3 times as long as the sepals ... 1. *C. pratensis.*

1. **Cardamine pratensis** Linn. is found in Kashmir. It is distributed to Northern and Western Asia, Europe, Abyssinia, and Noth America.

The plant is considered to be stimulant, diaphoretic, and diuretic.

In some parts of Europe the plant is used in the treatment of nervous affections. In Cornwall the flowering tops have been employed for the cure of epilepsy throughout several generations with singular success; though the use of the leaves only for this purpose has caused disappointment.

The seeds contain myronic acid.

Catalan: Creixans de prat, Creixens de prat—; *Dutch*: Gemeen schuimblad, Koekocksbloem, Pinksterbloem, Weidekers—; *English*: Apple-pie, Bird's-eye, Bogspinks, Bonny-Bird-Een, Bread-and-Milk, Canterbury Bells, Cuckoo's Bread, Cuckoo-flower, Cuckoo-pint, Cuckoo's Shoes and Stockings, Gilliflower, Gookoo-buttons, Headache, Lady Flock, Lady's Glove, Lady's Smock, Lamb Lakins, Lucy Locket, May Blob, May Flower, Milkgirl, Milk Maids, Paigle, Pigeon's Eye, Pink, Shoes and Stockings, Smell Smocks, Spink, Whitsuntide—; *French*: Bec à l'oiseau, Bouquet au coup, Cardamine, Cardamine des prés, Cresson amer, Cresson élégant, Cressonnette, Cresson des prés, Cresson sauvage, Passerage sauvage, Petit cresson aquatique—; *German*: Fleischblume, Gauchblume, Kuckucksschaumkraut, Schaumkraut, Schluesseblume, Wiesenkresse, Wiesenschaumkraut—; *Greek*: Kardamini, Sisymbrion eteron—; *Italian*: Cardamantina, Cardamina, Crescione pratense, Nasturzio salvaggio—; *Languedoc*: Creissouneto, Creissoun de prat—; *Moldavian*: Stupitul cuerlui—; *Polish*: Aengkrasse—; *Roumanian*: Pascele calului, Scuipatul cucului, Spumeala—; *Russian*: Kress, Serdechnik—; *Spanish*: Berros de prado, Mastuerzo de prado, Mastuerzo pratense—.

2. **Cardamine impatiens** Linn. occurs in the temperate Himalaya from Kashmir to Sikkim, at 5,000-12,000 ft. It is distributed to Afghanistan, temperate Asia and Europe.

The plant is stimulant and diuretic.

English: Mountain Bitter Cress, Narrow-leaved Bitter Cress.

Capsella.

The genus consists of 4 species, natives of temperate and subtropical regions.

Capsella Bursa-pasteris Medik. is a weed of cultivation; it is found in temperate India in cultivated places.

Plant astringent; seeds stimulant. The herb and its seeds were employed in former times to promote the regular monthly flow in women.

Apparently the uses of the plant are unknown in India.

It has been used in English domestic practice from early times as an astringent in diarrhoea; it was much used in decoction with milk to check active purgings in calves.

A well-known popular remedy in Europe and North-America. It is of prompt use to arrest bleedings and floodings, when given in the form of a fluid extract; and it may be considered a most reliable medicine for staying fluxes of blood. The fluid extract of the herb is also given for dropsy as a diuretic.

The Menomini of Wisconsin use the plant as a cure for poison ivy; the plant is steeped, and the water when tepid is used as a wash.

The flour of the seeds is used in the form of a poultice being a useful and simple rubefacient and vesicant. Mustard poultices prove highly serviceable in cases of febrile and inflammatory diseases, internal congestions, spasmodic, neuralgic, and rheumatic affections. Mustard flour in water is highly recommended as a speedy and safe emetic. It is reckoned as a medicine of great value by the Javanese and the Chinese.

The Meskwaki Indians of Wisconsin grind the seed and use the powder as a snuff to cure cold in the head.

The pure fresh oil is a stimulant and mild counter-irritant when applied externally. As such, it is very useful in mild attacks of sore-throat, internal congestion, and chronic muscular rheumatism.

Mûstard seed has been recommended by Sanskrit authors as a cure for snake bite and scorpion sting; but Caius and Mhaskar have shown that it has no antidotal value against snake or scorpion venom.

An alkaloid, sinapine, has been isolated from the seeds; also myrosin, sinigrin, inosite, albumins, gums, and colouring matters.

Arabic: Khardal, Khirdal, Khurdal—; *Bengal*: Baisarisha—; *Bogotá*: Rábano, Rábano de canarios—; *Bombay*: Rai, Sarsan—; *Canarese*: Bilesasive, Karisasive, Sasive—; *Danish*: Senep—; *Deccan*: Raiee, Suroo, Sursoo—; *Dutch*: Mosterd, Zwart mosterd—; *Egypt*: Kabar, Khardal, Khodar, Lifsan—; *English*: Black Mustard, Mustard, True Mustard—; *French*: Chou noir, Moutarde, Moutarde grise, Moutarde noire, Navuce rouge, Sénevé, Sénevé noir—; *German*: Gruener Senf, Hollaendischer Senf, Mustert, Schwarzer Senf, Senf—; *Greek*: Napi, Napia, Sinapi, Sinipi—; *Gujerat*: Kalirai, Rai—; *Hindi*: Aslra, Banarasirai, Ghorrai, Jagrai, Kalirai, Lahi, Makrarai, Rai, Sursu, Suru, Taramira, Tira—; *Iraq*: Khardal—; *Italian*: Senapa, Senapa nera, Senapa vera—; *Konkani*: Sansonv—; *Lepcha*: Kun-rang nok—; *Malta*: Black Mustard, Senapa, Senapa nera, Sinapa, Mustarda seuna—; *Meskwaki*: Fitciko, makani—; *Pacific Coast*: Black Mustard, Brown Mustard, Kerlock, Red Mustard—; *Persian*: Sarshaf—; *Polish*: Gorczyka—; *Portuguese*: Mostarda, Mostardeira—; *Potenza*: Lassand—; *Prairie Potawatomi*: Tcotca'mosikûn—; *Reggio*: Senva—; *Roumanian*: Mustar—; *Russian*: Gortchiza ; *Sanskrit*: Asuri, Atitikshva, Jwalanti, Jwalatprabha, Katuasuri, Krimika, Krishnasarshapa, Krishnika, Kshava, Kshavaka, Kshudhabhijanana, Kshujjanika, Kshutabhijanaka, Kshutaka, Madhurika, Raji, Rajika, Raktasarshapa, Raktika, Sarshapa, Tikshnagandha—; *Sind*: Ahor, Kali sursoon, Suraj—; *Sinhalese*: Ganaba, Kalu-aba—; *Spanish*: Mostaza—; *Swedish*: Senap—; *Tamil*: Chirukadugu, Kadugu—; *Telugu*: Avalu—; *Treviso*: Colzat—; *Urdu*: Rai—; *Uruguay*: Mostacilla negra, Mostaza negra—; *Verona*: Ravenele—.

Cardamine.

The genus includes 100 cosmopolitan species, natives of temperate and cold regions, especially of Europe and Western and Central Asia.

The plant is bitter and antiscorbutic. The flowers are diuretic, useful in chorea and asthma.

The following are used medicinally in Europe—*C. alpina* Willd., *C. amara* Linn., *C. asarifolia* Linn., *C. gelida* Schott., *C. hirsuta* Linn., *C. impatiens* Linn., *C. parviflora* Linn., *C. pratensis* Linn., *C. resedifolia* Linn., *C. sylvatica* Linn., *C. trifolia* Linn.—; in Indo-China—; *C. hirsuta* Linn.—; in Northern America—*C. pratensis* Linn.—.

A. Petals linear, erect, very minute, white, often absent ... 2. *C. impatiens.*
B. Petals spreading, 3 times as long as the sepals ... 1. *C. pratensis.*

1. **Cardamine pratensis** Linn. is found in Kashmir. It is distributed to Northern and Western Asia, Europe, Abyssinia, and Noth America.

The plant is considered to be stimulant, diaphoretic, and diuretic.

In some parts of Europe the plant is used in the treatment of nervous affections. In Cornwall the flowering tops have been employed for the cure of epilepsy throughout several generations with singular success; though the use of the leaves only for this purpose has caused disappointment.

The seeds contain myronic acid.

Catalan: Creixans de prat, Creixens de prat—; *Dutch*: Gemeen schuimblad, Koekocksbloem, Pinksterbloem, Weidekers—; *English*: Apple-pie, Bird's-eye, Bogspinks, Bonny-Bird-Een, Bread-and-Milk, Canterbury Bells, Cuckoo's Bread, Cuckoo-flower, Cuckoo-pint, Cuckoo's Shoes and Stockings, Gilliflower, Gookoo-buttons, Headache, Lady Flock, Lady's Glove, Lady's Smock, Lamb Lakins, Lucy Locket, May Blob, May Flower, Milkgirl, Milk Maids, Paigle, Pigeon's Eye, Pink, Shoes and Stockings, Smell Smocks, Spink, Whitsuntide—; *French*: Bec à l'oiseau, Bouquet au coup, Cardamine, Cardamine des prés, Cresson amer, Cresson élégant, Cressonnette, Cresson des prés, Cresson sauvage, Passerage sauvage, Petit cresson aquatique—; *German*: Fleischblume, Gauchblume, Kuckucksschaumkraut, Schaumkraut, Schluesseblume, Wiesenkresse, Wiesenschaumkraut—; *Greek*: Kardamini, Sisymbrion éteron—; *Italian*: Cardamantina, Cardamina, Crescione pratense, Nasturzio salvaggio—; *Languedoc*: Creissouneto, Creissoun de prat—; *Moldavian*: Stupitul cuerlui—; *Polish*: Aengkrasse—; *Roumanian*: Pascele calului, Sculpatul cucului, Spumeala—; *Russian*: Kress, Serdechnik—; *Spanish*: Berros de prado, Mastuerzo de prado, Mastuerzo pratense—.

2. **Cardamine impatiens** Linn. occurs in the temperate Himalaya from Kashmir to Sikkim, at 5,000-12,000 feet. It is distributed to Afghanistan, temperate Asia and Europe.

The plant is stimulant and diuretic.

English: Mountain Bitter Cress, Narrow-leaved Bitter Cress.

Capsella.

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Capsella Bursa-pastoris Medik. is a weed of cultivation; it is found in temperate India in cultivated places.

Plant astringent; seeds stimulant. The herb and its seeds were employed in former times to promote the regular monthly flow in women.

Apparently the uses of the plant are unknown in India.

It has been used in English domestic practice from early times as an astringent in diarrhoea; it was much used in decoction with milk to check active purgings in calves.

A well-known popular remedy in Europe and North-America. It is of prompt use to arrest bleedings and floodings, when given in the form of a fluid extract; and it may be considered a most reliable medicine for staying fluxes of blood. The fluid extract of the herb is also given for dropsy as a diuretic.

The Menomini of Wisconsin use the plant as a cure for poison ivy; the plant is steeped, and the water when tepid is used as a wash.

In Bogota the herb, and more particularly the inflorescence, is considered a cure for blennorrhagia.

In Tongking the seeds are given in troubles of the chest; the whole herb when fresh is used as an hemostatic.

Extracts of Shepherd's Purse have been used as substitutes for ergot. They have been asserted to contain acetylcholine, choline, and possibly tyramine, as well as fumaric acid and inositol; but, according to Wasicky (*Ber. deutsch. Pharm. Ges.* 1922, 32, 142), plants free from fungoid infection are devoid of active constituents.

Baluchistan: Halaku—; *Catalan*: Bossas de pastor, Bosses de pastor, Sarronets de pastor—; *Chinese*: Ch'i—; *Colombia*: Calzoncitos, Pan y quesito—; *Dutch*: Herderstaschje—; *English*: Bad Man's Oatmeal, Blind-weed, Case-weed, Clapper Pouch, Cocowort, Fat Hen, Lady's Purse, Mother's Heart, Naughty Man's Plaything, Pepper-and-Salt, Pepper-and-Shot, Pick Pocket, Pick Purse, Pick-your-mother's-heart-out, Poor Man's Permacety, Poor Man's Pharmacetty, Purse, Rattle Pouch, Sanguinary, St. James's Wort, Shepherd's Bag, Shepherd's Pouch, Shepherd's Purse, Shepherd's Scrip, Shepherd's Sprout, Tooth-wort, Toywort, Ward-seed, Witches' Pouchers—; *French*: Bourse à berger, Bourse à curé, Bourse de capucin, Bourse à Judas, Bourse à pasteur, Bourserette, Boursette, Capselle, Fleur de Saint Jacques, Houlette, Malette, Malette à berger, Millefleur, Molette, Molette de berger, Molette des pasteurs, Moufette, Moutarde de Mithridate, Moutarde sauvage, Tabouret, Thlaspi—; *German*: Bauensent, Beutelschneiderkraut, Blutkraut, Brillenkraut, Daxenkraut, Gaensekresse, Geldbeutel, Grischel, Groeschelkraut, Herzelkraut, Hirtentaeschel, Hirtentaeschlein, Hirtentasche, Klaffer, Klapperkraut, Kleep, Kuespelkraut, Lapatekrokt, Muenselkraut, Nadeldieb, Saeckelkraut, Schaeferkraut, Schedelkraut, Schinken, Taeschelkraut, Taschenblume, Taschendieb, Taschenkraut, Voegelikraut—; *Harboi Hills*: Chambraka—; *Indo-China*: Te, Te thai—; *Irish*: Clappedepouch—; *Italian*: Borsacchina, Borsa di pastore, Borsapastore, Erba raperina, Millefiori—; *Malta*: Shepherd's Purse, Borsacchina, Borsa di pastore, Gargir il gemel—; *Menomini*: Wisakipûko'sa—; *Roumanian*: Buruiana de figuri, Buruiana viermelui, Iraba rosie, Pungulita, Tascuta ciobanului, Tascutita, Traista ciobanului—; *Russian*: Pastushiya sumka—; *Spanish*: Bolsa de pastor, Botella, Hierba del cangrejo, Hierba del carbonero, Mastuerzo macho, Paniquesillo, Pan y quesillo, Zurrón de pastor—; *Tongking*: Dinh lich, Dinh luc—.

Cheiranthus.

The genus includes 20 species, natives of the Mediterranean region, Central Europe, the Himalayan region, and North America.

C. Cheiri Linn. is the only therapeutically active species. Its flowers are officinal in Portugal.

Cheirianthus Cheiri Linn. is cultivated in Indian gardens.

The seeds are tonic, diuretic, expectorant, stomachic, aphrodisiac; good in dry bronchitis, fevers, and injuries to the eye (Yunani).

The flowers, said to be cardiac and emmenagogue, are used in paralysis and impotence. They are boiled in olive oil; and this prepared oil is much used for enemata.

The dried petals are much used in Upper India as an aromatic stimulant.

The *seeds* are also used as an aphrodisiac.

An alkaloid, cheirinine, has been isolated from the leaves and seeds. The seeds contain cheiroline, which appears to exist in the plant as a glucoside. Quercetin has been isolated from the colouring matters of the flowers.

Bengal: Khueri—; *Catalan*: Violer groch—; *Dutch*: Muurbloem—; *Egypt*: Manthur—; *English*: Banwort, Bee Flower, Bleeding Heart, Blood Wall,

Bloody Warrior, Cherisaunce, Chevisaunce, Churl, Geraflour, Gilly-flower, Handflower, Heartsease, Jacks, Jeroffleris, Jilliver, July Flower, Keyry, Sweet William, Wallflower, Wallstock-gillofer—; *French*: Bâton d'or, Carafée, Casse col, Coquardeau, Giroflée, Giroflée jaune, Giroflée des murailles, Giroflée des murs, Giroflée suissard, Murayer, Murer, Rameau d'or, Ravenelle jaune, Violette giroflée, Violier jaune—; *German*: Gelbveiglein, Goldlack, Handblume, Lack, Lackviole, Gelbe Levkoje, Gelbe Viole—; *Hindi*: Lahurishubu, Todri-surkh—; *Iraq*: Shabbo asfar—; *Italian*: Violaciocca gialla, Viola gialle—; *Languedoc*: Girouflado fero, Granié—; *Malta*: Wallflower, Violaciocca gialla, Gizi safra—; *Portuguese*: Goivo amarelho, Violeta amarelha—; *Punjab*: Todrisrafarmani, Todrisiyah, Todrisurukh—; *Roumanian*: Micsunea—; *Russian*: Jeltofiol, Levkoi—; *Sind*: Todrisiyah, Todrisurkh—; *Spanish*: Alhelí amarillo—; *Urdu*: Todrisurkha—.

Cochlearia.

The genus consists of 20 species, natives of Northern temperate and Asiatic regions.

Acrid, bitter, antiscorbutic herbs.

The following species are used medicinally in Europe—*C. armoracia* Linn., *C. officinalis* Linn.—; in Brazil—*C. armoracia* Linn.—; North America—*C. officinalis* Linn.

Cochlearia flava Ham. is found in the Gangetic valleys from the Punjab to Bengal.

The plant is used as a febrifuge in Bihar.

Crambe.

The genus includes 20 European and temperate Asiatic species; some of them distributed to Polynesia and Patagonia.

In Europe *C. hispanica* Linn. and *C. maritima* Linn. are considered specifics against scrofula.

Crambe cordifolia Stev. is found in Kashmir and Baluchistan, whence it spreads to Afghanistan, Persia, and the Caucasus.

At Hindubagh, in Baluchistan, the plant is used as a cure for itch.

Baluchi: Pilgosch—; *Harnai*: Nawarra—; *Hindubagh*: Pashai, Skharyae, Skhrai—; *Khwas*: Naghour—; *Kila Saifulla*: Pursail—; *Nushki*: Pilgosch—; *Waziri*: Navgra—.

Descurainia.

The genus numbers 43 species; most of them inhabit the cold and temperate regions of the whole of America; some are found in Asia, Europe and Macronesia.

D. sophia (Linn.) Webb. is used medicinally in Europe and in the United States of America.

Descurainia sophia (Linn.) Webb. (=*Sisymbrium Sophia* Linn.) occurs in India from Kashmir to Kumaon up to 14,000 feet, in the Eastern Himalaya, the Salt Range, Peshawar and Baluchistan. It is distributed to Afghanistan, Persia, Mesopotamia, the Mediterranean region, Central Europe, arctic and subarctic Europe, China, Japan, Central Asia. The plant has run wild in South Africa, North and South America, and New Zealand.

The flowers and leaves are astringent and antiscorbutic. An infusion of them is a popular remedy in Spain.

In China and Malaya the drug is regarded as demulcent. laxative, and febrifuge.

In Baluchistan the seeds mixed in syrup are swallowed as a cure for fever. On the Pab Hills in Jhalawan the plant is used as a febrifuge.

In the United States of America the herb is used externally in indolent ulcers, and the seeds are given internally in worms, calculus complaints, etc.

The juice, mixed with an equal quantity of honey or vinegar, has been recommended for chronic coughs and hoarseness, and ulcerated sore-throats. A strong infusion of the herb has proved excellent in asthma, and the seeds formed a special remedy for sciatica.

Arabic : Khubah, Robesetti—; *Catalan* : Herba de la sabiduria, Herba de Santa Sofia—; *Chinese* : T'ing Li—; *English* : Flixweed, Fluxweed—; *French* : Argentine rouge, Herbe des chirurgiens, Herbe de la sagesse, Herbe de sainte Sophie, Mort aux vers, Moutarde de chien, Rhubarbe des paysans, Sagesse des chirurgiens, Sisymbre sophie, Sophie des chirurgiens, Thalictre des marchands, Thalictron, Thalictron des boutiques—; *German* : Besenkraut, Feinblaetrige, Rauke, Schuttrauke, Sophienkraut, Sophienrauke, Wurmkraut—; *Harboi Hills* : Rush—; *Hindi* : Khubkallana—; *Indo-China* : Bo nuong cao—; *Jhalawan* : Rush—; *Kalat* : Rush—; *Kirani* : Khashir—; *Malaya* : Tien theng yan, T'ing li yen—; *Mastung* : Rush—; *Pab Hills* : Rush—; *Persian* : Khakshi—; *Pishin* : Khakshir—; *Quetta* : Khakshir, Khashir—; *Spanish* : Ajenjo de Serifo, Hierba de los cirujanos, Hierba de la sabiduria, Serifio absintio, Sofia de los cirujanos—; *Teheran* : Towdri—; *United States* : Flax weed—; *Urdu* : Khakshir—.

Draba.

This genus includes 150 species; natives of the northern temperate, arctic, and alpine regions, and of the Andes of South America.

Draba muralis Linn. is found in Kashmir up to 6,000 feet. It extends to Asia Minor, Europe, and North Africa.

The plant is used in Spain as an antiscorbutic.

English : Small Whitlow Grass—.

Erophila.

The genus includes 4 species, natives of the Mediterranean region and spread over Europe.

Erophila vulgaris DC. is found in Kashmir at 5,000-6,000 feet. It is distributed to Afghanistan, Western Asia, and Europe.

The plant is considered in Spain as an astringent and vulnerary; it is a popular remedy for the whitlow.

English : Spring Whitlow-grass—; *French* : Drave—.

Eruca.

The genus consists of 5 species, natives of the Mediterranean region.

E. sativa Gars. is used medicinally in Europe.

Eruca sativa Gars. is indigenous in the Mediterranean; but is cultivated in many parts of India.

The seeds are vesicant, and the whole plant is considered aphrodisiac.

In Europe the young leaves are used as stimulant, stomachic, diuretic, and antiscorbutic. A strong dose will cause vomiting, and may be taken in the place of ipecacuanha. Powdered, the effect is less strong than that of mustard.

Afghanistan: Mandao—; *Arabic*: Buckl—; *Bengal*: Shwetsursha, Suffed-shershi, Swetsarish—; *Catalan*: Ruca—; *Egypt*: 'Afin, Gergir, Gery, Shiltam—; *English*: Dame's Rocket, Dame's Violet, Jamba, Purple Rocket, Rocket, Vesper-Flower, White Rocket—; *French*: Roquette, Roquette cultivée, Roquette des jardins—; *German*: Senfkohl—; *Hadramaut*: Buckl—; *Hindi*: Duan, Taramira, Taranuri, Tira—; *Italian*: Ruchetta, Rucola—; *Kumaon*: Chara, Dua—; *Loralai*: Mulai—; *Malta*: Rocket, Ruchetta, Rucola, Aruca, Eruca—; *North-Western Provinces*: Duan, Lalu, Sahwan, Tara, Taramira, Tira—; *Persian*: Jambeh—; *Punjab*: Assu, Jamnia, Tara, Taramira, Usan—; *Sanskrit*: Bhutaghna, Bimbata, Daradharsha, Grahagna, Kadamba, Kadambada, Kadambaka, Rajakshawaka, Rajika, Rakshitaphala, Sarishapa, Sarshapa, Sidhaprayojana, Sidharta, Tantubha, Tantuka, Tuverika, Ugragandha—; *Sind*: Jambeho, Kalasurson—; *Spanish*: Oruga, Raqueta, Roqueta—.

Erysimum.

The genus number 80 species, natives of the Mediterranean region, and inhabiting Europe and Asia.

Erysimum repandum Linn. is found in Kashmir at 5,000-7,000 feet; it is distributed to Persia, and westwards to Eastern Europe and North Africa.

The plant is used in Spain as an antiscorbutic.

The seeds, when placed in water, become coated with transparent mucilage. In Persia they are given in fever; and externally, in the form of a poultice, to relieve pain in the stomach.

Arabic: Khubah—; *Baluchistan*: Kashir—; *Hamadan*: Tukhm-i-khakhshir—; *Persian*: Khakechi—.

Farsetia.

The genus includes some 20 Mediterranean species, spread over North Africa, Western Asia, and Northern India.

F. ramosissima Hochst. var. *macrocarpa* Schweinf. is used medicinally by the Moors.

1. An erect rigid shrub. Flowers large. Seeds biseriate ... 1. *F. Jacquemontii*
2. Twiggy, covered with denser and finer, closely appressed pubescence. Flowers small. Seeds uniseriate ... 2. *F. Hamiltonii.*
3. A rigid hoary undershrub. Flowers large. Seeds usually biseriate ... ... 3. *F. aegyptiaca.*

1. **Farsetia Jacquemontii** Hook. fil. and Th. is found in Northern India, West Rajputana and Sind, extending to Afghanistan.

The plant has a pleasant pungent taste and is taken as a cooling medicine after pounding. In the Punjab it is considered specific for rheumatism.

Punjab: Faridbuti, Faridmuli, Lathia, Mulei—; *Rajputana*: Kagpilang—.

2. **Farsetia Hamiltonii** Royle occurs in the Punjab, Western Rajputana, Sind and Baluchistan; it extends to Afghanistan, Persia, Arabia and North Africa.

The plant is pounded and taken as a cooling medicine. It is considered specific for rheumatism in the Punjab.

Punjab: Faridbuti—.

3 **Farsetia aegyptiaca** Turra is found in the Punjab. It is distributed to Afghanistan, Arabia, Syria, and North Africa.

In the Punjab the plant is considered specific for rheumatism. It is taken as a cooling medicine after pounding.

Arabic: Djarba, Garba, Garbun, Gjerba, Haifal, Turra—; *Punjab*: Faridburi—.

Isatis.

This genus includes about 50 species, natives of the Mediterranean region, and Central and Western Asia.

Isatis tinctoria Linn. is found in Western Tibet, and is cultivated in many parts of India. It is distributed westwards to Europe and the Canary Islands.

The leaves have been used medicinally in the treatment of jaundice, scurvy, and other ailments; but they are of no value.

California: Ash-of-Jerusalem, Dyer's Weed, Dyer's Woad—; *Catalan*: Herba de Sant Felip, Pastell—; *English*: Dyers' Weed, Dyers' Woad, Woad—; *French*: Gouède, Guède, Guesde, Pastel, Pastel des teinturiers, Vouède—; *German*: Faerber, Waid—; *Italian*: Guado, Isatide, Pastello—; *Roumanian*: Dobrisor, Dobrusor—; *Russian*: Sinilnik, Vaida—; *Spanish*: Añil de Aragón, Hierba pastel, Hierba de San Felipe—.

Lepidium.

The genus includes 100 cosmopolitan species.

The genus is acrid, antiscorbutic, and sternutatory.

The following are used medicinally in Europe—*L. campestre* R. Br., *L. crassifolium* W. K., *L. Draba* Linn., *L. graminifolium* Linn., *L. Iberis* Linn., *L. latifolium* Linn., *L. perfoliatum* Linn., *L. ruderale* Linn., *L. sativum* Linn., *L. virginicum* Linn.—; in West Africa—*L. sativum* Linn.—; in Southern Africa—*L. capensis* Thunb., *L. schinzii* Thel.—; in Brazil—*L. ruderale* Linn.—; in Guiana—*L. virginicum* Linn.—; in North America: *L. medium* Greene.

I.	Pods orbicular-ovate, notched at tip, valves winged ...	1. *L. sativum*.
II.	Pods transversely oblong, tip entire, valves wingless ...	2. *L. Draba*.
III.	Pods elliptic or ovoid, tip entire, valves wingless ...	
	1. Leaves fleshy	3. *L. crassifolium*.
	2. Leaves not fleshy	4. *L. latifolium*.
IV.	Pods elliptic or oblong, tips retuse or notched, valves keeled, wingless or winged at tip only	
	1. Valves winged at tip	5. *L. ruderale*.
	2. Valves almost wingless	6. *L. perfoliatum*.

1. **Lepidium sativum** Linn. is cultivated throughout India.

The seeds are used by both vaids and hakims on account of their mucilaginous properties. They are prescribed as a laxative, and applied to hurts or sprains as a poultice.

According to Honigberger, the plant in the Punjab was administered in cases of asthma, cough with expectoration, and bleeding piles. The root is used in secondary syphilis and tenesmus.

According to Bellew, the seeds are also considered to be galactagogue in the Punjab, and are administered after being boiled with milk, to cause abortion. O'Shaughnessy found the drug to answer as a gentle and warm aperient.

The leaves are mildly stimulant and diuretic, serviceable in scorbutic diseases.

The seeds are a popular Hausa medicine; preparations are made both for internal and external use. The chief medicinal use is for rheumatic pains and swellings, the seeds crushed and mixed with water as a draught or made into liniments; also a dressing for sores in camels and horses. They are also given for diarrhoea and dysentery.

Afghanistan: Tara tezak—; *Arabic*: Habb-er-reshad, Habrasjat, Half, Harfulabaz, Hurf, Jarjir, Reschad—; *Bengal*: Alevarie, Alleevree, Halim—; *Bombay*: Ahaliva, Asalia—; *Bornu*: Karabou—; *Burma*: Mongnyin, Samungni—; *Canarese*: Allibija, Kurutige—; *Catalan*: Enciamet de caputxi, Herba de la fluxió, Morritort, Murissa—; *Deccan*: Halim—; *Egypt*: Habb-er-reshad, Reshad—; *English*: Common Cress, Garden Cress, Passerage, Pepperwort, Town Cress—; *French*: Anitor, Cresson alénois, Cresson des jardins, Cresson de terre, Nasitar, Nasitor, Nasitort, Passerage cultivée—; *Fulani*: Takere fondu—; *German*: Gartenkresse, Kresse, Pfefferkraut—; *Gujerati*: Asalio, Halim—; *Hausa*: Labsur, Lausur—; *Hindi*: Chansur, Chaunsar, Halim, Halon, Hurf, Malavan, Tara, Tezac—; *Iraq*: Rashad—; *Italian*: Lepidio, Nasturzio—; *Kano*: Lausuru—; *Kanuri*: Lapsur—; *Kaisina*: Lafsu—; *Languedoc*: Cercoucello—; *Malta*: Garden cress, Agretto, Crescione inglese, Habberxa—; *Marathi*: Ahliva—; *Mundari*: Camcur, Cancur, Ilicamcur—; *North-Western Provinces*: Halang, Halim—; *Persian*: Rukhame-ispanda, Tereh tizec—; *Portuguese*: Mastruco—; *Punjab*: Halim, Halon, Shargundei, Tezak—; *Sanskrit*: Ashalika, Bhadra, Chandrashura, Chandrika, Charmahantri, Darakrishna, Drighabija, Kalamesha, Karavi, Nandini, Pashumehankarika, Raktabija, Raktaraji, Sidhaprayojana, Suvasura, Vasupreshpa—; *Sind*: Ahree, Ahreo, Assaria—; *Sokoto*: Lafsur—; *Spanish*: Berro de jardin, Malpica, Mastuerzo, Mastuerzo hortense—; *Tamil*: Aliverai—; *Teheran*: Tukhm-shahi—; *Telugu*: Adalavitulu, Adeli, Adityalu, Adiyalu—; *Urdu*: Halim—; *Waziristan*: Halayo—; *Yemen*: Half—; *Zaria*: Lafsur—.

2. **Lepidium Draba** Linn. is found as a weed of cultivation in the Punjab. It occurs in Persia, Mesopotamia, Caucasus, Europe, and the Mediterranean region.

The plant is said to possess antiscorbutic properties; and to control bleeding, if used raw.

In Loralai the seeds are used as a cure for flatulency, seven or eight being taken at a time.

In Waziristan it is used as a stomachic and tonic. In Europe as an antiscorbutic.

Afghanistan: Bijindak—; *Arabic*: Neffélé—; *Baluchi*: Garbust—; *Brahui*: Garbust—; *Catalan*: Capellans, Palitra—; *English*: Hairy Cress, Hoary Cress—; *French*: Drave—; *Hindi*: Bajindak—; *Iraq*: Jinaibrah, Qunaibrah—; *Ispahan*: Montchih—; *Jhalawan*: Garbast—; *Kalat*: Garbust—; *Kila Saifulla*: Buska—; *Kohlu*: Halia—; *Loralai*: Buski—; *Malta*: Hoary Cress, Cocola, Lattona—; *Mushki*: Garbast—; *Pishin*: Bushka—; *Quetta*: Bushka, Busk—; *Spanish*: Lepidio drava—; *Tabriz*: Khili-wili—; *Tasmania*: Hoary Cress, White Weed—; *Waziri*: Bashka—; *Zhob*: Bushka, Buska—.

3. **Lepidium crassifolium** W. K. is found in Baluchistan and the Oriental region, spreading over to Europe.

The plant is employed as a rubefacient in rheumatism. The seeds are prescribed internally in rheumatism and dropsy.

4. **Lepidium latifolium** Linn. is found in Kashmir. It is distributed to Northern and Western Asia, Europe, and North Africa.

The plant is depurative and antiscorbutic. It is used as a resolvent in skin diseases.

Catalan: Herba de la fluxió, Morritort bort, Morritort salvatge, Piperotis—; *English*: Cress, Dittander—; *French*: Passerage à larges feuilles, Grande passerage—; *German*: Breitblaeterige Kresse, Pfefferkraut—; *Italian*: Mostardina, Peperella—; *Ladak*: Gonguch—; *Portuguese*: Herva pimenteira, Herva serra, Lepidio—; *Spanish*: Lepidio, Lepidio de Plinio, Mastuerzo mayor, Piperitas, Piperitis—.

5. **Lepidium ruderale** Linn. is found in Kashmir at 7,000-13,000 feet. It extends through the Oriental region to Europe. It also occurs in Australia.

The plant is used in impetigo.

Brazil: Mastruco, Menstruco—; *English*: Narrow-leaved Pepperwort—; *Tasmania*: Narrow-leaved Cress—; *Uruguay*: Yuyo de resfrio.

6. **Lepidium perfoliatum** Linn. is found in Baluchistan and Afghanistan, whence through the Oriental region it extends to Southern Europe.

In Europe this plant is popularly believed to be a useful antiscorbutic.

MATTHIOLA.

This genus includes 50 species of the Mediterranean region, inhabiting Europe, South Africa, and the Western Himalaya.

The leaves of the following species were formerly used as emmenagogues in Europe—*M. incana* R. Br., *M. tristis* R. Br., *M. varia* DC.—.

Matthiola incana R. Br. is indigenous in the Mediterranean region and in Western Europe; it is cultivated in Indian gardens.

The Mahommedan authors distinguish between three kinds of seeds; yellow, red, and white; but in practice no distinction seems to be made between them. They are all considered bitter, tonic, diuretic, expectorant, stomachic, aphrodisiac; good in dry bronchitis, fevers, and injuries to the eye.

The seeds are used in infusion in cancer; mixed with wine they are given as an antidote to poisonous bites. In the Punjab and in Sind they are reckoned aphrodisiac.

Mhaskar and Caius have shown experimentally that the seeds are not an antidote to snake venom.

Arabic: Bajar-ul-kumam, Manthur—; *Catalan*: Violé comú—; *Egypt*: Kheyly, Manthur, Manthur madbag—; *English*: Gilliflower, Hoary Stock, Queen Stock, Stock—; *French*: Mathiola—; *German*: Winter Levcofe—; *Indo-China*: Tu la lan hoa—; *Iraq*: Shabbo—; *Malta*: Queen's Stock, Stock, Violaciocca, Gizi—; *Persian*: Todri—; *Punjab*: Todri liba, Todri safed—; *Sind*: Todri safed—; *Spanish*: Aleli encanecido—; *Urdu*: Todri safed—; *Uruguay*: Aleli—.

MORICANDIA.

The genus consists of 10 Mediterranean species.

Moricandia tortuosa Hook. fil. and Th. occurs in the salt plains of the Punjab, west of the Indus.

A decoction of the flowers is rubbed on for eczema in Waziristan.

NASTURTIUM.

The genus consists of 50 cosmopolitan species.

The plant is diuretic, stimulant, and antiscorbutic. The seeds are mildly laxative.

The following are used medicinally in Europe—*N. fontanum* Aschers., *N. palustre* DC., *N. sylvestre* R. Br.—; in La Reunion —*N. fontanum* Aschers.—; in Madagascar—*N. barbareaefolium* Baker, *N. fontanum* Aschers.—; in China—*N. montanum* Wall.—; in Indo-China—*N. fontanum* Aschers., *N. indicum* DC.—; in Brazil —*N. fontanum* Aschers.—; in North America—*N. curvisiliqua* Nutt., *N. fontanum* Aschers., *N. palustre* DC.—.

1. Aquatic, stem creeping and floating ... ... 1. *N. fontanum.*
2. Stems weak, suberect, smooth, slightly hairy ... 2. *N. palustre.*
3. Erect, rough-hairy or sometimes glabrous annual ... 3. *N. indicum.*
4. An annual much resembling *N. indicum* but less robust with larger, smoother, less divided leaves ... 4. *N. montanum.*

1. **Nasturtium fontanum** Aschers. is found in many hill stations, in the Punjab, Waziristan, Baluchistan; and thence to Afghanistan, temperate Asia and Europe.

The fresh plant is widely known for its antiscorbutic and stimulant properties. It is used in Brazil in troubles of the chest.

Amarah: Kobani—; *Brazil*: Agriao—; *Catalan*: Creixans, Creixens, Gredas, Morritort d'aigua—; *Deccan*: Lutputiah—; *Dutch*: Water-kers—; *Egypt*: Gorrat-el-aïn—; *English*: Shamrock, Stertion, Water-cress—; *French*: Cailli, Cresson, Cresson aquatique, Cresson d'eau, Cresson de fontaine, Cresson officinal, Cresson de ruisseau, Nasitord, Santé du corps—; *German*: Braunkersch, Brunnenkresse, Kersche, Quellranke, Wasserraute, Wassersenf, Wiesenkresse—; *Greek*: Sisymbrion—; *Hindi*: Deskandai—; *Hova*: Anandrano—; *Irish*: Biolar—; *Italian*: Agretto—; Crescione, Nasturzio, Sisimbrio, Sisimbro—; *Malta*: Water-cress, Crescione d' acqua, Cresciuni, Sija—; *New-Zealand*: Kowhiti-whiti—; *North-Western Himalayas*: Piriyahalim—; *Portuguese*: Agriao—; *Provençal*: Creiso—; *Roumanian*: Brancuta, Cardama de izvor, Hrenita, Nasturel—; *Russian*: Kress—; *Sinhalese*: Kakutupala—; *Spanish*: Berro, Berro común, Berro de fucute, Mastuerzo acuatico—; *Swedish*: Kiaellkrasse—; *Waziri*: Dalamira, Thermera—.

2. **Nasturtium palustre** DC. occurs in North-Western India, the temperate Himalaya up to 10,000 feet, Assam, and Bengal; it is spread over the temperate regions of both hemispheres.

The fresh plant possesses the antiscorbutic properties of the genus.

China: T'ing Li—; *Egypt*: Manthur, Mufrad—; *New South Wales*: Native Cabbage—; *Pacific Coast*: Marsh Cress, Marsh Yellow Cress—.

3. **Nasturtium indicum** DC. is found throughout India in wet places from Ceylon to Kashmir and Mishmi, Bengal, Assam, Chittagong, Tenasserim, Malay Peninsula. It extends to Malaya and China.

In Indo-China the plant is considered diuretic, stimulant, and antiscorbutic. The seeds, which are said to be laxative, are also used in the treatment of asthma.

Indo-China: Cai cot xoi, Dirh lich, Lai hoang, Thuy gioi thai—.

4. **Nasturtium montanum** Wall. occurs in North-Western India up to 7,000 feet, in Sikkim, the Khasia Hills, and Burma. It extends to Java, China, and Japan.

The plant has antiscorbutic properties.

China: Han Ts'ai—.

RAPHANUS.

The genus consists of 8 species, mostly Mediterranean.

R. sativus Linn. is used medicinally in Europe, China, Indo-China, Malaya, and the Malay Archipelago.

Raphanus sativus Linn. is found in temperate and warm countries; it is cultivated all over India up to 16,000 feet.

The radish has a hot, sharp, bitter taste; stomachic, binding, anthelmintic; nervine tonic; good in tumours, piles, and all inflammations; useful in diseases of the heart, amenorrhea, hiccough, leprosy, cholera; the juice relieves earache. The flowers are bechic and cholagogue (Ayurveda).

The root is useful for urinary complaints and piles. The seeds are sharp and bitter; laxative, tonic, emmenagogue, carminative; good for the spleen and in paralysis; produce alopecia; mixed with wine they counteract the effects of the bites of snakes and other poisonous animals (Yunani).

Radish seeds are peptic, expectorant, diuretic, laxative, carminative, and corrective. In the Punjab they are considered to be emmenagogue. They are much used in Indo-China by native practitioners.

The roots are used for urinary and syphilitic diseases; they are a reputed medicine for piles and gastrodynic pains.

The juice of the fresh leaves is also used as a diuretic and laxative.

The syrup of radishes is excellent for hoarseness, bronchial difficulty of breathing, whooping-cough, and other complaints of the chest.

These seeds are not an antidote to snake venom (Mhaskar and Caius).

Arabic: Bajrulkijal, Bokel, Boukir, Bou-toum, Fidgel, Figl, Fugel—; *Bengal*: Mula, Muli—; *Bombay*: Mula, Muro—; *Burma*: Monelahmungla, Moula—; *Canarese*: Bili, Mullangi, Mullangiyanne—; *Catalan*: Raba—; *Chinese*: Lai Fu, Tsai Fu Ken—; *Danish*: Redike—; *Deccan*: Mulli—; *Dutch*: Radijs—; *Egypt*: Fidjel—; *English*: Garden Radish, Rabone, Radish—; *French*: Navet rave, Radis, Petit radis, Radis rond, Radis rose, Petite rave, Rave rose, Tendrette—; *German*: Gartenrettich, Rettich, Retting, Sommerrettich, Winterrettich—; *Greek*: Raphanis—; *Gujerat*: Mala, Mura—; *Hausa*: Fijil—; *Hindi*: Eugil, Mula, Muli, Muro, Purabi sarisha, Sweti sarisha, Tora, Toorub—; *Hova*: Radisa—; *Hungarian*: Retek—; *Indo-China*: Cu cai, Lai bac, Lo bac, Lu bu—; *Iraq*: Fujl—; *Italian*: Rafano, Ramolaccio, Ravanello, Ravano—; *Japanese*: Daion—; *Kolami*: Morai—; *Konkani*: Mullo—; *Kurdish*: Tur—; *Languedoc*:

Rabasso, Rafe—; *Malaya*: Lobak, Loh fook—; *Malayalam*: Mullangi—; *Malta*: Radish, Radice, Rafano, Figel, Ravanall—; *Marathi*: Mula, Muri—; *Mongolia*: Laopang, Lobin, Turma—; *Mundari*: Morai, Moroe, Murai, Muroe—; *Mysore*: Magunigadde—; *Nepal*: Mulasinki—; *North-Western Provinces*: Muli—; *Persian*: Tukhmeturub, Turup—; *Philippines*: Rabano—; *Portuguese*: Rabanete, Rabano, Rabao, Rabao negro—; *Punjab*: Muli, Mungra, Taramira—; *Roumanian*: Ridiche—; *Russian*: Radis, Rediska—; *Sanskrit*: Bhumikakshara, Dirghakandaka, Dirghamulaka, Dirghapatraka, Hariparna, Hastidanta, Hastidantaka, Kandamula, Karukandaka, Ksharamula, Kunjar, Kahakanda, Mritakshara, Mulaka, Mulavha, Nilakantha, Rajaluka, Ruchira, Ruchishya, Shankhamula, Shimbiphala, Sita—; *Sind*: Muri—; *Sinhalese*: Rabu—; *Spanish*: Ràbano, Ràbano cultivado, Ràbano negro—; *Swedish*: Raettika—; *Tamil*: Mullangi, Mulinghie—; *Telugu*: Mullangi—; *Tibet*: La phug—; *Turkish*: Turp—; *Urdu*: Mulekebija—; *Uruguay*: Rabanito, Rabano—; *Yemen*: Bokel, Fidyl—.

Sisymbrium.

The genus includes 77 species, found chiefly in the temperate regions of both hemispheres.

The genus is diuretic and expectorant.

The following species are used medicinally in Europe—*S. altissimum* Linn., *S. austriacum* Jacq., *S. Irio* Linn., *S. Loeselii* Linn., *S. officinale* Scop., *S. strictissimum* Linn.—; in North America—*S. officinale* Scop., *S. pinnatum* Greene—.

A.	Fruiting pedicles as broad as the pod	2. *S. altissimum.*
B.	Fruiting pedicles slender	
	1. Pods 3.8-5 cm., erect	1. *S. Irio.*
	2. Pods 2.5-3.8 cm., slightly curved ...	3. *S. Loeselii.*

1. **Sisymbrium Irio**, Linn. is found in Rajputana, Punjab, Peshawar, Baluchistan, and Kohat. It is distributed to Central Asia, Afghanistan, Arabia, the Mediterranean, and Eritrea.

The seed is expectorant and restorative, and used externally as a stimulating poultice.

It is also said to be febrifuge.

In Spain an infusion of the leaves is given in affections of the throat and of the chest.

Arabic: Khubah, silihg—; *Catalan*: Apagallums, Mata-llums—; *Egypt*: Figl-el-gemmal, Harra—; *English*: London Rocket—; *Iraq*: Huwairah—; *Malta*: London Rocket—; *Merwara*: Parjan—; *Persian*: Kharkasi—; *Punjab*: Janglisarson, Maktrusa—; *Sind*: Junglisurson—; *Spanish*: Matacandiles, Oruga leonina, Rabanillo amarillo—; *Urdu*: Khubakalan—.

2. **Sisymbrium altissium** Linn. occurs in Kashmir up to 8,000 feet and in Chitral. It is distributed to Persia, Western Asia, the Mediterranean, and Central Europe.

The leaves and flowers are considered astringent and antiscorbutic.

3. **Sisymbrium Loeselii** Linn. occurs in Kashmir up to 8,000 feet and in Peshawar. It is distributed to Central Asia, Siberia, Western Asia, Central Europe.

The leaves and flowers are given in scurvy and in scrofula.

THLSAPI.

The genus consists of 60 species inhabiting the Northern temperate regions.

Thlaspi arvense Linn. is found as a weed of cultivation throughout the temperate and subalpine Himalaya, ascending to 14,000 feet. It is spread over Europe and Asia, always in cultivated places.

The seeds and the shoots are used medicinally by the Chinese. In Spain the plant is considered astringent and the seeds stimulant.

Catalan : Traspic—; *Chinese* : Hsi Ming—; *English* : Mithridate Mustard, Penny Cress, Shepher's Furse—; *French* : Monnoyère, Tabouret des champs—; *Italian* : Erba storna—; *Spanish* : Mostaza salvaje, Talaspico, Tlaspios—.

BOMBAY'S FISHING INDUSTRY.

BY

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FISHERMEN'S STRUGGLE FOR EXISTENCE.

Bombay's pre-eminence as a port and a great commercial centre has tended to obscure from our mind the fact that originally it was nothing but a group of unconnected, mean fishing islets. From such humble origin it has grown to be India's Gateway and foremost port, with ships from all the world calling at its magnificent harbour. The fishing trade, which was its original mainstay, has not, however, kept pace to the same degree with its commercial progress. The trade is still conducted at various spots in the city where it undoubtedly was in days gone by, and this serves as a useful reminder of the former origin of our great city.

The fish landed in Bombay averages 50,000 tons only and yields Rs. 80 lakhs. An idea of the wealth which the harvest of the sea is capable of producing may be had from the example of Japan, where vast revenue is realised from Fisheries (coastal, deep sea, whaling, trawling and fish rearing). The complete figures for 1934 showed a catch of 50,00,000 tons, valued at 3,04,450 million yen (Rs. 2,38,612 millions). This is equivalent to about one-third of the world's sea fisheries. Fish landed in Spain, Great Britain, Australia and France annually is valued at approximately Rs. 53,00,000, Rs. 27,00,00,000, Rs. 1,60,00,000 and Rs. 9,33,00,000 respectively.

Supplies inadequate:—The immense potentialities of a flourishing fishing industry have not yet been realised in our Province. Although there has been a substantial improvement in recent years, the progress is slow. The increasing demand for fish in Bombay is clear evidence of the fact that there is a real and profitable market for the sale of this valuable foodstuff in our city. The supply falls, however, considerably below the demand as a visit to any market will show. Bombay, with its lengthy coast-line of over 1,300 miles, has numerous estuaries, creeks providing natural facilities for fishing, but despite these, the supply is still far from adequate to cope with the demand. Not only during the monsoon when the local supply is practically nil, but even during the fair season, large quantities of fish have to be imported into the city to meet but unsatisfactorily the needs of the people. The result of this scarcity is that fish is frequently not available to many who would otherwise make it a regular item of food.

The main reason why fishing does not occupy the rightful place that is due to it among our country's industries is because

the peculiar structure of our society ordains that fishing and the trade in fish must be conducted exclusively by those whose avocation it is by caste. The whole industry is, thus, in the hands of people who belong to the lower strata of our society, with no capital, no education, no initiative and no business capacity. Under such circumstances, it is hardly to be wondered at that the fisheries of the Bombay Province, in common with those of other maritime provinces in India, are undeveloped and that our supply is what may best be described as scanty and unsteady.

Neglected industry:—The general belief that fishing is a mean occupation solely to be pursued by one or two special castes results in restricting fishing to those whom the accident of birth makes it their life's calling. Except for a few individuals, there have been no instances of men of education and capital entering the fishing trade on a large commercial scale. Fisheries, in consequence, have not attracted capital from any of the high caste money-owning classes in this Province, whereas in other maritime countries, the importance of fisheries in the commercial organisation has always been recognised.

The result of conditions obtaining in this country is that the industry is unable to provide, from the meagre resources of the few who pursue the craft, the capital and the driving power necessary to exploit to the fullest extent the ungathered harvest of our teeming seas. The insufficiency of the supply of fish is due to the low catching capacity of our fishing methods and also to our faulty system of distribution. These difficulties are further enhanced by the limited period of the year during which fish is available. Experience has shown, that Bombay has an abundant supply of fish from September to December. These four months represent the peak of the fishing season for Bombay fishermen. Later on from December to June, when enough fish is not available in the immediate vicinity of Bombay, it is brought from distant sites by rail, sailing craft, bus and launches.

Small scale of operations:—Sea fishing in the Bombay Province is conducted on a small scale only. As a rule, fishermen do not go out more than 10 to 12 miles from the shore to fish. Occasionally they go as far as 20 to 30 miles; but the smaller boats do not venture into water deeper than 16 fathoms. Moreover, most of the fish landed by sail boats is caught in huge bag nets which are attached to long stakes planted in the sea bed and it is obviously impossible to fix these stakes in waters more than 12 or 15 miles from the coast owing to the great depth. Our fishermen, owing to the distance of the fishing fields from Bombay and their frail fishing craft, are thus not able to touch more than the bare fringe of the fishing grounds. If fishermen could go further afield and land their catch in Bombay, the result would be many times more satisfactory. There is room for an increase of 50 per cent. in the quantity of fish normally sold in the Bombay markets. The position in the mofussil, so far as supply is concerned is acute, and in several districts fish as an article of diet is more often than not a rare luxury which few can afford. There is no reason why this state of affairs should continue as

there are fruitful fishing fields not very far off from Bombay. There is another facility and that is the number of landing sites in Bombay itself, so that the increased supplies could be judiciously landed at appropriate distributing centres.

Landing site and fishing grounds:—Fish is landed at various ports in Bombay both on the East and West side of the island. These places are Arthur Bunder, Sassoon Dock, Bhaucha Dhakka, Chowpathi, Mazagaon, Sewri, Worli, Mahim, Dharavi, etc. By far the bulk of the fish brought to Bombay is landed at Arthur Bunder and Sassoon Dock, both in the Colaba area. These centres have been traditional sites of fishermen's colonies for generations past, and the fishermen have plied their trade there for countless years. The most flourishing colony, where trade is briskest, is undoubtedly Sassoon Dock. It affords a safe and convenient anchorage for the frail fishing craft. Moreover, there are suitable facilities for landing fish here, from whence it is quickly despatched for sale to the markets. The ubiquitous bus is used to transport the fish to the markets. The increasing use of motor vehicles is gradually displacing human labour and the sight of the fisherwomen staggering under a ponderous load, once so familiar in the streets of Bombay, is now becoming increasingly rare. Handcarts are also extensively employed to carry fish from the landing sites to the markets.

Apart from Bombay's own colonies of fishermen, there are also fishing communities at Worli, Chimai, Korah, Danda, Manori, Bhyandar, Bassein, Virar, Kelva, Satpati (near Palghar), Nawapur, Chinchani, Dahanu, etc. The fisher folk at these places fish not only off shore and in creeks but also in the deep sea at a distance of about 12 miles from the coast.

The fishermen of Satpati, it may be added, venture as far as Kathiawar for Pomfrets, although it must be made clear that they do not actually catch fish but merely buy it from the Kathiawar fishermen and bring it to Bombay. These fishermen willingly incur the hazards of a long voyage in their primitive vessels, because they know that the return voyage from Diu to Bombay will be assisted by favourable winds and that their pomfrets, which in February, March and April are not available in Bombay, will then fetch an attractive price in our city.

Fish from places such as Danda, Vesava, Manori, Uttan, Bassein, Palghar, Broach, etc. situated on B.B. & C.I. Railway is invariably brought by train to Bombay and landed at the Grant Road Railway station, whence the B.B. & C. I. Railway vans hurriedly set off with the fish parcels to the various markets. Of the two railways namely the B.B. & C.I. and the G.I.P. Railway, which serve Bombay, it is through the former that fish is imported into Bombay, as this railway runs more or less parallel with the coast. Fish is also imported by steamers from Karachi, Okha in Kathiawar, Veraval and Jamnagar, either in air-proof ice-boxes or ordinary ice-boxes. Had it not been for these imports by rail and steamer, it is certain that the fish caught locally would by no means suffice to meet the large and the constant demand for fish in the city.

It would not be out of place here to describe the various processes from the time the fish is caught till it is sold to the public.

Stages in marketing of fish:—Landing of fish comes first in the natural order of sequence. As soon as the catch is landed, the fishermen's problems begin. This aspect of the fishermen's trade has never been fully explored and explained. The marketing of fish is an elaborate affair in view of the numerous links in the business. The central figures in the picture of the fish trade are undoubtedly the owners of the fishing craft, the fishermen who actually fish, the wholesale fish merchants, the commission agents, fish retailers and lastly the consumers. There are many other actors who make up the full cast, but I shall deal only with the principals and try to show how each one of them hopes to benefit from the landing of a catch of fish.

Some of the fishermen do their own marketing. Their womenfolk carry the fish to the market and retail it there. A large majority of the fishermen are dependent, however, for marketing on wholesale fish dealers. Here, a local dealer acts as a banker. At the beginning of the fishing season merchants enter into contracts with as many fishermen as possible undertaking to buy up their entire catches from time to time at definite fixed prices for different types of fish. These dealers advance the fishermen the money necessary for boats and nets. They also give the fishermen periodic cash advances for incidental domestic expenditure, marriage and death expenses, etc. Some dealers own sail boats which they send out to sea to collect fish from the various fishermen with whom they have entered into a contract and bring it to the landing site. Before the fish is handed over to the collecting boat, the catch is individually counted and made over to the dealers. Accounts are struck up later, after about a week or so, when the fishermen return to port. The accounts are finally settled by the contractor after he has deducted the advance made for the upkeep of boats and nets. Any balance, if outstanding to the fishermen, is then paid to them by the wholesale dealer. These dealers in their turn send the catch to Bombay to the Crawford market to their commission agents, who auction the fish and charge six per cent for their service. At this stage the fish passes into the hands of people who retail the fish in the Crawford market or pass it on to their sub-agents for retail sale in other markets of the city.

Meagre earnings:—Our fishermen have no other source of livelihood than fishing. Their earnings are meagre. If one takes into consideration the months when no fishing is done, owing to the monsoon or to the disappearance of fish from our coast on account of migration, the earnings obtained during the fishing season if spread over the period of a year are reduced to an insignificant figure. Thus in a few months of brisk fishing they must earn for the whole year. Even in the fishing season earnings are far from great, owing firstly to fierce competition and secondly, to the fact that the commodity before it finally reaches the consumer from the boat, passes through many hands the

wholesale dealer, the commission agent and the retail vendor. The money obtained by the fisherman, who has incurred all the risks and hazards of his trade, is scarcely a fraction of what the consumer pays the retail vendor. Whether every man who handles the fish makes a big or small profit, or no profit, does not alter the fact that every transaction is to be paid for. The fisherman's catch as it changes hands gets dearer in the process and his legitimate margin of profit is narrowed down by the superfluous intermediate agencies that cumber his trade for their own gain.

An illustration will make this clear. I shall refer specifically to pomfrets, the season for which is from September to November. The wholesale dealer, from whom the consumer eventually gets his supply, pays the fisherman about Re. 1 to Rs. 1-8-0 per *kodi*, —the technical term used in the fishing trade for a lot of 22 fish, but never does the public get pomfrets at an anna each or even at four annas a pair, even the height of the fishing season. Any household that buys fish at this time will confirm the statement that the cook never charges less than six to eight annas a pair. The price of course rises when the pomfret is out of season, and then Re. 1 to Rs. 1-8-0 per pair of pomfrets is not uncommon.

Precarious calling:—Apart from the distributing media which absorb, without much effort, the profit that is readily due to the fishermen the latter have to contend with a number of adverse factors. If foul weather is left out of count, the fisherman has yet other problems. He has no certainty that every trip to the fishing fields will be productive. On a bad day the catch will be small, even an abundant catch may be a mixed blessing. It means a glut on the market for that day, with a corresponding diminution in the prices paid by the wholesale dealer and therefore in the margin of profit. Further, fish have first to be caught and landed, they do not fall into the nests. They have to be tracked and their favourite haunts located. This means time, money and effort. Boats and fishing gear have to be purchased before any fishing can be undertaken. Wear and tear and destruction of gear are heavy, and repairs and replacements take away a large share of the return. It is scarcely to be wondered at therefore that our fishermen lead a hand-to-mouth existence, for they are invariably in debt. Conditions are against them, and even if they want to, they cannot modernise their methods, owing to habitual poverty.

Fishermen's apathy:—The possibilities of the development of the fishing industry in and around Bombay are great, but the reason why no progress has been made is, first, the chronic poverty of our fishermen and secondly, their inveterate disinclination to introduce modern methods. No improvements can be expected as long as they continue to fish in the manner of their forefathers. Our fishermen, it must be admitted, are a conservative community, indifferent to the introduction of new devices. They lag behind only because they have steadily failed to keep pace with the times. The prime necessity is to educate our fishermen to a realisation of the value of adopting modern and improved methods of fishing.

That the seas around Bombay teem with fish, has been abundantly proved by the investigation of the *William Carrick*, the

trawler specially brought out by the Bombay Government to survey and locate the fishing grounds in our waters. The work of this vessel showed that just the bare fringe of the fishing grounds is now touched, and that with improved fishing gear, our fishermen could not only venture further afield and augment the yield but also earn greater profit for themselves.

Other main problems confronting the fishing industry are the question of rapid transport, cold storage of the catch and efficient methods of distribution, so that fish reach the market within the minimum time.

Government's help to industry:—The first problem, namely, that of transport has in some measure been tackled by the Government of Bombay, who have successfully demonstrated that there is a fine opening for private enterprise, either for fishermen themselves or others co-operating with them, in the use of launches for the speedy transport of fish. The Bombay Government, in 1933, inaugurated an experiment to popularise the use of motor launches as fish carriers. That the progress of the experiment has been encouraging is evident from the fact that every year since, there has been an addition to the number of vessels. The vessels, of which there are now nine, were originally meant to operate within a radius of about 30 miles from Bombay in order to demonstrate to the fishermen the advantages of launches over sail boats for the rapid carriage of fish.

The launches did not, however, confine themselves to this restricted sphere of operation. They went farther and farther afield, first to Ratnagiri, then to Malwan and so until they now bring fish from Karwar, which is nearly 300 miles from Bombay. The time taken in the round trip to Karwar is about five days. The fish, which is stored in the holds of the vessels in ice, reaches Bombay in excellent condition.

The launches have not only served to demonstrate the advantages of fast mechanical transport. They have also fulfilled another great object; by making available in Bombay a supply of fish at a period of the year when fish was usually not available in sufficiently large quantities to meet the constant demand. The launches have also, incidentally, served to introduce to local consumers types of fish, which, before the operation of the launches along the Konkan coast, were scarcely ever to be seen or even heard of in the Bombay markets. Foremost among these is the mackerel, known in the vernacular as *bangda*. This is a fish of exceptional nutritive value, rich in proteins and fat contents. Since the introduction of the launches the city's supply of fish has been augmented by lakhs of pounds. During the current fishing season these launches brought from the Kanara coast, about 270 miles from Bombay, 15,00,000 lb. of fish.

The success achieved by the Bombay Government's experiment to popularise the use of rapid sea-going transport has stimulated and encouraged capitalists and educated people to come forward and invest in launches. A most encouraging sign! for capitalists, who have so far kept aloof, can do much to develop our fishing industry and help our fishermen, who by their own unaided efforts

cannot prosper. The fishing industry occupies a prominent place in most maritime countries of the world. Even Kings and aristocrats support and encourage it. It may not be generally known that the king of the Belgians is the patron of a fishing organization known as the 'Ibis', which owns a number of fishing vessels.

Neglected varieties of fish :—The co-operation of the public is also an essential factor in any scheme to develop the fishing industry. As matters stand at present the public confines its choice of fish to only three or four popular varieties, with the result that other types are usually unsold and converted into manure. A part of the fishermen's catch is thus rendered entirely unremunerative and profitless. Usually about 30 varieties of fishes are landed in Bombay daily, but there is a real demand for only about four or five varieties, namely, pomfrets, *rawas*, *dara* and *surmai*. Other equally tasty and good fish, such as mackerel, dog fish, sardine, *kupa*, *kokeri*, *bhing*, *pala*, *ghol*, *akru* are bought by only poor people. Yet the fish bought by the poor are no less tasty or nutritive than those in constant demand by the more well-to-do. The better classes are merely the victims to their own ignorance, and do not know what they are missing.

These neglected varieties could be popularised by the general public widening their usual sphere of choice. The public will not only be extending a non monotonous menu but will also be helping our fishermen to realise a larger return for their arduous and hazardous labours. By increasing the demand for such fish, the public can indirectly stimulate general business throughout the country. With the marketing of bigger catches, the purchasing power of the fishermen will increase.

Fish a health food:—There are several reasons why fish should commend itself as an item of diet. The dietetic value of fish and its superiority over other flesh foods such as meat and game is unquestioned. Centuries ago it was known in a vague way that the eating of fish was conducive to health, but only within comparatively recent years has it been established that the belief had a basis in fact. Scientists and dieticians have examined various fish foods and revealed many startling facts by their investigations and experiments. Some of the oils extracted from the livers and bodies of certain fish are nowadays renowned the world over for their wonderful health-building and curative properties. At the present time, scientists in Canada and elsewhere are conducting intensive studies into the nutritive qualities of fish and every year there is announced some discovery of importance to the health of mankind. Only recently, it was stated that Ling Cod, a Pacific Coast food-fish 'has been found to be one of the richest known sources of insulin'—a substance which is of great value in the treatment of diabetes.

Fish contains a relatively high percentage of protein, the most important constituent of food, but its dietic value is enhanced because of the health-guarding and health-building elements found in it. These factors, combined with the tastiness and ease of digestion make it a food of exceptional value.

Another valuable property in which fish abounds is iodine. This inexpensive drug is so commonly used for the treatment of wounds that we do not realise its great therapeutic value. Iodine is a great prophylactic against such diseases as goitre. Vast areas of land contain almost no iodine at all, and hence iodine does not occur in the flesh of land-living food animals which feed upon them. On the other hand, it is relatively abundant in the bodies of different varieties of fish. Such common fish as cod, haddock, halibut, lobsters, etc., contain, per pound, several times the human body's daily iodine requirements, so that if fish is eaten regularly the body is supplied with the iodine essential to health. Dr. J. F. McClendon, who several years ago was sent to Japan by the Rockefeller Foundation to make an exhaustive study of the diet of the Japanese people, reported that in Japan there is only one case of goitre to every 10,00,000 people. Another very striking observation recorded was that there was no radium in Japan. This is because they have little or no cancer. This new association of no goitre and no cancer in a country where the diets are enormously high in iodine leads one to believe that the goitre-preventing qualities found in sea foods are also valuable preventives for cancer.

Enough has been said to make it abundantly clear that the fisherman is undoubtedly the most conspicuous figure in the picture of the fishing trade, but the public thinks little of him, or of the hardships and difficulties he unmurmuringly undergoes.

The fisherman is entirely an unknown entity to us. His humble personality never comes within our ken. We are practically ignorant of his very existence and this is because we entrust our marketing to a legion of servants. It is true we have no fish markets devoted exclusively to the sale of fish as in other European countries; but this ought not to deter us from visiting the fish-landing sites and learning something of the numerous varieties of fish landed and the conditions under which the trade is pursued. Only thus could we come into more intimate contact with the fisherman. The welfare of the fisherman and his trade is in our own hands. Visits to fish-landing sites can be of immense educative value. The average fish-eater in this country does not know the names of more than half a dozen stock varieties of fish. It is by visiting fish markets and fish-landing sites that we can widen our knowledge of the infinite variety of the denizens of the seas and perhaps kindle among our children an interest in marine fauna, for it is on the younger generation, who will have to deal with the changed conditions of life and food supply that the future prosperity of the industry will eventually depend.

THE HABITS OF THE COMMON EARWIG OF ANNAMALAINAGAR, *EUBORELLIA STALI* (DOHRN).

BY

K. B. THIAGARAJAN, B.SC.

To collect material for studying the development of the common South Indian Earwig, I have kept under observation for the past six months a large number of living specimens collected mostly from Annamalainagar and to a small extent from Tanjore and Coimbatore. The observations I have made so far are embodied in this note. Observations on the Indian *Dermaptera* were made by Dr. Annandale (**1**),[1] M. Burr (**2**), and Morgan Hebard (**3**). My observations, as shown below, differ from theirs in certain respects.

In my laboratory the earwigs were placed in slightly moist humus in wide-mouthed jars. They were periodically fed on earthworms, petals of *Hibiscus rosa sinensis*, garden snails, etc.

The natural haunt of *Euborellia stali* (Dohrn) is under stones, dead leaves, and in almost all places in the soil where a certain amount of moisture is present. Like all other earwigs, they burrow in the soil. The insects are nocturnal in habit and do not emerge by day-light. They are not attracted by light. They are alert active creatures, running away, when disturbed, holding their forceps widely opened.

The forceps of earwigs are weapons of offence and defence. Dr. Annandale with reference to *Labidura riparia* Pall., var. *inermis*, Br., remarked as follows :—

'I have never seen an earwig nip another, nor I have been able to induce one to nip my finger' (**1**). But I find that not only does this earwig protect itself with its forceps but it can inflict severe wounds with them. Gadeau de Kerville has shown that the forceps are used as weapons of offence and defence and he has recorded a number of interesting notes on the function of the forceps of the earwigs. 'Gadeau de Kerville was nipped by . . . *Forficula auricularia* so strongly that blood was drawn, and Commander J. J. Walker had the same experience in New South Wales with the largest known earwig *Anisolabis colossea*' (**2**).

Euborellia stali is a small species and is not able to pierce tough skin, but nevertheless when caught it tries to extricate itself, by using its forceps.

Though chiefly carnivorous these earwigs feed freely on vegetable matter. They eat the petals of *Hibiscus rosa sinensis*, of *Thespesia*, and of the rose, also rotten oranges, tomatoes, plantains, etc. They also eat killed garden snails, small soft-bodied insects, dead grass-

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[1] Numbers in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

hoppers, dead prawns, earthworms, mutton, eggs of small creatures, etc. Mr. B. Burr fed *Labidura riparia* on blue-bottle flies. They sucked them dry and left the empty skin (2). Dr. Annandale noticed that *Labidura riparia*, sometimes carries its prey on its forceps (1). I find the forceps are really very useful implements for catching the food and conveying it to the mouth. The earwig attacks and seizes its prey with its forceps and then bending its body to one side, transfers it to its mouth.

When these earwigs are placed in large numbers in a single jar they become cannibalistic, the stronger ones eating the weaker. The young are very active and move more quickly than the adults. Green found that *Elaunan bipartitus* (Kirby) 'when handled gave off a pungent odour like that of the Bombardier beetle' (2). The species with which this note is concerned did not exhibit the same character.

The sexes can be distinguishd to a certain extent by their size, the shape of the forceps, and the number of segments. Males are smaller in size, and their forceps are more curved than those of the female. The straight and unnotched or entire forceps of the female are heavier in build and stronger than those of the male. There are only 6 abdominal segments in the female while in the male there are 8.

Euborellia stali is neither a household nor a garden pest.

Breeding habits.—To study their breeding habits the earwigs were sorted out in pairs, and placed in separate jars. In mating the male usually backs up to the female and touches her forceps. The female in her turn expands her forceps and comes closer to the male. The male then twists its tail portion and effects a connection tail to tail. In the act of copulation the ventral side of the male is opposed to the ventral side of the female. Copulation usually lasts for about 15 minutes. The female, being stronger, sometimes drags her partner.

My observations in these respects conform to those of de Geer, Lesne, de Bormans and Gadeau de Kerville (2).

Oviposition.—I have collected eggs of *Euborellia stali* in the months of November, December, January, February, March, April, June, July and August (i.e., practically all through the year). The female takes about 20 hours to lay the full complement of eggs which are usually about 35 in number, ovoid in shape, white in colour, and small in size. Milton observed 48 eggs laid by a female earwig (4). Some species, as several observers have recorded, are known to lay as many as 90 eggs at a time (2).

Maternal care.—The female earwig sits over her eggs, and guards them. The male never approaches the brooding female. If the eggs are separated from the mother they are not found to hatch. Mr. and Mrs. Milton observed the same thing in their study (4). If disturbed when brooding, the mother takes the eggs one by one in its mandibles and removes them to a safe corner. She cleans them every now and then with her mouth; and, if seriously disturbed, she eats them. If, for instance, the cluster of eggs is scattered, the mother makes no attempt to collect them, but responds by eating them. de Geer in the case of the species

observed by him found that the mother picked up all the eggs when scattered in the different parts of the sand-box (2).

Incubation takes about eight days in the case of *Euborellia stali* (Dohrn). In the case of *Forficula auricularia* it is said to be about 16 days (4). The young ones are white in colour, and there is no structural difference between the young and the adult except in size. The active newly hatched young cluster round the mother sometimes sitting on her back. If one of her young tends to stray the mother seizes it in her mandibles and restores it to the family circle. The mothers' solicitude for her brood lasts for nearly 3 days after hatching, then she leaves them to fend for themselves. I have not as yet been able to determine the number of moults passed through before a young becomes an adult.

Enemies.—At night, when the earwigs came to the surface of the soil in the jar, they were attacked by lizards and cockroaches; and I actually found a lizard eating a large number of my captives. Cockroaches usually attack the smaller ones. Ants sometimes invade the jars in large numbers and do considerable damage. Some of my earwigs were also infected with ticks. The ticks are ectoparasites, and many may be found adhering to the body of a single earwig. The whole metabolism of the victim is affected and it usually dies after two or three days of infection.

I am highly thankful to Mr. Hemsingh Pruthi, Imperial Entomologist, New Delhi, for his identification of my specimens as *Euborellia stali* (Dohrn). He was also kind enough to suggest some literature for my study of earwigs.

I am also thankful to Mr. R. V. Seshaiya, Lecturer in Zoology, Annamalai University, under whom I have been carrying on my study on Dermaptera.

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2. *Fauna of British India—Dermaptera*, by Malcolm Burr.
3. *Studies in Indian Dermaptera*, by Morgan Hebard.
4. *Ent. News*, vol. xxxvi—1926, 8 months study of earwigs by Milton.

EARTH-EATING AND SALT-LICKING IN INDIA

BY

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AND

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ANALYSES XLVIII—LI

XLVIII—*Soil from Salt-Lick*

Serial No. 107.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Hard buffy lumps. Powder gritty and soapy to the touch.

Minerals	26·55	per cent.
Clay	7·65	,,
Sand	52·58	,,
Organic debris	1·81	,,
Moisture	3·64	,,

Fine Earth (20 mesh sieve)	69·800	,,
Insoluble in nitric acid	42·550	,,
Magnesia (MgO)	0·330	,,
Lime (CaO)	0·944	,,
Alumina (Al_2O_3)	3·546	,,
Silica (SiO_2) soluble	11·360	,,
Phosphorus (P_2O_5)	0·303	,,
Ferric oxide (Fe_2O_3)	7·544	,,
Moisture and organic matter	3·638	,,

Remarks: 1. The soil contains traces of sodium, potassium, chlorine, manganese and carbon dioxide, 0·043 per cent. water-soluble inorganic matter, and 0·090 per cent. water-soluble organic matter.

2. The lick is a little nullah down which there is a tiny stream flowing during the south-west monsoon. It dries up very quickly.

The Reserve borders Coorg in the North, and Mysore on the East. The forest is good deciduous forest consisting mainly of teak, *Terminalia tomentosa*, *Lagerstroesmia*, and *Pterocarpus marsupium*. The rainfall is about 70 inches. The country is undulating and in parts hilly. The elevation is about 2,700 feet.

3. The lick is much visited by sambhur and chital.

XLIX. *Common Earth*

Serial No. 108.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Friable lumps of black soil. Powder soft.

Minerals	...	24·50 per cent.
Clay	...	21·70 ,,
Sand	...	36 63 ,,
Organic debris	...	1·52 ,,
Humus	...	9·16 ,,
Moisture	...	3·78 ,,
Fine Earth (20 mesh sieve)	...	71·960 per cent.
Insoluble in nitric acid	...	43·060 ,,
Soda (Na_2O)	...	0·390 ,,
Potash (K_2O)	...	0·342 ,,
Lime (CaO)	...	0·451 ,,
Alumina (Al_2O_3)	...	2·966 ,,
Silica (SiO_2) soluble	...	10·030 ,,
Phosphorus (P_2O_5)	...	0·275 ,,
Ferric oxide (Fe_2O_3)	...	3·553 ,,
Moisture and organic matter	...	9·984 ,,

Remarks : 1. The soil contains traces of magnesium, sulphur, chlorine, manganese and carbon dioxide, 0·060 per cent. water-soluble inorganic matter, and 0·105 per cent. water-soluble organic matter.

2. The earth was collected from a spot about 200 yards away from Salt-lick No. 107.

L. *Soil from Salt-Lick*

Serial No. 109.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Hard lumps of greyish earth ; fracture mottled white and brown. Many rootlets. Powder buffy, soft.

Minerals	...	11·49 per cent.
Clay	...	35·75 ,,
Sand	...	46·61 ,,
Organic debris	...	0·56 ,,
Moisture	...	4·05 ,,
Fine Earth (20 mesh sieve)	...	83·070 ,,
Insoluble in nitric acid	...	74·131 ,,
Soda (Na_2O)	...	0·032 ,,
Magnesia (MgO)	...	0·039 ,,
Lime (CaO)	...	0·021 ,,
Alumina (Al_2O_3)	...	0·198 ,,
Silica (SiO_2) soluble	...	0·597 ,,
Ferric oxide (Fe_2O_3)	...	3·850 ,,
Moisture and organic matter	...	4·189 ,,

Remarks : 1. The soil contains traces of potassium, phosphorus, chlorine and carbon dioxide.

2. The lick is situated on the bank of a little stream, which always contains water, about two miles distant from Salt-lick No. 107.

3. The lick is much frequented by sambhur and chital.

LI. *Common Earth*

Serial No. 110.

Locality—Begur Reserve, about 15 miles from Manantoddy, Wynaad.

Collected and sent by—D. Mc D. Currie, Esq., District Forest Officer, Wynaad.

Friable lumps of black soil, with many rootlets. Powder soft.

Minerals	...	38·12 per cent.
Clay	...	16·03 ,,
Sand	...	35·74 ,,
Organic debris	...	2·07 ,,
Humus	...	0·78 ,,
Moisture	...	5·68 ,,

Fine Earth (20 mesh sieve)	...	58·200 per cent.
Insoluble in nitric acid	...	45·160 ,,
Lime (CaO)	...	0·326 ,,
Alumina (Al_2O_3)	...	0 269 ,,
Silica (SiO_2) soluble	...	6·610 ,,
Ferric oxide (Fe_2O_3)	...	0·594 ,,
Moisture and organic matter	...	4·930 ,,

Remarks: 1. The soil contains traces of sodium and phosphorus.

2. The earth was collected from a spot about 200 yards away from Salt-lick No. 109.

REVIEWS.

I.—PAGEANT OF WINGS, by Douglas Gordon. Pp. 304. London: John Murray; 1938. Price 8*s.* 6*d.*

This book consists of seventeen chapters describing the marvels of animal life and behaviour; and though dealing mainly with birds, it has also many references to the denizens of the sea and coast-line, of the field, wood and moor. It makes no claim to strict scientific treatment, and its best portions are those farthest from the systematic method of professional studies. The author abandons himself to those aspects of animal life that have been a most constant source of interest and pleasure, and have come most frequently under his observation. His standpoint is one of experience and common sense, and his watchful eye is always open to the seeming eccentricities and drolleries of animal behaviour rather than to those proper responses to environment and evolution duly catalogued by the science of the schools. Mr. Gordon tells many good stories of personal encounters, the humour of which is enhanced by gay little drawings.

The reader will find here much that he may wish to know about the aeronautic artistry of birds, the mysteries of night and dawn, vocal expression, colour scheme, comedy and tragedy at home and abroad, domestic life in the open and behind the green curtain, perils at sea and on land, the charm of the seal, the land of pigs and poetry, etc.

The author may lay claim to be a writer of singularly charming narrative.

J. F. C.

II.—TREES AND MEN, by E. Hughes-Gibb. Pp. 172. London: Alexander Moring, Ltd.; 1938. Price 8*s.* 6*d.*

Mrs. Hughes-Gibb always impresses one as knowing what she is writing about, and her books hold the attention of the specialist and of the general reader alike. This volume, which aims at describing the true relationship of men with trees, is intensely interesting and full of curious details about the characters, habitats and provenance of trees; it contains plenty of solid observed fact, and this is never allowed to slide into hypothesis.

Right from the dawn of history, records reveal that the trees have nursed us, watched over and sheltered us, fed and warmed us. We have to thank them for the production of soil and the fertilisation of the earth; for the control of climatic conditions by regulating temperature and dryness; for the check they exert on jungle life, and for their value as purifiers and oxygen manufacturers in great towns and cities. And ever as our powers and needs grew and the complexity of our life developed, the trees have been ready for us and supplied us with paper and artificial silk, the greens and blues and purples of aniline dyes, cordite and lyddite, turpentine and rosin, rubber and cork, and sugar. Science has shown the way to many profitable by-products and, impelled by their greed for money, men have wantonly destroyed the friends on whom they depend so much.

The trees that have been sacrificed wholesale by man must by man be replaced. And it is gratifying to note that at present there are everywhere in the civilised world signs that man is awakening to the great value of trees and to their real place in the economy of Nature. He no longer thinks of them merely as producers of useful or necessary commodities; he realises that they have a larger rôle. The need of Afforestation is no longer a disputed question, and already the work has begun in many countries. However good the other chapters of the book may be, those on afforestation and forest fires are the best of all and the most interesting.

J. F. C.

III.—LE PETIT PEUPLE DES RUISSEAUX. Par Marcel Piponnier. Pp. 130. Paris: *Bourrelier*; 1938. 13 francs.

The author writes of the lower animals which people small streams, a fauna which is largely cosmopolitan and, on this score, ought to arrest the attention of naturalists the world over, India not excepted.

The book is attractively got up, well printed, generously illustrated, and inexpensive. It opens with a chapter on aquatic plants, by way of an introduction to the habitat, a factor of paramount importance in the everyday life of the occupants: their likes and dislikes, their tempers and humours, their modes of getting a living, and their relation to man. Here are the surface gliders and the divers: beetles, bugs, and the larvae of drone-flies and mosquitoes; lower down, all manners of crustaceans, such as *Cyclops* and carp-lice; still further down, the larvae of caddis-, crane-, dragon-, and May-flies; and at the bottom, shrimps and molluscs in plenty. Dipping almost at random into these chapters, the reader may be sure of coming upon curious and out-of-the-way happenings, quite unlike the commonplaces of many natural history books. Especially engaging are the accounts of the mosquitoes and the shrimps. Another good chapter is that about worms and leeches.

M. Piponnier has done his work admirably, and the whole book bears the authentic stamp of the nature lover.

J. F. C.

IV.—THE ANNUAL REPORT AND BALANCE SHEET OF THE CEYLON GAME AND FAUNA PROTECTION SOCIETY FOR THE SEASON 1937-1938 has been recently issued (November 1938).

This Society was first formed over forty-four years ago 'To prevent the elimination of Game in Ceylon, by destruction of animals for trading purposes, to further the interests of legitimate sports, and to conserve one of the food supplies of the inhabitants.'

The objects of the Society were revised in 1928, the Rules being also revised, and the scope of the Society extended so as to embrace the general Fauna of the Island. In these the reference to 'one of the food supplies of the inhabitants was rightly omitted for the great reduction in the number of animals and birds which has taken place no longer permits of such supply, apart from the fact that in these modern days domestic animals and birds can furnish all the meat that is needed by the people, and there is no justification for slaughter of wild creatures for food.

A comprehensive History of the Society was published in 1931 by Mr. A. C. Tutein-Nolthenius, a most enthusiastic and hard-working member of the Society for the past twenty-two years, and reviewed in our *Journal* (vol. xxxv, No. 3 page 665). The many difficulties up to then encountered by the Society were fully set out, these including the failure to enforce the Laws, and Rules thereunder, enacted by the Ceylon Government which, if memory serves correctly, stated on one occasion that 'Our Game Laws are quite efficient but we regret we have not the power to enforce them'!

That regrettable state of affairs appears to continue, for at the present time the new Fauna and Flora Protection Ordinance (No. 2 of 1937) which was proclaimed and came into force on the 1st March 1938 has (page 3 of the Report), 'been considerably better honoured in the breach than the observance. It has already, in fact, become another dead-letter Ordinance, outside certain of the Reserved Areas that are watched by Forest Department Guards and Watchers, and the small areas watched by our own Watchers.'

Such a regrettable state of affairs is not peculiar to Ceylon. Madras goes one better! (or worse) as the South of India Wild Life Protection Society launched in 1933 with a flourish of trumpets from Ootacamund and Madras was moribund within a very few months of its inception, and has not since been heard of. It appears to be as dead as the Dodo.

The Ceylon Society however, its work carried on by a strong Executive Committee aided by a very able Honorary Secretary, does all that is possible: so there is much hope for the future.

The membership of the Society is now 280: 2 Life Members, 251 Ordinary Members, 23 Overseas and 4 Honorary Members.

The Society's Journal *Loris* continues to appear with increasing popularity; and the Wild Life Calendar for 1939 with 24 full plate photographs of Wild Life of Ceylon jungles (Rs. 2·50, post free) is a very excellent idea which might be copied by our own Society.

Reports on Reserves by the five Honorary Wardens are interesting to read.

In 1929, there were 66,936 licensed firearms in Ceylon and about 836 game licenses. The Game Licenses issued in 1937-38—1st November to 30th April—were 526. We are not informed if the 66,000 have increased or decreasd: but judging by what has been happening in India it is likely that they have very largely increased and that many of them are used for the slaughter of all kinds of small animals and birds to satisfy the meat-hunger of the people—the something-for-nothing demand.

The appointment of a whole-time Game Warden has been urged by Dr. R. L. Spittel as vitally necessary to the proper enforcement of the new Ordinance and the Rules. In this he will, as he says, no doubt have the support of every member of the Society and of all who have real knowledge of the realities of wild life preservation. It is likely, indeed, that the Ordinance will continue to be a dead-letter unless such an appointment is made.

A cash balance of Rs. 1,971 is carried over to 1938-39.

Mr. A. C. Tutein-Nolthenius has been elected President of the Society and Mr. W. W. A. Phillips, Honorary Secretary for the past ten years, continues his good work.

The Report for 1938-39 Season will be looked forward to with much interest.

R. W. B.

MISCELLANEOUS NOTES.

I.—WHY ELEPHANTS VISIT SALT-LICKS.

I obtained the answer to a phenomenon that has puzzled me for years when photographing elephants, and incidentally am able to record something to the *credit* of the salt-licks. I have often noticed that at salt-licks frequented by elephants there are enormous accumulations of droppings more or less in the same place and all looking as if they had been placed there at the same time. But as, in some cases there was so much, even what appeared to me to be far beyond the capacity of an elephant, I often wondered how they managed to do it. I know now. Here is the solution. When I went into the lick I carefully examined the edge of the lick with my glasses and saw that although the elephants or an elephant had been there about two days before, the rim of the pool was practically free from droppings. The big elephant came in about a quarter to five and after I had exhausted all my available films I left him to it. The following morning I went to the lick but the elephants had moved off. But, along the edge of the lick there was an accumulation of droppings which would have been a credit to an entire herd of elephants. No doubt the smaller one had been there too but he evidently did not go to exactly the same place as the big bull. I did not make any examination then because I expected to be there for some days and did not want to disturb the lick. But at the end of my last day there—the elephants never came in again—I made a thorough examination of the place and found that this enormous accumulation of dung—about half a bullock cart load!—had obviously been made by the big elephant; partly on account of its size and partly on account of its coarseness. The dung of the smaller one was much smoother. I had a good look round the game tracks leading into the lick and I have no hesitation in saying that the night those two elephants had been in the vicinity they must, or at any rate the big one must, have gone in and out of the lick very many times. I therefore deduce that the sulphur, which from the length of time the elephant sucks up the water must amount to a considerable quantity, acts as a pretty quick aperient and the 'walk round' is done between times to get it to work properly! Finally I suppose when he feels he wants a little more of the lick, 'that salt-lick feeling' he goes down again and has a good drink. While there his tummy works and he adds to the mound. Of course there is a good deal of speculation about these deductions of mine, but I think it is more or less a fair conclusion to arrive at. The salt-lick is their chemist's shop, and in the case of a sulphur-lick it works very quickly. I am sure this will interest you.

SUNLAWS,
BUKIT BETONG,
KUALA LIPIS, PAHANG, F.M.S.
November 12, 1938.

T. HUBBACK.

II.—THE MATING OF ELEPHANTS.

While out shooting wild elephants in 1919 on the west of Payagale, about 20 miles north-west of Pegu, Burma, I chanced to witness a unique sight, and was sorry to be without a camera at the time. It was the mating of a wild bull-elephant and cow-elephant. I was searching for a tusker that morning and came upon a herd of wild elephants which were scattered grazing. Entering stealthily in their midst followed by two Burman guides, I saw from a hill streamlet, after an hour's stalking, two wild elephants—a bull tusker and a cow—far removed from the herd just at the foot of a hillock. The bull had its trunk round the left hind leg of the cow-elephant, at the same time pressing his right tusk on her left rump, using this as a lever to inflict pain so that the cow would be obliged to submit to his wishes. No resistance was shown, apparently because the bull had a thorough hold on her.

From my place of vantage, say within 50 feet away, I saw the bull forcing the cow, held in the above manner, to walk up the rising ground for about the space of 20 or 30 yards; they turned and the bull loosening his hold, rose on the cow in the act of service. They gradually descended in this manner to the foot of the hill. On reaching level ground the bull got off, laid hold of the cow again as described above and made her repeat the ascent. This movement was carried out three or four times in succession till the service apparently came to an end.

The wild bull then released the cow which ran away to join the herd once more. The bull stood for sometime before he moved off.

The scene was so impressive and unique that I was loath to shoot the tusker, and allowed him to go his way. I don't think such a sight has been witnessed by many shikaries, and I therefore record this note.

No. 10. 3RD STREET,
PEGU. J. GONZALEZ.

November 27, 1938.

III.—BEHAVIOUR OF GAUR OR INDIAN BISON (*BIBOS GAURUS*).

Major Rossel in his article on page 325 of your September 1938 issue, comments on the apparent inability of bison to recognize men moving in the open at over 50 yards; I have had many experiences of the same kind and at much shorter ranges, when trying to obtain photos. Twice recently I have stalked up to solitary bull bison in fairly open country. In one case I managed to conceal myself behind a bush while I prepared my camera for action. When all was ready I found that the bison was walking

slowly straight for my bush and when he had reached a distance of about 20 yards I stepped out into the open. As he had his head down when I first stepped out from behind the bush I gave a shout in order to make him look up. This he did at once and remained staring at me for some considerable time. He did not appear unduly alarmed and eventually turned round and trotted off slowly, pausing several times to look back.

Personally I think the eyesight of the gaur is poor. When first observing a strange object, his curiosity overcomes all other inclinations. The sense of hearing is quite good, but as bison themselves generally make a lot of noise, either feeding or beating off flies, most ordinary sounds are inaudible to them.

Their ability to scent human beings at a distance is distinctly good and I have known a herd wind me at a distance of a quarter of a mile in open country. When compared with the Burma *saing* or *banteng*, the gaur seems a rather stupid animal or at any rate he exhibits a much greater indifference to danger. The *saing* has much better powers of vision and a far greater sense of smell. Twice recently I saw very definite proof of this. On the first occasion I arrived at a big salt-lick to find a herd of bison and a solitary bull *saing* with the bison. The wind was not really favourable for the animals to get my scent, but in a couple of minutes the bull *saing* had galloped off whilst the bison appeared quite unconcerned. On another occasion I came on a herd of about 50 bison resting in open country with a pair of bull *saing* lying down with bison. On this occasion a fairly strong wind was blowing from the herd towards me and I was able to approach to within about 30 yards of the nearest bison. I then sat down chiefly with the object of seeing whether any of the animals would become suspicious. Within a few minutes the two saing began to show uneasiness and after walking towards me for a short distance, they charged off. The bison on the other hand, after the first alarm caused by the saing running away, did not appear worried. Another characteristic of bison is the manner in which they will fraternise with elephant.

I have often seen wild elephant and bison feeding peacefully together; and last rains I obtained rather striking proof of this characteristic of bison. I was touring in the Pidaung Sanctuary (where incidentally the animals are just as wild as elsewhere) and spent a few days riding round on a tame elephant. One morning I came on a huge herd of bison, numbering more than 100 animals resting in open scrub forest and I was able to approach within a few feet of the bison which showed not the slightest suspicion. It was indeed a rather remarkable sensation when I 'looked an old bull in the eye' at a range of 15 feet. I should mention however that it was necessary to keep the wind in the right direction and when eventually I began to wander into the herd the bison knew that something was wrong. The effect of more than a 100 huge black bodies rising simultaneously from every bush in the locality was indeed striking. All attempts to approach saing on the elephant proved futile and I could never approach nearer than 50 yards. Hog deer were also thoroughly

frightened by the elephant, but I passed several sambhur at very close range without causing them any alarm.

MAYMYO, BURMA. F. J. MUSTILL.

November 5, 1938.

IV.—DERIVATION OF THE NAME SELADANG

In the very interesting article by Mr. Hubback on the Malayan Gaur or Seladang a derivation of the name seladang is suggested on page 10. It seems possible that the name was imported into Malaya with the animal, as it is suggested that the animal came in from the North. The Manipuri word for the mithun (*Bibos frontalis*) is *sandang* and the Kuki word for the same animal is *sel*. Further research might revel that the word is similar in other languages.

IMPHAL,

MANIPUR STATE, C. GIMSON.

ASSAM.

December 27, 1938.

V.—SORE NECK IN SAMBAR.

The Theory of 'Atavistic Degeneracy'.

In my article on the Malayan or Burmese Sambar (*Rusa unicolor equinus*) which was published in the *Journal of the Bombay Natural History Society*, vol. xxxix, No. 2, dated 15th April 1937, I touched at considerable length on the subject of the 'Sore Neck in Sambar'. Subsequently Mr. S. R. Daver of Jagdalpur, Bastar State, India in an interesting article entitled 'Cause of Sore Neck in Sambar' (*Journal*, vol. xl., pp. 118 to 122) gave his views on the subject. He stated that he had the good luck to read a passage in a small book *The Story of Animal Life* by Mr. B. Lindsay which explains the cause of 'Sore Neck' in Sambar in such a manner that it *leaves no room for any doubt*. Mr. Daver states that the fact of the matter is that the Sambar, although sometimes described as the 'Monarch of the Dale', does not carry any blue blood in his veins. He has a much humbler origin than people think. The 'Sore Neck', Mr. Daver says, is nothing but a badge of an inferiority complex which sambar and other higher forms of animals carry round their necks to remind them for all time that they were once marine animals. When the Himalayas were under water these animals including the ancestors of the Sambar perhaps, were swimming in the shallow sea. Mr. Daver says that he has

seen several sambar at close quarters during the course of 20 years of his roaming in the jungle but has never seen a single specimen of a sambar with a 'sore neck'. In biological language 'sore neck' according to Mr. Daver, is an instance of 'atavistic degeneracy'. Mr. Daver quotes Mr. Lindsay:

'What we see as a bare patch and a sore on the necks of the animals used to be a place where gills were attached when these animals were leading a marine life. The disease is called "cervical fistula".'

Mr. Daver goes on to quote another extract from Mr. B. Lindsay's book as follows:

'Nor do we need to go into the nursery to find links with our inferiors. Much, indeed far too much, has been written of late years about "atavistic degeneracy", that is to say, degeneracy which imitates the characteristics of our forefathers. Many things which are classed as diseases, whether of the body, mind, or moral nature may be explained in this way. Take the gills which as we have stated exist in all the vertebrates but not in the adult of the highest groups. In a sickly individual even amongst the highest vertebrates, traces of this are sometimes seen existing in the adult as a gap or open space in the neck called by the medical man "cervical fistula": this is an instance of degeneracy in the body. Take, for another instance, the kleptomaniac who snatches up everything he takes—a degeneracy of the mind, a relic of savage nature out of place in civilized man. Yet the gill space is an ancestral feature which has its right time to appear though it is out of place in the adult: and the "want to snatch" stage, as we have already seen is quite natural in the young child.'

To understand clearly the development, position, and modification of gills in the modern animal Mr. Daver quotes another passage from Mr. B. Lindsay's book, as follows:

'The classes of the vertebrata are fishes, amphibia, reptiles, birds, and mammals. We used to learn that these fishes had gills, and amphibia gills for a time; but to be strictly accurate, we must say that fishes have gills and all the rest of the vertebrates have gills for a time. There is no exception to this rule not even among the highest vertebrates. But in these vertebrates which stand higher in the scale of life than amphibia, viz. reptiles, birds, and mammals, these gills are never brought into use. They only exist in the early embryo and afterwards disappear, giving rise by their modification to other structures. Strange to say one of these structures is the ear. This takes its origin from one of the gill clefts or spaces. The Eustachian tube which communicates between ear and nose is part of this cleft; and the little bones which are inside in the ear represent the bones of the "gill cleft". For in fishes, bones support each gill and are conected together to form a complex arrangement. In the higher vertebrates, which possess gills only in the embryo, this gill skeleton is much modified and persists as a bone, its hyoid bone supporting the tongue. The gills of vertebrates arranged in successive pairs along the throat, are "performing gills, that is to say they consist essentially of holes or spaces which pass right through the wall of the throat."

Since reading Mr. Daver's theories in the *Journal* regarding the cause of 'sore neck in sambar' I have tried but failed to obtain a copy of Mr. Lindsay's book. However, I also had the luck to come upon an article entitled 'The Concept of Atavism', which it appears to me does not quite uphold Mr. B. Lindsay's theory or Mr. Daver's explanation that the sore in question is a gill. The salient portions of the article in question are herewith reproduced.

'During the days when biologists were sedulously engaged in supplying the finishing touches to the house that Darwin built, it was the usual practice

to regard every possible arrest in development or unusual character of an organism as the persistence or recurrence of an erstwhile normal feature of the particular organisms, ancestor, or ancestors. Such a reversion to the presumed ancestral condition was termed an "atavism" from the Latin "atavus", an ancestor. This concept and the term expressing it, abounds in the writings of nineteenth century biologists. Haeckel's "Biogenetic Law" really represents a generalized synoptic version of this concept applied to a particular case, and calculated to resume a certain supposed routine of phenomena under a particular law. Today few biologists believe that in its ontogenetic development any animal actually repeats the developmental stages of its phylogenetic history. In development the organism apparently passes only through those stages of development which are akin to similar stages passed through in the ontogenetic development of its ancestors; and this is essentially what Van Baer said in his "Hypothesis of Recapitulation", which is not to be confused with the so-called Biogenetic Law. In development the organism does not repeat the adult stages of its ancestors, but only those stages of development through which its ancestors as a whole have more or less in common passed. This, as Van Baer originally pointed out, is why the early stages of related animals resemble one another more closely than do the differentiated adults. Modern recognition of these facts has brought the Biogenetic Law into disrepute. The conception of Atavism however, persists. Reference to many modern texts on embryology, general biology, and the writings of a fair number of morphologists, will supply examples of the uncritical usage of this term. One recent work by a notable worker has a section entitled "Reappearance of Lost Ancestral Structures in Man" and as the example of such structures we are given the gill pouches . . . (of) the early embryo . . . (which) may . . . persist and form an open fistula on the side of the neck". Surely it is clear that such a fistula is due to the mal-development or arrest in development of an embryonic character of the individual and not to the reappearance of a character which the species and class has lost but which may have been present in some remote phyletic ancestor. In this connection it is worth drawing attention to the fact that the conventionally accepted homology between the gill pouches or arches of fishes and the branchial arches of mammals is open to serious question.

The occasional occurrence of a tail in man or of an azygos lobe of the right lung, microcephaly, large canine teeth, the fourth molar, the divided molar bone, the "third trochanter" of the femur, the entepicondylar foramen of the humerus, super numerary mammae, and many other characters have been and still are cited as examples of atavism. Yet in every case it can be conclusively shown that such characters are not upon *any view* to be regarded as reversions to an ancestral condition. Changes in development and in development rates resulting in persistence, suppression, reduction, hypertrophy, duplication, multiplication of structures and normal variability are processes quite adequate to account for the so called "atavisms" which are commonly cited. In short it is more than doubtful whether the concept of atavism has any counterpart in reality; and I think it will be agreed that unless the concept can be applied to some demonstrable type of phenomenon it were better that the term were altogether dropped from the vocabulary of the biologist.'

It seems to me therefore that we can hardly accept as correct Mr. B. Lindsay's theories which Mr. Daver has supported in his article about the sambar sore being a gill and its appearance being due to atavistic degeneracy. There is nothing degenerate about the Malayan Sambar as we hunters know full well. It really is not a bare patch at all but an area oozing out. . . . something, a scent, a perfume gland. Black buck, elephants, and camels have them; whilst serow have them between the toes. It seems strange nevertheless that although there must be quite a large number of experienced scientists and naturalists in the country apart from experienced sportsmen none of them have as yet succeeded in discovering why that circular sore on the sambar's neck is there,

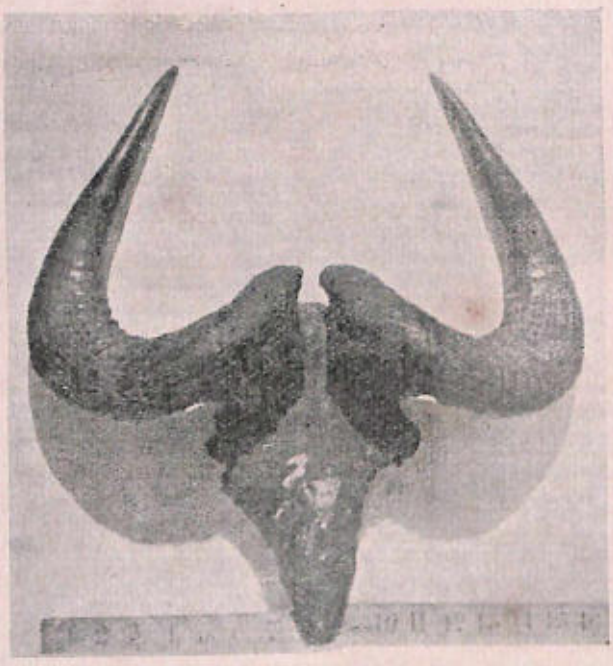
always in the same spot. Can it be a secretory gland? No doubt we will get to the bottom of this matter in the near future.

KALAW,
SHAN STATES,
BURMA.
October 1938.

W. S. THOM.

VI—THE RECORD THAKIN HEAD.

(*With a photo*).



I enclose herewith a photo of a thakin head which has recently come into my possession. The head was brought down by a Mishmi tribesman several years ago and came into my possession through the courtesy of Mr. F. P. O'Connor of Itakhooli Tea Estate.

The frontal part of the horns are extremely gnarled and ridged and this point combined with close proximity of the two tips indicates the great age of the beast.

The measurements—very carefully taken and checked by a friend—are as undernoted :—

Length.	*Girth.*	*Tip to tip.*	*Widest spread.*
25¼ Rt. }	15 }	8	17
25 Lt. }	15 }		

Unless Rowland Ward's Records contain measurements which can beat it this head would appear to be the record.

There is one head given in Burke's *Indian Field Shikar Book* which has horn lengths of 25 and 24¾ but the spread is no more than 13¼.

The measurements, when compared with those given in this book of records, are remarkable for the 'tip to tip' measurement, and the 'widest spread'.

HOOGRIJAN TEA ESTATE,
UPPER ASSAM. F. WOOLEY SMITH, D.F.C.
November 18, 1938.

[The largest head of a Mishmi Thakin recorded in Rowland Ward (9th Edition) is one belonging to the late J. F. Needham. The owner's measurements are as follows:—

Length on Front curve	*Circumference*	*Tip to Tip*
25″	13″	11⅛″

—Eds.]

VII.—A TREE MOUSE (*VANDELURIA OLERACEA*) IN THE NEST OF A SPIDER.

Dr. Gravely, in his notes on 'Indian Insects, Myriapods and Arachnids' (*Rec. Ind. Mus.*, xi, 1935, p. 535), while discussing at length the habits of the spider *Stegodyphus* (Fam. ERESIDAE), observes as follows:

'Associations of other animals with African species of *Stegodyphus* have been recorded by Marshall and Pocock. Marshall describes a doormouse which lives in *Stegodyphus* webs and ultimately drives away the spiders, and both authors refer to a *Microlepidoptera* which lives with the spiders in their nests.'

To add to this his own experience in India, Gravely cites the case of the Moth (*Brachmia xerophaga*), living with *Stegodyphus sarasinorum*: also that of a *Uloboid* spider making use of the webs of *Stegodyphus* and concludes that 'other associations, probably of a more casual nature, may also occur.' To illustrate this remark, he narrates how, once in Orissa 'when pulling STEGODYPHUS nests to pieces in order to obtain lepidopterous larvae,' he found 'in addition, the following animals alive within them:

one Cribellate spider (? DICTYNIDAE),
one Centipede (? GEOPHILIDAE),
one large LEPISMATID and
two minute Beetles (ANTHICIDAE and CLAVICORNIA).'

In support of the foregoing, may I venture to place before your readers further evidence which I have recently come across. Whether the association is casual or of a permanent nature cannot be said without further evidence but the case is quite unique as no similar incident has been, to my knowledge, ever recorded from India.

On 11-8-1938, I went for a whole day cross-country tramp with my friend, Mr. R. G. Kharadi, B.SC. We intended to collect insects for the museum of the Gujarat Natural History Society.

After going for about ten miles, we entered a grove of mango trees, where I saw a spider's nest at the end of a branch. The height of the nest was about 8 feet and I had to take a couple of jumps before I was able to take hold of it. While trying to locate the entrance to the nest which appeared to be blocked by some dark object in the interior, I was startled to find a pointed nose and beady eyes staring at me! Hastily I let go of the branch and up it went to its original position. We now determined to collect both the nest and its occupant (which we realised was a mouse) and again after some fancy jumping, I succeeded in breaking off the portion which supported the nest. The mouse had disappeared inside the nest; to prevent its escape, I placed the nest in a cloth bag and tied its mouth. On the way home we came across several spider nests in cactus hedges, which we collected with their occupants but nowhere did we find any other animal occupying them nor did we again see another tree with a spider's nest in it.

On inspection in the laboratory the nest was found to contain not only several spiders and a mouse, but also a litter of six young mice! Mr. Kharadi was able to identify the mouse as *Vandeluria oleracea*, the Long-tailed Tree Mouse, which was later verified by Mr. Prater. The spiders were dark brown or blackish in colour with markings on the top of the abdomen. I think they are *Stegodyphus sarasinorum*.

AHMEDABAD, H. G. ACHARYA,
NORTH GUJARAT, F.Z.S.
October 9, 1938.

[One of the spiders taken in the nest forwarded to the Society for identification by Mr. Acharya has been identified by Dr. Gravely as an Epeirid (near *E. nauticus*), but not actually that species. *E. nauticus* is nocturnal in its habits, resting by day in a small silk-lined retreat and going to the centre of its orb-web for the night. The retreat of this particular species is ordinarily not large enough to hold anything bigger than the owner and could certainly not contain a tree mouse and its family. The actual nest which was subsequently forwarded to us by Mr. Acharya proved to be that of the Common Social Spider, *Stegodyphus sarasinorum*. These spiders live in colonies and their nests take the form of a dense untidy mass of cobwebs, spun amongst leaves and branches, and usually contain the dry remains of various insects devoured by the owners of the nest. As indicated in the note, the nests of these spiders provide a lodging for a variety of creatures which live in association with them. In the instance under comment, the Epeirid Spider, discovered in the nest was, like the tree mouse, an intruder. The tree mouse not finding the nest quite to his liking proceeded to refurnish it with pieces of dry grass, the remains of which were found in the nest. The Long-tailed Tree Mouse lives in trees and shrubs and usually builds a nest of grass or grass and leaves in the branches. It occasionally places its nest in the thatch of

houses or in beams; but, like the African Doormouse, it may occasionally take up its quarters and rear its family in the nests of other creatures. McCann found one of these mice occupying the deserted mud nest of a swallow.—EDS.]

VIII.—NUMBER OF YOUNG OF LONG-TAILED TREE-MOUSE *VANDELURIA OLERACEA*.

Blanford (*F.B.I. Mammalia,* p. 403) says that he found '3 young on one occasion and 4 on another'.

I recently came across a nest of social spiders (*vide*—Misc. note no. VII in this Issue) inhabited by a ♀ Long-tailed Tree-Mouse (*Vandeluria oleracea*) with 6 young which had not opened their eyes yet. The measurements of the young were as follows:

Head, body 1⅜ in., tail 1 in. Adult female: head, body 3 in., tail 4½ in. (Blanford's measurements for a full-grown adult are: head, body 2.2 in. to 3 in., tail 3.5 to 4.5 in.)

AHMEDABAD, H. G. ACHARYA,
NORTH GUJRAT. F.Z.S.

October 9, 1938.

IX.—LEOPARDS FROM VICINITY OF NAGA HILLS.

These are the particulars of some adult leopards shot in this vicinity.

	Length.	*Weight*
Males	6′–11″	123 lbs.
	7′– 3″	130 ,,
	7′– 1″	135 ,,
	7′– ½″	127 ,,
	6′– 7″	89 ,,
	7′	–
	7′	–
	6′– 8″	100 ,,
	6′– 6″	–

	Length.	*Weight.*
Female	6′– 1″	82 lbs.
	6′– 3″	79 (Black)
	6′– 2″	72
	5′–10″	–

It would appear that unlike the tigers of this district the Leopards compare in length and weight with those recorded from other parts of India.

TOWKOK TEA ESTATE, G. H. L. MARSHALL.
SONARI P.O.

X.—MEASUREMENTS OF TIGERS SHOT IN THE NAGA HILLS

A Correction

In the proceedings and account Section of Vol. XL. No. 2 I notice you state Mr. Marshall publishes records of tigers shot 'by him' in the Naga hills, Assam. I would like to point out that this is incorrect. The total of 59 animals comprises the bag of many fellow sportsmen to whom I am greatly indebted as well as my own. I am responsible for the game register of this district and have personally measured many of these tigers and can vouch for the accuracy of the figures.

TOWKOK TEA ESTATE, G. H. L. MARSHALL.
SONARI P.O.
December 15, 1938.

XI—MIGRATION AND METHODS OF BIRD SNARING IN NORTH EAST ARABIA.

(*Five text figures*).

From a bird life point of view, Kuwait, and the promontory on which the town lies, would appear to be one of the most interesting spots in the Middle East for the study of migratory birds. I do not profess to be able to explain why this is so, but to my mind Kuwait can be likened to the Northern end of a long narrow corridor or tunnel, through which migratory birds, moving up from South East Arabia and India, along the Western shore of the Persian Gulf, and conversely moving south again (though to a lesser degree), have to pass. Thousands of migratory birds seem to pass over Kuwait town and the strip of coast about twenty miles wide, which stretches south along the Arabian shore.

The phenomenon may have to do with the fact that birds flighting to and from Northern climes and the Tropics, and who happen to choose the Western shore of the Persian Gulf for their route, are inclined to hug the sea coast, as being cooler and having more watering places where they can assuage thirst than in the interior.

Certain it is that every variety of migratory bird is so common during the Spring, and to a lesser extent during the Autumn migration, that almost the entire youth population of Kuwait town, and the tribes lying on the coast to the south of it, go in for catching and trapping these birds as a regular pastime.

The birds so caught are sold in the bazaars as playthings to amuse other children, or are eaten, or again are sold to those owning Falcons with the object of providing a change of diet for

these birds in the non-hunting season. The market price is about nine pence for just over four pounds of small dead birds.

On almost every house roof in Kuwait and the villages to the south of it, as well as on the ground in the vicinity of Badawin encampments, one can see small artificial trees, made of clumps of bushes tied together and placed in prominent positions to attract birds in flight. Each of these bushes contains several traps of the type called *Sulāba,* and it is astonishing how many birds are caught and brought down from the house tops by the youth of the city.

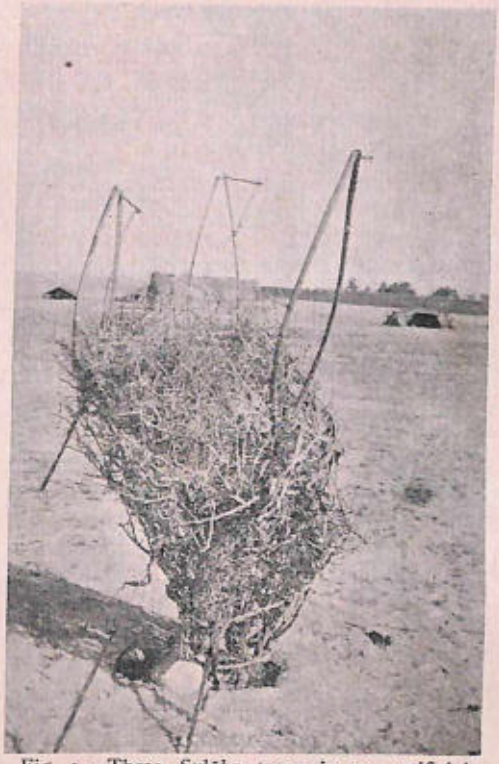


Fig. 1.—Three *Sulāba* traps in an artificial bush made of cut branches of thorn.

Though it is all very heartless and cruel from a Westerner's point of view, I must admit that the sport affords great happiness and joy to thousands of youths, and young boys, who have little else in the world to brighten their drab lives.

The skill with which these young Esaus set their traps and entice birds to come and be caught, has only to be seen to be believed. It is little short of marvellous.

There are three main types of traps used for snaring small birds. They are known as:—

(1) 'Fakh'
(2) 'Sulāba'
(3) 'Sālia'

(1) The 'Fakh' is mostly used for catching the Lesser Kestrel Hawk which appear some years literally in tens of thousands over the town during the end of March and April. These birds are caught with a decoy. A Kestrel is obtained, and tied by both legs to a heavy stone with a strong piece of cord about 2 ft. long, in a place near some trees where the birds are known to roost. All round this bird are placed 'Fakhs', carefully covered with light sand and pegged to the ground, with only a wriggling grub visible. The Hawks seeing the one on the ground circle round

X.—MEASUREMENTS OF TIGERS SHOT IN THE NAGA HILLS

A Correction

In the proceedings and account Section of Vol. XL. No. 2 I notice you state Mr. Marshall publishes records of tigers shot 'by him' in the Naga hills, Assam. I would like to point out that this is incorrect. The total of 59 animals comprises the bag of many fellow sportsmen to whom I am greatly indebted as well as my own. I am responsible for the game register of this district and have personally measured many of these tigers and can vouch for the accuracy of the figures.

TOWKOK TEA ESTATE, G. H. L. MARSHALL.
SONARI P.O.
December 15, 1938.

XI—MIGRATION AND METHODS OF BIRD SNARING IN NORTH EAST ARABIA.

(*Five text figures*).

From a bird life point of view, Kuwait, and the promontory on which the town lies, would appear to be one of the most interesting spots in the Middle East for the study of migratory birds. I do not profess to be able to explain why this is so, but to my mind Kuwait can be likened to the Northern end of a long narrow corridor or tunnel, through which migratory birds, moving up from South East Arabia and India, along the Western shore of the Persian Gulf, and conversely moving south again (though to a lesser degree), have to pass. Thousands of migratory birds seem to pass over Kuwait town and the strip of coast about twenty miles wide, which stretches south along the Arabian shore.

The phenomenon may have to do with the fact that birds flighting to and from Northern climes and the Tropics, and who happen to choose the Western shore of the Persian Gulf for their route, are inclined to hug the sea coast, as being cooler and having more watering places where they can assuage thirst than in the interior.

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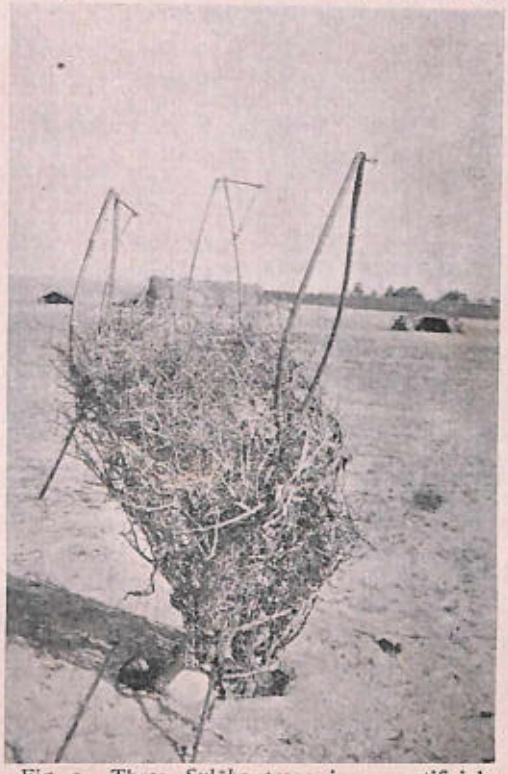


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and round above it, and eventually settle round about and are caught as they peck at the grub on the trap. The boys, who lie hidden behind a wall or in some shallow pit, then rush out and



Fig. 2.—A 'decoy' Kestrel, tied by the leg and surrounded by carefully covered traps of the *Fakh* type.

capture the flapping bird. The traps are carefully adjusted so that the bird's legs are never broken, but the trap is just too heavy to enable them to fly away with it, although they very often drag the peg out of the ground.

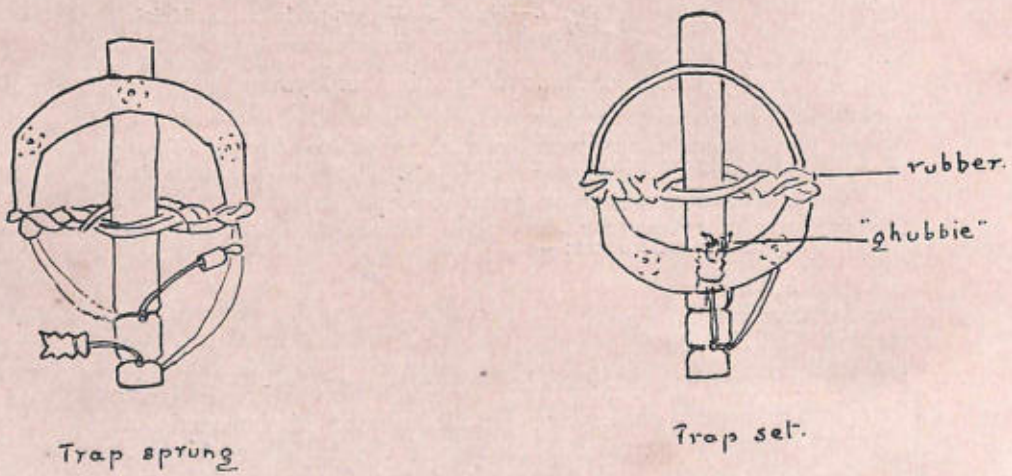


Fig. 3.—*Fakh*.

These lesser Kestrels are a great joy to the boys of Kuwait who walk about with them on their wrists imitating the Sheikh's falconers.

The Oil Company's rig, which has been put up this year some 35 miles South of Kuwait town has attracted these birds to roost on it in thousands.

Shrikes and many other small birds are caught in this trap, when it is placed near a small tree where birds come to settle. The same grub, known locally as a 'ghubbie' is used, but the trap is not pegged down.

(2) The 'Sulaba' is usually placed sticking out above the artificial bushes on the house tops of Kuwait. As many as 6 can

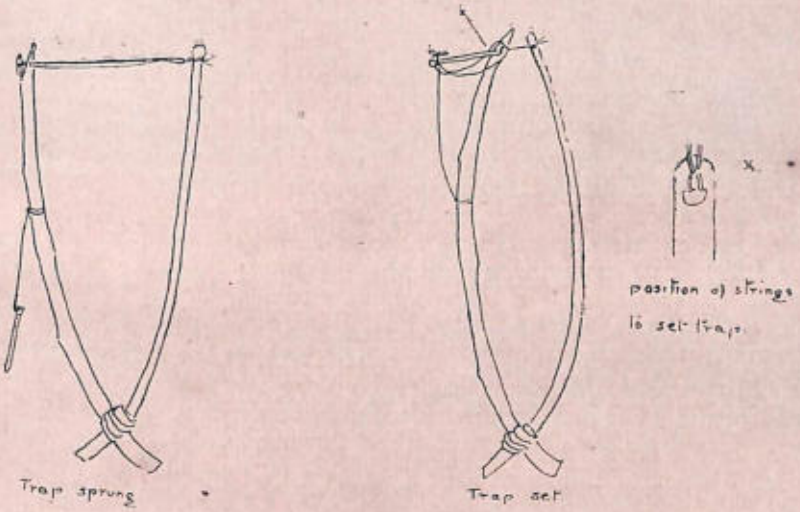


Fig. 4.—Sulāba.

be put into one bush. In the small gardens outside the town these traps may be seen placed against the low mud walls, or perhaps in a bush of flowers or other prominent place. They are not baited, but attract merely as a perch in a land where trees and bushes are scarce. The bird alights on the peg, along which the fine string is carefully arranged, and its feet are caught in the string as the peg falls, and the two sticks spring open.

The bird so caught, if it be a Shrike, has one of its wing feathers removed and passed through its nostril and round its beak twice; this prevents it from opening its mouth. It also has one of its wings twisted, which prevents it flying away. Other varieties of birds have, when caught, one wing only twisted, and then are put into small palm frond baskets and sold in the streets or bazaar.

(3) The 'Salia', or net trap, is the third kind, and is used on trees in the 'Hautas' or gardens of Kuwait. It is composed of a fine fishing net fastened to a curved bamboo frame. This is thrown over a small tree such as a 'Sidr' or Tamarix, and slopes

down to the ground at the back where heavy stones are placed on it. The small birds go to roost in the tree, and in the early



Fig. 5.—The *Sālia* trap.

morning are driven down into the net on the ground and picked out.

KUWAIT, PERSIAN GULF.
September 20, 1938.

(MRS.) H. R. P. DICKSON.

XII.—BIRDS OBSERVED IN AND NEAR TAMBARAM, SOUTH INDIA.

(Supplementary observations made between April and October 1938 issued as an addendum to the paper published in No. 3, p. 467 of this Volume).

7. **The Red-vented Bulbul**: *Molpastes cafer cafer* (Linn.).

August 11th 1938—nest and 3 eggs in a bauhinia tree, about 7 ft. above the ground. August 14th—eggs stolen.

8. **The Red-whiskered Bulbul**: *Otocompsa jocosa emeria* (Linn.).

July 24th 1938 and several following days—a small and newly fledged bulbul was about the garden; its red 'whiskers' seemed absent, and the red of the vent was a pale yellowish scarlet. A parent bird was observed feeding this young one.

9. **The White-browed Bulbul**: *Pycnonotus luteolus luteolus* (Lesson).

August 15th 1938—nest in gmelina bush in garden; two very newly hatched chicks. August 23rd—one of these chicks observed

apparently dead in the nest at 12-30 p.m.; by 5-30 p.m. it had been removed from the nest. August 28th—the other chick almost fully fledged. August 29th—the nest empty.

11. **The Black Redstart**: *Phoenicurus ochrurus* (Gmelin).

A hen redstart in the garden on October 23rd 1938.

16. **The Paradise Flycatcher**: *Tchitrea paradisi* (L.).

October 10th 1938—a male in full white plumage in the garden. A bird in chestnut plumage, with short tail, was about the garden for about ten days from October 1st onwards. Neither bird has been seen since October 10th. Two birds in chestnut plumage, with short tails, observed catching insects from a pond in Vandalur Forest on October 3rd 1938.

19. **The Grey backed Shrike**: *Lanius schach caniceps* (Blyth).

August 7th 1938—nest in a terminalia tree in the garden, about 15 ft. from the ground, in a very exposed position. Nest very untidy, with a long bit of rag hanging from the side. Four eggs, bluish-speckled. The parent bird was seen on the nest every day for over a week. August 19th—the nest empty.

24. **The Black Drongo**: *Dicrurus macrocercus peninsularis* (Ticehurst).

July 24th 1938 and several following days—two very young drongos, with very short tails and red mouths, in the garden with adult birds. Parent birds seen feeding the young.

30. **The Brahminy Mynah**: *Temenuchus p. pagodarum* (Gmel.).

June 26th 1938—two birds seen in the garden. August 5th 1938—a small flock first seen in the neighbourhood. This is earlier than we have ever seen a flock appear before.

33. **The White-throated Munia**: *Uroloncha malabarica* (Linn.)

July 19th 1938 and several following days—several munias observed in the college jungle.

43. **The Pitta**: *Pitta brachyura* (Linn.).

October 8th 1938—the pitta heard for the first time this season in the jungle about a mile north of the college.

October 18th 1938—pittas established in the garden again.

45. **The Coppersmith**: *Xantholaema haemacephala.*

July 1938 to October 1938—coppersmiths now very common in the gardens of the college estate.

56. **The Hoopoe**: *Upupa epops* (Linn.).

July and October 1938—two hoopoes observed for several days at a time in the garden.

58. **The Common Indian Swift**: *Micropus affinis* (Gray).

Two of these swifts spent the afternoon of August 19th 1938 flying through and round our house. They have not been seen since then.

67. **The Pale Harrier**: *Circus macrourus* (S. G. Gmelin).

A female, presumably of this species, first seen this season over the college jungle, on October 6th 1938.

72. **The Spotted Dove**: *Streptopelia chinensis suratensis* (Gmel.).

August 28th 1938—a nest, with brooding bird, in a duranta bush, about 12 ft. above the ground, immediately outside a window of our house. Eggs not seen. The bird was still sitting when we went away from home on September 3rd, but the nest was empty and deserted when we returned on September 19th.

In addition to these further observations on birds already in our original list, the following have been noticed within the last few months:—

The Orange-headed Ground-thrush: *Geocichla citrina citrina* (Lath.).

October 24th 1938—an orange-headed ground-thrush in the garden for about half an hour this evening. It settled in a bauhinia tree, watching us and waiting for our departure, and therefore gave us an excellent opportunity to observe it with the field-glasses at quite short range. There was no doubt about its identity.

The Indian Koel: *Eudynamis scolopaceus scolopaceus* Linn.

Koels were heard for the first time since December 1932 in this neighbourhood on August 19th 1938, in Vandalur Forest, when the characteristic call was quite unmistakable, and was heard at frequent intervals for about an hour. Koels are very common in the gardens of Madras City, and it is surprising that they are so rarely heard in and round Tambaram.

The Indian Shikra: *Astur badius* Gmel.

October 9th 1938—a shikra bathing in one of our bird baths just outside my window, and then sitting for some time in the tree above the bath, affording excellent opportunity for close observation.

The Asiatic Sparrow-hawk: *Accipiter nisus nisosimilis* (Tickell).

October 21st 1938—a sparrow-hawk, probably a female, being distinctly brownish above, bathing in one of our small bird baths for several minutes. Birds of this type have been frequently seen

here before, but have never given the same facilities for close observation and identification.

MADRAS CHRISTIAN COLLEGE, A. M. BARNES.
TAMBARAM,
CHINGLEPUT DISTRICT.
October 23, 1938.

XIII.—THE DISTRIBUTION AND NIDIFICATION OF THE INDIAN (PUNJAB) RAVEN (*CORVUS CORAX LAURENCEI* HUME) IN SIND.

The distribution of the Punjab Raven in Sind, as Ticehurst records, is rather curious.

Parts of the Province, particularly Upper and Middle Sind possess physical features and a climate similar to the southern districts of the Punjab, where this Raven is common and a permanent resident, yet its range and distribution in Sind, even in districts which are like the Punjab, are peculiar and of great ornithological interest.

So far as I am aware it is a permanent resident only in the Khirthar Range and in the Thar Parkar district, where also, it is *not* met with, except as a straggler, outside the southern and eastern talukas of the Thar desert, which is bordered by the Rann of Cutch on the South and Rajputana on the East.

I am reliably informed that this Raven is resident in the west of Jodhpur and Jaisalmir States and birds met with in the eastern *rejistan* tracts of Khairpur State and Sukkur district probably enter Sind from Jaisalmir State which borders these localities.

Ghotaru, where Blanford found it late in the breeding season is only about 25 miles from the Sind border.

Elsewhere in Sind this bird is purely a winter visitant, though quite a few remain to breed in suitable localities.

In Upper Sind, though a regular winter migrant, it is, strange to say, very localised. It is as abundant in Jacobabad now, as it was in Hume's time, 66 years ago.

At Shikarpur it is common, yet at Sukkur only about 20 miles south-east, it is rarely seen. I saw only two birds during five winters. At Ghari Yasin 10 miles south-west of Shikarpur, it is again common and extends further south, another 10 miles to Gaheja. It is again met with in Khairpur State and the northern talukas of Nawabshah district extending as far south as Darbelo and Kot Laloo, about 60 and 75 miles respectively, south of Sukkur.

To Lower Sind it is but a rare winter straggler. In 1872 Hume found it at Hyderabad and Ticehurst met with it below the Baran gorge near Soorjana, in Karachi district.

In Thar Parkar where Blanford found it 'everywhere', this Raven is known to the Tharis as Rodh Kang. As already mentioned it is resident in the desert tracts bordering the Rann of Cutch and

Rajputana and breeds on lone Kandi or Babur trees in the vicinity of desert towns, villages and hamlets.

A clutch of 4 eggs which incidentally reached me in an omelette, was sent to me from Ranahu in Khipro taluka, and 2 nestlings, there were 5 in the nest, from Diplo. Thari goatherds also told me that they had come across nests near Gadro, Chachro, Sami Vari and Mithi.

I failed to find any birds at Mirpurkhas, Jâmesabad, Samaro, Digri, Chhor or Umarkot during January and February 1936 and *Tharis* told me that these places were only occasionally visited by these Ravens. At Char about 8 miles south of Samaro I came across a few birds, but failed to find any nests. *Tharis* at Char told me that it was common around desert villages and hamlets further north, east and south.

In Middle Sind I came across it in Khairpur State and Nawabshah district during the winter of 1935 and found them around town and village refuse heaps or near cultivation, at Gambat, Kot Laloo, Mehrabpur, Kandiaro and Darbelo. At Kandiaro a pair were viciously attacked by a horde of House Crows and literally driven out and away from the Canal Bungalow Compound. As I left Nawabshah district in December 1935 I am unable to say if any birds breed there.

In Upper Sind, where this Raven is a regular cold weather visitant, it is common in some places and yet conspicuous by its absense in others. In January 1930 I met with it in Sukkur district at Gaheja, Ghari Yasin, Jagon, Kot Sultan and Shikarpur, where it was very common and able to hold its own with the House Crows which swarmed there. It was partial to town and village refuse dumps, but was also met with in sprouting cultivation, particularly if freshly watered, and ploughed fields lying fallow. On the 19th January 1930 I found a nest ready for eggs in a lone Kandi tree* in open forest near some cultivation between Jagon and Kot Sultan. A few days later I took a nest with 5 eggs between Kot Sultan and Zarkhel. The nest was in a stunted Kandi tree in thin forest. Here again the tree chosen was well away from any others.

During my stay in Sukkur district from 1930 to 1934, though I came across this Raven yearly on both sides of the river I found it very localised. On the left bank of the Indus it was fairly common in parts of Ubauro taluka and I found it at Khambra, Reti and Kobar. I was fortunate enough to find almost yearly, a nest or two, with eggs or young, near Janwar Belo, between Kobar and Daharki. In each case the nest was placed on a long Kandi or Babur tree in thin forest interspersed with patchy cultivation. I never found more than 5 young or eggs in a nest.

In Sukkur itself, on the right bank of the river, I met with this Raven but twice, seeing a single bird on the 14th August 1931 and another, probably the same bird, as the locality was the same, on the 25th of the month.

I did not come across it on the left bank of the Indus south of a line roughly linking Khambra and Daharki.

In the Khirthar Range, Day met with it in January. In

February 1933 I was brought a highly decomposed bird and four cracked, frothing eggs, taken from a rock ledge, near Khenji Nai, in the Northern Khirthar. The Rind Baluch who brought the evil smelling mess told me that quite a few birds bred annually, mostly on inaccessible rock ledges, in the Khenji and Sita Nai gorges.

Ticehurst saw eggs taken 'from near Jacobabad', and Culbertson also had eggs sent him from this locality. I was in Jacobabad in 1934; but unfortunately left the district in late November, too early for nests. Nevertheless I found several *old* nests on rock ledges in the hills near the Uch oasis, in Bugti territory, about 8 miles from the Sind Border and about 24 from Jacobabad. Mrs. C. J. Rae told me that she had seen many Ravens and had also noticed some nests on the cliffs there, in December or January the year previous.

At Jacobabad itself the birds were common, and were also met with along the Desert and Begari canals and at Mauladad 7 miles south of Jacobabad. Birds were first seen at Jacobabad in any numbers on the 11th October and by the 25th of November they were abundant. At one of the Regulators on the Begari Canal I once saw quite a dozen Ravens, three Small Cormorants and a House Crow or two gorging on dead and dying fish left behind in shallow pools formed by the receding waters of the canal, and Ticehurst records that Hume was informed that great numbers die because of the heat and the diet of putrid fish.

In Upper Sind this Raven is known by the name of *Takru Kang, takar* meaning 'hill'; while on the Bahawalpur State Border (Punjab), the *Seraikis* know it by its Punjabi name, *Dodar Kang*.

A shikari zamindar of Daharki told me that he often came across this Raven when shooting *chink* between Reti and Khenju in Ubauro taluka, and once found a nest on an isolated Kandi tree in the desert near Khenju, about 15 miles south-east of Janwar Below, where I have taken nests myself.

In late August and early September 1930 I came across quite a few birds in the sand *bhits* of Rohri taluka, near Mamro and Sauhara, in the desert tracts of Sukkur district, drained then, during the abkalani season, by the Eastern Nara and the Karo Naro. These birds, though, were probably early arrivals from Jaisalmir State, due to the abnormal conditions that year, a year of floods and wide spread inundation, as the same year I saw a pair at Shikarpur as early as the 30th July.

The majority of birds visiting Upper Sind arrive early in October and begin to leave early in March. I have come across birds however as early as the 30th July and as late as the 9th May, but these being either single birds or lone pairs, were obviously stragglers. It can safely be said however, that the migration of this Raven to Upper Sind begins in late September and lasts till late March, and that quite a number of birds remain to breed in selected localities beyond their permanent habitat, to which they return for the hot weather after rearing their young.

Why birds which remain to breed and even those which are purely winter visitants fail to make a permanent abode in parts of Sind, which afford a habitat similar in many respects to the

lower Punjab, where this Raven is a permanent resident, is a puzzle. The intense heat of Upper Sind and lack of rainfall may be reasons, but on the other hand the southern Punjab can be just as hot, though the rainfall I think is better, as is definitely, the irrigation system, factors which make conditions very different to what they are at present in parts of Upper Sind not affected by the Sukkur Barrage.

Since I met this Raven so frequently in the northern *talukas* of Nawabshah district in 1935, it may in time extend to suitable tracts along the whole of the Sukkur Barrage Canals system and perhaps the favourable conditions created by perennial canals, between Sukkur and Hyderabad, will result in this Raven being less localised in Sind than it is at present. May this be so, as the Punjab Raven is a useful, handsome and interesting bird.

KARACHI,
October 27, 1938.

K. R. EATES,
F.Z.S., M.B.O.U.
Indian Police.

XIV.—A NOTE ON THE RESIDENT OWLS OF SIND.

1. **Tyto alba stertens** (Hartert). The Indian Barn Owl.

The Indian Barn Owl is rare in Sind. Hume met with it at Larkana, Scrope Doig and Butler at Hyderabad, and Ticehurst at Karachi, while Culbertson obtained a clutch of eggs from the river banks at Malir in Karachi district.

I first came across this owl in January 1923, in Karachi, where a pair had their home in the dome of the D.J. Sind College, and till 1928 frequently met either one or both of them in Burns Garden or in the vicinity of the college itself. They moved about freely after dark and rent the stillness of the night with their unearthly screeches.

During the summer of 1925 a pair took possession of a corner turret of the old Chartered Bank building, one of the oldest buildings of modern Karachi, but something disturbed the birds, probably my prying into their private affairs, and they deserted the place in October the same year.

On the 25th April 1928 I came face to face with a full grown bird in perfect plumage hopping sedately up the main stairway of the City Police Quarters, a four storied block with a tower, in the heart of the city. On seeing me, the bird flew up on to a cross-beam at the top of the stair-tower and gave me a look as much as to say, 'What the devil are *you* doing here'. I stared at him till I got a crick in the neck, and that night left the tower window open. The next morning he had gone, but had left behind, as a souvenir perhaps, a solitary pellet consisting of the bones of what appeared to be a small rat and some bird, possibly a sparrow.

On the 20th December 1929 I came across a pair in an old Kubh, on a spur of the Makli Hills at Pir Patho, Karachi district. This pair evidently had eggs or young in a recess, about 30 feet

high, in the cracked and tottering wall of the Kubh, as the female (presumably) was sitting close, while her mate sat in stony silence on a brick ledge near by and calmly looked down at me.

Both birds flew out on being disturbed but an hour or so later were again in the Kubh, one in the recess scarcely visible, the other on the ledge, peering down at me in the way owls have. The nest was too risky to take so I left the birds to continue their vigil over the thousands of graves surrounding the Kubh and littering the whole spur, at the extreme end of which overlooking a bend of the Bagar canal, was that 'holy of holies', the shrine of Pir Patho, which is still reverenced by Muslims and Hindus alike.

I did not come across this owl in Hyderabad district in 1929, or in Sukkur, Jacobabad and Nawabshah districts from 1930 to 1935. In February 1936, however, I found a pair occupying an old Rest House at Mirpurkhas, Thar Parkar district. The floor under the cross beams on which the birds sat was strewn with pellets, which contained mostly the bones of small rodents. I looked for a nest and found a suitable recess which may have been used as one the year previous. It contained nothing.

At nights I often came across either one or both of these birds on the outskirts of the town, my attention being attracted by their ear splitting screeches.

In June 1936 I saw a captive bird sharing a cage with a Dusky Horned Owl in the Karachi Zoo. Both birds looked very miserable and unhappy. In May 1938 I saw a bird on several occasions at dusk in the vicinity of the G.P.A. Hall. It, like the others I have met, appeared to take a delight in screeching when on the wing.

2. **Ketupa zeylonensis semenowi** (Sarudny?) - The Arabistan Brown Fish Owl.

The Fish Owl is one of the rarest owls in Sind. I have come across it but twice in 18 years and was lucky enough to obtain an egg on my first acquaintance with it. Ticehurst did not meet with it, but records East Narra, Larkana, Gaj River and Jungshahi as localities where it has been obtained.

In the plains of Sind it is only met with in riverain, canal and dhand tracts, where there are large leafy trees which afford close cover. In the hills it is probably confined to the rocky gorges of more or less perennial streams, such as the Gaj-i-Nai, Sita Nai and the Baran river, where shade and shelter are available.

On the 29th December 1922, between Talhar and Palh in the Hyderabad district, I stumbled across a small deep dhand, growing dense thickets of tamarisk and *sar* grass, the place was teeming with Lesser Whistling Teal. In the vicinity were several great *siris*, *pipal* and *bar* trees. While resting in the shade of an immense *bar* tree I noticed a partly eaten mud fish on the ground below and a careful search among the leafy branches above revealed a Fish Owl taking quiet stock of me. Realising that its mate was 'In' somewhere on the tree, I flung a clod of earth at the only likely place, a junction of massive bifurcating boughs, and out, to my joy, flew another owl. I was up that tree, which was luckily easy to climb, in less time than it takes to tell, and found, in a hollow

formed by branching boughs, a single, perfectly fresh egg. The nest hollow contained some mud, small clods of earth, a few dried *bar* sticks and *bar* leaves, fish bones, the remains of a Whistling Teal and some feathers, mostly Pond Heron and Whistling Teal. Thinking I would be able to visit the place again and secure not only the birds but also a full clutch of eggs, I left the birds in peace, but as ill luck would have it, I was transferred to Karachi shortly after and so do not know whether the single egg I have is that of *semenowi* or *leschenaulti*.

On the 10th March 1936, about 14 years later, I came across another of these owls, which did not appear to be quite full grown, seated on a shady tree on the bank of the Jamrao canal near Jheluri, Thar Parkar district. On the 16th of the month I was again in the locality, this time with a gun, but failed to find the bird. Unfortunately I did not have the time to thoroughly search all the thickly foliaged trees along *both* banks of the canal.

3. **Bubo coromandus coromandus** (Lath.). The Indian Dusky Horned Owl.

The Dusky Horned Owl, which is found throughout the plains, in forest, riverain and canal tracts is by far the commonest Horned Owl in Sind. I have met with it frequently in suitable habitat in *every* District in the Province.

It breeds from December to February, but few fresh eggs will be found after the middle of January. As a rule it appropriates an old nest, generally that of a Pallas' Fish Eagle or a Vulture. On several occasions I have taken eggs from a deserted Kite's nest.

During the breeding season both sexes are exceedingly noisy and call, one answering the other, both night and day.

During the first week of November 1935, a pair took possession of an old kite's nest on a Kandi tree in a thick clump of other large trees in the compound of the D.S.P.'s bungalow at Nawabshah. The birds were very noisy at all times, but more so at night. As a rule the female occupied the nest, while her mate sat stolidly in a *sirs* tree near by. Their diet was varied, as from time to time I found the remains of ring doves, crows, a roller, a pond Heron, rats, a squirrel and a huge frog on the ground below the 'homes' of these two birds. Only on one occasion did I see them mating, it was late in the evening, in the nest itself, and judging from the row that went on at the time, and that often heard at night, mating apparently took place, on occasions, several times during a night. On the 14th December the nest contained two perfectly fresh eggs. The birds on losing their eggs moped a bit and left the locality for a short while. They did not however go far, as they were still heard at night. They returned within a few days, more noisy than ever and once again took possession of the deserted kite's nest. On the 31st December, my last day in Nawabshah, I sent a man up to the nest, about 40 feet high, and he reported that the nest contained nothing except mud and some clods of earth. Two fresh eggs however were taken on the 17th January, 17 days later, and sent to me by a friend, who packed the eggs so carelessly, in spite of detailed instructions, that they were both broken in transit.

I have taken quite a score of nests in Sind and one in the U.P. and have always found this owl in possession of a deserted nest, that of an eagle, vulture or kite. On the ground below and sometimes in the nest itself lie the remains of past meals.

On one occasion I found the remains of a leveret, on another, those of a monitor lizard. Ticehurst records that T. R. Bell found two dead porcupines in a nest.

In Sukkur district I found one of these owls, on a river bund at dusk, devouring a freshly killed Brush-tailed Rat. A *Mohano* told me that he saw one of these owls catch and eat a fish about a foot in size. I have at times found fish bones below a nest, but not often. To a Sindhi an owl is either a *Gug* or a *Chibiru*. As the term *Gug* is applied indiscriminately to all large owls, the owl the Mohano saw may have been a Fish Owl. He said that it pounced upon the fish in shallow water and flew off with it in its talons.

He could not see what fish it was, as it was getting dusk, but thought that it was a mud fish.

4. **Bubo bubo bengalensis** (Frankl). The Indian Great Horned Owl.

The Great or Rock Horned Owl though not often met with in the plains is not uncommon in dry, hilly tracts, where there are ravines, *nullahs* and dry water courses with high banks. I have met with it in such localities in Karachi, Sukkur and Thar Parkar districts.

Culbertson took a clutch of 4 fresh eggs in December, which he found in a depression at the foot of a mango tree on the banks of a canal at Badin, Hyderabad district. In March 1924 I took 2 eggs from a hole in the bank of a dry water course near Jungshahi, Karachi district. In Sukkur district I came across two nests, one in an old Kubh (February 1930), and the other in a ravine (March 1931). Again in February 1936 I found a nest with 3 young in a hole in the side of a *nullah* in some sand *bhits* near Umarkot, Thar Parkar district.

A note on the distribution and nidification of this owl in Sind, appears in vol. xxxix, No. 3, page 631, of the Society's *Journal*.

5. **Otus bakkamoena deserticolor** (Ticehurst). The Sind Collared Scops Owl.

The Collared Scops Owl which is by no means uncommon in Sind is met with in suitable places throughout the Province.

Owing to its habit of lurking by day, it is more often heard than seen. Its soft 'ūk-ūk-ūk', repeated at intervals is most often heard during the stillness of the night. This little owl is partial to forests and topes, but nevertheless is met with in gardens, on canal banks and road sides where there are suitable trees.

It loves to sit, looking for all the world like a little gnome, well concealed amongst the leafy branches of some densely foliaged tree, the mango being a favourite.

I have come across it frequently during the past 18 years in every district in Sind and have taken nests with either eggs or

young in Karachi, Hyderabad and Sukkur districts. It breeds from February to April, both months inclusive. I have taken fresh eggs in early February, March and April from holes in mango, *kandi* and *lai* trees. Butler took a nest in Hyderabad in April. T. R. Bell records finding a nest in a hole in the bottom of the foundation of a deserted *Neophron's* nest in a large white poplar. I have never found more than 4 eggs in a nest. As a rule the eggs are deposited on an apology for a nest lining in the way of a few feathers, grass stems and dried leaves. The eggs as a series, are larger and more spherical than those of the Sind Spotted Owlet.

At Mirpurkhas I saw one of these owls mobbed by a crowd of White-eared and Red-vented Bulbuls. The Scops was decidedly 'hot and bothered', and how he did not twist his head off trying to face the chattering attacks of his tormentors launched simultaneously from all sides was a wonder. The noise attracted a family of Jungle Babblers, who added their shrill abuse to the shower of invective overwhelming the unfortunate Scops from every direction. He stuck it stoically for some minutes and then made a dash for the shelter of a leafy pipal tree, followed by his horde of tormentors.

Harrington Bulkly took a nest of this owl on the 1st March in the Pabb Hills, in Las Bela State.

6. **Otus brucei** (Hume). The Striated Scops Owl.

The Striated Scops Owl is rare in Sind and has seldom been met with, nevertheless I am inclined to believe that many a bird is missed on account of its lurking habits and that, to some extent, it is resident and breeds. Blanford obtained a pair east of Umarkot, Thar Parkar district, in January; and Scrope Doig one at Hyderabad in December.

I have met with it but thrice in 18 years, at Khebar, Hyderabad district, 12th March 1929; Taror, Sukkur district, 30th December 1930 and Karachi 28th March 1932. At Khebar a single bird was found seated in a leafy mango tree. I searched for the pair but was unable to locate it. In a tamarisk belt in a valley between sand *bhits* near Taro, I noticed one of these owls peeping out of a hole in an old *lai* tree. The hole contained some feathers and dry *lai* leaves but no eggs.

At Karachi, a single bird chased by House Crows took shelter in an upper storied flat in Civil Lines. It was caught and sent to me. I kept it caged for some days but as it refused all food, in the way of crickets, cockroaches and black beetles, and began to droop, I gave it its freedom. I feel sure that a systematic hunt for this Scops Owl in suitable localities during the breeding season would prove that it is more elusive than rare, and that it breeds in Sind.

7. **Athene brama indica** (Frankl.). The Sind Spotted Owlet.

This Owlet is by far the commonest owl in Sind and is met with everywhere, throughout the Province. It breeds in February, March and April, laying as a rule in holes in trees and buildings. In the hills around Khadeji, Rehri and Bram Hyderi in Karachi district,

it breeds in holes in cliffs and the precipitous sides of gorges and water courses. I have also found eggs or young on several occasions in deserted crows' nests, and once in a hole in the side of a small quarry; while in Sukkur district several pairs had their homes in natural holes in solid stone, great masses of rock, in the old bed of the Indus near the ruins of Aror. The nest lining which is generally very meagre, consists of a few feathers, grass stems or dry leaves.

Three to five eggs are laid, in most cases four and these as a rule are found, like most owls' eggs, in all stages of incubation, due presumably to the irregular intervals at which they are laid and the habit this owl in particular has of holing up during the day, with the result that incubation begins, intentionally or otherwise, from the time the first egg is deposited. It is not unusal to find both female and male in a nest containing eggs. On one occasion I rooted out three full grown birds and their parents, five in all, from a hole in a mango tree.

In the U.P. this bird is most appropriately named, *Khus-kut-kuttia*, and in Upper Sind I have heard Seraikis call it, also appropriately, *Chugal-chiri*. It is surely needless for me to explain why. In Sind, the name *Chibiru* is applied indiscriminately to it and all other small owls.

KARACHI,
October 26, 1938.

K. R. EATES,
F.Z.S., M.B.O.U.
Indian Police.

XV.—VULTURES FEEDING AT NIGHT.

I have heard it said that vultures will occasionally feed on a carcase at night, if there is a moon; but I cannot remember having actually observed this myself, so the other night out of curiosity I went out after dinner at about 9 o'clock to visit the remains of a cow that lay on the hill side below my cottage.

The moon was about three-quarters full, but misty clouds reduced visibility. The carcase of the cow at which the vultures had been feeding on during the day time lay on the open hillside, but round it on two sides was fairly thick cover-bushes and long grass, and the ground fell away below it to pass into a bushy ravine. As there had been a leopard about recently I took a shot-gun and electric torch.

Coming to the carcase I passed within twenty yards of it screened by bushes, and as I did so, I heard the vultures on the remains. They were apparently actively feeding on it as they were hissing and apparently squabbling over it. I took a half turn round it and suddenly appeared some ten yards from the carcase and flashed my torch on it—though it was hardly necessary to do so in the moonlight. There were about fifteen vultures gathered all round the body and they stretched up their heads and necks to view the intruder. They consisted of White-backed Vultures and the Northern Long-billed Vultures in about equal numbers. There

was one Black Vulture among them though three had been at the carcase during the daytime.

They then began to leave the carcase flying off downhill towards the ravine—one by one—some pitching again on the hill side nearby. But one of them a White-backed Vulture crouched—drawing his neck in and depressing his head as if trying to hide himself and refused to go. I went right up to him and poked him with the muzzle of my gun! He then made a short flop of a few yards down the hill where I left him in the grass. It is possible that he was injured in a fight with the others or with a piedog during the daytime.

What would a leopard have done had he come to this 'kill'? Do leopards and tigers ever kill vultures in order *to eat them*? I have seen a tiger in the daytime spring up from his 'kill' and jump up at the vultures but he did not get one. That was apparently only to drive the vultures off.

On the other hand I shot a leopard who was in the habit of climbing the big Banyan trees to eat the young vultures in the nests! Was that an exceptional depravity—or is it not unusual?

I am now of the opinion that vultures will feed by moonlight if they are not afraid to come to ground at the carcase. That we never see them do so when waiting up for tigers and leopards is no doubt from their fear of the big cats and other night prowlers.

Many interesting questions arise from this observation. What species of vultures are given to feeding by moonlight? How much moon must there be to tempt them down? Do they feed ever when there is no moon? It should be possible to test their sight by night at any Zoo where they are held captive . . . and also their sense of smell . . . has that ever been investigated?

TAUNGGYI, S.S.S. T. R. LIVESEY.

BURMA.

October 4, 1938.

XVI.—THE STATUS AND NIDIFICATION OF THE PERSIAN BEE-EATER (*MEROPS PERSICUS PERSICUS* PALL.) IN SIND.

The Persian, or rather Iranian Bee-eater is an early summer migrant to Sind, where it breeds in suitable localities, freely in some places, sparingly in others.

Thousands of birds enter the Province yearly, numbers remain to breed, others pass on into Rajputana, which so far as I am aware is the limit of its extension east.

The route through Sind embraces the whole Province, from Kashmor in the north, to Karachi in the south. The general direction of migrating birds is always towards the east and birds any distance away from their regular breeding haunts fly very high, except when feeding.

Birds as a rule begin to arrive in Sind in late April or early

May, the movement continuing till the end of the month and at times extending into early June. Early arrivals may be met with in middle April.

Butler records it on the 16th April. I have not met with it in any numbers earlier than the 27th April. The majority of birds however are seen during the first half of May. Birds forming the eastern fringe of the movement are often carried out to sea and these on returning to the coast line, take a north-easterly route over the creeks and mangrove swamps *via* Bram Hyderi, Jari, Petiani and Keti Bunder towards Thar Parkar, where I am told they breed in the sand *bhits* in the desert tracts of the district, which extend into Rajputana.

Birds in flight attract attention by the habit they have of chirping to each other, and the peculiar call notes when heard during the silent hours of the night, just before dawn, are most pleasing to the ear. From my yearly Rough Notes I find that migrating birds have been heard or seen from 4-30 a.m. to 5-30 a.m. and from dusk to 11-40 p.m., so it's fairly evident that they rest or feed during the heat of the day, which is intense in Sind during May and June, yet this Bee-eater builds as a rule in most hot, arid tracts, where there is no water except that in canals, the full flow of which is somewhat later than the arrival of the birds. Butler found it at Hyderabad in July, and Scrope Doig thought that it bred in July and August in the Eastern Nara district. Ticehurst received a breeding bird from Draklan near Kashmor in May, and Gordon came across it around Jacobabad and at Kubo on the Desert Canal in June, where it was plentiful.

During my stay in Sind, now 18 years, I have met with this Bee-eater, at suitable times of the year from Karachi to Kashmor.

In Karachi district, where there are no suitable breeding grounds, it is met with only as a bird of passage.

On its arrival in early summer it tarries but to rest and feed, and passes on, flying high, to its breeding haunts on the eastern borders of the Province and Rajputana.

Numbers of birds however remain in suitable places in Middle and Upper Sind to breed, the majority continuing east to their regular breeding grounds. It arrives again in Karachi district in late August and September and numbers, more young birds than adults, may be met with in the vicinity of *dhands*, where they perch on *pan*, *sar* and *lai* and delight in hawking the numerous winged insects which infest the *lai* thickets and reed beds, which are to be found in the majority of Sind *dhands*. Around Karachi itself they are seldom met with on their return, and when seen or heard, are flying high, towards the Persian Gulf or Baluchistan.

Personally I believe that these flights, which pass over Karachi in October and early November, are on their return passage to Iran and Irak, and that this Bee-eater returns to these countries by the end of November, as, to the best of my knowledge, none have been met with anywhere in Sind from December to mid-April.

The reason why more of these autumnal or return flights are not seen is due probably to the great height at which the birds fly.

My attention has invariably been attracted by the call notes and

even with these as a guide I have often found it difficult to spot the birds and have often failed altogether to do so. Even when located, few, comparatively to the numbers heard, are actually caught sight of.

In Sukkur district in 1930 I came across great numbers of this Bee-eater *en route* to their breeding grounds in late April, May and June and on the 28th August the same year found hundreds of adults and young hawking over Ghari *dhand*, then an immense sheet of water with great reed beeds and thickets of *lai* and *sar*. The birds which were scattered over an area of several square miles permitted an easy approach and I was able to watch them gracefully hawking insects at very close quarters.

The next year I was able to follow up my observations and on the 12th June was rewarded by discovering a small colony digging nest holes in a high bank of the Kalandar Shak, Mirpur Mathelo taluka. I also came across in the same taluka, many birds in small parties of a dozen or so around Yaro Lund, Sahib Khan Lund and the Raini Wah. The majority of birds however appeared to be making their way to some sand *bhits*, which I could just see in the dim distance further east. On the 25th June I found a small scattered colony near Detha Bhaya, breeding in low sand *bhits* and mounds near the Mahie Wah. I dug out several nests, some quite 4 feet deep, but was too early for eggs. On the 6th July I came across a few pairs, which were obviously breeding in some sand *bhits* at Nur Shah-jo-Bhit in the Rohri taluka but did not have the time to look for nests. The 11th of the same month found me at Khenju, in Ubauro taluka, near the Rajputana border, where I found quite a large but scattered colony breeding in the banks of a *Kario* and in sand *bhits* in the vicinity. I dug out a number of nests and collected 23 fresh eggs, some of which I sent Mr. Stuart Baker. No nest had more than five eggs or young. In one nest we found only three callow young, in another the largest Saw-scaled Viper it has been my lot to see, and I have seen scores. This particular specimen measured a trifle over 26 inches in length and almost 4½ inches in girth. It had dined on five callow young. Incidentally it was its last meal. Men with me, who live in tracts where this Viper abounds said that they had never before seen such a large *lundi*, a name by which this viper is known in Upper Sind, meaning 'bob-tailed'.

The nests dug out varied in length from 3 to 6 feet, the egg chamber being quite large enough for a bird to turn round in when seated.

In one case we caught a sitting female by placing an *ajrak* (sheet) over the nest entrance and thumping the ground above. The bird, a female with a well marked incubation patch was given to W. H. Cole, who had not a specimen in his collection.

On my return, I was able to revisit the small colony at Kalandar Shak on the 14th July. I dug out two nests, one containing five, and the other four eggs.

The year following I saw many birds flying over Sukkur and met with them at Duber, in Rohri taluka and in talukas further north where I had met them the year previous.

In July and August 1934 I came across this Bee-eater from Ghari Khairo to Kashmor in the Upper Sind Frontier (Jacobabad district), and on the 20th July found a scattered colony of about two score birds breeding in the banks of an old Kario and in mounds in semi desert between Thull and Tangwani. In September birds were still to be seen along the Desert and Begari canals but were fewer in numbers.

At the end of November I failed to meet with it anywhere.

In Nawabshah district I saw many birds in flight in May and June 1935. On the 9th May a single bird passed over Nawabshah, shortly after a terrific dust storm.

It was calling loudly and evidently had been separated from the flock during the storm. It was obviously in distress but struggled on manfully in a north-easterly direction, calling pitifully at short intervals.

Near Tharushah on the 14th July I came across about a score of birds in pairs or single in suitable breeding ground alongside a canal, but did not have the time to look for nests. I also found a small scattered colony in a similar situation along the Rohri canal, near Saurie about 35 miles from Sakrand, but here also I did not have the time to look round for nests, the predominance of single birds however told a plain tale.

When at Umarkot in Thar Parkar district in February 1936, a Meghwar *shikari* informed me that numbers of this Bee-eater arrived in the district in May and bred in the sand *bhits* throughout the desert portions of the district.

This bird is well known in Sind as 'Wado Tracalo', and the smaller species, the Sind Green Bee-eater (*Merops orientalis beludschicus* Neum) as 'Nando Tracalo'.

KARACHI,
October 10, 1938.

K. R. EATES,
F.Z.S., M.B.O.U.
Indian Police.

XVII.—HAUNT AND HABITAT OF *PITTA C. CUCULLATA* HARTL. IN WEST BENGAL.

(*With a plate*).

During an excursion in quest of breeding birds to Satgachia (District Burdwan), which lies 20 miles east of Burdwan town, on 23rd June, 1935 I came across a pair of *Pitta c. cucullata* Hartl., one of which was captured with the aid of a bird-catcher who happened to be with me. The occurrence of this species is unknown in Western Bengal, and it is therefore of interest to record the circumstances connected with my excursion.

The location of Satgachia is attractive in many ways, but apart from its physical peculiarities which are described below, and its accessibility by motor road, the fact that an acquaintance lives there,

whose repeated invitation for my visit to his country bore pointed reference to the prospect of an almost untrodden field from a bird-collector's point of view, was enough inducement for this excursion. An exceptionally protracted summer, however, with its attendant discomforts made an earlier trip impossible. A few showers having occurred preliminary to the breaking of the monsoon which helped to bring down the temperature I found my opportunity and at once decided to come out. The trip was made on June 23, 1935 in my motor car. The drive *via* the Grand Trunk Road was at once enjoyable and instructive, as I had a chance of looking at the countryside, which embraces long stretches of the contiguous districts of Howrah, Hooghly and Burdwan. The approach to my destination lay through a feeder road, which takes off from the main road at mile 56. As I reached the outskirts of Satgachia I perceived a difference in the outlook, specially in vegetation and in the upward trend of the level of the land. The thickets and scrub-jungle on the bed and along the banks of the river Banka arrested special attention and I obtained a few interesting species from this locality, e.g. *Pycnonotus luteolus* Less. (reported in *J.B.N.H.S.*, xxxviii, 620-21, 1936). The neighbourhood, to the north, alongside the Kalna Road reveals other interesting spots overgrown with scrub jungle, where I was busy collecting in the afternoon. My prospect was about to be marred, however, by the gathering clouds which so overcast the sky that I felt inclined to return, when I heard from a short distance some loud notes, very like those of the Indian Pitta, which is not uncommon in Bengal. Following these sounds, I reached an orchard at the far end of a low-lying and grass-covered field bordered with bamboos. It seemed less frequented and was overgrown with fruit trees interspersed with patches of scrub and prickly thickets. Here as I anticipated, I came upon, a pair of *Pittas*. In the approaching gloom of the evening made darker by the thickening clouds, I could hardly discern them clearly, but what little I saw of them left me in no doubt as to their behaviour, which was evidently of courtship,—erect posture with characteristically Pitta-like movements of the body and tail, and loud impetuous calls, uttered almost alternately by the couple. As I came closer I saw clearly on the ground two moving figures, hopping about and almost challenging each other by gesture and voice. On my approach they flew up to a mango tree. I set my catcher on to them and, in a minute one was caught. To my utter surprise I found it to be a *Pitta c. cucullata* Hartl. The rain had now burst with terrific force, making me retreat for shelter, and when it stopped, full thirty minutes later, my search for the second bird proved in vain. For it was too late then, and no clue was found as to any possible nest of the Pitta in the neighbourhood. The exquisite condition of plumage of the captured specimen, its time of occurrence and incidental behaviour bespeaking courtship display, suggests that it is obviously a breeding species of the locality. It has since been thriving in my aviary.

Measurements: Wing 114 mm., tail 42 mm., tarsus 43 mm., culmen 23 mm.



Fig. 1.—Swamp and marsh fed by overflow water of the river Banka.

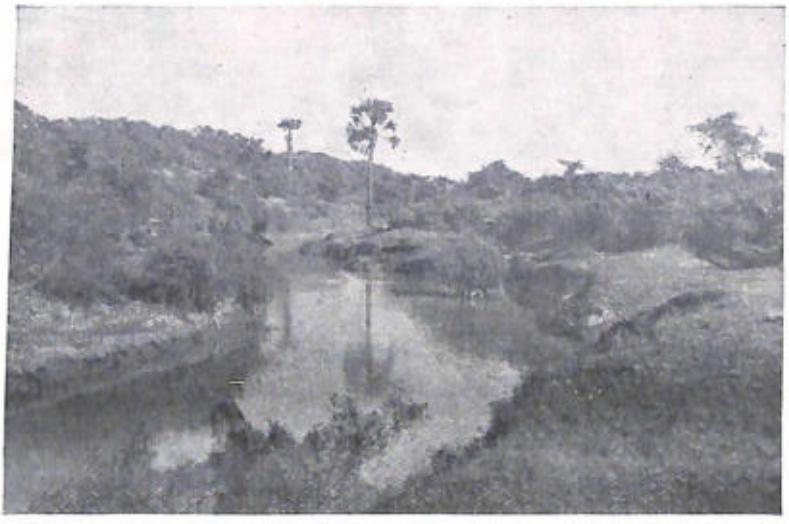


Fig. 2.—Aspect of the 'transition belt' along the course of the Banka. Stretches of waste land overgrown with scrub- and bush-jungle.

It is remarkable that there is no record of this species from any part of Central and Western Bengal, although it is found to occur in Eastern Bengal, e.g. in Chittagong, Noakhali, Tipperah and Mymensingh. It is common in the hills of Jalpaiguri, but in North Bengal generally it appears to be a breeding species both in the hills and plains. It is also known to breed in some places in the plains of the United Provinces. The species does not seem to be exclusive in its choice of habitat, occurring as it does in different haunts and situations, both in the hills and plains. Mr. Stuart Baker writes, 'it frequents forest of all kinds, the deepest and wettest as well as the driest and thinnest, while it may also be met with in bamboo-jungle, scrub-jungle, and in crops, such as mustard and rice, or in cultivation outside forest.' In its habitat in the plains it appears to affect cover, tree- and bush-jungle, orchard and overgrown waste land. Shy and always alert, it rarely shows itself in the open. The orchard and tree-grove in Satgachia in the district of Burdwan where I found the Pittas offer cover, shelter and seclusion sufficient for their mode of life, while the neighbouring bamboo-clumps, prickly thickets and undergrowth apparently provided additional attraction to the breeding pair.

Mention is necessary of the fact that Burdwan, due to its peculiar physical features, naturally resolves itself into two distinct areas, entirely different from each other. The whole of the western part and an inconsiderable area to its east have a marked affinity to the rocky, non-alluvial plain of Chota Nagpur, while the remaining eastern portion, in which Satgachia lies, presents many features of homogeneity with the districts in the neighbourhood of Calcutta, e.g. Hooghly and 24-Parganas. Ecologically this tract, which forms a rather narrow belt of alluvial land, may be regarded as a continuation of the Gangetic delta with patterns of vegetation characterising Central Bengal. The climate is moist and equable. The mean maximum temperature in the dry season (December to April) varies from about 80° to 101°, and remains steady at about 90° in the monsoon months. The total average of rainfall between May and November amounts to 53 inches. While these physical conditions are to a great extent reflected in the topography of Satgachia, its proximity to the more open, undulating, rocky and arid zone cannot altogether leave it impervious to its influences. Nor is it difficult to detect in or around this area evidences of a process of transition whereby the rocky soil merges into the alluvial tract. An impetus to such merging may be looked for in the action of the river Banka, which traverses the whole of this tract, it being originally a spill channel of the Damodar which is pre-eminently a hill-fed stream, bringing down vast quantities of silt from the Chota Nagpur plateau. How far this reacts on the flora and fauna of the locality requires careful investigation, but it is apparent that while the characteristics which it shares in common with the rest of the Gangetic delta remain more or less constant, minor modifications have crept in under stress of circumstances and environmental factors, which tend to invest it with features peculiarly its own. These are manifestly of interest and importance, for, ornithologically, they appear to induce an influx of species not ordinarily

attached to a habitat in the deltaic region of Central Bengal. The salient features of the locality are noted below :

1. Mainly alluvial country typical of the rice plain of the Gangetic delta, featuring low water-logged areas as well as high lands; the latter harbouring hamlets and villages while the former give rise to swamps and *jhils* covered with tall grass, marsh weeds and sedges characteristic of the Gangetic plain. Extensive marshes lying near the banks of the *Banka* are sustained by the overflow of that river.

Absence of genuine forest, though a certain amount of jungle including genuine forest trees, e.g. *Sal* (*Shorea robusta*) has grown up through depopulation of villages or abandonment of sites formerly inhabited. Orchards and tree-groves mixed with shrubberies of semi-spontaneous and sub-economic trees and shrubs are found in abundance, while trees grown to a gigantic height line as a rule the roads and highways.

2. What may be called the 'transition belt' lies some distance off to the north and northwest, along the course of the river *Banka*, and in a marked degree on its northern bank, where the peculiar soil deposits bear evidence of transfusion of rocky decomposition with deltaic alluvium.

A rugged and rather open tract, devoid of tree-groves in striking contrast to the rest of the locality, where vegetation is unimportant and mostly uneconomic and of stunted growth. Scrub- and bush-jungle abounds in this belt, pre-eminently featuring the flanks of the river Banka and the stretches of waste land around, the tangled hedges and prickly thickets lying buried in overhanging creepers and various milk weeds.

50, Kailas Bose Street, S. C. LAW.
Calcutta.
September 8, 1938.

XVIII.—ON THE OCCURRENCE OF THE INDIAN PURPLE MOORHEN (*PORPHYRIO P. POLIOCEPHALUS*) IN CHITRAL.

I enclose the skin of a Purple Moorhen (*P. p. poliocephalus*) shot today in Mastuj. As apparently no one has previously seen a bird of this species in Chitral, I thought it might possibly be of interest to you.

Chitral Scouts, H. S. STANSFELD,
Chitral, *Capt., Chitral Scouts.*
N.W.F.P.
November 17, 1938.

XIX.—ON THE OCCURRENCE OF THE BANDED CRAKE (*RALLUS E. AMUROPTERA*) AND THE MALABAR WOODPECKER (*MACROPICUS J. HODGSONI*) IN THE BILLIGIRIRANGAN HILLS, S. INDIA.

It may be of interest to record that a young specimen of the Banded Crake (*Rallus eurizonoides amuroptera*) was killed here in the middle of August. I should like to know whether the Banded Crake has previously been recorded at this altitude (Billigirirangans, Central South India—5,700 ft.).

The Malabar Woodpecker (*Macropicus javensis hodgsoni*) is now fairly common here, although I am sure it did not occur on the Billigirirangans some years ago. I think records todate place this bird on the Western Coast, from Travancore to Belgaum.

HONNAMETTI ESTATE,
ATTIKAN—MYSORE, P.O., R. C. MORRIS.
S. INDIA.

September 20, 1938.

[Mr. Morris' note adds to the few records of the occurrence of the Banded Crake in Southern India. No examples of this bird were obtained by the Society's Surveys in this region. The bird occurs in the Sub-Himalayas and from east to west and ranges southwards in smaller numbers in the Western and more wooded parts of Peninsula India. The extension of the range of the Malabar Woodpecker to the central hills of South India is interesting. Previous records are confined to western ranges of the Presidency.—EDS.]

XX.—THE BREEDING OF THE INDIAN SOOTY TERN (*STERNA FUSCATA INFUSCATA*) IN THE LACCADIVE ISLANDS.

I send herewith 4 eggs and would be very grateful if you could help me in identifying them. They are the eggs of Oceanic Terns of apparently two species and were collected in May on Putti Sandbank in the Laccadive Group. As breeding had not begun when I visited the Islands last February, I left word asking for specimens of eggs from the tern colony to be taken when obtainable and if possible skins also of the breeding birds. Unfortunately the latter have not been forthcoming, so that I am afraid certain identification is impossible.

COOVERCOLLY,
SOMWARPET, F. N. BETTS.
COORG.

October 10, 1938.

[Mr. Stuart Baker to whom the eggs were sent for identification writes as follows:—

'The eggs taken during May in the Laccadives by Mr. F. N. Betts are undoubtedly those of the Indian Sooty Tern (*Sterna fuscata infuscata*) and are all of the same species; the largest and smallest of the 4 eggs sent come well within my *maxima* and *minima* measurements. The eggs of this bird vary in the most extraordinary way in colouration and very greatly in size. Hume found Sooty Terns breeding in the Laccadives in February when there were well grown chicks as well as hardset eggs and from this we could infer that one egg laying season lasted from December to February. Now it is interesting to have a second laying season recorded for May. Although we have no doubt ourselves that the eggs belong to our Indian form, it would be desirable to get some specimens of the birds to confirm this'.—EDS.]

XXI.—MIGRATION ROUTES OF GEESE.

Perhaps the following information may be worth while placing on record. Over the village of Dambuk in the Sadiya Frontier Tract lies what must be in Assam one of the chief migration routes of Geese on their way to and from their breeding grounds. I was twice lucky enough to see this migration flight, in 1934 and again in 1936. It appears to start as early as the middle of January, and goes on until the end of March. The beginning and middle of March seem to be the peak periods for the northward migration. Dambuk lies right at the foot of the Hymalayan foothills which rise to between 5,000 ft. and 6,000 ft. immediately behind the village, gradually rising still higher as one goes further north; nothing but a jumbled mass of mountains. The valley of the Dibang river is some little distance to the east, whilst that of the Dihang (Brahmaputra) is roughly thirty miles to the west.

In 1934 I was at the village for the first week of March, and from about 4 o'clock in the afternoon every day until late at night gaggle after gaggle of geese appeared at intervals of about fifteen minutes from the south and south-west, flying at an altitude of about 4,000 ft. to disappear over the saddles in the hills towards the north behind the village. Their 'honking' sounded very melancholy as if they did not relish the thought of the inhospitable country over which they had to fly for there is nowhere en route where they could possibly alight.

Thousands of birds must have passed over each day I was there and when one woke up during the night the birds could still be heard going over.

Apparently there must be at the sources of the Dibang on the Great Snow Range some very convenient passes which the birds make regular use of. By far the bigger valley is that of the Dihang where my headquarters were at that time; but not a single goose ever went north by this route. I toured along the foot hills for a hundred miles during several migrating seasons; but never

anywhere else did I see even one per cent of the number of birds going north that I saw at Dambuk.

In 1936 I was there from the 11th to the 13th of January; but the migration had evidently only just started and very few gaggles were seen. On the average only two or three gaggles of 25 to 30 birds each were passing northwards each day I was there. The birds were at too great a height for even a guess at their species. Dambuk is, I should mention, some 25 miles or more from the nearest point where geese are usually found and there is dense jungle between.

This migration route appears to be a very old and well established one, for the Abors have a legend that on their northward flight the birds are advancing with war cries to make war on the Musk Deer, whilst when they return they come with shouts of victory after sucessful combat! Unfortunately I have never been able to see the southward migration.

GAUHATI, KAMRUP DISTRICT, ASSAM.
October 16, 1938.

R. E. PARSONS.
Indian Police.

XXII.—COTTON TEAL (*NETTOPUS COROMANDELIANUS*) AT NASIK

This bird was a single female (no others were seen) and was shot on Lake Beale, near Ghoti, about 20 miles South West of Nasik, on January 2nd. I regret the skin was not preserved, but a careful examination was made, in comparison with the description and illustration found in *Game Birds of India* by Stuart-Baker, and there is no doubt whatsoever as to the identification.

NASIK.
January 3, 1939.

C. J. RAE.

XXIII.—'FISH OF GREAT AGE'.

(*Reprinted from the 'Field'*).

SIR,—With reference to the above article by Mr. T. C. Bridges, in the *Field* of October 22nd, it is worthy of interest that the majority of modern ichthyologists appear to be of the opinion that 'centenarian' carp are non-existent; that, in fact, they never have existed. According to the *Fishing Gazette* of May 25th, 1935, a German scientist, Professor Rochner, who has studied carp for many years, states that they 'live twenty-five to thirty years only. The ancient carp of Fontainebleau are a legend . . . for the ponds there were emptied in 1789, in 1825, and again during the Commune. The monster carp there, 90 centimetres long and 60 in girth, is only twenty-five years old.'

In his *History of Fishes* (pages 425-6), Mr. J. R. Norman quotes Dr. Regan's comment that the statements concerning most of the

very old carp 'rest on very unreliable evidence,' and adds that, 'although there is good reason for believing that under artificial conditions this fish may attain to a good old age, it is doubtful whether it exceeds fifteen years in a wild state.' This, I think, aptly sums up the position in the case of carp, since these placid fish take very easily to a domestic life.

Both authors are equally sceptical about the alleged great age of certain pike, though Dr. Regan concedes 'it is probable that fish of sixty or seventy pounds weight are at least as many years old.' Mr. E. G. Boulenger (*Angling*, October-December, 1936, page 7) states that 'no pike of over fifteen years is *definitely recorded*' (my italics). Ireland, as is well known, produces some superb pike; yet, so far as I am aware, scale readings, where practicable, have not revealed any evidence of notably long-lived individuals. One of the heaviest Scottish pike netted in recent years—a female fish weighing 35 lb., and measuring 4 ft. in length (Loch Ken, 1935), was estimated, from examination of scales, to be eighteen to twenty years old (*Fishing Gazette*, June 29th, 1935).

Unfortunately, numerous discrepancies are to be found between various authors' accounts of 'long-lived' carp and pike. In some cases even the metal of which the marking ring was composed differs in different stories, some writers having that it was brass, others copper, and yet others insisting on gold! Gesner's marked pike, taken (*circa*?) 1497, was supposed to have been placed in a lake by the Emperor Frederick II in the year 1230, but, as Mr. Norman has pointed out, '. . . they (*i.e.*, other authors) cannot agree as to which of the Fredericks was responsible for marking the fish, or as to the exact locality at which it was finally captured. Its length has been stated to be 19 ft., and its weight *five hundred and fifty pounds*' (my italics).

Incidentally, it would appear that the Teutonic sense of humour was more pronounced in those times than now; for we read (I really must apologise to Mr. Norman for quoting him so extensively !) that the actual skeleton of this monster pike is said to be preserved in the cathedral at Mannheim, but 'a celebrated German anatomist' who studied it during the last century 'found that the vertebrae in the backbone were too numerous to belong to a single individual—in other words, that the skeleton had been lengthened to fit the story !'

PETER MICHAEL.

'DAVENA,'
56, CRANMORE LANE,
ALDERSHOT,
HANTS.

XXIV.—ON THE NESTING HABITS OF THE GOURAMI. (*OSPHRONEMUS GORÄMY* [*LACÉPÈDE*]).

The nesting habits of Anabantoids are interesting in that the male constructs a floating nest of air bubbles to the under side of which are attached the eggs deposited by the female. The paternal parental care lasts till the absorption of the yolk in the

young larvae which after this are capable of leading an independent existence. The spawning habits of *Colisa fasciata* (*Colisa vulgaris*) and *Osphronemus goramy* which are essentially alike have been given by Carbonnier (1876 and 1877). The breeding habits of *Macropodus chinensis* (*M. opercularis*) are also apparently the same in view of the reference made by Carbonnier in his paper (Carbonnier, 1876). Waite (1904) has given an account of the breeding habits of the Siamese fighting fish, *Betta pugnax* Cantor. There is a short note on the breeding habits of *B. splendens* by Chute (1935). The nesting habit of a South Indian form, *Macropodus cupanus* (*Polyacanthus cupanus*) has been worked out by the present writer (Jones, 1939) and this has been found to be just as in the other Anabantoids.

While engaged in going through the literature connected with the breeding habits of the Anabantoids, the author was surprised to find divergent nesting habits attributed to the Gourami by different workers. The observations of Carbonnier (1877) on the nesting habits of this form is in general agreement with that of other Anabantoids. A few extracts from his account are given below. 'He' (referring to the male fish) 'soon commenced in one of the angles of the aquarium the formation of a nest of froth, which in a few hours attained a considerable size—6 to 7¾ inches in diameter and 4 to 4¾ inches in height.' The life of the bubbles depends on the quantity of mucus contained in them and the fish appears to make a selection of the good bubbles. 'For this purpose he kept at the surface of the water, turning his back to the nest, and drawing in the outer air, expelled it by degrees in front of him in the form of gaseous bubbles. The badly preserved bubbles burst, and there only remained those the envelop of which possessed suitable consistency; these he then collected and carried into his nest.' 'At times the buccal secretion seemed to slacken, and the male could no longer elaborate his globules. He then descended to the bottom of the water to seek for some confervae, which he sucked and chewed for a few moments as if to excite and re-awaken the activity of the mucous membrane.' With regard to the behaviour of the male after the eggs have been deposited by the female he says 'A *Macropodus* or *Colisa* would not have been embarrassed about collecting the eggs and arranging them in his mouth; and in order to raise them to the surface he made use of a most curious stratagem. He rose to take in an abundant provision of air; then, descending, he placed himself well below the eggs, and suddenly, by a violent contraction of the muscles of the interior of the mouth and pharynx, he compelled the air collected there to escape by the gill apertures. This air, infinitely divided by the branchial lamellae and fringes, was, so to speak, pulverized; and the violence of the expulsion was such that it escaped in the form of a regular gaseous powder, which enveloped the eggs and conveyed them to the surface.' It takes three days for the eggs to hatch out (Temp. 25°C. = 77°F.) and the paternal care lasts for about another ten days. About 2,000 to 3,000 eggs are laid at a time, and the fish has the faculty to spawn several times a year.

The nesting habit of the Gourami as given by other workers is quite different from the one given above. No reference is made of a floating nest consisting of air bubbles. Weber and de Beaufort (1922), say: 'The eggs are attached to water plants or received in a nest, composed of plants.' Deraniyagala (1929), dealing with the Labyrinthici of Ceylon, says 'This fish is reported to breed when six months old and builds a bird-like nest of mud and weed, to which the ova are attached. The young according to Indian workers, hatch out after a month and are guarded by the parents.' Sundara Raj (1931) in a pamphlet issued by the Madras Fisheries Department says, 'During the breeding season nests are constructed by the fish in the weedy margins of the pond with stems and blades of grass and aquatic plants (*Elodea, Ceratophyllum, Hydrilla,* etc.) and in these the eggs are deposited by the female. The male generally guards the nests. The young fry emerge from the eggs in about a fortnight but if the weather is warm, in shorter times.' In the Fisheries Department Aquarium at the Madras Beach (Marina) the nest of a Gourami resembling very much the nest of a bird can be found exhibited in a show case.

In no other Indian fresh water fish so far as I know a definite nest made of water weeds or grasses is recorded. Apart from the Anabantoids eggs attached to floating mass of air bubbles are not known in any other Indian Fish. In the Ophiocephalids, where we get floating eggs, bubbles of air are absent and the eggs are self-buoyant due to the presence of a large oil globule. Budgett (1901) when dealing with breeding habits of some West African fishes refers to frothy floating egg masses in the case of the Characinid, *Sarcodaces odoe.* In *Gymnarchus niloticus* and *Heterotis niloticus,* two other West African fresh water fishes, nests made out of water weeds are recorded (Budgett 1901).

It is evident from the extracts given already that the nesting habits of the Gourami are different according to different workers. It is rather strange that the same species should exhibit such varied habits. We find that the observation of Carbonnier does not differ from the typical nesting habits of the Anabantoids and therefore one is disposed to consider it as more probable. However this is an interesting problem that requires further investigation.

Since writing the above account a few more references concerning the nesting habits of the Gourami have come to the notice of the writer and the relevent portions in them are given below. It has not however been possible to consult the works of Dabry de Thiersant[1] and of General Hardwicke.[2]

Gilbert has given in this *Journal* (1894, vol. viii, Part 3, pp. 435-8) the following notes on the breeding habits of this form that he observed in an aquarium of about 15 gallon capacity with some ornamental rock work at the bottom consisting of a central curved stone: 'One morning when I came as usual to look at

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[1] La pisciculture et la pêche en Chine, 1872.
[2] *Zool. Journ.*, iv, p. 309.

my fish I noticed that some thing unusual had happened; all the fish but one had hidden themselves amongst the weeds and the only visible fish was truly terrifying spectacle. He had turned a jet black and his red eyes by contrast, shone like live coals; his fins were all erect, and he was making furious charges at any of the other fish which ventured to show their noses. Presently I espied another black-looking fish quite motionless underneath the rock-work bridge, and then I understood what was taking place. After chasing away all intruders the male came down to the female under the bridge.'

Immediately after they separated the female emitted a stream of 15 or 20 eggs, and to my disgust the pair immediately set to work (apparently) to gobble them up. One or two eggs which were caught in the eddies and carried down amongst the rocks were immediately snapped up by the other fish which were hanging around for this purpose. This took place several times and at last I noticed that the pair had frequent mysterious visits to the undersides of the hollow stone, but there was nothing there that I could see.'

The next morning these visits were explained and I then noticed the female frequently rising to the surface and bringing down with her a mouthful of air which she let go against the underside of the bridge until there was a large silvery globule accumulated. The eggs had, it appeared, been plastered to the underside of the rock and she was now supplying them with air.'

Every now and then the globule would overflow and a large bubble would rise to the top; she however kept on bringing down more air with the idea, I suppose, of keeping the supply fresh.'

I have already mentioned that these fish seem capable of actually breathing atmospheric air, but what the eggs should want with air, and compressed air at that, I leave others better versed in fishlore to explain. The eggs could hardly have been less safe had the parents put them on the top of a floating leaf, as one or other had to remain constantly on guard to keep away the other fish.'

Another point struck me, which was the great self-denial exhibited by the pair, and more especially by the male; these eggs seemed to be regarded by the other fish as great delicacies, and I could quite imagine a bad husband (and I suppose there are such things amongst fish as amongst other animals) bolting his mouthful of eggs and explaining the contretemps and excusing himself on the grounds of a sudden inclination to cough.'

Jordan in 1905 in his *Guide to the study of Fishes* referring to the work of Hardwicke says (p. 166) 'General Hardwicke tells how the Gouramy (*Osphromenus gouramy*) in the Mauritius, forms a nest amongst the herbage growing in the shallow water in the sides of tanks'. Here one cannot say for certain what kind of a nest he refers to.

Sundararaj (1916, *Rec. Ind. Mus.*, xii, p. 281) while dealing with the fresh water fish of Madras after referring to the works of the previous authors on the subject says 'the nest is of a nearly spherical form composed of plants, preferably tuft of a

peculiar grass (*Panicum jumentorum*) which grows on the surface of the water, and considerably resembles a bird's nest in form. It is usually attached to plants or weeds growing at the edge of the pond and the bottom selected is muddy while the depth varies.' According to Darby de Thiersant in natural surroundings the eggs are attached to water plants.

J. A. Thomson in his *The New Natural History*, vol. ii, p. 533 says 'At the breeding season it makes a nearly spherical nest of water grass and the like, and usually fastens it to plants growing at the margin of the Pond. At this time the fish assumes a jet black colour and flashing red eyes, and becomes very pugnacious in defence of the nest. The Gourami is one of those fishes that can use dry air gulped in at the surface and a very interesting fact is that every now and then the mother brings down a mouthful of air and discharges it upon the eggs, thus securing their thorough aeration. Here we have a fish puffing air on its eggs! Surely that is *experimental*.' On page 536 of the same work, under the photograph of a Gourami he says 'This malayan fresh water fish, acclimitised in India, the Guianas and Mauritius, is famous for the bubble nest that the male constructs and guards. It is made of air bubbles entangled in a mucous secretion from the mouth. The fish itself may grow to be two feet long, and is very palatable.' The two statements are contradictory.

Boulenger (*Zoo and Aquarium Book*, 1932) gives the figure of a bubble nest of *Macropodus opercularis* (=*M. viridiauratus*) with the parent guarding the nest and producing fresh bubbles in the place of those lost.

It has not been possible for the present writer to observe the nesting habits of the Gourami. Gilbert's observations tally with those of Carbonnier in that the male makes a bubble nest as all other Anabantoids whose breeding habits are known. It is however difficult to conceive the same species exhibiting two quite different nesting habits even granting conditions are different. Habits like these are derived by instinct and as such it is impossible for them to get changed under different conditions. In the author's opinion one should consider a bubble nest as the natural and probable one in the Gourami till it is definitely proved to be otherwise.

I am indebted to Mr. S. H. Prater and Dr. S. L. Hora for clearing my doubts, regarding the nomenclature of certain Anabantoids and to Mr. L. de Fonseka of the Colombo Museum Library for sending me certain extracts dealing with the breeding habits of the Gourami.

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TRIVANDRUM. S. JONES.

[A mistake in the identity of the species concerned probably accounts for the extraordinary divergence in the nesting habits of the Gourami as described by various authors. It is possible that the species whose nesting habits were described by M. Carbonnier (*Ann. Mag. Nat. Hist.*, vol. xix, p. 274, 1877) was not the true Gourami (*Osphronemus gorämy* Lacépedé) but one of the other Anabantoid fishes which habitually constructs a 'bubble' nest. Many fishes of this group bear a general resemblance in form and have the same distinctive prolongation of the ventral fin rays into long thread-like appendages, and require for their correct identification a little more than the cursory examination possible through the glass of an aquarium. Further, it should be indicated that the popular name of Gourami has been generally applied not only to the true *Gourami* (*O. gorämy*) but to various Anabantoid fishes of different genera such as *Trichogaster, Colisa, Helostoma* and *Trichopsis;* some of which, such as *Trichogaster trichopterus,* and *Trichopsis vittatus,* were formerly included, with the true Gourami, under the genus *Osphronemus.* Dr. Kyle (*Biology of Fishes*) gives the name Gourami to fishes of the genus *Trichogaster* and illustrates the bubble nest of *Trichogaster labiosus* (=*Colisa labiosus* Day) which he calls the Thick-lipped Gourami. *Colisa labiosa,* like the true Gourami, is marked with irregular bands across its sides; only these markings are more vividly coloured —light, blue-green bands alternating with darker bars of orange brown. Another distinctive feature in this species is that the lips of the male are thickened and more prominent than in the female. The true Gourami on the other hand is a sombre coloured fish, its general colour is dark brown with a few irregular whitish bands across the body. Also in this species there is no marked and prominent thickening of the lips in the male. Carbonnier, in his description of the nesting habits, gives no clue to the colouration of the nest builder, he refers however to the 'brilliant' colours of the male—a character by no means strikingly apparent in the true Gourami. Further his description of the lips of the male which he says were 'tumefied in an abnormal fashion' seem to indicate that the species he was dealing with was not the true Gourami (*O. gorämy*) but *Colisa labiosa* Day, formerly known as *Trichogaster labiosa,* the thick-lipped Gourami, which habitually builds a bubble nest. Gilbert's description of the nesting habits of the *'Gouramï'* which appeared in the Society's *Journal* is probably again a case of mistaken identity. He describes his

Gourami as 'jet black with red eyes' a description which hardly fits the colouring of the true Gourami. Further he expresses surprise that his 'Gourami' weighing not more than three or four penny weights should breed. The average weight of the breeding Gourami would run into as many pounds and more. The necessity for careful identification of the species in recording breeding habits is made clear. Writers who have subsequently referred to the 'bubble nest' of the true Gourami have probably accepted Carbonnier's original description. The most recent of these is Innes (*Exotic Aquarium Fishes*, 1935) who writing of the Gourami (*O. gourami*) refers to them as 'bubble nest' builders and qualifies his account by stating that they do not usually breed in aquaria. Which is probably correct as the usual type of aquaria do not provide these fishes with the conditions or the facilities for constructing the 'nest' of reeds which they build for the reception of the eggs.—Eds.]

XXV.—FRESH WATER FISHES OF NORTH GUJRAT.

This is a list of fishes collected in one season in 1936 from the Sabarmati River and one or two tanks neighbouring Ahmedabad. These specimens were originally to form part of an extensive collection from all sources around this city, but owing to unavoidable circumstances, the work was indefinitely postponed.

The fishes collected by the author, together with some other from Prof. J. J. Asana of the Gujrat College, were submitted to Dr. S. L. Hora who very kindly identified and named them. Each of the species mentioned has got a separate Gujrati name, but due to conflicting nomenclature prevalent here, it is thought advisable not to include the vernacular synonyms in the present note. In a future note, it is intended to give these, together with new material; also an attempt will be made to give a short description of the several fishing places which provide for the Ahmedabad market and information on the economic side of the Fishing Industry in this part of the Presidency.

The present collection has been handed over to the Gujrat Natural History Society for their museum.

Mastacembelidæ.

1. *Mastacembelus pancalus* (Ham.).
2. *Mastacembelus armatus* (Lacep.).

Notopteridæ.

3. *Notopterus notopterus* (Pallas).

Cyprinidæ.

4. *Labeo fimbriatus* (Bloch).
5. *Labeo calbasu* (Ham.).
6. *Labeo dussumieri* (C. & V.).
7. *Labeo potail* (Sykes).
8. *Labeo boggut* (Sykes).

9. *Labeo* sp. young specimens.
10. *Cirrhino cirrhosa* (Bloch).
11. *Cirrhina reba* (Ham.).
12. *Amblypharyngodon mola* (Ham.).
13. *Barbus sophore* (Ham.).
14. *Barbus sarana* (Ham.).
15. *Barbus arulius* (Jerdon).
16. *Barbus ticto* (Ham.).
17. *Barbus* sp. (Large-scaled Barbel).
18. *Barilius bendelisis* (Ham.).
19. *Chela clupeoides* (Bloch).

BAGRIDÆ.

20. *Mystus cavasius* (Ham.).

SILURIDÆ.

21. *Wallago attu* (Bloch).

XENENTODONTIDÆ.

22. *Xenentodon cancila* (Ham.).

OPHICEPHALIDÆ.

23. *Ophicephalus punctatus* Bloch.

AMBASSIDÆ.

24. *Ambassis ranga* (Ham.).

GOBIIDÆ.

25. *Glossogobius giuris* (Ham.).

AHMEDABAD,
NORTH GUJRAT,
September 6, 1938.

H. G. ACHARYA,
F.Z.S.

XXVI.—A CASE OF POISONING FROM THE BITE OF A SPIDER.

In the accompanying parcel I am sending you a large black Tarantula-like Spider. I think it is dead but please be careful when opening the tin. I did not know one got these creatures in India. My *mali* was cutting some low jungle in the garden yesterday when it ran up his arm and bit him near the elbow. His arm began to swell immediately and became very painful. The swelling had the appearance of a lump with small blisters beneath the skin, covering an area of some four square inches. He found it difficult to bend the elbow after about two hours. After treatment the symptoms subsided within 24 hours except for a slight stiffness and soreness. There was no fever. The bite drew

blood in one place. Could you very kindly name the spider for me and be so good as to let me know if its occurrence is at all rare.

GAUHATI,
KAMRUP DISTRICT,
ASSAM.
October 29, 1938.

R. E. PARSONS.

[The spider referred to by Mr. Parsons is one of the large Mygalomorph spiders, commonly known as 'Tarantulas'. It has been identified by Dr. Gravely as *Cheliobrachys* sp. The name *Tarantula* is derived from Tarentum a town in Italy, and originally was applied to a species of Lycosid or Wolf Spider which is common in the Mediterranean countries. The term is now generally extended to the large Mygalomorph spiders so widely distributed in the tropics of which a number of genera and species occur in India. The most remarkable of the Indian forms are the spiders of the genus Poecilotheria; great hairy creatures some large enough to cover the span of a man's hand. Despite their forbidding appearance, these spiders do not usually bite except under extreme provocation. All spiders possess a pair of poison glands opening near the tip of the fangs, but few seem to have the power of injecting their poison into human beings. It is believed that the poison is not automatically injected whenever the fangs are used but is under the spider's control and that the venom is economised when a simple wound is sufficient for the purpose. This probably explains the divergent views regarding the effect of a spider's bite. We have no precise knowledge regarding the effects of poisoning by the various Indian forms of Mygalomorph spiders. Dr. Gravely in his article on Indian Spiders (*J.B.N.H.S.*, xxviii, p. 1045) refers to a case communicated to him by Dr. Sutherland of Kalimpong in which a boy of 14 years was bitten in the finger by a well grown female of the species *Macrothele vidua*. The pain extended up to the arms and down the side. After 24 hours the finger was still swollen. In a second instance recorded by Dr. Gravely, the victim of a much larger species *Chilobrachys fumosus* suffered no ill effects beyond a slight local swelling. Dr. Gravely suggests that the feeble effects in this instance might have been due to the spider having emptied its poison glands under the irritation to which it was previously subjected. Drops of poison were seen exuding from the tips of its fangs. No precise experiments have been carried out with the Indian species: but Mons. B. Houssay has demonstrated that some of the large Mygalomorph spiders of the Argentine are highly venomous to animals and present some danger to man. Full grown rabbits, guinea pigs and pigeons may be killed in a few minutes. In Man the bite of certain species produces intense pain, local swelling accompanied with fever and delirium and may in children and persons in ill health, result in death. Aguilar (*Rec. de la Soc. Med. Argentina*, xvi, 1908) records the death of a child of 7 years who succumbed to the effect of the bite of one of these large spiders, 7 days after being bitten. There is also

the authenticated case (*Insect Life*, I, 1889, p. 205) of the death of a farm labourer bitten by a spider *Latrodectus mactans*. In this instance the victim was bitten at half past eight in the morning and died between 11 and 12 o'clock in the night. Small pimples were raised in the neighbourhood of the bite. Intermittent pains and spasms ended in a comatose condition from which the man did not rally. *Latrodectus* is a Theridid whose poisonous reputation almost rivals the Tarantula. It is regarded as particularly dangerous in such widely spread regions of the world as Madagascar, New Zealand, Algeria, the West Indies and North America.—Eds.]

XXVII.—ON THE OCCURRENCE OF CERTAIN BUTTERFLIES AT NASIK.

1. **Gomalia elma albofasciata** (African Marbled Skipper).

A single specimen of this insect, a male, was taken in a garden in Nasik in June 1938. It is at present in my private collection and is available for examination if required. According to Evans, *Identification of Indian Butterflies*, this insect is shown to range from South India as far North as Poona and to be rare everywhere, it appears from this that its occurrence in Nasik, some distance North of Poona is even more rare, being at the extreme limit of its previously recorded range.

2. **Kallima philarchus horsfieldii** (Blue Oakleaf).

A specimen of this butterfly was taken in December 1938 in a garden in Nasik. The one taken was a female, and is in fairly good condition, only one hind wing being slightly damaged. Another of the same species was seen, but not taken, near Bhandara, some 40 miles from Nasik during the month of August. The identification has been made by reference to the same authority.

Nasik,
January 3, 1939.

C. J. RAE,
Executive Engineer.

XXVIII.—AN IMPROVED CELLOPHANE WING MOUNT.

In a previous note (1936 *Journ. Bomb. Nat. Hist. Soc.*, xxxviii, 634) I described a method of mounting the wings of Lepidoptera on cards under cellophane. Time has shewn that the method then described is not altogether satisfactory and the present one has been evolved in order to get over the various drawbacks.

Materials required:—Visiting, or other suitable, cards, moisture proof cellophane and a suitable adhesive, such as Gripfix. Moisture proof cellophane should be used in preference to ordinary as it is not affected by changes in humidity.

A suitable sized window is cut out of one card (the cover) with a sharp knife or razor blade and any projecting edges at the back of

the cut scraped down. The size and position of the window is then traced with a sharp pencil on a second card (the support). A piece of cellophane, slightly larger all round than the window, is then cut out.

The wings to be mounted are severed as close to the point of attachment as possible, a razor blade is the most satisfactory instrument to use for this, but care must be taken to see that no shred of flesh or muscle is attached as this will give rise to mildew in the finished mount.

A film of the adhesive is then brushed over the previously pencilled window on the supporting card, the wings placed in position with a pair of fine pointed forceps, the cellophane put in place and pressed down and the whole thing is then put in a heavy book or under a weight and left for twelve hours or until it is completely dry.

The support and cover are then pasted together and allowed to dry under pressure, after which the name, locality and date can either be written on the mount itself or typed on a separate slip and stuck on.

CALCUTTA. D. G. SEVASTOPULO,
F.R.E.S.

October 13, 1938.

XXIX.—THE ORIGINAL HOME OF THE COCONUT.

(*A correction*).

From the citation in Dr. H. N. Ridley's monumental work *The Dispersal of Plants throughout the World*, p. 321, I had assumed that Peter Martyr himself had visited the Moluccas. Later I could see that he was the historiographer of the court of Spain and wrote the history of the voyage of Magellan and his followers round the world under orders of Charles V who placed into his hands all the journals of that voyage.[1] Thus the sentence beginning with Peter Martyr in the text on page 177 of my paper on the 'Original Home of the Coconut' in the September number of this *Journal*, vol. xl, No. 2 has to be altered in the following manner. Peter Martyr who wrote the history of the voyage of Magellan and his followers round the world has recorded that in the Moluchas Islands (Moluccas) the coccus (coconut) grew quite accidentally (1521).

This minor error could have been avoided had I been able to look into Dr. Ridley's reference firstly. However, the following two references may be relevantly let in with this.

Antonio Pigafetta,[2] one of the lucky survivors of Magellan's terrible voyage and a man of letters, had kept his notes of the voyage himself after giving a copy of it to Charles V. His account was separately published, though in a somewhat mutilated form, in France and later in Italy. He has given an elaborate account of the uses of the coconut in the islands of the West Pacific and has recorded its occurrence in an island, between Moluccas and Timor, inhabited by savages who were more beasts than men and who

were anthropophagi. Saavedra[3] sailing in a southerly direction from New Guinea in 1529 found many small low islands full of palm trees (evidently coconut) at 10° or 12° S. latitude. The people of those islands knew no fire and ate cocos instead of bread and raw fish. 'They break cocos before they be ripe and putting them under the sand, and then after certain daies they take them out and lay them in the sunne, and then they will open.'

MADRAS. P. V. MAYURANATHAN,
Curator, Botany Section,
Government Museum, Madras.

October 10, 1938.

REFERENCES.

[1] Pinkerton: *Voyages and Travels*, vol. xl, p. 299.
[2] *Ibid*, p. 374.
[3] Galvano: *Discoveries of the World*. Hakluyt Society's Publication, pp. 178 and 179.

XXX.—OCCURRENCE OF TWO PLANTS NEW TO KASHMIR.

During the course of his limited scope of work as a Forest Ranger, the writer found to his great surprise *Lilium giganteum* Wall., growing wild in the Kishenganga Valley. Curiously enough the plant is localised in a single place, far away from habitation and in a steep nala where the possibility of its introduction by human agency is remote. This species, so far as the writer thinks, has not been recorded west of the Sutlej up to now. The only reference of its existence in the Punjab is by Collett in Narkanda.

A specimen of Iris collected in the Liddar Valley was sent to Kew and identified as *Iris Milesii* Foster. No record about its collection west of Kulu is available.

The writer would be interested to know if any of the readers of your *Journal* has come across or known of these two plants having ever been collected west of the Sutlej and the Ravi respectively.

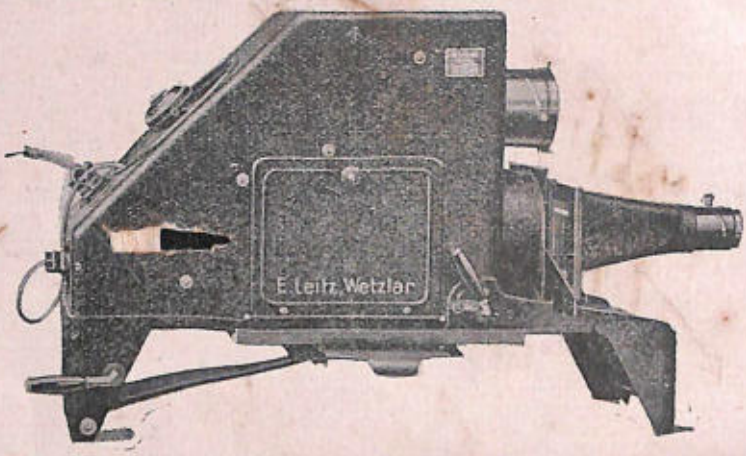
FOREST SCHOOL, PREM NATH KOHLI.
BANDAPORE—KASHMIR.

September 28, 1938.

PRINTED AND PUBLISHED BY V. M. PHILIP AT THE DIOCESAN PRESS, 18 CHURCH ROAD, VEPERY, MADRAS
EDITORS: F. M. D. SANDERSON, S. H. PRATER, C. MCCANN, 6 APOLLO STREET, FORT, BOMBAY

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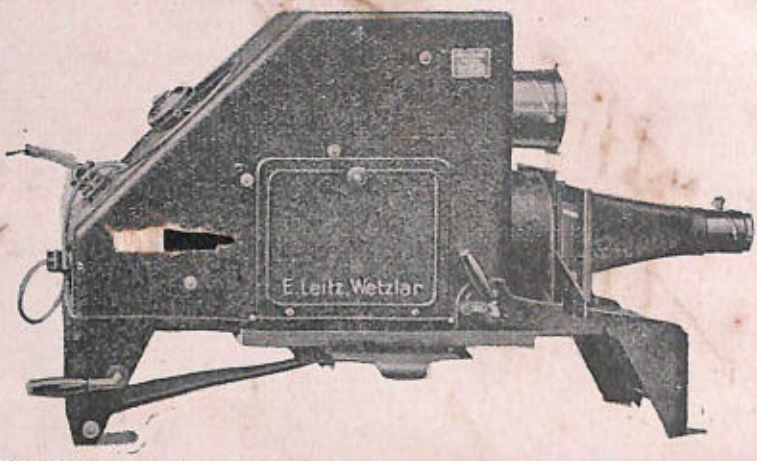
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