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"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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LIST OF CONTRIBUTORS.

Page

BLANFORD, H. F. ;—*On some recent Evidence of the Variation of the Sun's Heat* (Woodcut), ... 21

BLANFORD, W. T. ;—*On the scientific names of the* Sind "Ibex," *the* Markhor, *and the* Indian Antelope, ... 12

———— ;—*Note on the Molluscan genera* Cœlostele, *Benson and* Francesia, *Paladilhe, and on some species of Landshells from Aden*, ... 41

———— ;—*List of* Mammalia *collected by the late* DR. STOLICZKA, *when attached to the embassy under Sir* D. FORSYTH *in Kashmir, Ladák, Eastern Turkestán, and Wakhán, with descriptions of new species*, ... 105

———— ;—*On the species of* Marmot *inhabiting the Himalaya, Tibet, and the adjoining Regions*, ... 114

———— ;—*List of* Reptilia *and* Amphibia *collected by the late* DR. STOLICZKA *in Kashmir, Ladák, Eastern Turkestán, and Wakhán, with descriptions of new species*, ... 191

———— ;—*Note on* (i) Elachistodon Westermanni, (ii) Platyceps semifasciatus, *and* (iii) Ablepharus pusillus *and* Blepharosteres agilis, ... 207

———— ;—*Note on a large Hare inhabiting high elevations in Western Tibet*, ... 214

FRASER, O. L. ;—*Note on the occurrence of a partially ossified Nasal Septum in* Rhinoceros Sondaicus (Plate V), ... 10

GODWIN-AUSTEN, H. H. ;—*Descriptions of New Species of* Mollusca *of the genera* Helix *and* Glessula *from the Khási Hills and Manipur* (Plate I), ... 1

———— ;—*Descriptions of new species of* Mollusca *belonging to the family* Zonitidæ *from the N. E. Frontier of Bengal, with drawings of* Helicarion gigas, *Benson, and of a variety of the same*, (Plates II & III), ... 4

———— ;—*Descriptions of new operculated Landshells belonging to the Genera* Crapedotropis, Alycæus, *and* Diplommatina, *from the Nága Hills and Assam* (Plate IV), ... 7

Page

GODWIN-AUSTEN, H. H. ;—*Notes on the Geology of part of the Dafla Hills, Assam ; lately visited by the Force under Brigadier-General* STAFFORD, *C. B.*, (Plates VI & IX), ... 35

———————— ;—*The Evidence of past Glacial Action in the Nága Hills, Assam* (Plates X—XIII), ... 209

KURZ, S. ;—*Contributions towards a Knowledge of the Burmese Flora* (Part II), ... 128

——— ;—*Notes on a few new Oaks from India* (Pl. XIV), ... 196

——— ;—*Description of a new species of* Tupistra *from Tenasserim*, 198

——— ;—*Descriptions of new Indian Plants* (Pl. XV), ... 199

NEVILL, G. & H. ;—*Descriptions of new marine* Mollusca *from the Indian Ocean* (Pls. VII & VIII), ... 83

SCHWENDLER, L. ;—*On the General Theory of Duplex Telegraphy* (Woodcut), ... 47

WATERHOUSE, J. ;—*Photography in connection with the observations of the Transit of Venus at Roorkee, December 9th (Civil)*, 1874, ... 64

WOOD-MASON, J. ;—*On new or little-known species of* Phasmidæ, *with a brief preliminary Notice of the Occurrence of a Clasping Apparatus in the Males throughout the Family* (Pls. XVI & XVII), ... 215

Dates of issue of the different numbers of Journal, Part II, 1875.

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ADDITIONS AND ERRATA.

Page 135, 16 lines from bottom of page, *for* "Geoff." *read* "Griff."

Page 136, 6 lines from top of page, *for* "its," *read* "it."

Page 151, 8 lines from top of page, *for* "*Conspectus of species*," *read* "*Conspectus of genera.*"

Page 161, 13 lines from bottom of page, *for* "*monotana*," *read* "*montana.*"

Page 170, 6 lines from top of page, *for* "*Conspectus of species*," *read* "*Conspectus of genera.*"

Page 180, 19 lines from top of page, *beneath* the word "SAPINDACEÆ," *insert* the words "*Conspectus of genera.*"

Page 198, 6 lines from top of page, *for* "Upper Assam," *read* "Upper Tenasserim."

Page 112, 9 lines from bottom of page, *for* CAPRIOLUS, *read* CAPREOLUS.

ZOOLOGICAL GARDEN
CALCUTTA

JOURNAL

OF THE

ASIATIC SOCIETY.

Part II.—PHYSICAL SCIENCE.

No. I.—1875.

I.—*Descriptions of New Species of Mollusca of the genera* Helix *and* Glessula *from the Khasi Hills and Munipur.—By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., &c.—Deputy Supt. Topgl. Survey of India.*

(Received Sept. ;—Read Nov. 4th, 1874.)

(With Plate I.)

The following shells were obtained in the above hills between the years 1868 and 1873, when I was employed in the survey of that tract of country; the work afforded opportunities of visiting almost every part and of bringing together a very large collection of the land and freshwater shells, a complete list of which I hope some day to draw up.

Helix delibrata, Bs., var. fasciata, Plate I, Fig. 1.

Shell openly umbilicated, depressedly globose, rather solid, pale ochraceous epidermis; spire slightly raised, in some specimens quite flat, very prettily striped with brown concentric bands, one or two of which are broader and more pronounced than the rest, especially on the base of shell; some specimens are ornamented with a single band only, last whorl expanding towards aperture and slightly descending; aperture sub-oblique, circular, peristome thick, white, and reflected.

Major diam. 0·82, minor 0·67, alt. 0.38 in.

Hab.—On the high open grassy country of the West Khasi Hills.

True *delibrata*, Bs. unbanded, with flat spire, and a larger shell, is also found in the Khasi Hills.

Helix (Nanina) atricolor, n. sp., Plate I, Fig. 2.

Shell imperforate, depressedly conoid, very strong, colour varying from rich bright brown to greenish ochre, pure brown or ochre near aperture, with a glassy surface finely striated; spire flatly conoid, whorls 6½, periphery rounded, flat at base; aperture sub-oblique, broadly lunate, peristome well thickened and slightly reflected near the columella.

Major diam. 0·93, minor 0·85, alt. 0·45 in.

Animal quite black throughout, tentacles long with the extremities paler, extremity of foot short and glandular, as in *Nanina decussata*, Bs.

Hab.—On the higher parts of the North Cachar Hills, never seen to the westward of that portion of the range, and tolerably abundant in certain spots. The colour of the animal is its most distinctive character, shells of this group of Helices being very similar, and the characters of the animals of great importance; I may mention as an instance *N. petrosa*, Hutton, found in damp ravines on limestone at Mussoorie, which has been confounded with other species and the animal of which is almost black; by this character it is identified at once and is rendered a very good species.

Helix (Nanina) Shisha, n. sp., Plate I, Fig. 3.

Shell depressedly turbinate, imperforate, exceedingly thin, brittle, transparent, pale greenish horny, sharply keeled; whorls 5, ornamented above with fine and even ribbing, quite smooth at base; aperture oblique, semicircular, lip thin.

Major diam. 0·6, minor 0·51, alt. 0·3 in.

Hab.—Two specimens were found, the one at Moyong, north side of the Khasi Hills, and the other at Nenglo, Naga Hills, in damp forest, but such a fragile form would be probably abundant during the rainy season, and like so many others only then to be seen.

Animal not seen, but in all probability is naninoid. In the plication of the upper surface it is like *N. plicatula*, W. Blf. (J. A. S. B., 1870, Vol. XXIX.) a species the animal of which had not been observed at the time when the shell was described. I now give a short description of it:—pale brown, mottled very evenly with umber over the head and sides, a distinct line of darker colour down the centre of back; tentacles rather thick at base, moderately long gland at extremity of foot, which is rather truncate; length 1·25 inch.

Glessula orthoceras, n. sp., Plate I, Fig. 4.

Shell very slender and elongate, pale grey or white, very finely and regularly ribbed throughout, very solid, apex blunt; whorls 13 to 14, slightly rounded, suture well impressed; aperture oblique, rounded below, outer lip sharply edged and continued as a well developed callus upon the strong thickened columellar margin.

Length 2·32, major diam. 0·4 in.

Hab.—Abundant on the nummulitic limestone of the West Khasi Hills, particularly near Nongumlai, where the finest specimens were collected; a smaller variety occurred on the peak of Laudomodo on gneiss, and was not so solid. This species can be at once distinguished from *G. Casiaca*, Bs. by its white colour and by the absence of the dark brown epidermis that covers the latter; the whorls also are much more rounded, whereas in *Casiaca* they are nearly flat. It is very close to *G. obtusa*, W. Blf., brought from Yunan by Dr. J. Anderson, but is altogether a larger shell and differs in its general form.

Fine *Glessula Casiaca*, I only found to the eastward in the Naga Hills, whence, I suspect, Griffith's specimens were obtained and sent to Benson, who imagined they were from the Khasi Hills.

Glessula illustris, n. sp., Plate I, Fig. 5.

Figured in 'Conchologia Indica', Pl. 102, Fig. 9.

Shell elongately oval, greenish horny, finely striated longitudinally; whorls 7, very slightly rounded, suture moderately impressed, the lip thickened, columellar margin slightly curved and strong, apex blunt.

Length 0·75, major diam. 0·3, length of aperture 0·3 in.

Hab.—Hengdan Peak, North Cachar Hills, at 7000 feet, in forest, also near Nenglo at 6000 feet and in the Lukah Valley, Jaintia Hills, at 1000 feet.

This species is an elongate and larger form of *Glessula crassilabris*, Bs., of which *G. pyramis* is a closer variety; but its much more elongate form and stronger striation make it a good connecting species with *G. Butleri* described further on. The form from the Lukah Valley is a tumid departure from the type figured.

One specimen—alt. 0·75, major diam. 0·38 in.
Another „ „ 0·65 „ 0·35 „

I look on all these species as properly varieties, and *G. crassilabris*, very abundant in all the grass country of the Khasi Hills, may be taken as the type; a difference in elevation and condition of habitat, from damp dark forest to hot grassy slopes, having produced modifications of form.

Glessula Burrailensis, n. sp., Plate I, Fig. 6.

Shell turreted, elongate, solid, in fresh state brown and lustrous, finely longitudinally striated; whorls 10, rather flat, suture shallow, apex blunt; aperture sub-vertical, fusiform, angular above, peristome very thick, paler brown on margin, columella strong.

Alt. 1·37, major diam. 0·4 in.

Hab.—The finest specimens were collected under the Peak of Khunho, Eastern Burrail Range; they were also abundant under Japvo at about 7000 feet.

This species is an extremely elongate, solid form of the *crassilabris* section of *Glessula*—and one of the most distinct.

Glessula Butleri, n. sp., Plate I, Fig. 7.

Shell elongately turreted, very thin and brittle, tumid, pale corneous, glassy, very minutely striated, apex very blunt; whorls 8, rather rounded, suture deep, body whorl much swollen and capacious; aperture vertical, pear-shaped, lip rather thin.

Alt. 1·13, major diam. 0·45 in.

Hab.—Eastern Burrail Range at 6000 feet—not a common form.

I name this shell after Captain J. Butler, Political Agent in the Nágá Hills, with whom I had the pleasure of being associated when mapping that very interesting and beautiful district.

EXPLANATION OF PLATE I.

Fig. 1. *Helix delibrata*, var. *fasciata*.
„ 2. *H.* (*Nanina*) *atricolor*.
„ 3. „ „ *Shisha*.
„ 4. *Glessula orthoceras*.
„ 5. „ *illustris*.
„ 6. „ *Burrailensis*.
„ 7. „ *Butleri*.

II.—*Descriptions of four New Species of Mollusca belonging to the family* Zonitidæ *from the N. E. Frontier of Bengal, with drawings of* Helicarion gigas, *Benson and of a variety of the same.—By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., &c., Deputy Superintendent of the Topographical Survey of India.*

(Received Sept. 1874,—Read January 6th, 1875.)

(With Plates II—III.)

Helicarion Shillongense, n. sp.

Animal ochre colour, the mantle being slightly paler than the rest of the body, there is no longitudinal streaking on the side of the foot, which, viewed under a lens, is covered with minute protuberances evenly distributed; foot beneath dull ochre brown.

Shell horny, thin, long and narrow, pale green in colour. (Plate II, Fig. 1*a*).

Length 0·9″, diam. 0·28.″

The dimensions of these creatures are not so easily taken, the different parts expanding and contracting alternately.

Extremity of foot to posterior end of the mantle,...	1·9	inch.
Mantle,.....	1·5	
Anterior end of mantle to head,.....	0·9	
Total,	4·3	
Eye tentacles, ...	0·42	

Helicarion Shillongense, var., Plate II, Fig. 1.

Animal dark umber brown, body concolorous, the mantle a shade lighter, nearly covering the shell in both varieties, the foot beneath is ash-coloured; when taken fresh there is a slight indentation at the anterior edge of the mantle (*vide* fig.). Shell as in fig. 1 a.

Extremity of foot to posterior edge of mantle, ...	1·70	inch.
Mantle, ...	1·70	
Anterior end of mantle to head, ...	0·95	
Total,	4·35	
Eye tentacles, ...	0·45	

Hab.—Shillong and North Khasi Hills. Both these forms are near *H. Theobaldi*, but may be distinguished at once by the absence of the white stripe on the edge of the left lobe of the mantle, and by the longer form of the shell. The tentacles are longer than in *H. brunneum*.

Helicarion brunneum, n. sp., Plate II, Fig. 2.

Animal a rich brown, mottled on the mantle with dark sepia, distinctly marked with parallel streaks, that extend from a zigzag line running along the side of foot, the margin of which is edged below with a series of short parallel markings; foot beneath dark ochre. Large portion of shell exposed, which is of same form as that of *H. Shillongense*.

Dimensions when fully extended:

Extremity of foot to posterior end of mantle,.....	1·5	inch.
Mantle, ...	1·6	
Anterior end of mantle to head, ...	0·47	
Total,	3·57	
Eye tentacles, ...	0·32	
Breadth of body, ...	0·56	

Hab.—Shillong, Khasi Hills, in grassy localities.

Helicarion Nagaense, n. sp., Plate II, Fig. 3.

Animal ochre colour, prettily mottled and dotted with a darker shade of the same, the mantle covers nearly the whole shell; a narrow white line, commencing near the posterior margin of the slit disclosing the shell, extends round towards the respiratory orifice on the right hand side, and in

front another line curves round to the left anterior side (fig. 3*b*). Mucous gland as in *H. gigas*. Length about 3 inches.

Shell ovate, exceedingly thin and brittle (fig. 3).

Major diam. 0·90, minor 0·55 in.

PARMARION? RUBRUM, n. sp., Plate II, Fig. 4.

Animal of a fine orange pink, grey on under side of the foot; tentacles short, mantle entirely covering the shell, with only a slight trace of a longitudinal opening running back from the anterior left side, three parallel bands of greenish grey along the back of the neck, the eye-tentacles being of the same colour. The gland at extremity of foot with a long, overhanging lobe.

Extremity of foot to posterior end of mantle, ...	0.9	inch.
Mantle, ...	0·8	
Anterior side mantle to head, ...	0·4	
Total length when moving, ...	1·8	

Shell quite rudimentary, minute, granular (fig. 4*b*).

Major diam. 0·14 in.

Hab.—Kohima, Nágá Hills, in brushwood.

The mucous gland in this species differs considerably from that of *Helicarion gigas* and its allies, the upper lobe projecting and hanging over so as to present, when viewed sideways, a narrow horizontal slit.

HELICARION SOLIDUM, Godwin-Austen, Plate II, Fig. 5.

When this species was first brought to notice by me in the P. Z. S., 1872, Plate XXX, the animal had never been observed. It has the form of *Shillongense*, &c., and a specimen from Kohima was dark umber, pinker below, with no mottling on the body; tentacles dark.

In another specimen from the Dunsírí valley, Assam, the animal was pinkish grey with dark mottling, the mantle covered the whole shell and had a slight indentation on the extreme anterior margin; the mucous gland with small lobe above, the extremity of foot cut off rather square.

Total length 2·70, mantle 1·3, mantle to head 0·5 in.

Shell—major diam. 0·44 in. (fig. 5).

The specimen from this locality may be young, but the shell is so similar in form to *H. solidum*, first observed on the peak of Hengdan, Munipur frontier, that I have not separated it.

HELICARION GIGAS, Benson, small var.

I found that typical *gigas*, originally described from Teria Ghat at base of the Khasi Hills, was replaced on the Burrail Range, by the form a drawing of which, together with one of *H. gigas*, I give on Plate III.

Desc.—Animal dark ochre brown with very dark mottlings, particularly distinct upon the margin of the foot.

Shell—major diam. 0·85, minor 0·56 in.

Helicarion gigas was described by Benson as *Vitrina* in J. A. S. B., Vol. V, p. 350.

EXPLANATION OF PLATES.

Plate II.

Fig. 1. *Helicarion Shillongense*, var. 1*a*. Shell of ditto.
2. „ *brunneum*.
3. „ *Nagaense*. 3*a*. Animal: mantle, side view. 3*b*. Mantle from above. 3*c*. Mucous gland.
4, 4*a*. *Parmarion ? rubrum*. 4*b*. Shell of ditto. 4*c*. Extremity of foot. 4*d*. Head withdrawn below mantle. 4*e*. Mantle from above.
5. *Helicarion solidum*, *G-A.*, shell. 5*a*. Mantle from above. 5*b*. Mantle, side view. 5*c*. Mucous gland. 5*d*. Extremity of foot.

Plate III.

1. *Helicarion gigas*, Bs., nat. size.
2. „ small var. „

III.—*Descriptions of New Operculated Landshells belonging to the genera* Craspedotropis, Alycæus, *and* Diplommatina, *from the Nágá Hills and Assam.*—*By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., &c.*

(Received Sept. 1874;—Read February 3rd, 1875).

(With Plate IV).

Craspedotropis fimbriatus, n. sp., Plate IV, Fig. 1.

Shell conoidly turbinate, closely umbilicated, thin, covered with a rough dark brown epidermis, longitudinally striate, a leaf-like fringe adorns the periphery of the last whorl, spire conoid, its side concave, apex attenuate, blunt, suture deep; whorls 5, flat above, aperture diagonal, circular, the lip slightly reflected, peristome thin. Operculum multispiral, flat, smooth on outer surface. Animal not seen.

Major diam. 0·19, alt. 0·15 in.

Hab.—Hengdan Peak, Naga Hills, at 7,000 ft., in forest.

Only one specimen was obtained. This is a very interesting shell, as being the first of the genus from this part of India; *Craspedotropis*, esta-

blished by Mr. W. T. Blanford, having been hitherto only known from the hills of Southern India and represented by *C. cuspidatus*, Bs., the fringe on the keel of which is however hairy. Colonel Beddome has, I believe, discovered one or two other new forms.

ALYCÆUS SCULPTURUS, n. sp., Plate IV, Fig. 2.

Shell closely umbilicated, turbinate, horny or grey, with distant well-marked costulation on the upper whorls, smooth below, finely ribbed on swollen part of whorl, still more finely on the constricted portion, spire subconoid; whorls 4, the last slightly swollen, then constricted and slightly swelling again towards the peristome, which is longitudinally undulated; sutural tube moderate, aperture oblique, waved, peristome thickened, expanded a little, double, with four deep undulations on the outer margin and one less developed on the lower, the first undulation forming a deep notch in the peristome near its junction with the last whorl. Operculum as in *A. crispatus*, mihi.

Major diam. 0·14, minor diam. 0·10, alt. 0·08, diam. of aper. 0·06, sutural tube, 0·55 in.

Hab.—Obtained by me on the hill ranges from near Tellizo Peak to the eastward, and on Mungching Hill in Munipur. Abundant.

This species is very close to *A. crispatus*, G-A. from the Khasi and Jaintia Hills (J. A. S. B., Vol. XL, Pl. IV, fig. 1), but is a much more closely wound shell—a character which, when a large series of the two were placed side by side, was found to be constant, and this, with the absence of the ridge on the constriction, marks it as distinct. *A. sculptilis*, Bs., originally described from Burmah, and of which I collected identical specimens in Munipur, is another form near to *sculpturus*, but has no crenulation of the peristome and is plain and ridgeless on the constriction; the three forms pass into one another.

DIPLOMMATINA BURTII, n. sp., Plate IV, Fig. 4.

Shell dextral, tumidly and ovately fusiform, colour pale umber or sienna-brown, very finely and closely costulated under lens, almost smooth to the naked eye, spire rapidly attenuate, apex sharp, suture well impressed below; whorls 8, the three last swollen and rounded, those near apex flat, penultimate the largest, the last rising slightly towards the aperture, which is vertical, broad, and well rounded below, peristome double, very thick, continuous, columellar tooth strong.

Hab.—Base of the Eastern Himalaya, at the debouchement of the Burrowli River, Assam, where it was collected by Mr. J. Burt, after whom I have named it, and who kindly collected some other interesting shells in the same locality.

It is a form of the type *D. diplocheilus*, Bs., but the peculiar attenuate spire and tumid shape below are very distinctive.

DIPLOMMATINA SHERFAIENSIS, var., Plate IV, Fig. 5.

A form similar to that from the Peak of Sherfaisip, North Cachar Hills, described in J. A. S. B., Vol. XXXIX, 1870, p. 3, and differing from it only in its much more tumidly fusiform shape and larger size.

Alt. 0·14, diam. 0·09 in.

It was very abundant on the Peak of Japvo at 10,000 ft., and shews an interesting divergence from the form found at the highest elevation of the same range further west. On the Peak of Shiroifurar at an equal altitude but 40 miles to the south-east, the form, with the same essential characters, had again changed into a still larger and more solid shell with a more acuminate spire, yet the differences from the original type are not sufficient on which to found a new species.

DIPLOMMATINA TUMIDA, var., Plate IV, Fig. 7.

Shell elongately fusiform, thin, pale yellowish green, sculpture very faint above, quite smooth on the 3 last whorls, spire attenuate, sides flat, suture moderate; whorls 8½ to 9, the antepenultimate the largest, constriction in front, above the aperture, last whorl ascends slightly; aperture oval, vertical, peristome double, thickened, slightly reflected, columellar tooth small and remote.

Alt. 0·22, diam. 0·13 in.

Hab.—Kézákenomih, Nágá Hills. This shell is a better type of this form of *Diplommatina* than the very tumid shell first described from Asalu; the form changes much in different localities, in some being much more solid and more distinctly and distantly sculptured near the apex; a variety from the Eastern Burrail is 0·20″ in alt., rich dark amber coloured, has the 3 lower whorls smooth and glassy, the columellar tooth still more remote, and the constriction just behind the peristome; it departs so widely from the original type that it might almost be separated. Accurate drawings of a series of specimens are requisite to shew these gradual changes, and these I hope to be able to give hereafter.

DIPLOMMATINA CONVOLUTA, n. sp., Plate IV, Fig. 8.

Shell dextral, elongately fusiform, solid, pale yellowish or greenish horny, very finely costulated towards the apex, 2 last whorls smooth, striated near the aperture, spire with rather flattened sides, suture impressed; whorls 8, antepenultimate the largest, the penultimate constricted at ⅓ turn behind the peristome, the last ascends very sharply, contracting the breadth of the penultimate very considerably; aperture sub-vertical, lying to the right of the axis, peristome circular, solid, double, the tooth small and situated far within the columellar margin, lip scarcely reflected. Animal not seen.

Alt. 0·25, diam. 0·15 in.

ZOOLOGICAL GARDEN CALCUTTA

Hab.—Slopes of the Eastern Burrail at about 6,000 ft., tolerably abundant.

A very near ally of *D. Jatingana*, G-A., from which it is readily distinguishable by the situation and reduced size of the columellar process, its elongate flat-sided form, and very different sculpture.

EXPLANATION OF PLATE IV.

Fig. 1. *Craspedotropis fimbriata.* With magnified drawing of the leaf-like fringe.
„ 2. *Alycæus sculpturus.*
„ 3. „ *crispatus* (basal side).
„ 4. *Diplommatina Burtii.*
„ 5. „ *Sherfaiensis*, var.
„ 6. „ *tumida*, type form.
„ 7. „ „ var.
„ 8. „ *convoluta.*

IV.—*Note on a partially ossified Nasal Septum in* Rhinoceros Sondaicus.

By O. L. Fraser.

(Received 1874;—Read March 3rd, 1875.)

(With Plate V.)

Whilst cleaning the skull of a *Rhinoceros Sondaicus* lately obtained by me in the Sunderbuns, I was much surprised to find a partially ossified *septum narium*—a structure which I had hitherto looked upon as solely characteristic of the fossil Rhinoceros and for any mention of which in a recent species I have looked in vain; indeed Cuvier (Oss. foss. Vol. 2, p. 26,) distinctly states that no such thing occurs in the recent ones.

The specimen in question was a female 5 feet 6 in. high and, though a fully adult one (as the size of a fœtus she was carrying proved), from the unworn condition of her teeth she certainly was not old, so that the ossification could not be merely the result of age, as is so very often the case with the cartilages and even the tendons of mammals, birds, &c.

On looking at some other skulls, I found in two old specimens (one from Java, and the other the locality of which is unknown) traces of where such a structure might have been but had been destroyed either in cleaning or in some other way. In a third (not so old as the two preceding but still an older one than mine) there is distinct evidence of an exactly similar formation to that I am about to describe, though the anterior bone has been lost and part of the posterior portion broken away; this specimen was also from the Sunderbuns.

In some 6 or 7 skulls of *R. indicus* that I examined there was not the slightest indication of it, the vomer being quite distinct, and there being no roughened articulating surface on the inner side of the nasals.

In the first mentioned ♀ specimen, the septum, commencing from the ethmoid, is ossified for about 3 inches; it then divides, the lower portion running to within 5½ in. of the maxillo-premaxillary articulation and being intimately connected with the vomer, along whose channel it runs, the upper portion forming a fringe about an inch deep along the inner surface of the conjoined nasal bones (to which it is ankylosed) to within 5¾ in. of their tip (the curved upper walls of the nasal cartilages being also completely ossified and ankylosed to the inner surface of the nasals and maxillaries for the same distance); here there is a break and the bone is perfectly smooth for a space of 2 inches, when there commences a diamond shaped roughened surface, which occupies the whole of the remaining 3¾ in. of the inner side of the nasals, and on this was articulated the ossified termination of the nasal cartilage. This is of subtriangular form and consists of a plate of bone 3⅞ in. long, about 1½ deep, and ¼ thick. Its upper edge is expanded laterally to a width (in its greatest measurement) of 1⅞ in., and forms a deep sulcus, into which the tip of the nasals and the roughened articular surface of their underside fit. The anterior edge of this bone is slightly in advance of the tip of the nasals and is 1½ in. in advance of the anterior point of the præmaxillæ, between which point and the lower edge of the septal bone there is a distance of one inch.

I have since seen the skulls of two other specimens shot at the same place, the one an adult and the other a younger ♂ This structure was present in both.

As can be seen from the accompanying drawing, it bears a strong resemblance to the figure given by Prof. Owen (in his Hist. of Brit. Foss. Mamm.) of *R. leptorhinus*. There is this difference that in *R. leptorhinus* the ossified terminal portion of the septum is ankylosed to the nasals, whilst in *R. Sondaicus* it is not. This, however, might take place at a more advanced age, as, in a foot-note to p. 367, he mentions that the bony septum of *R. ticorhinus* is free until the animal has quite attained maturity. Judging, however, from the old skulls of *Sondaicus* before mentioned, I should not think that it would do so, or it would still remain *in situ* in those skulls. Again, Prof. Owen speaks of the edges of the septum of *leptorhinus* as being complete, whereas in *sondaicus* they are not. They bear distinct marks of the insertion of the posterior cartilage, thus leading one to think that, even if it did not ankylose to the nasals, it might in a very old animal become a completely ossified septum.

Prof. Owen also (Anat. of Vertebrates, Vol. III, p. 356) regards the cloison in *Rh. tichorinus* as indicative of the great development of the horns in that species, but in *Rh. sondaicus* the horn is small (5 or 6 inches as a rule and never exceeding a foot or 18 inches) in the male, and what is very peculiar, the female has no horn whatever. I do not know of any other

Rhinoceros in which this is the case; as in *Rh. indicus*, as well as the double-horned species with which I am acquainted, the female carries a horn or horns, though they are generally smaller than in the male.

EXPLANATION OF PLATE V.

Fig. 1. Side view of the skull with the terminal ossification (*) *in situ*.

„ 2. Section of the skull showing the posterior ossification (**)

„ 3. Inner or under view of the conjoined nasal bones showing (a) the anterior termination of the upper fringe with the ossified nasal cartilages (b. c.) and (d) the roughened articular surface for the terminal bone.

„ 4. Front view of the tip of the nasals with the terminal bone *in situ*.

„ 5. Front view of the bone disconnected.

„ 6. Upper or articular surface of ditto.

V.—*On the Scientific Names of the* Sind "Ibex," *the* Markhor, *and the* Indian Antelope.—*By* W. T. Blanford, *F. R. S., F. G. S.*

(Received 27th May,—Read June 2nd, 1875.)

In the Proceedings of the Asiatic Society for December last, p. 240, Mr. Hume proposed the names of *Capra Blythi* for the Sind wild goat or ibex, and *Capra Jerdoni* for the Suliman variety of the Markhor. The former animal is only incidentally mentioned in Jerdon's Mammals of India, p. 293, and then it is called *Capra Caucasica*.* The two forms of Markhor inhabiting Kashmir and Afghanistan are mentioned by Jerdon, but very briefly. As the idea is prevalent in India that neither the Sind goat nor the Suliman Markhor are known to naturalists, I think it may be useful to shew that this view is erroneous, and that neither animal requires a new scientific name.

To take the Sind "ibex" first. This animal is, I think, clearly identical with the wild goat of Persia, Armenia and the Caucasus, and probably of Crete. There is another wild caprine animal in the Caucasus, more nearly allied to the Alpine and Central Asian species of ibex, and this animal is the true *Capra Caucasica*. The wild goat of Persia and Sind has long been known throughout the civilized world as the source of the genuine bezoar,† so greatly famed in former times for its supposed virtue as an antidote to poison.

* It should be borne in mind that the Sind goat does not occur east of the river Indus, which was adopted by Dr. Jerdon, in the Prospectus published at the commencement of his "Birds of India," as the western boundary of the Indian fauna.

† This word is Persian, or rather, a corruption of the Persian *pdzahr*, which again is derived from *pá-zahr*, useful or profitable (against) poison.

By many old writers, however, it was supposed that the bezoar was procured from a kind of antelope, and Linnæus confounded the wild goat of Persia, the *Pá-sang* (rock-footed), with the Persian gazelle, the horns of which apparently were described by him as those of his *Capra bezoartica*. The first author who gave a clear account of the bezoar goat was S. G. Gmelin, frequently called the younger Gmelin, who obtained a specimen in the Elburz mountains of Northern Persia close to the southern coast of the Caspian Sea. He, however, erroneously stated that the females have no horns. A head and horns procured by Gmelin were sent to St. Petersburg and carefully described and figured under the name of *Ægagrus* by Pallas in his Spicilegia Zoologica, Fasc. xi, pp. 43-49, tab. v, fig. 2, 3, published in 1776. In this paper, which contains a description of *Capra Sibirica* (or as Pallas terms it *Ibex alpium Sibiricarum*), Pallas points out that the *Ægagrus* is the apparent progenitor, in part at least, of the domestic goat, a view which has been generally admitted. Indeed Gmelin in the 13th edition of the Systema Naturæ united the tame goat, *Capra hircus*, L., with the *Ægagrus* of Pallas, under the name of *Capra ægagrus*.

Schreber and other writers did little more than adopt the name *Capra ægagrus* and copy Pallas's description and figures, which were repeated with an additional representation of the skull and horn-cores in Pallas's Zoographia Rosso-Asiatica. The only difference shewn by these figures from the ordinary horns of the Sind ibex is that, in the head figured by Pallas, the horns are slightly curved towards each other near the tips, which is not the case in most Sind specimens. But any one who has studied ruminants knows that trifling variations of this kind occur, and that the difference is of no importance is shewn by Hutton's remarking* that, out of five pairs of horns in his possession, three were curved towards each other near the tips, and two were not. He also says† that some horns (of *C. ægagrus*) are turned inwards, others outwards, at the extremities. I think there can be no reasonable doubt but that the Sind ibex is identical with *C. ægagrus*.

It is quite unnecessary to enter further into the accounts of the animal in various European works beyond pointing out the confusion which has arisen about its name, and which has doubtless been the cause of its now receiving an additional synonym.

In the first Mammalian Catalogue published by the British Museum, the 'List of the specimens of Mammalia' issued in 1842, the name *Capra ægagrus* does not appear, but certain specimens, which are referred to *Capra Caucasica*, are said to be those described by Col. Hamilton Smith, who was one of the editors of Griffith's translation of Cuvier's 'Animal Kingdom'. The references in the British Museum list under *C. Caucasica* are; first:

* Calcutta Jour. Nat. Hist. II., p. 541. † Ibid. p. 528.

Güldenstädt, Act. Petrop. 1779, t. 16-17; second: H. Smith, Griffith, A. K. V. 871. The first is the original description of *Capra Caucasica*, an animal differing widely from *C. ægagrus*, and having massive horns not angulate in front. To the second I shall refer immediately.

In the next British Museum Catalogue, that of the *Ungulata Furcipeda* published in 1852, p. 153, the *Capra Caucasica* of the former catalogue is placed as a synonym under *Hircus ægagrus*, under which name both the *ægagrus* of Pallas and the tame goat, *Capra hircus* of Linnæus, are included, as they were by Gmelin, and again reference is made to Col. Hamilton Smith's description in Griffith's Animal Kingdom. It thus appears that Dr. Gray, the author of both British Museum catalogues, attributes the mistake about the name to Col. Hamilton Smith. But on turning to Griffith's Animal Kingdom, V, p. 357, I find No. 870, *Capra Caucasica* described as having "the horns triangular, the anterior edge obtuse, irregularly marked with transverse knots and uniform wrinkles," while *C. ægagrus* is quite correctly said to have the "horns forming an acute angle to the front, rounded at the back, transversely ribbed, forming an undulating anterior edge." It appears to me that the species were correctly discriminated by the older writer, and that the mistake of confounding them is Dr. Gray's.

Dr. Adams obtained the name *C. Caucasica* from the British Museum, and thus misled Jerdon, who, it may be seen, mentions in his Mammals, p. 292, that *Capra ægagrus* is found in Persia and other parts of Central and Western Asia; whilst on Adams's authority, though evidently with some doubt, he refers the wild goat of Sind and Baluchistan to *C. Caucasica*.

The synonymy given below will shew the confusion which has existed at the British Museum as to the name of this species. It figures by turns as *Capra Caucasica*, *C. hircus*, *Hircus ægagrus*, and if I am not mistaken *Hircus gazella*. Part of this confusion is I think due to the circumstance that Dr. Gray apparently looked upon the horns of *C. ægagrus* as those of a tame or feral race, and consequently united them with various tame goats. I have shewn that the wild *C. ægagrus* was united to the tame *C. hircus* by Gmelin, and the same author apparently mixed up half a dozen animals, one of which was the bezoar goat of Persia, in his *Antilope gazella*.*

Indian naturalists of a former generation were better acquainted with the wild goat of Western Asia than Dr. Gray appears to have been. The first mention that I can find of the existence of *Capra ægagrus* in the neighbourhood of India is in a paper by Captain Hutton published in the Calcutta Journal of Natural History for 1842, where the animal is correctly named, and an excellent description given of its colour at different seasons, its appearance and habits. The accompanying figure is not good. Captain

* *Capra gazella* of Linnæus is, I believe, the Cape Oryx.

Hutton also relates the success of some experiments made by him as to the effect of crossing the wild *Capra ægagrus* with tame goats, but he is disinclined to believe that the former is really identical in species with the latter. In Hutton's 'Rough notes on the Mammals of Candahar' in the Journal of the Society for 1846, he only refers to his previous description, and mentions the final result of his experiments in breeding between *C. ægagrus* and tame goats. The same animal apparently was obtained by Sir A. Burnes in Cabool, and was described by Dr. Lord in Appendix V to Burnes's work on that country, p. 386. He speaks of it as the Markhor-Pazuhu; the (latter word being perhaps a corruption of Pásang,) and notices that it is probably *Capra ægagrus*. A pair of horns obtained by Sir A. Burnes and named *C. ægagrus* by Blyth is in the Asiatic Society's collection, now the Indian Museum.

The following synonymy will enable any one to examine the history of the animal more fully: other references might be given, but the greater portion of them will be found quoted by the authors named. A most elaborate account of the habits of this animal in the Caucasus is given by Kotschy (l. c.).

CAPRA ÆGAGRUS.—*The Pásang or Persian wild goat.*

S. G. Gmelin, Reise. III., p. 493.
Ægagrus, Pallas, Spic. Zool. Fasc. XI, p. 43, Tab. V. fig. 2, 3, (1776).
Caucasan, Pennant, hist. quad. No. 14, p. 51.
Antilope gazella, Gmel., Syst. Nat. I, p. 190, *partim*, nec *Capra gazella*, L.
Capra ægagrus, Gmel., Syst. Nat. I, p. 193, *partim*.
Ægoceros ægagrus, Pall. Zool. Ros. As. I, p. 226, Tab. XVI, fig. 3, 4, 5.
Capra ægagrus, Schreb. Säugth. V, p. 1266, Pl. CCLXXXII.
Ægoceros ægagrus, Wagner, in Schreb. Säugth. V, 1, p. 1315.—Ib. Suppl. Pt. IV, p. 502.
Markhor-Pazuhu, Burnes, Cabool, p. 386, (1842).
Capra ægagrus, Hutton, Calcutta Jour. Nat. Hist. 1842, II, p. 521, Pl. XIX, (a poor figure of the whole animal).—J. A. S. B., XV, p. 161.
Capra Caucasica, Gray, List. Mam. Brit. Mus. (1843) p. 167.—Adams P. Z. S. 1858, p. 525; Wanderings of a naturalist, p. 36.
Hircus ægagrus, Gray, Cat. Ungulata Furcipeda Brit. Mus. (1852), p. 153, *partim*.—Cat. Rum. Mam. (1872), p. 53, *partim*.
Capra hircus, Gray, Cat. Ungulata Furc. Pl. XX, fig. 1, 2, (horns).
Capra ægagrus, Kotschy, Verh. Zool. Bot. Ver. Wien, IV, 1854, p. 201.—Blasius, Säugth. Deutschl. p. 485, fig. 264, (skull and horns).
? Hircus gazella, Gray, Cat. Rum. Mam. p. 53, *partim*.
Capra ægagrus, Blyth, Cat. Mam. Mus. As. Soc., p. 176. No. 544, (1863).
Capra Blythi, Hume, Proc. As. Soc. 1874, p. 240.
Pásang, male, *Boz*, female, Persian; *Borz*, Afghan; *Ter* (male) and *Sora*, Sindhi; *Phashin*, Baluchi.

I now turn to the Markhor. The first description of this animal was given by Wagner, under the name of *Ægoceros* (*Capra*) *Falconeri*, Hügel, and I may here remark that this name, given in honour of one of the most eminent of Indian naturalists, must be adopted for this wild goat, as it has priority by 3 years over Hutton's name *Capra megaceros;* Wagner's description having appeared in 1839 in the 'Gelehrte Anzeigen' of Munich. The skin and horns described were obtained by Freiherr v. Hügel from Kashmir. The animal was figured and again described in Wagner's appendix to Hügel's Kashmir, and both figure and description were repeated in the snpplement to Schreber's Säugethiere by the same author. The references are given at full in the synonymy below. The horns of the typical specimen have an unusually open spiral curve.*

Captain Hutton in 1842, described the 'Markhore' or the 'Snake-eater' of the Afghans, under the name of *Capra megaceros*, in the Calcutta Journal of Natural History, and gave a figure of the skull and horns. The form here figured is the Afghan variety, in which the spiral is so slight that the horns approach a straight line. This is the race for which Mr. Hume has proposed the name of *C. Jerdoni*,† but it is clear that if this animal be considered specifically distinct from the Kashmir *C. Falconeri*, Hutton's name must be retained for it. The same name *C. megaceros* was subsequently given by Cunningham in 1854, (Ladák p. 200), to the Kashmir form, but the author was under the impression that the animal was undescribed, and was unacquainted with either Hügel's or Hutton's name.

The most important question, however, is whether the Kashmir and Suliman forms of the Markhor are specifically distinct. At first it appears difficult to believe that animals belonging to the same species have in some instances horns with the open spiral of a corkscrew, and in others straight horns with only a deep spiral groove. As Mr. Blyth justly says‡, the horns vary in curve as much as those of the Koodoo do from those of the Impoofo (or Eland). But on the other hand it should be remembered not only that both forms of horns have long been perfectly well known to naturalists, but

* So different are these horns from those of most Markhor, that some naturalists have supposed them to have been obtained from a tame goat. But as has been shewn by Blyth, the spiral in tame goats is always reversed, the anterior ridge just above the forehead turning inwards or towards the other horn at first. In the Markhor this ridge turns outwards. Judged by this test Wagner's figure represents a wild Markhor and not a game goat. I have never myself seen Markhor horns with so open a spiral as those of Hügel's type of *C. Falconeri*.

† It is probable that Mr. Hume's specimens may have been less spiral in form than Hutton's type, for the former are described as resembling an ordinary screw. But as I shall shew, the precise form of the horns varies greatly.

‡ P. Z. S. 1840, p. 80.

that there are large numbers of them in Europe. Blyth, who was certainly not disposed to unite distinguishable forms, was well acquainted with both races, so were Gray, Jerdon, and Adams, yet every one of these naturalists looked upon the different forms of horn as of no specific importance, no other difference having been shewn to exist in the animal, and the form of the horns varying in each locality. There was a living male from near Peshawar recently (and there may be still) in the gardens of the Zoological Society of London with very straight horns, differing, if my recollection is correct, from the type of *C. megaceros* of Hutton, almost as much as this does from the Kashmir race, and on a photograph published by Mr. E. Ward, four distinct forms of Markhor horns are represented. Hutton in his original description of *C. megaceros* says, "They (the horns) are spirally twisted but differ much in the closeness of the volutions, some turning round a straight and direct axis from the base to the apex, others taking a wider or more circular sweep." Indeed so notorious is the fact that these horns vary in curvature, that Blyth for a long time looked upon the animal as a feral race of tame goat and not a truly wild animal*, and Vigne, who met with the Markhor both in Afghánistán and Káshmir, and who noticed the difference in the horns, pointed out that no other distinction existed in the animal.

As in the case of *Capra ægagrus* I give the synonymy below. In this I do not separate the two forms, because, so far as I am aware, no sufficient evidence has yet been adduced to shew that they deserve separation. But should such evidence hereafter be brought forward, I may repeat that the name *Capra Falconeri* will stand for the Kashmir form with openly spiral horns, and that of *C. megaceros* for the Suliman race with the horns more nearly approaching a straight line; it being remembered that much variation exists in both cases.

CAPRA FALCONERI.—*The Markhor.*

Markhor goat, Vigne, Personal Narrative of a visit to Ghuzni, Cabul, &c. p. 86, and vignette, p. 67.—Travels in Kashmir, &c., II., p. 279.

Ægoceros (Capra) Falconeri, Hügel: Wagner, Münch. Gel. Anz. IX, p. 430 (1839).

Markhor, Blyth P. Z. S. 1840, p. 80.—Ann. and Mag. Nat. Hist. VII. 1841, p. 196, note.

? Rass, Wood, Journey to source of the Oxus, p. 369 (1841).

Markhor, Burnes, Cabool, p. 387 (1842).

Capra megaceros, Hutton, Calcutta Jour. Nat. Hist. II, p. 535, Pl. XX, (horns), (1842). J. A. S. B., XV., p. 161.

Capra Falconeri, Hügel; Wagner, Beiträge zur Säugeth. Faun. in Hügel's Kaschmir, p. 579, (with a lithograph of the animal), (1844).

Ægoceros Falconeri, Wagner, Schreber's Säugethiere, Suppl. IV, p. 499, Tab. CCLXXXVII E,—Ib. V, p. 466.

* P. Z. S. 1840, p. 80.

Hircus ægagrus, var. 1. Gray, Cat. Ung. Furc. B. M. (1852), p 159.
Capra megaceros, Rapho-chhe, (Markhor) or large wild goat. Cunningham's Ladák, p. 199, Pl. 17, (1854).
Hircus megaceros, Adams, P. Z. S., 1858, p. 525.
Capra megaceros, Blyth, Cat. Mam. Mus. A. S., p. 176 (1863).—Jerdon, Mammals of India, p. 291 (1867).
Hircus Falconeri, Gray, Cat. Rum. Mam. B. M. 1872, p. 53.
Capra Jerdoni, Hume, Proc. A. S. B. 1874, p. 240.
Markhor, Afghan: *Ra-che*, (Rawa-che and Rapho-che ♂ and ♀), Ladák.

I have already referred to the *Capra bezoartica* of Linnæus. This was founded on the various accounts of the bezoar goat given by older writers, amongst whom was Aldrovandi. Blyth has derived the specific name *bezoartica*, which he adopts* for the common Indian antelope, from Aldrovandi, and Jerdon† has followed Blyth in this as in most questions of mammalian nomenclature, so that in both lists this animal stands as *Antilope bezoartica*, Aldrovandi.

Now there is no rule more generally admitted, amongst English zoologists at least, than that specific names given before the publication of the 12th edition of Linnæus's Systema Naturæ in 1766 are invalid.‡ Aldrovandi§ dates from 1621.

* Cat. Mam. Mus. As. Soc. p. 171, No. 528.

† Mam. Ind. p. 275, No. 228.

‡ Unless there is agreement amongst naturalists as to the adoption of rules for nomenclature, it is evident that the sole object of a scientific terminology, that all people of whatever race, despite difference of language, should employ the same term for the same animal, plant, mineral, &c., would not be gained. Any one would suppose that this is a self-evident proposition and that it is to the advantage of all naturalists to agree to fixed rules of nomenclature, but, strange to say, it is incredibly difficult to induce many to consent to any rules. So long as the absurd idea exists that species and genus-makers have rights which require protection, so long will anarchy prevail. The law of priority is established for general convenience and to enforce a fixed nomenclature, not to commemorate the makers of species.

The rules drawn up by a Committee of the British Association in 1842 (Rept. Brit. As. 1842, p. 106) and approved, with slight alterations, by another Committee of the same body in 1865 (Rept. B. As. 1865, p. 25) are the fairest yet proposed for regulating scientific nomenclature, and they should be adopted until other rules are established by general consent. To many naturalists in India these rules do not appear to be known, and I may therefore be excused for referring to them. The rules of Linnæus are republished at the commencement of the "Nomenclator Zoologicus" of Agassiz, but so many of them have been broken habitually for years, that they have become obsolete. Had they been enforced, zoological nomenclature would never have become the chaos it now is, and much advantage would I think be gained if they were better known than they are, and their general spirit at least adopted.

§ Aldrovandi, Quad. Bis. p. 256, under *Capra bezoartica*, gives a figure probably meant for the Indian antelope, but in the text he describes several species, one of them

The *Capra bezoartica* of Linnæus is thus described "*Capra bezoartica cornibus teretibus arcuatis totis annulatis, gula barbata.*" The bearded chin, and the description of the animal's habits refer, I think, to the bezoar goat of Persia, *Capra ægagrus*, whilst the round *arcuate* horns are probably those of a Gazelle, and very possibly those of *Gazella subgutturosa*, the species found in Persia. The description cannot possibly be made to agree with the Indian antelope.

The first description of the Indian antelope published after the appearance of the 12th edition of Linnæus is that of Pallas, whose first fasciculus of the Spicilegia Zoologica, published in 1767, contains a monograph of the genus *Antilope*. The Indian antelope is there described as *A. cervicapra*, p. 18, No. 16, and figured in Tab. I. and II. The *bezoartica* of the same monograph No. II., p. 14, is apparently an oryx.

Gmelin, Schreber, Wagner, and almost all continental writers have adopted Pallas's name for the species, and it has undoubted priority over all others. The same name appears to have been used by most English writers until lately. Error in this case, as in that of *Capra ægagrus*, is to be traced apparently to the British Museum Catalogues,* in which the species was named *Cervicapra bezoartica* upon a well known principle, which although admissible, is extremely objectionable, that of converting the specific name into a generic term and coining a new specific term. This was in the catalogue of 1843, in which the only species retained under the genus Antilope was *A. melampus*. In both the subsequent catalogues, those of 1852 and 1872, the Indian antelope is made the sole member of the genus *Antilope*, Sundevall's genus *Æpyceros* being employed for *A. melampus*, but instead of restoring Pallas's specific name, Dr. Gray has in violation of all rule retained his own (or Aldrovandi's) most objectionable appellation *bezoartica*. It is a question whether this name should be preserved at all, in the first place it is misleading, as the Indian antelope is not the bezoar goat, and in the second place it leads to confusion because the animal is not the *Capra bezoartica* of Linnæus; but if the antelope be placed in the genus *Antilope*, there can be no question that its proper name is *A. cervicapra*.

There remains, however, one question to be decided, and that is, whether *A. cervicapra* is correctly made the type of the genus *Antilope*. This genus was not employed by Linnæus, who placed the species of antelope known to him, with the goats, under *Capra*. The modern genus must therefore be derived from Pallas, who, as already mentioned, published a

probably the wild goat of Persia. It is evident that he meant to give the name to the animal from which bezoar was obtained, and he figured the Indian antelope under the mistaken idea that it was the real bezoar-producing animal.

* List Sp. Mam. B. M., 1843, p. 159.—Cat. Mam. Ungulata Furcipeda, 1852, p. 66.—Cat. Rum. Mam. 1872, p. 40.

monograph of *Antilope* in 1767, (Spic. Zool. No. I.) This monograph includes 16 species, the last of which is *A. cervicapra*.

The old Linnæan rule is that when a genus is divided, the majority of the species shall be retained under the old generic name, and a new name be given to the smaller section. There is another rule adopted by some naturalists, *viz.*, to keep the generic name for the species first placed in the list by the original author of the genus. This last rule has led to absurdities, and, as Dr. Günther has shewn, it would render the common crocodile the type of the genus *Lacerta*. Practically it has been usual to allow any one dividing one of the old genera into several to retain the original name for whichever section he thought best, and the old generic name has usually been preserved for the best known species and its affines.

The first naturalist who divided the old genus *Antilope* was Blainville,* who in 1816 broke it up into 9 generic groups. In the first of these, *Antilope*, he retained 3 species, *A. cervicapra*, *A. saiga*, and *A. gutturosa*. The next author who divided the genus, Hamilton Smith, retained the same species with some additions, but this is of small importance. Blainville also established a genus *Cervicapra* containing a very miscellaneous collection of species; *A. dama*, *A. redunca*, *A. oreotragus*, *A. saltiana*, *A. sumatrensis*, *A. quadricornis*, and several others.

Of the three species left in the genus *Antilope* by Blainville, *A. saiga* was made into a distinct genus by Gray in 1843, and *A. gutturosa* appears to belong to *Gazella* and not to restricted *Antilope*. It is placed in *Gazella* by Sundevall and Sir V. Brooke, whilst Gray in his later catalogues associates it with *Procapra picticauda* of Hodgson, a form which must I think also be referred to the gazelles. The sole remaining representative of the genus *Antilope* is consequently the Indian antelope, which cannot be assigned to the genus *Cervicapra*, because it was not placed in that genus by Blainville, who first used the name, nor is it congeneric with any of the species assigned to *Cervicapra* by Blainville. Gray's genus *Cervicapra* falls to the ground, because if the name be used at all, it can only be employed for Blainville's genus or part of Blainville's genus. On all grounds, therefore, it appears that the correct generic and specific name of the Indian antelope is *Antilope cervicapra*.

* Bul. Soc. Phil. 1816, p. 74. I have not access to this work and quote from Wagner and Fitzinger.

VI.—*On some recent Evidence of the Variation of the Sun's Heat.*—By Henry F. Blanford, *Meteorologist to the Government of India.*

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Since the British Association meeting at Brighton in 1872, at which Mr. Meldrum brought to notice the fact that the Cyclones of the Indian ocean vary in frequency with the period of sun-spot frequency, several attempts have been made to trace out the evidence of a similar periodicity in other meteorological phenomena. Mr. Meldrum and Mr. Norman Lockyer have done this in the case of the rainfall, with the result of shewing that in the Mauritius, Australia, South Africa and some other parts of the world such a variation is to be detected more or less distinctly in the registers. And Professor Köppen has arrived at a similar conclusion in the case of air temperature, a result on which I shall have again to offer some remarks in the sequel. All these results point to the conclusion that the radiation of the sun is not appreciably constant from year to year,* but varies with the appearance and physical state of his surface.

Long prior to any of these discoveries, the possible variation of the sun's heat and of its influence on the earth had been the subject of speculation among solar physicists. According to Professor Wolf, (as quoted by Professor Köppen,) Riccioli, in 1651, shortly after the first discovery of sun-spots, surmised that some coincidence might exist between them and terrestrial weather changes. Sir William Herschell endeavoured to establish such a connexion by discussing one of their remote effects, *viz.*, the rise and fall in the price of wheat in past years. Sabine established a connexion between the solar-spot period and that of magnetic storms; Fritz between the former and the frequency of auroras; and finally, in 1867, Mr. Joseph Baxendell of Manchester succeeded in tracing out a distinct and very striking relation between the number of the sun spots, and the ratio that exists between the difference of the mean maximum temperature of solar radiation and the mean maximum air temperature on the one hand, and that of the mean temperatures of the air and of evaporation on the other.

All these investigations, it will be noticed, have dealt with the problem in an indirect form: that of Mr. Baxendell being, however, the most direct, and perhaps as direct as the data at his command (six years observations of the Radcliffe observatory, and five years of Mr. Mackereth's register at Eccles near Manchester) would admit of. The causes that interfere with the direct transmission of the sun's heat to the earth's surface are so powerful and at the same time so variable, that even with more perfect instruments than

* As was assumed by Mr. Meech in his elaborate treatise on Solar heat in the IXth Volume of the "Smithsonian Contributions to Knowledge."

we possess at present, it is not to be expected that in English latitudes and under her variable and cloudy skies, the temperature of the solar heat incident on the earth's surface, recorded at two stations only, should coincide at all distinctly in variation with that of the heat emitted from the sun. Still, by a very ingenious treatment of the data, Mr. Baxendell succeeded in shewing, with great probability, that the sun's radiation varied in intensity directly with the observed number of the spots during the years 1859 to 1866.

It was still desirable, however, that further and more direct proof should be obtained, and it is obvious that for such a purpose, no country offers more favourable conditions than India; and fortunately, owing in no small degree to the urgent representations of this Society in past years, the means provided by the Government of Bengal, in the establishment of systematic observations throughout its provinces, have put it in my power to bring before the Society this evening, evidence, which if not absolutely conclusive, at least leaves, I think, but little room for doubt, that the old speculations are true; and that the sun's heat varies from year to year, to such an extent as must appreciably affect terrestrial phenomena.

Registers of the readings of a maximum thermometer, the bulb of which is coated with lamp-black and which is enclosed in an exhausted tube,* were commenced at a few stations in Bengal in the latter part of 1867 or the beginning of 1868; at others the observations were begun in subsequent years. The instruments are freely exposed to the sun's rays, supported on forked sticks at a height of one foot above the ground† and their readings have been recorded on all days, whether clear or cloudy. Being very fragile, and exposed without protection, they are unfortunately very subject to breakage, and although therefore their registers extend in most cases over a period of six or seven years, I can find but one station on my list at which the register has been kept continuously for more than five years with one and the same instrument. This fact very much reduces the quantity of data available for discussion. It appears that, from some cause at present unexplained, these thermometers, made by the best London makers, sometimes differ in their readings to the extent of several degrees (I have known differences of 10° and 15°) when exposed under apparently identical circumstances; and there have been hitherto no means of comparing them together in Calcutta in the only effectual way, *viz.*, by exposing them side by side to the solar radiation, and correcting all to some one instrument, arbitrarily selected as a standard. In dealing with the registers then, I

* In one of these tubes which I opened, (that of a thermometer by Messrs. Negretti and Zambra,) I found the residual air to have a pressure at the freezing point of 1·26 ins. about equal to a vacuum of $\frac{1}{24}$.

† At Roorkee the instrument is about 4 feet above the ground.

have been obliged to restrict my comparison to those of consecutive years that have been recorded with the same instrument, and wherever an instrument has lasted over a single twelvemonth only or less, its register has been totally set aside.

The next precaution necessary is to eliminate as far as possible from the individual registers, those irregularities which are due to variations in the state of the sky. This, however, can be done but very imperfectly, otherwise than on the mean of a very large number of observations. It results from the actinometric observations of Pouillet, Kämtz, Quetelet and Althaus, that with a vertical sun, and a sky free from all visible cloud or haze, the proportion of solar heat that penetrates the whole thickness of the atmosphere, and is therefore effective at sea-level, does not amount to more than two-thirds or at the utmost three-fourths of that which reaches the exterior of our atmosphere. Herschell estimates it at the former quantity. But in India, the atmosphere, when cloudless to the eye, is by no means so diathermanous as is here assumed. Sometimes for many days together, with settled weather and a cloudless sky, the sun thermometer gives steady maximum readings, not differing more than one or two degrees. A day follows on which there is a good deal of cloud, and perhaps some rain, and the diathermancy of the atmosphere is so increased in the intervals of the clouds, that the sun-thermometer registers 10° or 15° above any of its previous readings. Such cases occur frequently in all the registers. It is probable therefore that on days registered as cloudless, not less than half the solar radiation and frequently much more is absorbed by the atmosphere. In order to obtain data that shall be fairly comparable, I have in most cases selected those days on which the sky was either cloudless at 10 A. M. and 4 P. M., or had on the average not more than one-fifth of cloud. In the case of the two comparatively cloudy stations Silchar and Port Blair, I have been obliged to extend these limits; in the former case to three tenths, in the latter to one half. The monsoon months, June to September, are omitted in these tables.

Another method of proceeding which I have adopted in order to verify these results is to take the two highest readings recorded in each month (including the monsoon months) as the data for comparison.

The four following tables give the results. In Tables I. and II. the comparison is restricted to the registers of those stations and years in which the same instrument has been read continuously for at least two consecutive calendar years. The differences of each pair of years are given separately for each station, and the means of the whole. This method of comparison, however, admits of a very small portion only of the data being utilized, since it excludes all broken years, and therefore in Tables III. and IV. I have adopted a modified course of proceeding, which admits these.

I have taken first for each station separately the temperature differences of each pair of homonymous months in consecutive years, rejecting as before all those in which the instrument has been changed in the interval; and next the mean of all the differences thus obtained for the same pair of months. A rise of temperature is indicated by +, a fall by —.

TABLE I.—*Differences of annual means of black-bulb temperatures with a clear sky (as above defined).*

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair.		+2·2				—1·7
Cuttack,				+1·8	+1·4	0
Chittagong,				—0·8	—1·9	0
Dacca,				+2·6	—2·2	—0·4
Hazaribagh,	+2·9	+1·9				—4·4
Berhampore,						—2·4
Patna,	+7·7					
Monghyr,		+2·9	—0·1			
Silchar,			—2·1	0	—1·8	+6·3
Roorkee,			+2·3			—5·6
Sums,	+10·6	+7·0	+0·1	+3·6	—4·5	—8·2
Means,	+5·3	+2·3	0	+0·9	—1·1	—1·0

TABLE II.—*Differences of annual means of two highest black bulb temperatures monthly.*

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,		+2·9				—1·3
Cuttack,				+2·6	+2·5	—2·3
Chittagong,				—1·7	—0·4	+1·3
Dacca,				+1·7	—1·2	+1·2
Hazaribagh,	+2·8	+3·7				—3·9
Berhampore,						—1·2
Patna,	+6·0					
Monghyr,		+0·3	—1·0			
Silchar,			+1·8	—2·3	—0·3	+7·7
Roorkee,			—0·9			—3·9
Sums,	+8·8	+6·9	—0·1	+0·3	+0·6	—2·4
Means,	+4·4	+2·3	0	+0·1	+0·1	—0·3

TABLE III. A.—*Differences of monthly means of black-bulb temperatures with clear sky.*

JANUARY.

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,		— 1·3	+ 3·3			— 8·2
Cuttack,				— 5·0	+ 8·3	— 0·6
Chittagong,				— 2·5	— 3·0	— 1·5
Jessore,	+ 1·7					
Dacca,				— 1·0	— 2·6	— 3·2
Hazaribagh,	— 3·5	+ 5·9	— 1·0			— 5·5
Berhampore,		— 2·9		— 3·4		— 11·8
Silchar,			+ 2·3	— 5·1	— 1·0	0
Monghyr,		+ 1·5	+ 3·8	— 4·7		
Patna,	+ 6·7	+ 8·6				
Roorkee,			— 3·1	— 5·2		— 12·0
Means,	+ 1·6	+ 2·4	+ 1·3	— 3·8	+ 0·4	— 5·3

FEBRUARY.

Port Blair,		— 2·7	+ 4·9			— 2·5
Cuttack,				— 5·0	+ 7·2	— 1·4
Chittagong,				— 4·7	— 0·7	+ 0·5
Jessore,	+ 1·6					
Dacca,				— 1·7	— 0·5	— 3·3
Hazaribagh,	+ 2·2	+ 2·5	+ 3·9			— 0·8
Berhampore,		— 4·2		— 5·1		— 11·3
Silchar,			+ 0·5	— 5·1	+ 2·4	0
Monghyr,		+ 3·2	+ 1·5	— 4·8		
Patna,	+ 20·2	— 3·4				
Roorkee,			— 6·8	— 0·2		— 9·7
Means,	+ 8·0	— 0·9	+ 0·8	— 3·8	+ 2·1	— 3·6

MARCH.

Port Blair,		+ 5·4	+ 2·8			— 7·1
Cuttack,				— 4·8	+ 4·0	+ 0·2
Chittagong,				+ 0·5	— 0·4	— 1·5
Jessore,	+ 2·7					
Dacca,				+ 4·3	— 2·1	+ 0·2
Hazaribagh,	+ 5·0	— 2·3	+ 8·2		— 3·4	— 4·7
Berhampore,		+ 1·6		— 3·1		+ 13·1
Silchar,			— 1·5	— 1·9	— 1·4	+ 1·9
Monghyr,		— 0·4	+ 3·6	— 1·5		
Patna,	+ 19·2					
Roorkee,			+ 0·9	— 9·3		— 15·3
Means,	+ 9·0	+ 1·1	+ 2·8	— 2·3	— 0·7	— 1·7

APRIL.

Stations.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,		+ 3·8	— 3·2			+ 1·0
Cuttack,			— 0·6	+ 2·7	— 3·9	+ 2·3
Chittagong,			— 0·2	+ 1·8	— 2·0	— 1·7
Jessore,	+ 4·2					
Dacca,			— 4·0	+ 5·1	— 2·9	0
Hazaribagh,	+ 10·0	— 2·1	+ 1·7		— 6·3	— 6·2
Berhampore,		+ 3·6		— 7·3		+ 5·7
Silchar,			— 3·5	+ 1·4	— 6·0	+ 5·3
Monghyr,		— 0·3	+ 1·9	— 2·5		
Patna,	+ 8·4					
Roorkee,			+ 6·1		+ 5·6	— 8·1
Means,	+ 7·5	+ 1·1	— 0·2	+ 0·2	— 2·6	— 0·2

MAY.

Port Blair,		— 0·7	— 3·9			— 7·7
Cuttack,			— 5·9	+ 9·7	— 5·5	— 1·9
Chittagong,			+ 3·7	— 5·6	— 1·8	— 0·2
Jessore,						
Dacca,			— 6·7	+ 5·4	— 3·7	+ 0·1
Hazaribagh,	+ 14·2	— 6·6	+ 2·6		— 2·6	— 4·4
Berhampore,		+ 9·9			+ 5·0	— 7·2
Silchar,			— 1·9	+ 1·0	— 3·2	+ 5·9
Monghyr,		+ 1·7	— 4·6			
Patna,	+ 3·9					
Roorkee,			— 1·1		+ 6·7	— 4·9
Means,	+ 9·1	+ 1·1	— 2·2	+ 2.6	— 0·7	— 2·5

OCTOBER.

Port Blair,	— 1·7	— 8·0			— 8·8	+ 4·0
Cuttack,			— 3·8	+ 4·0	+ 0·2	+ 2·5
Chittagong,			— 5·5	+ 4·1	— 4·3	+ 2·4
Jessore,		+ 6·0				
Dacca,			— 0·6	+ 2·5	— 2·3	+ 4·7
Hazaribagh,	— 7·0	+ 10·6			— 6·9	— 4·1
Berhampore,			+ 0·3		— 12·7	— 1·9
Silchar,			— 4·0	+ 4·6	— 1·3	+ 6·4
Monghyr,	— 4·4	+ 9·0	— 2·9			
Patna,	— 5·0					
Roorkee,			+ 4·6		— 1·3	+ 3·8
Means,	— 4·5	+ 8·4	— 1·7	+ 4·0	— 4·7	+ 2·7

NOVEMBER.

STATIONS.	1868-9.	1869-70.	1870-1.	1871-2.	1872-3.	1873-4.
Port Blair, ...	— 6·4	+ 0·8			— 2·1	+ 2·1
Cuttack, ...			— 0·5	+ 4·6	+ 1·2	— 1·8
Chittagong, ...			— 2·3	— 0·5	— 1·8	+ 3·1
Jessore, ...		+ 5·7				
Dacca, ...			+ 0·1	+ 4·6	— 1·9	— 0·8
Hazaribagh, ...	— 1·2	+ 4·8			— 3·6	— 7·9
Berhampore, ...	— 0·5		+ 1·9		—13·4	— 4·3
Silchar, ...			— 5·9	+ 5·4	— 4·0	+15·4
Monghyr, ...	— 2·8	+ 3·9	— 0·8			
Patna, ...	— 0·3					
Roorkee, ...		— 9·6	+ 3·1		— 3·5	+ 0·3
Means,	— 2·2	+ 1·3	— 0·6	+ 3·5	— 3·6	+ 0·8

DECEMBER.

Port Blair, ...	— 1·7	+ 4·8			— 4·8	+ 4·6
Cuttack, ...			— 2·5	+ 6·2	+ 1·7	— 1·4
Chittagong, ...			— 2·6	+ 0·3	— 0·7	— 1·4
Jessore, ...		+ 2·8				
Dacca, ...			+ 0·2	+ 2·0	— 2·3	— 0·4
Hazaribagh, ...	+ 3·4	+ 2·1			— 0·4	— 5·7
Berhampore, ...	— 4·8		— 0·7		—10·9	— 5·1
Silchar, ...			— 3·4	+ 0·2	— 0·3	+15·5
Monghyr, ...	+ 0·5	+ 4·3	— 3·5			
Patna, ...	+ 8·5					
Roorkee, ...		— 2·6	+ 1·3		— 5·3	+ 1·3
Means,	+ 1·2	+ 2·3	— 1·6	+ 2·2	— 2·9	+ 0·9

TABLE III. B.—*Mean monthly and annual differences of black-bulb temperatures with a clear sky.*

MONTHS.	1868-9.	1869-70.	1870-1.	1871-2.	1872-3.	1873-4.
January, ...	+ 1·6	+ 2·4	+ 1·3	— 3·8	+ 0·4	— 5·3
February, ...	+ 8·0	— 0·9	+ 0·8	— 3·8	+ 2·1	— 3·6
March, ...	+ 9·0	+ 1·1	+ 2·8	— 2·3	— 0·7	— 1·7
April, ...	+ 7·5	+ 1·1	— 0·2	+ 0·2	— 2·6	— 0·2
May, ...	+ 9·1	+ 1·1	— 2·2	+ 2·6	— 0·7	— 2·5
October, ...	— 4·5	+ 8·4	— 1·7	+ 4·0	— 4·7	+ 2·7
November, ...	— 2·2	+ 1·3	— 0·6	+ 3·5	— 3·6	+ 0·8
December, ...	+ 1·2	+ 2·3	— 1·6	+ 2·2	— 2·9	+ 0·9
Sums,	+29·7	+16·8	— 1·4	+ 2·6	—12·7	— 8·9
Means,	+ 3·7	+ 2·1	— 0·2	+ 0·3	— 1·6	— 1·1

TABLE IV. A.—*Differences of monthly means of two highest black-bulb temperatures in consecutive years.*

JANUARY.

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,		0	— 1·0			— 13·0
Cuttack,				— 3·5	+ 7·8	— 0·1
Chittagong,				— 2·0	— 1·3	+ 1·4
Jessore,	+ 1·0					
Dacca,				+ 0·6	— 0·9	— 4·7
Hazaribagh,	— 3·0	+ 9·0	— 2·5			— 4·0
Berhampore,		— 5·7		— 3·2		— 8·5
Silchar,			— 3·0	— 3·0	+ 4·5	+ 1·0
Monghyr,		+ 2·5	— 2·0	— 1·0		
Patna,	+ 17·0	— 7·0				
Roorkee,			+ 2·0	— 4·0		— 10·1
Sums,	+ 15·0	— 1·2	— 6·5	— 16·1	+ 10·1	— 38·0
Means,	+ 5·0	— 0·2	— 1·3	— 2·3	+ 2·5	— 4·7

FEBRUARY.

Port Blair,		— 3·0	— 1·0			— 5·0
Cuttack,				— 7·2	+ 7·4	— 2·3
Chittagong,				— 8·6	— 1·4	+ 4·6
Jessore,	+ 3·4					
Dacca,	..			— 0·6	+ 0·6	+ 0·6
Hazaribagh,	+ 9·0	— 2·5	+ 3·5			— 3·0
Berhampore,		— 6·7		— 0·2		— 10·7
Silchar,			— 0·5	— 3·5	+ 2·0	— 1·0
Monghyr,		+ 0·5	+ 3·5	— 10·5		
Patna,	+ 20·0					
Roorkee,			— 9.5	+ 4·5		— 10·8
Sums,	+ 32·4	— 11·7	— 4·0	— 26·1	+ 8·6	— 24·6
Means,	+ 10·8	— 2·9	— 0·8	— 3·7	+ 2·1	— 3·1

MARCH.

Port Blair,		+ 6·5	+ 1·0			— 5·5
Cuttack,				+ 0·5	+ 0·2	— 2·3
Chittagong,				+ 2·0	— 1·2	+ 0·2
Jessore,	— 2·5					
Dacca,				+ 4·1	— 3·5	— 0·6
Hazaribagh,	+ 2·0	+ 7·5	+ 1·0		— 3·7	— 6·0
Berhampore,		+ 5·7		— 2·5		— 6·7
Silchar,			— 1·0	— 6·0	— 3·0	+ 4·5
Monghyr,		+ 1·0	+ 2·5	— 3·5		
Patna,	+ 12·5					
Roorkee,			+ 0·5	+ 4·2		— 9·6
Sums,	+ 10·0	+ 25·7	+ 4·0	— 1·2	— 11·2	— 26·0
Means,	+ 3·3	+ 6·4	+ 0·8	— 0·2	— 2·2	— 3·2

APRIL.

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,		+ 5·0	— 3·0			— 2·5
Cuttack,			+ 1·0	— 3·2	— 0·4	+ 3·0
Chittagong,			+ 5·6	— 3·5	— 2·0	+ 1·7
Jessore,	— 0·5					
Dacca,			+ 1·4	+ 3·2	— 4·2	+ 1·4
Hazaribagh,	+ 10·5	0	+ 2·0		— 7·5	— 4·0
Berhampore,		+ 2·2		— 6·7		— 6·7
Silchar,			— 5·5	— 4·5	— 4·5	+ 10·0
Monghyr,		— 3·5	+ 1·5	0		
Patna,	+ 2·5					
Roorkee,			+ 1·5	— 3·7		— 7·1
Sums,	+ 12·5	+ 3·7	+ 4·5	— 18·4	— 18·6	— 4·2
Means,	+ 4·2	+ 0·9	+ 0·6	— 2·6	— 3·7	— 0·5

MAY.

Port Blair,		+ 3·5	— 2·5			— 5·0
Cuttack,			— 7·0	+ 4·0	— 1·5	+ 1·9
Chittagong,			— 1·0	— 4·2	+ 6·6	— 6·9
Jessore,						
Dacca,			— 3·1	+ 1·6	+ 0·4	— 1·9
Hazaribagh,	+ 7·5	+ 1·5	— 6·0		— 8·0	— 1·2
Berhampore,		+ 7·5		+ 1·2	+ 8·0	— 2·0
Silchar,			+ 8·5	— 2·0	— 6·5	+ 8·5
Monghyr,		+ 3·0	— 7·0			
Patna,	+ 0·5					
Roorkee,			— 2·0		— 1·0	+ 2·4
Sums,	+ 8·0	+ 15·5	— 20·1	+ 0·6	— 2·0	— 4·2
Means,	+ 4·0	+ 3·9	— 2·5	+ 0·1	— 0·3	— 0·5

JUNE.

Port Blair,		+ 14·0				+ 6·5
Cuttack,			— 14·0	+ 9·0	+ 15·0	— 19·0
Chittagong,			— 2·5	+ 2·1	— 2·3	+ 5·4
Jessore,						
Dacca,			+ 2·5	+ 1·1	+ 0·1	+ 2·4
Hazaribagh,	+ 3·5	+ 7·5	— 4·5		— 4·5	— 12·0
Berhampore,	+ 3·0	+ 4·0			+ 4·2	— 0·5
Silchar,			+ 17·5	— 1·5	— 7·5	+ 14·5
Monghyr,	+ 5·0	+ 5·0	— 3·5			
Patna,	+ 4·0					
Roorkee,			— 4·0		+ 1·5	— 6·3
Sums,	+ 15·5	+ 30·5	— 8·5	+ 10·7	+ 6·5	— 9·0
Means,	+ 3·9	+ 7·6	— 1·2	+ 2·7	+ 0·9	— 1·1

JULY.

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,		+ 3·0				+ 11·0
Cuttack,			+ 1·5	— 3·5	— 0·2	+ 4·9
Chittagong,			— 1·4	— 4·5	— 3·4	+ 3·7
Jessore,						
Dacca,			+ 3·1	+ 0·1	— 5·7	+ 4·1
Hazaribagh,	— 5·0	+ 7·0	— 8·0		— 4·2	— 2·2
Berhampore,	+ 0·5		— 3·5		+ 1·7	— 4·5
Silchar,			+ 9·5	— 3·5	— 1·0	+ 7·5
Monghyr,	— 2·0	— 2·0	+ 0·5			
Patna,	— 4·5					
Roorkee,			— 3·0		+ 11·1	— 12·1
Sums,	— 11·0	+ 8·0	— 1·3	— 11·4	— 1·7	+ 12·4
Means,	— 2·8	+ 2·7	— 0·2	— 2·8	— 0 2	+ 1·5

AUGUST.

Port Blair,		+ 3·0				— 9.5
Cuttack,			— 2·2	+ 2·2	+ 0·9	+ 0·6
Chittagong,			— 0·9	— 3·6	+ 3.6	+ 1·3
Jessore,						
Dacca,			0	+ 7·0	— 0·9	+ 2·4
Hazaribagh,	+ 0·5	— 2·0	+ 0·5		— 9·5	+ 2.2
Berhampore,	+ 10·0		— 2·7		— 7·0	+ 3·5
Silchar,			— 2·0	— 3·0	+ 7·0	+ 5·5
Monghyr,	+ 5·0	— 5·0	+ 1·0			
Patna,	+ 16·5					
Roorkee,			— 0·6		+ 2·8	— 1·2
Sums,	+ 32·0	— 4·0	— 6·9	+ 2·6	— 3·1	+ 4·8
Means,	+ 8·0	— 1·3	— 0·9	+ 0·6	— 0·4	+ 0·6

SEPTEMBER.

Port Blair,		— 3·5			— 2·0	+ 3·0
Cuttak			— 5·7	+ 14·4	—10·9	+ 3·7
Chittagong,			— 3·0	+ 0·4	+ 1·7	— 1·4
Jessore,		— 5·0				
Dacca,			— 4·9	+ 2·0	— 1·6	+ 8.1
Hazaribagh,	+ 1·5	+ 6·5			—10·5	+ 0.5
Berhampore,	— 1·5		— 1·0		— 9·7	+ 5·5
Silchar,			+ 8·0	— 3·0	+ 6·5	+ 2·0
Monghyr,	+ 6·5	— 5·5	— 1·0			
Patna,	+ 6·5					
Roorkee,			+ 1·5		+ 3·1	+ 1·0
Sums,	+ 13·0	— 7·5	— 6·1	+ 13·8	—23·4	+ 22·4
Means,	+ 3·3	— 1·9	— 0·9	+ 3·4	— 2·9	+ 2·8

OCTOBER.

STATIONS.	1868-9	1869-70	1870-1	1871-2	1872-3	1873-4
Port Blair,	— 1·0	+ 6·0			+ 0·5	0
Cuttack,			— 4·0	+ 7·5	— 0·9	+ 0·1
Chittagong,			— 0·4	— 0·5	— 1·7	+ 4·0
Jessore,		— 2·1				
Dacca,			— 3·4	+ 0·4	— 0·1	+ 2·9
Hazaribagh,	— 5·5	+ 7·0			+ 1·5	— 7·5
Berhampore,	+ 8·0		— 1·0		— 11·2	+ 4·0
Silchar,			+ 8·0	— 11·0	+ 2·5	+ 15·5
Monghyr,	+ 0·5	+ 3·0	— 3·0			
Patna,	+ 1·5					
Roorkee,			— 0·5		+ 0·7	+ 2·7
Sums,	+ 3·5	+ 13·9	— 2·3	— 3·6	— 8·7	+ 21·7
Means,	+ 0·7	+ 3·5	— 0·3	— 0·9	— 1·1	+ 2·7

NOVEMBER.

Port Blair,	— 5·5	+ 2·0			— 3·0	+ 4·0
Cuttack,			—13·0	+ 9·2	+ 0·8	— 4·7
Chittagong,			— 4·8	+ 7·4	— 3·9	+ 3·9
Jessore,		+ 7·9				
Dacca,			0	— 0·6	+ 1·6	+ 5·6
Hazaribagh,	0	+ 6·5			— 4·7	— 4·2
Berhampore,	+ 1·5		— 3·5		—12·0	+ 2·0
Silchar,			— 4·5	+ 3·5	— 1·5	+14·5
Monghyr,	— 6·5	+ 5·5	— 1·5			
Patna,	— 2·0					
Roorkee,		— 7·5	0		— 4·1	+ 4·3
Sums,	—12·5	+14·4	—27·3	+19·5	—26·8	+25·4
Means,	— 2·5	+ 2·9	— 3·9	+ 4·9	— 3·3	+ 3·2

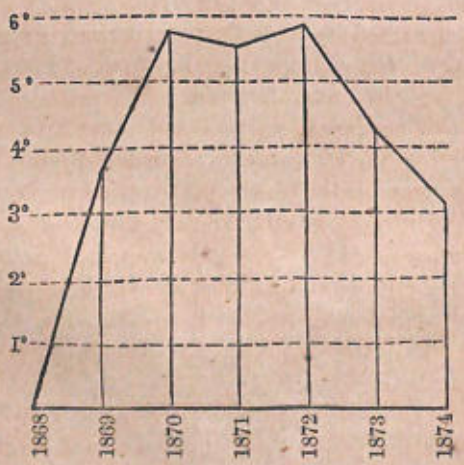
DECEMBER.

Port Blair,	+ 2·0	+ 4·0			+ 2·5	+ 1·5
Cuttack,			+ 1·5	+ 5·2	0	— 4·4
Chittagong,			— 4·2	— 4·8	0	— 1·3
Jessore,		+ 2·7				
Dacca,			— 0·6	+0·9	+ 0·4	— 5·9
Hazaribaore,	+ 1·5	+ 0·5			— 2·0	— 0·5
Berhamp	+ 1·2		— 3·5		—12·5	— 9·0
Silchar,			— 2·5	0	— 3·0	+14·0
Monghyr,	+ 5·0	— 1·5	— 2·5			
Patna,	— 3·0					
Roorkee,		— 6·0	+ 3·5		— 8·9	+ 0·7
Sums,	+ 6·7	— 0·3	— 8·3	+ 1·3	—23·5	— 4·9
Means,	+ 1·3	— 0·1	— 1·0	+ 0·3	— 2·9	— 0·6

TABLE IV. B.—*Mean monthly and annual differences of maximum black-bulb temperatures.*

MONTHS.	1868-9.	1869-70.	1870-1.	1871-2.	1872-3.	1873-4.
January,	+ 5·0	— 0·2	— 1·3	— 2·3	+ 2·5	— 4·7
February,	+10·8	— 2·9	— 0·8	— 3·7	+ 2·1	— 3·1
March,	+ 5·7	+ 6·4	— 0·8	— 0·2	— 2·2	— 3·2
April,	+ 4·2	+ 0·9	+ 0·6	— 2·6	— 3·7	— 0·5
May,	+ 4·0	+ 3·9	+ 2·5	— 0·1	— 0·3	— 0·5
June,	+ 3·9	+ 7·6	— 1·2	+ 2·7	+ 0·9	— 1·1
July,	— 2·8	+ 2·7	— 0·2	+ 2·8	— 0·2	+ 1·5
August,	+ 8·0	— 1·3	— 0·9	+ 0·6	— 0·4	+ 0·6
September,	+ 3·3	— 1·9	— 0·9	+ 3·4	— 2·9	+ 2·8
October,	+ 0·7	+ 3·5	— 0·3	— 0·9	— 1·1	+ 2·7
November,	— 2·5	— 2·9	— 3·9	+ 4·9	— 3·3	+ 3·2
December,	+ 1·3	— 0·1	— 1·0	+ 0·3	— 2·9	— 0·6
Yearly sums,	+41·6	+21·5	—11·6	— 0·5	—11·5	— 2·9
Means,	+ 3·5	+ 1·6	— 0·9	0	— 0·9	— 0·2

The results obtained by these four different methods, resting on two distinct kinds of data, agree then, in shewing a very decided variation of the incident solar heat; a variation which, in the epoch of its maximum approximately, its rapid rise before that maximum and slower decline after it, agrees with the variation curve of the solar spots. Table III being based on a far larger quantity of data than either of the others, probably gives the most trustworthy results. The curve obtained from this table is given in the adjoining figure.



What proportion the variation may bear to the total incident heat, the present data of course cannot show; and in order to know this, we must await the regular actinometric observations which it is to be hoped may be undertaken at the new Solar Observatory under Col. Tennant at Simla. But judging from the present results, it would certainly appear probable that the variation is such as must exercise a very appreciable influence on the Meteorology of our earth. "It is a dynamical law absolutely universal and one which extends beyond the domain of mere dynamics, that all periodicity in the action of a cause, propagates itself into every, even the remotest effect of that cause, through whatever chain of intermediate arrangements the action is carried out."*

If then the sun's radiation vary directly with the number of the spots and prominences, every other meteorological phenomenon must likewise so vary, rainfall and temperature included, and we have therefore *a priori* grounds for the validity of Meldrum, Lockyer, and Köppen's discoveries. With regard to the rainfall, the coincidence of its variation with that of the sun spots has been only partially verified by the data; but seeing that the rainfall of the larger part of the world has not been taken into consideration in the comparison, this is no more than we should expect. In India, for instance, the registers of most of the few stations that have been compared, fail to conform to the supposed law, but India is but a small part of the region on which precipitation takes place during the SW. monsoon, and I have shewn in a former volume of this Journal, that there are independent grounds for believing, that owing to protracted variations in the distribution of atmospheric pressure in different years, (from what causes arising we are at present unable to determine,) deficient rainfall in one part of the monsoon area is probably compensated in great part by an excessive rainfall elsewhere. As far as the coincidence has been established, the quantity of rain that falls, varies directly with the intensity of the sun's radiation; in other words, with the quantity of energy received from the sun, which of course determines the quantity of water evaporated and afterwards condensed.

This consideration appears to me to throw some light on the apparently anomalous variation of temperature detected by Professor Köppen.† He finds that, in the tropics, the maximum temperature coincides, not with the maximum of the sun-spots, but more nearly with their minimum; which, however, it precedes by $\frac{1}{2}$ to $1\frac{1}{2}$ years. His inference, partly based on this fact, and partly on his erroneous idea of the nature of the spots, is the reverse of that which follows from the facts now adduced. He concludes that the spots are an indication of the diminished radiation of the sun,

* Herschel's 'Meteorology,' p. 137.

† Zeitsch. d. Oesterr. Gesellschaft für Meteorologie, Vol. VIII, pp. 241 and 257.

and adopts the earlier hypothesis of De la Lande and of Zöllner that they are solidified scoriaceous masses floating on the glowing fluid surface ["Schollen fest-gewordener Stoffe auf der glühendflüssigen Sonnenkugel"]. The great discovery of Chacornac and Lockyer in 1865, that the spots are produced by a down-rush of the cooled external atmosphere of the sun, would seem to be unknown to him.

The spots being then, in all probability, an indication of increased radiation, how is this to be reconciled with the facts ascertained by Professor Köppen. Possibly, I think, in this way. The temperatures dealt with by Professor Köppen are of course those of the lowest stratum of the atmosphere at land stations; and must be determined, not by the quantity of heat that falls on the exterior of the planet, but on that which penetrates to the earth's surface, chiefly to the land surface of the globe. The greater part of the earth's surface being, however, one of water, the principal immediate effect of the increased heat must be to increase the evaporation, and therefore, as a subsequent process, the cloud and the rainfall. Now a cloudy atmosphere intercepts the greater part of the solar heat; and the re-evaporation of the fallen rain lowers the temperature of the surface from which it evaporates and that of the stratum of the air in contact with it. The heat liberated by cloud condensation doubtless raises the temperature of the air at the altitude of the cloudy stratum; but, at the same time, we have two causes at work, equally tending to depress that of the lowest stratum. As a consequence, an increased formation of vapour, and therefore of rain, following on an increase of radiation, might be expected to coincide with a low air-temperature on the surface of the land.

It is needless to point out that a vast train of enquiry is opened up by the fact, once established, that the solar heat undergoes a periodical variation. It is I believe of high importance to Meteorology, or will be so when the amount of the variation shall have been ascertained in terms of absolute measurement, and it affords a strong additional incentive to the establishment of an observatory in India, such as have already been founded under the less favoured skies of Germany and on the Rocky mountains, for observing and measuring the variations of the sun. These and their immediate effects are, by prerogative, the study of the tropics.

P. S. *July 12th.*—Since the foregoing paper was read, I have examined the register of Darjiling; a station which, although frequently obscured by cloud, has the advantage over stations on the plains, that it is above the level of the dust haze that absorbs so much of the solar heat over the latter. I have discussed the registers by a method somewhat different from either of those followed in the body of the paper, *viz.*, by selecting the three highest recorded sun temperatures in each half month, deducting from each the maximum temperature of the air in the shade on the same days, and taking

the mean of the six differences to represent the solar intensity of the month. The result, as will be seen from the following table, is in complete accordance with that previously arrived at from other data. The same thermometer has been in use throughout.

TABLE V.—*Solar intensity at Darjiling.*

STATIONS.	1870.	1871.	1872.	1873.	1874.	1875.
January, ...		57·8	67·7	59·2	57·8	62·3
February, ...		62·2	62·8	62·3	56·5	60·3
March, ...		63·3	63·5	62·	58·2	57·8
April, ...		64·2	63·2	62·8	55·7	60·2
May, ...	62·2	67·9	66·8	63·8	59·8	
June, ...	67·	68·	67·3	62·5	59·2	
July, ...	63·3	66·2	65·7	60·8	56·3	
August, ...	70·8	65·7	66·8	60·	57·8	
September, ...	71·5	69·3	63·7	62·3	59·3	
October, ...	65·5	68·2	70·	63·3	60·8	
November, ...	62·5	67·3	62·5	57·3	63·3	
December, ...	59·	66·3	59·	53·8	60·5	
Year, ..		65·5	64·9	60·8	58·6	

VII.—*Notes on the Geology of part of the Dafla Hills, Assam; lately visited by the Force under Brigadier-General* STAFFORD, *C. B.—By Major* H. H. GODWIN-AUSTEN, *F. R. G. S., F. Z. S., &c., Deputy Superintendent Topographical Survey of India.*

(Received June 18th,—Read July 7th, 1875.)

(With Plate VI.)

My survey duties with the late expedition into the portion of the Eastern Himalaya known as the Dafla Hills gave me an opportunity of making a few notes on the geology of this portion of the North-eastern frontier, of which so little is known up to the present time.

From the Brahmaputra near Bishnáth and Dunsiri Mukh, the outer range of the Tertiary sandstones is well seen, the steep scarps shewing white against the dense forest with which they are covered. I first entered this outer range by a route up the bed of the Darpang stream, a tributary of the Pichola, when proceeding to clear the hill Dihirhi Párbat for a Trigonometrical station. After leaving Borpathar, the road leads over the plain in a direction WNW., and after 5 miles the shallow bed of the Darpang is followed up and leads directly by a narrow gorge into the hills: these rise suddenly from the level plain of recent detritus, no outlying beds of later age being seen here.

The strata dip about 20° NW., and consist of thick-bedded fine sandstones with strings of water-worn pebbles here and there, but no conglomerate was seen ; they weather on the higher ridges into spheroidal masses indented with small holes, in a precisely similar manner to the upper sandstones of the Burrail range. The most conspicuous beds are of a very pale grey colour with black grains. Pieces of lignite are commonly found *in situ* and lying in the beds of the water-courses. The ravines are bounded by very steep sides, and are deep and gloomy. Looking from Dihirhi Párbat westward, the fringing range of the sandstones is well seen, rising at Gorusutia or Peak 1 of the G. T. S. into a sharp scarped point 3,319 feet high, but the ridge descends here and there on the line of strike to below 1000 feet. It presents the same feature all along of a steep scarp towards the plains, and of a slope dipping 20°—25° NNW. towards the main mass of the mountains on the north, from which it is separated by a broad valley or "dhún" drained by the Pomah. This dhún is cut up by numerous ravines and low ridges all buried in dense forest.

To the eastward, 3 miles from Dihirhi Párbat, the sandstone ridge is much subdued. A change takes place in the strike of the mountain mass, and a broad forest-clad plateau, much intersected by ravines and about 200 feet above the plains, extends as far as the gorges of the Dikrang at Harmatti. On this side, the Borpani and Dikrang on their SW.—NE. courses represent and take up the continuation of the Pomah Dhun. At Harmatti is seen another quite recent deposit, in an alluvial plateau of sand, clay, and boulders, on which land for a tea-garden has been taken up. It corresponds to similar terraces in the Western Bhutan Duars, as those on the Jholdaka, &c., but is nowhere more than 30 to 40 feet above the river bed, and is found fringing the older rock slopes for some distance up the valley and to the eastward. It lies against a broad extent of very low intricate hills, which, from this towards the east, are a conspicuous feature. The very hurried examination I was able to make of these beds near Harmatti shewed them to be ferruginous-coloured sandstones and thick conglomerate beds resting on fine blue grey sandy beds dipping 5° to South-eastward. No lignite was seen *in situ*, but rolled pieces were common in the bed of the stream, evidently brought down some distance. At Harmatti similar beds dip 15° SE. ; they appear to me to represent the newest beds of this Tertiary series, here extending out into the plains beyond the strike of the 1st or Dihirhi Párbat line of elevation. This line is taken up again east of the Dikrang by a low ridge which bounds the river on the SE. as far as the great bend it takes 10 miles above the junction of the Borpani.

Leaving the stockade at this junction, the winding bed of the Sibjúli is followed, and this 1½ miles farther is joined by the Niosi, a much larger stream. In the bed of the last, the gravels are found to be a great mixture

of gneiss, clay shales, and dark-coloured sandstones belonging to a different series of rocks, with a few pebbles from Tertiary sandstones, shewing that the river must cut through the whole series of stratified rocks up to the metamorphics. This I afterwards found to be the fact. I found here several pieces of silicified wood (a large grass) 8 inches in diameter. The first exposed section, seen about four miles further up the Sibjúli, presented the Tertiary sandstones with a high dip, 75° SE by S.: these are here very dark and hard, thick-bedded, with a slight violet tint. They contain no pebbles, and are of a different character from the outer or Dihirhi group of beds. At the low pass over into the Harjúli they are thin-bedded, softer, and vertical. Passing on northward, on the SE. spur from Tánir Peak, the sandstones are horizontal, and evidently roll over at the Peak to 35° NW., which is the dip all along the crest of this second ridge. Crossing it and proceeding down the spur to the Dikrang, at the few places where the sandstone is uncovered, the dip has become high to the North-west-ward.

But it was on the Dikrang itself that the most interesting section was obtained. On following up the first and eastern stream on the right bank of that river near Camp No. 6, below the village of Shikhi (Phekfis), the first trace of an older series of rocks was found, about a quarter of a mile up the bed, where a dark, hard, heavy sandstone occurs, vertical with a NE.—SW. strike. The soft Tertiary sandstones immediately succeed, having a local dip E. by S. 75°: they are much crushed, very thick-bedded and micaceous, with scattered small pebbles, and they appear the equivalents of the sandstones of Dihirhi. Proceeding up the bed of the next stream (the largest, which I shall, for the sake of distinction, call the Tánir júli, became it drains the northern face of the Tánir ridge), we first come upon the Tertiary sandstones nearly perpendicular, strike SW.—NE.; a very few yards further on are clay shales, very dark and carbonaceous, dip 70° high, NW. Some 50 yards further up the stream, the dip was reversed to 75° ESE., with considerable crushing, and here occurred a thick seam of black carbonaceous shale 5 to 6 feet thick, interstratified with dark close-grained sandstones; this can be traced along the strike NNE.—SSW. for 200 yards, as it crosses the bed of the stream three times. It is rather a crushed splintery coal than a shale, and no doubt would prove better below the surface. Where now exposed it is either in the water or just out of it, in fact, to see it at all one has to wade up the bed of the stream, the jungle on the banks being too thick to move about in.

It was most interesting to come on these rocks in this position, as they are no doubt the representatives of the Damúda Series lately examined and worked out along the base of the Darjeeling and Western Bhútán mountains by Mr. F. R. Mallet,* and first noticed by Dr. J. D. Hooker in 1849, near

* Memoirs of the Geological Survey of India, Vol. XI, Pt. I.

Pankabári. The coal seam has exactly the flaky structure described by Mr. Mallet. The crushing to which it has been exposed has apparently altered its original and probably even thickness, both the upper and lower surfaces being waved irregularly, so that it never retains the same thickness for many yards together along the strike. I could not find time to follow the ravine further, but, at the head of the valley, a full section of these beds would be found along the low ridge connecting the Tánir Lampah with the Misa Párbat ridge. The boulders and gravel consisted principally of (1) the hard sandstone of a pale blue slaty colour, the darkest often speckled with minute grains of quartz (?); (2) a few of the soft Tertiary sandstones, but these apparently soon get ground away; (3) a very hard lighter coloured rock of the Damúda Series; (4) some hard conglomerate; and (5) a few of gneiss from the ridge on the north side of this valley, on which is the little hamlet of Dápú.

I am inclined to think there is unconformity between this Damúda series and the sandstones, but the crushing is great and renders it very difficult to make out clearly; exposed sections being so very scarce. There cannot, however, be here a greater thickness of Damúdas than 1000 feet in the area intervening between the sandstones and the quartzites and gneiss. Overlying the denuded outcrop of the Damúdas, in this lateral valley, is a mass of sandy clay and large sub-angular blocks (some 15 feet long) of the harder strata and quartzitic sandstones, &c.; this, combined with the dense forest, affords a geologist few opportunities of seeing much. The Tánir júli marks the junction of the stratified rocks and the metamorphic series, for some distance, by its wide open valley, the breadth corresponding with the outcrop of the whole Damúda series. The valley of the Dikrang corresponds with the continuation of this outcrop for a long distance to the NE.; its very probable extension westward is marked on the map by several streams excavated on the main line of strike, along the base of the gneissic rocks.

Having once found this thick carbonaceous seam,* it was very easy to follow it up. It crosses the Dikrang in a NE. direction and shews on the left bank close to the suspension bridge, beyond which it leaves the river and becomes covered up with alluvial deposits. Down the Dikrang from this spot, a set of very hard compact sandstone strata, perpendicular and shewing metamorphism, is exposed along the bed of the river, and, about half a mile down, their junction with the unaltered soft Tertiary sandstones is capitally displayed on the right bank. The latter rocks have a high southerly dip, and although having the same strike, gave me a still stronger impression of their unconformity.

* This coal would have to be worked up into an artificial fuel, such as is described by Mr. Mallet at page 60 of his memoir.

To the Damúdas, quartzitic beds succeed, some very white, but I nowhere found an actual contact. On the road to the bridge built by the force above Camp No. 6, a dark green rock is conspicuous by its very trappean appearance: at the bridge a very white quartzite underlies it, dipping 55° SE. These metamorphic rocks have a regular strike SW.—NE., nowhere better seen than from Zorúpútú; that peak with the peaks of Dorkorpútú and Shengorh lying in the main axis of elevation in a true NE.—SW. line. The metamorphics seem to pass by degrees into micaceous schists and hornblendic gneiss (which was noticed 3 miles above the bridge), and then into true granite with large feldspathic crystals, very similar to that of the North Khási Hills, at the Kollong rock, &c. The peaks of Misa Párbat and Shengorh are of this granite. Near Camp 9, under Nanang's village, the gneiss was very talcose, tale occurring in pieces of an inch square or more. The quartzites, mica schists, &c., probably represent Mallet's "Daling Series."

River-terraces of Recent Age.—Near the junction of the Tánir júli with the Dikrang, a higher and a lower terrace are well-marked features: they are composed of sand, clay, and large transported blocks, more or less rounded. The lowest is well seen on the left bank about 20 feet above the river bed at Camp 6. The highest, between that and the bridge about one mile above, has a thickness of some 125 feet. Their deposition here no doubt occurred during the period of glacial extension throughout the Himalayan Range, and they would naturally have accumulated more at the junctions of large lateral valleys than elsewhere. The remains of these terraces are to be traced at intervals up the valley, notably at Pachitah, but the highest is not seen in the valley below Nanang's village and above the junction of the Niúmtay.

The Burroi Gorge.—At the deep pool where the Tertiary sandstones are first seen on the left bank there is an interesting section. The beds are dipping about 50° towards the pláins; the denuded surface is smooth and undulating, and here not more than 8 to 10 feet above the water level (March). Proceeding up the river about a quarter of a mile to the next large pool, the same section is again seen, but the upper surface of denuded sandstone is there quite 15 to 20 feet above the river, shewing a very considerable slope of the old earth-surface from the hills. On this surface rests a very recent series of iron-coloured sands and gravels, quite 60 or 70 feet thick, nearly horizontal, but the very slight incline is towards the Southward. These beds abut against the older rocks, which soon commence to rise into well-marked spurs from the outermost range.

These comparatively recent deposits are no doubt the same as those composing the plateau at Behali Tea-garden, miles out in the plain towards the Bramaputra, and also of the Bishnáth plain. About 300 yards below

the first deep pool (where our camp was pitched), near the head of the next rapid, the last of the Tertiary rocks is exposed in the water and about a foot out of it, and dips south about 70°, the strata apparently falling over into a sharp uniclinal. This feature I have introduced into the section from Harmatti to the Tánir Ridge as it probably extends along the whole base of the hills, but is covered with the more recent alluvial deposits.

To the west of the Burroi, the sandstone range has a general dip NE., but a very conspicuous longitudinal roll occurs at the second large ravine west of the main gorge. The strata immediately east of this ravine dip 50° W., while in the main gorge of the Burroi they have a general easterly underlie, but are a good deal crushed and exhibit high dips. To the west the beds are much less disturbed and again assume regular dips of 30° to 40° northerly, the whole series gradually ascending towards Gorusuttia to the main longitudinal axis of elevation. Looking at the hills 20 miles to the west of the Burroi, the dip of the lowest outer range appeared 20° southerly, producing a long even slope towards the plains.

The Bisnáth Plain.—I first came on this remarkable portion of the country, on the road between Rangsali and Burigaon, just after crossing the Borgang, which has a wide sandy bed, but a volume of water not more than half that of the Burroi. The rise is sudden out of the "kadir" land of the former river, and about 20 to 25 feet, succeeded at from 200 to 300 yards by another of perhaps 3 feet, but very distinctly marked. The surface is perfectly flat, covered with a thin growth of grass, a few of the highest stalks of which may be about 6 or 7 feet high, but it is a short grass for Assam. Patches of forest of a few acres in extent are dotted about here and there, their limits very defined and generally round or oval in shape. The plateau ends abruptly on its southern side, towards the Brahmaputra, but its edge is irregular in outline, having been scooped into by the river in its wanderings from side to side. Traces of the former channel occur in the re-entering angles, in long crescentic pieces of water fringed with marsh and high reeds and grasses; these extend mile after mile to the main river. The view from the plateau, especially off the back of an elephant, is very fine, the dead level surface stretching afar, the line of horizon only broken here and there by a solitary tree or by the embankment of some old tank, for the day has been when all this area was thickly studded with villages. The low scarps of the dry nulla east of Burigang rest-house shew that there the plateau is sandy, and small rounded pebbles, mostly of quartz, occur quite near the top of the section. On the Sudoro, however, away from the influence of the ancient Borgang, red clay predominates, as well as in the scarp to the west of Partabghar, where the plain of Bisnath ends. The thickness of the alluvium here appears much greater, but there is no

real increase; the Giladeri nulla has cut into the alluvium and flows at its very base, and, instead of the usual gradation of fall from terrace to terrace, the whole thickness is seen at once and amounts to some 40 feet. The high level of the Bisnáth Plain is seen from here to extend on the north and north-west by the tea-gardens of Diplonga and Dikro, and an isolated high patch of alluvium occurs about 4 miles west of Sútia, gradually falling by steps at long intervals into the present level of the land on both banks of the Barowli. A series of accurate levels taken over this country would be most interesting, but that it is of the same age as the clay plateau at Tezpúr and many other places in the Assam valley as far down as Gwálpára is certain. It could only have been formed under very peculiar conditions,—in still water, with the surface higher than it now is towards the delta, and with a far larger water supply from the mountains; gradual subsidence in the direction of the delta to the extent of a few feet and change of climate would soon model such outliers of an alluvium probably coeval with the extension of the Himalayan glaciers, the fine mud and sand from which would form just such clays and sands as the plateaus are composed of.

VIII.—*Note on the molluscan Genera* Cœlostele, *Benson and* Francesia, *Paladilhe, and on some species of Land-shells from Aden.*—*By* W. T. Blanford, *F. R. S., F. G. S.*

(Received June 24th;—Read July 7th, 1875.)

In the 'Annali del Museo Civico di Storia naturale di Genova' for 1872, Vol. III, p. 5, is a description by Dr. A. Paladilhe of *Francesia*, a supposed new genus of Asiatic mollusks. As the typical form of the genus was found in India by Benson, a short notice of this paper may be useful to Indian naturalists, the more so as there is, I think, good reason for doubting whether the genus is really undescribed, and there are some details in the paper in question, and in a subsequent one, containing descriptions of some mollusca from Aden, which require correction.

The genus *Francesia* was proposed by Dr. Paladilhe for a small species found by M. Issel close to Aden, and recognised by its describer as identical with a specimen from the banks of the Jumna sent to him by Prof. Mousson. This Indian shell was received by Mousson from Benson under the name of *Carychium scalare*. M. Paladilhe relates at length the enquiries which he undertook in order to ascertain if this *Carychium scalare* was described, and after consulting various authorities, amongst whom were Messrs. Gwyn Jeffreys and Hanley, he concluded that it was not; Mr.

Hanley assuring him that the name could not even be found in Benson's manuscripts.

It is quite true that no such species as *Carychium scalare* was ever described, but I cannot help feeling some surprise that none of the naturalists consulted should have noticed that a description of the shell was published by Benson in 1864 as the type of a new genus under the name of *Coilostele* (more correctly *Cœlostele*) *scalaris*.* There cannot, I think, be any hesitation in identifying the species ; the types were procured from the banks of the Jumna and Betwa, and the new genus *Coilostele* is, though with some little doubt, ascribed to the *Auriculacea* and compared with *Carychium*. The description agrees in all the external characters of the shell with that given by Dr. Paladilhe ; in the latter, it is true, no mention is made of the absorption of the axis in the apical whorls, from which character the name *Cœlostele* is derived, but this might be easily overlooked, and there cannot, I think, be much doubt as to the identity of the two genera *Cœlostele* and *Francesia*, the former name having priority by 8 years.

There appears, however, to be a specific distinction between the Indian and Arabian forms which has escaped the notice of Dr. Paladilhe. The Indian *C. scalaris* is described by Mr. Benson as smooth (*testa lævi hyalina nitida*), whilst the Aden *Francesia scalaris* is said to be finely and very regularly marked with very elegant rather flexuous costulations. I have recently procured specimens of the Indian form from the neighbourhood of Karáchi in Sind, which agree with Mr. Benson's description and are entirely destitute of costulation.

As has already been mentioned, the genus *Cœlostele* was referred by Benson, though not with great certainty, to the *Auriculidæ*, his principal reason being that he found the axis of the spire to be obsolete or absorbed as in *Auricula*, *Pythia*, and several other genera of *Auriculidæ*.† Paladilhe looked upon his *Francesia scalaris* as probably a fresh water mollusk, and he proposed to attach it provisionally to the family of the *Lymnæidæ*.‡ His principal reason, as he states, for believing it to be of aquatic origin, was that the numerous specimens examined by him had the whole shell and especially the aperture free from clay or mud, whereas he had noticed that small terrestrial mollusca, such as *Pupa*, *Vertigo*, &c. when left on the banks of torrents or rivers by floods (the position in which alone *C. scalaris* has

* Ann. and Mag. Nat. Hist. Ser. 3, XIII, p. 136. See also Zool. Record, 1864, p. 235 under *Auriculacea*.

† I find that the axis is equally wanting in the upper part of the spire in Sind specimens.

‡ He subsequently explained that in his opinion it was allied to the singular little genus *Moitessieria*, which is said to be aquatic, and on this account he had believed it allied to the freshwater pulmobranchs (Issel. Ann. Mus. Civ. Gen. IV, p. 525).

hitherto been found), have their surface more or less dirty and their orifice filled with detritus, the reverse being the case with fluviatile species.

Issel, who collected the Aden specimens, in a paper published* soon after that by Paladilhe, gives his reasons for disputing the systematic position assigned to *Francesia* by its author, and for considering it a terrestrial and not a fluviatile mollusk. In his opinion it belongs to the *Helicidæ*, and is allied to *Bulimus*. He points out certain characters which it has in common with *Stenogyra*, *Cæcilianella* and *Ennea*.† I think that there can be very little doubt as to the correctness of Issel's view so far as the terrestrial nature of the mollusk is concerned, and that his opinion of its affinities to the *Helicidæ* are more probable than Benson's supposition that the genus belongs to the *Auriculidæ*, or Paladilhe's that it should be assigned to the neighbourhood of the *Lymnæidæ*. I cannot see that the absorption of the spiral axis, the character upon which alone Benson appears to have relied, is sufficient evidence of affinity, because it is found in gasteropodous genera belonging to widely different families, *e. g.*, in *Nerita*, and there is no other character in which the shell of *Cœlostele scalaris* is shewn to have any close resemblance to *Auricula;* whilst the reason assigned by Paladilhe for supposing his genus *Francesia* fluviatile, the complete freedom of the shell, and especially of the orifice, from clay or sand is certainly an insufficient argument, at all events in those countries in which *Cœlostele* has hitherto been found. I have just examined a small collection of minute shells, picked out from flood deposits in Sind, and amongst them I have found several specimens of *Planorbis* and *Bythinia* with their aperture filled with sand, whilst this appears to be very rarely indeed the case with the minute *Achatina balanus* of Benson, a species which Paladilhe assigns to *Francesia*, but evidently without having a clear idea of the species, for he, immediately afterwards, unless I am greatly mistaken, redescribes it as a new species under the name of *Cœcilianella Isseli*.

It is very singular that the animal of *A. balanus* should never have been observed and that we should be as much in doubt about its real affinities as we are about those of *Cœlostele*. I am strongly disposed to believe that it is very closely allied to a shell described by Crosse from New Caledonia under the name of *Geostilbia Caledonica*.‡ The figure representing this form might almost be mistaken for that of *Achatina balanus*, but the geographical position of *Geostilbia Caledonica* is unfavorable to its identification with

* Ann. Mus. Civ. Gen. IV, p. 521.

† This genus does not belong to the *Helicidæ* but to a distinct family. Conf. Dohrn, Malakoz. Blätt. XIII, p. 129; and Stoliczka J. A. S. B., 1871, XL, pt. 2, p. 159.

‡ M. Crosse very kindly gave me a specimen of this shell, but I have unfortunately left it in England and am unable to compare it with *Achatina balanus*.

the Indian species, which is found in the drier parts of India and apparently in other parts of South-western Asia where the fauna has Arabian and African affinities. The animal of *Geostilbia* has not been examined, but it is said to live underground. It is far from improbable that both *Cœlostele scalaris* and *Achatina balanus* have a similar habitat, and this would account for their not having hitherto been observed living.

I think that there is some possibility too that these forms may be allied to *Ennea*, *Streptaxis*, and *Streptostele*. All have the very peculiar glassy structure characteristic of the *Streptaxidæ*. If this be the case, the animal will probably be brightly coloured, yellow or scarlet, or both. It is to be hoped that some Indian naturalist may succeed in obtaining these species alive and determining their affinities.

If the opinions above expressed be correct, the synonymy of the two forms of *Cœlostele* will be the following :

1. Cœlostele scalaris.

Coilostele scalaris, Benson, Ann. & Mag. Nat. Hist., 1864, Ser. 3, XIII, p. 136.

Hab.—Western and North-western India.

2. Cœlostele sp.

Francesia scalaris, Paladilhe, Ann. Mus. Civ. St. Nat. Gen., 1872, III, p. 10, Pl. I, fig. 1-4.—Issel, ib, IV, p. 521, 530.

Hab.—Aden in Arabia and Sek Said Island, Dahalac Archipelago, Red Sea.

I do not propose a new name for the second species, although I think it requires one, because I have a great dislike to giving names to species which I have not seen, because there is still a possibility that the genus *Francesia* may not be identical with *Cœlostele*, as the peculiar character of the latter, the absorption of the axis in the upper whorls, has not been observed in the former, and thirdly because I consider the practice so prevalent amongst some naturalists of giving new names to everything they are unable to identify extremely objectionable and liable to cause confusion. I trust, however, that either M. Issel or M. Paladilhe will re-examine the Aden shell, and, if, as I anticipate, it proves to belong to the genus *Cœlostele*, re-name it.

Besides *Francesia scalaris*, the following species are described from Aden by M. Paladilhe :

1. *Bulimus Yemenensis.*
2. *B. Samavaensis*, Mousson MS.
3. *B. vermiformis.*
4. *B. cerealis.*
5. *B. lucidissimus.*
6. *Limicolaria Bourgignati.*
7. *Ennea Isseli.*
8. *Pupa Antinorii.*
9. *Cœcilianella Isseli.*
10. *Physa Beccarii.*

Of these, *Cæcilianella Isseli** I believe, as I have already stated, to be identical with *Achatina balanus* of Benson. *Bulimus Samavaensis*, *B. cerealis* and *B. vermiformis* appear all to be varieties of the widely spread and variable *Pupa cœnopicta*, Hutton. This has already been indicated in the case of *B. cerealis* and *B. vermiformis* by Morelet (Ann. Mus. Civ. III, p. 201.) and Issel states that *B. Samavaensis* has also been identified with *B. cœnopictus* by the same naturalist.† It is quite true that the shells named by M. Paladilhe present well marked differences, and that the circumstance of all being found in one place is opposed to the idea of their being races of one species. At the same time it does not follow that all these forms inhabit the same spot because their shells are carried down by the same torrent and mingled in the flood deposits, and I have similarly found two or three varieties together in various parts of India. I have examined a large number of specimens from the drier parts of India, from Upper Burma, Persia, and Abyssinia, and although there are several well marked forms deserving distinctive names, I am inclined to believe that all pass into each other. At the same time I am not prepared to admit with M. Jickeli, as quoted by Issel, (Ann. Mus. Civ. IV, p. 528, note), that these tropical shells are identical with the North American *Pupa fallax* of Say. I have not access to Jickeli's original paper, and cannot say on what his opinion is founded. *Pupa fallax* is found in various parts of the United States, and the peristome is edentulous, and entirely destitute of the parietal tooth which is found more or less developed close to the posterior angle of the aperture in all forms of *B. cœnopictus*. Even should some shells of *B. cœnopictus* be undistinguishable from some of *P. fallax* it would, I think be well to compare the animals before uniting the two.

Issel has pointed out‡ that *Limicolaria Bourgignati* belongs rather to *Stenogyra* than to the genus to which M. Paladilhe assigned it. I am unable to distinguish it from a very common variety of *Stenogyra* (*Opeas*) *gracilis* (*Bulimus gracilis*, Hutton). M. Paladilhe considers it a peculiarly African form, but *Stenogyra gracilis* is found not only in India proper but in the Malay region.

It is remarkable that amongst the shells found near Aden, no form of *Bulimus insularis* (*B. pullus*, Gray) should have been comprised. One has

* My attention was called to this and some of the other identifications given below by my friend Mr. G. Nevill.

† Ann. Mus. Civ. IV, p. 527. I cannot however find the species mentioned by Morelet; can M. Issel has mistaken *Semaarensis* which Morelet does identify with *P. cœnopicta* for *Samavaensis* ?

‡ Ann. Mus. Civ. IV, p. 523, note.

been described by Pfeiffer under the name of *B. Adenensis*. The species is at least as variable and nearly as widely spread as *B. cœnopictus*.*

P. S.—Whilst the preceding paper was passing through the press, I received a letter from Colonel R. H. Beddome, in which he told me that he had compared, under the microscope, a specimen of *Geostilbia Caledonica* with a shell which he found in north Canara, and that they were identical. Now the north Canara shell was in all probability *Achatina balanus*, and if this be the case, it follows that the identity of that form with *G. caledonica* which I have long suspected, and to which I have referred at p. 43, is not merely generic, but specific.

* In an excellent account of the land and freshwater shells of Borneo by Issel, also published in the Annali del Museo Civico, Vol. VI, p. 366, I am credited with the authorship of the genus *Optediceros*. This is a mistake. I never invented the genus, but I shewed (Ann. and Mag. Nat. Hist. Ser. 3, XIX, p. 381) that *Optediceros* of Leith, described in the Journal of the Bombay Branch of the Royal Asiatic Society, Vol. V, p. 145, is identical with *Assiminea*. I think, too, it is to be regretted that a shell like *Assiminea cornea*, Pfeiffer *nec* Leith, should still be referred to *Hydrocena*, and *Assiminea carinata*, Lea to *Omphalotropis*. Martens long since pointed out (Malakoz. Blätt. 1864, p. 142,) that the type of *Hydrocena* belongs to a very different family, (*Georissa* is very close to it if not identical,) whilst I have shewn (Ann. and Mag. N. H. 4, III, p. 340) that *Omphalotropis* belongs to the *Cyclostomidæ*. *Assiminea* on the other hand is a Rissoid.

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IX.—*On the General Theory of Duplex Telegraphy.*

By LOUIS SCHWENDLER.

(Continued from Vol. XLIII, Part II, 1874.)

In the two preceding investigations* I have given the solution of the *first problem* for the bridge method. This solution established the general result of the *double balance* being the best possible arrangement for the bridge method. In the present paper I shall endeavour to find the solution of the *first problem* for the *differential method*, which in practical importance ranges second to the bridge-method.

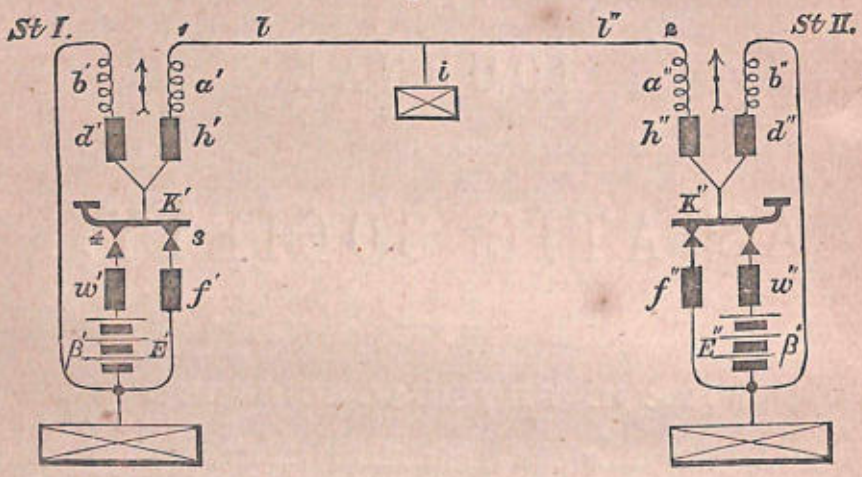
II. Differential method.†

This arrangement for duplex working is based on the well-known method, of comparing electrical resistances "differential method," and Fig. 2 gives the general diagram when this method is applied for duplex working.

* J. A. S. B., Vol. XLIII, Part II, 1874, pp. 1 and 218; Phil. Mag., Vol. 48, 1874, p. 117 and Vol. 49, 1875, p. 108; Journal Telegraphique, Vol. II, p. 580.

† The differential method was originally invented, as stated before, by Mr. Frischen, and Messrs. Siemens and Halske. A particular case of this method was patented by them in England in 1854.

Fig. 2.



Explanation of the Diagram.

E, electromotive force of the signalling battery.

β, internal resistance of the signalling battery.

k, a constant resistance key.

a and b, the coils of the receiving instrument. These coils, for any sent current, have opposite magnetic effects with respect to any given magnetic pole external to the coils; while for any received current, these coils add their effects with respect to that same magnetic pole. By a and b shall also be designated the resistances of the coils.

d, w, f, and h are certain resistances, the necessity of which will become clear hereafter.

i, the resistance of the resultant fault of the line, acting at a distance l' from Station I, and at a distance l'' from Station II, (both l' and l'' expressed in resistances, so that $l' + l'' = L$ equal the "real conduction resistance" of the line).

The other terms, *viz.* L', L'', ρ', ρ'', c', c'', &c., which will necessarily be of frequent occurrence also in this paper, will bear the same physical meaning here as before.

The practical inferiority of the *differential method*, when compared with the *bridge method*, it will be clear at once, is that specially constructed receiving instruments on the differential principle are required. That, therefore, the introduction of Duplex Telegraphy based on the differential method would at once involve also a total change of the receiving instruments hitherto used. This is clearly a serious disadvantage from an administra-

tive and financial point of view. But besides this, without going into details, the differential method has also a very serious objection from a technical point of view. While in the bridge method the balance is obviously independent of the resistance of the receiving instrument, in the differential method the balance is clearly a function of the resistances of the two coils of which the receiving instrument consists, and as these two coils may alter their resistances independently, and not in proportion as indicated by the balance equation, a new element of disturbance is introduced, which the bridge method does not possess.

Besides this, differential instruments are necessarily mechanically more complicated than others, and require therefore superior workmanship, entailing greater expense to arrive at working efficiency.

General expressions for the two functions "D" and "S."

In order to obtain the two functions D and S, we have to develop the general expressions for p, P, and Q; say for Station I.

p' in our particular case is the force exerted by the two coils a' and b' on one and the same magnetic pole when Station I is sending and Station II is at rest. This force is clearly the difference of the two forces exerted by the coils a' and b'.

Thus we have

$$p' = A' m' - B' n'$$

where A' and B' are the currents which pass through the two coils a' and b' respectively, when Station I is sending and Station II is at rest, while m' and n' are the forces exerted by these coils when the unit current passes through them. At balance in Station I, $p' = o$

Further $$P' = \mathfrak{A}' m' + \mathfrak{B}' n'$$

where $\mathfrak{A}'$ and $\mathfrak{B}'$ are the currents which pass through the coils a' and b' respectively, when Station II is sending and Station I is at rest (single signals).

Further $$Q' = \mathfrak{F}' m' + \mathfrak{G}' n'$$

where $\mathfrak{F}'$ and $\mathfrak{G}'$ are the currents which pass through a' and b' respectively when both stations are sending simultaneously (duplex signals).

To get the most general expressions for these three forces p, P, and Q, we have to fix the signs of the two terms of which they consist. This is best done by considering the forces m and n as absolute numbers, and determining the direction in which they act with respect to one and the same magnetic pole by the direction of the currents passing through the coils a and b.

To fix the signs of the currents, we shall call, arbitrarily, that current positive which passes through the coil a in the sending station, when the negative pole of the signalling battery is joined to earth.

Further, if we suppose at the outset, that the movement of the key k does not alter the complex resistance ρ of its own station, *i. e.*, the fulfilment of the key equation

$$w + \beta = f$$

a condition which is essential, it is clear that the currents V' and q' are the algebraical sums of the currents A', $\mathfrak{A}'$ and B', $\mathfrak{B}'$ respectively, whence it follows that

$$Q' = (A' + \mathfrak{A}')\, m' + (B' + \mathfrak{B}')\, n'$$

where the currents contain the signs.

Now, with respect to the manner of connecting up the two signalling batteries E' and E'', we have the following two different cases:

1*st.* The same pole of the signalling battery is connected to earth in each station, thus:

$$p' = \pm A'\, m' \mp B'\, n'$$
$$P' = \mp \mathfrak{A}'\, m' \mp \mathfrak{B}'\, n'$$
$$Q' = (\pm A' \mp \mathfrak{A}')\, m' + (\mp B' \mp \mathfrak{B}')\, n'$$

where the upper signs are to be used when the negative poles of the signalling batteries are connected to earth in both stations, and the lower signs when the positive poles of the signalling batteries are connected to earth in both stations.

2*nd.* Opposite poles of the signalling batteries are connected to earth in the two stations, thus:

$$p' = \pm A'\, m' \mp B'\, n'$$
$$P' = \pm \mathfrak{A}'\, m' \pm \mathfrak{B}'\, n'$$
$$Q' = (\pm A' \pm \mathfrak{A}')\, m' + (\mp B' \pm \mathfrak{B}')\, n'$$

where the upper signs are to be used when the negative pole in Station I and the positive pole in Station II are connected to earth, and the lower signs when the reverse is the case.

Subtracting in either of these two cases P' from Q', it will be seen that invariably

$$S' = Q' - P' = p'$$

or that, on account of having fulfilled the key equation $w + \beta = f$, the difference of force by which single and duplex signals are produced is equal in magnitude and sign to the force by which balance is disturbed. Further, that it is perfectly immaterial whether the same or opposite poles of the signalling batteries are put to earth. For reasons already explained I prefer to use the negative poles of the signalling batteries to earth in both stations, and this alternative we will suppose is adopted.

Thus we have:

$$p' = A'\, m' - B'\, n'$$
$$P' = -(\mathfrak{A}'\, m' + \mathfrak{B}'\, n')$$
$$Q' = (A' - \mathfrak{A}')\, m' - (B' + \mathfrak{B}')\, n'$$

If we now substitute for A', B', $\mathfrak{A}'$, $\mathfrak{B}'$ their values, we get :

$$p' = \frac{E'}{N'}\,\Delta'$$

$$P' = -\frac{E''(b''+d'')}{N''}\,\mu'\lambda'$$

and $$Q' = -\frac{E''(b''+d'')}{N''}\,\mu'\lambda' + \frac{E'}{N'}\,\Delta'$$

the sign of p' being contained in Δ', and

where

$$N' = f'(b'+d'+a'+h'+c') + (b'+d')(a'+h'+c')$$

$$N'' = f''(b''+d''+a''+h''+c'') + (b''+d'')(a''+h''+c'')$$

$$\mu' = \frac{i}{i+l'+\rho'}$$

$$\Delta' = (b'+d')\,m' - (a'+h'+c')\,n'$$

$$\lambda' = m' + \frac{f'}{b'+d'+f'}\,n'$$

Thus the general expressions for the two functions D and S are :

$$\left.\begin{aligned} D' = \frac{p'}{P'} &= \frac{E'}{E''}\cdot\frac{N''}{N'(b''+d'')}\cdot\frac{\Delta'}{\mu'\lambda'} \\ S' = p' &= \frac{E'}{N'}\,\Delta' \end{aligned}\right\}\text{for Station I.}$$

and

$$\left.\begin{aligned} D'' = \frac{p''}{P''} &= \frac{E''}{E'}\cdot\frac{N'}{N''(b'+d')}\cdot\frac{\Delta''}{\mu''\lambda''} \\ S'' = p'' &= \frac{E''}{N''}\,\Delta' \end{aligned}\right\}\text{for Station II.}$$

Rigid fulfilment of the two functions $D = o$ and $S = o$.

D can only become zero, for finite resistances of the branches, if

$$p = S = o$$

i. e. if $$\Delta = o$$

Now, to keep $\Delta = o$ we may adopt two essentially different modes of re-adjustment, namely :—

Either leave the coils and their armatures stationary, and adjust balance by altering the resistances of the branches $(a+h)$ and $(b+d)$ separately or simultaneously, or leave the resistances of these branches constant, and move the coils or their armatures. These two cases are to be considered separately.

(*a.*) *Re-adjustment of balance by altering the resistances of the branches.*

As a and b are resistances which in the form of coils have to exert magnetic force, it is impracticable to suppose them variable. If they have been once selected, they must necessarily be kept constant, whence it follows

that the re-adjustment of balance is restricted to a variation of the resistances h and d.

But as ρ is a function of h and d, to establish balance by altering one of them only, would invariably result in an alteration of ρ, and consequently *immediate* balance would become an impossibility.

Thus in order to readjust balance, and at the same time to keep ρ constant,* we must vary h and d simultaneously.

Now, it can be proved in exactly the same manner for the differential method as it was for the bridge, that in order to make the disturbance of balance for any given variation in the system as small as possible we must make ρ as large as possible, whence it follows from the form of ρ that

$$f = b + d$$

the "*regularity condition*" for the differential method.

But since

$$f = w + \beta$$

it follows that to re-establish balance by an alteration of the resistances h and d while a, b, β, and ρ keep constant, we have to vary *all* the four branches h, d, w and f simultaneously, in such a manner that their variations fulfil the following condition:

$$\delta f = \delta d = \delta w = -(2\ \delta h)$$

which is simple enough to allow of its practical application; but which nevertheless shows again the inferiority of the *differential method* as compared with the *double balance*, *i. e.*, in order to fulfil *immediate balance*, the *key equation*, and the *regularity condition* for the *differential* method, we have to make the four branches of the system simultaneously variable, while in the *double balance* the same effect can be obtained by having *one* branch only variable (the b branch).

It is worth while to mention here that there is a special case of obtaining *immediate balance* for the differential method by the adjustment in one branch, namely, when $f = o$, for then ρ would be independent of d, and therefore balance could be obtained by varying d without altering p.

However, on account of the key equation $f = w + \beta$, it would follow from $f = o$, that β must be zero also, which represents a physical impossibility inasmuch as the internal resistance of galvanic cells cannot be reduced

* $\rho = a + h + \dfrac{(b + d) f}{b + d + f}$

keep a, b and f constant and vary h and d, whence we should have:

$$\delta\rho = (b + d + f)(b + d + f + \delta d)\,\delta h + f^2\,\delta d = o$$

an equation, which it is always possible to fulfil for any variations of h and d if taken of opposite signs, although it may be difficult to achieve it practically by a simple motion, such as that of turning a handle. The absolute value of these variations depends of course on the variation of e which disturbs the balance, and in order to have accelerated balance we ought to decrease h and increase d when e increases, and *vice versâ*.

to zero, not even approximately. Besides the E. M. F. requisite for duplex working being necessarily comparatively large, β will always be a quantity which cannot be neglected against the other resistances of the system, even if the single cells were of small resistance.

But supposing it were practicable to construct a battery of exceedingly low internal resistance, then, as $f = b + d$, it would be necessary to make $\zeta = o$ and $d = o$ another physical impossibility, as b must consist of convolutions to produce magnetism, and d must be variable to produce balance.

This solution $f = b + d = w + \beta = o$, or even each of these three branches of an only exceedingly small resistance, must therefore be rejected.

(*b.*) *Adjustment of balance by moving the coils or armatures.*

This, it will be clear, is *the* solution for *immediate balance*, for such a mode of adjustment would involve no relation between the resistances of the three branches, leaving their determination free for other purposes. In order that the slightest movement of the two coils, or their armatures, may produce the required balance, it will be best to move both the coils or armatures simultaneously in the same direction. In fact to be able to produce balance, no matter how great the variation in the resistance of the line may become, it will be necessary to make the coils movable for the changes of seasons, and the armatures for the daily changes.

It is clear that the differential method, when balance is adjusted by the movement of the coils or armatures, can alone be compared in efficiency with the *double balance*, and the superiority of the latter is most striking. While *immediate balance*, and the fulfilment of the other two essential conditions, can be obtained with *the double balance method* within any given range by a variation of the resistance in *one* single branch (b branch), this same result with the differential method can only be arrived at by either supposing four branches simultaneously variable, or by supposing the coils and armatures movable,—both pre-supposing complicated mechanical arrangements requiring delicate workmanship and being liable to get out of order.

Rapid approximation of the two functions D *and* S *towards zero.*

Supposing the fulfilment of the key equation as one of the most essential conditions, we know that

$p = S$ for each station invariably.

Now for Station I we have

$$p' = S' = E' \frac{\Delta'}{N'}$$

where

$$\Delta' = (b' + d')\, m' - (a' + h' + c')\, n'$$

$$N' = f'(b' + d' + a' + h' + c') + (b' + d')(a' + h' + c')$$

If we call c' that value of the measured circuit, which for any given values of the two branches $b' + d'$ and $a' + h'$ produces balance in Station

I, *i. e.* for which $\Delta' = o$, then if c' varies $\delta c'$, we have $\Delta' = n' \delta c'$, while N' becomes $N' + \delta N'$.

Thus we have

$$S' = E' \frac{n' \delta c'}{N' + \delta N'}$$

$$S' = \frac{E' n'}{f' + b' + d'} \cdot \frac{\delta c'}{a' + h' + \frac{f'(b' + d')}{f' + b' + d'} + c' + \delta c'}$$

but as $a' + h' + \frac{f'(b' + d')}{f' + b' + d'} = \rho'$ the complex resistance in Station I, and as further $\delta c'$ can be neglected against c', we have finally:

$$S' = E' \frac{n'}{f' + b' + d'} \cdot \frac{\delta c'}{c' + \rho'}$$

Further n', the force exerted by the coil b' on a given magnetic pole when the unit current passes through the coil, can be expressed as follows:

$$n' = r' \sqrt{b'}*$$

where r' is a coefficient depending only on the dimensions and shape of the coil, on the manner of coiling the wire, and on the integral distance of the coil from the magnetic pole acted upon.

Thus we have

$$S' = E' \frac{r' \sqrt{b'}}{b' + f' + d'} \cdot \frac{\delta c'}{c' + \rho'} = E' . W' . \theta'$$

Now supposing the factor W' constant,† S' becomes smaller the smaller θ' is.

In the second part it has been proved quite generally that θ decreases permanently with increasing ρ' ρ'', no matter to what special cause the variation of c' is due, whence again it follows that ρ should be a maximum.

From the form of ρ however we see that for any given sum $b + f + d$, ρ becomes largest if

$$f = b + d$$

which is "*the regularity condition*" of the differential method.

* This expression supposes that the thickness of the insulating covering of the wire can be neglected against the diameter of the wire, which is allowable. r' is a constant with respect to b'.

† That W' can be kept constant while θ' decreases and $\frac{f'}{b' + d'}$ varies, and $f' + b' + d'$ is constant, it will be clear is possible, for if $d' > o$ the variation of $b' + d'$ may be considered entirely due to a variation of d', equal and opposite in sign to the variation of f'. If $d' = o$ then we must consider r' variable with b' in order to keep W' constant while $\frac{f'}{b'}$ varies, which is admissible since the position of the coils has not been fixed as yet.

To have S'' therefore for any variation as small as possible, we must make $f = b + d$. Substituting this value of f we get an expression for S' which shows that it has an absolute maximum for b but no minimum, from which we conclude that b should be made either very much smaller or very much larger than the value which corresponds to a maximum of S, but no fixed relation between b and d or a can be found.

In order to prove that $b + d = f$ is *the solution*, we must now show that it also makes D as small as possible.

But as $$D = \frac{S}{P}$$

we have only to show that the regularity condition $b + d = f$, makes P either as large as possible, or, which would be still better, a maximum.

Now $$P' = A'' \mu' \lambda'$$

where A'' is the current which enters the line at point 2 (Fig. 2) when Station II is sending alone, while μ' is the factor which determines the loss through leakage of the line, and λ' is the factor to which the magnetic force, exerted by the current $A'' \mu'$ in Station I, is proportional.

μ' as well as λ' are functions of the resistances in Station I only* but not of those in Station II.

Now for constant values of μ' and λ' (*i. e.* leaving everything in Station I constant) P' becomes larger the larger A'' is:

$$A'' = E'' \frac{b'' + d''}{N''}$$

Substituting its value for N'', and dividing numerator and denominator by $b'' + d''$, we get

$$A'' = \frac{E''}{f'' + \frac{f''(a'' + h'')}{b'' + d''} + a'' + h'' + c''\left(1 + \frac{f''}{b'' + d''}\right)}$$

Supposing balance in Station II rigidly fulfilled, we have

$$(b'' + d'')\, m'' - (a'' + h'' + c'')\, n'' = o.$$

$$\therefore \quad c'' = (b'' + d'')\frac{m''}{n''} - (a'' + h'').$$

Substituting this value of c'' in the expression for A'' and reducing, we get

$$A'' = \frac{E'' r'' \sqrt{b''}}{f'' r'' \sqrt{b''} + q''(b'' + d'' + f'')\sqrt{a''}}$$

---

* $\mu' = \frac{i}{i + l' + \rho'}$; $\lambda' = m' + \frac{f'}{f' + l' + d'} n'$

Dividing by q^{ν}, and putting $\frac{r''}{q''} = v^{\nu}$ we have

$$A'' = E'' \frac{v'' \sqrt{b''}}{f'' v'' \sqrt{b''} + (b'' + d'' + f'' \sqrt{a''}}$$

This expression has a maximum* for

$$b'' = f'' + d''$$

which contradicts the regularity condition $f = b + d$ so long as d is different from zero.

Thus, in order to fulfil the regularity condition, and the maximum current, for the differential method simultaneously, we must put up

$$d = o$$

It has, however, been shewn that in order to have immediate balance, when adjusting balance by a variation in the resistances, we have to alter the resistances of the four branches $b + d$, $a + h$, f, and $w + \beta$ simultaneously according to a relation already given. Thus it is proved that adjustment of balance by an alteration of the resistances must be rejected, since, as pointed out before, a variation of the resistances of the coil b is impracticable.

We are obliged, therefore, to adjust balance by moving the coils or their armatures, and the further solution of the problem is only required, when this mode of adjustment is adopted.

Maximum magnetic moment.

It has now been proved that d is to be made zero, in order to be able to fulfil the conditions of *regularity* and *maximum current* simultaneously; and that therefore, to obtain immediate balance, readjustment of balance is to be effected by a movement of the two coils a and b or their armatures, and *not*, as has been generally proposed, by an alteration of the resistance in the branches $(a + h)$ and $(b + d)$.

Hence h appearing in the denominator of P only, and $h \geqslant o$ not being any more required for adjusting balance, the best value we can give to h is:—

$$h = o$$

which will make P, obviously largest.†

* In order to keep the balance in Station II rigid when b'' varies we must suppose v'' simultaneously variable with b''. This is perfectly justified, for v'' can be altered by an appropriate movement of the coils to keep up the balance in Station II, without altering the outgoing current A''.

† The resistances d and h, without exerting magnetic force, were originally introduced in order to investigate the possibility of adjusting balance by an alteration of the resistances in the branches. But since it has been shown that this mode of adjustment is to be rejected it is of course clear that the dead resistances in these branches should be made zero when P will become largest.

Substituting therefore in the expression for P

$$h = d = o$$
$$f = w + \beta = b$$

we get

$$P' = \frac{E'}{2\,(a'' + c'') + b''}\,\mu'\,\lambda' \qquad \text{for Station I.}$$

and

$$P'' = \frac{E'}{2\,(a' + c') + b'}\,\mu''\,\lambda'' \qquad \text{,, Station II.}$$

These two expressions do not as yet contain the balance conditions.

The factors $\frac{\mu'}{2\,(a'' + c'') + b''}$ and $\frac{\mu'}{2\,(a' + c') + b'}$ are identical, namely :—

$$\frac{\mu'}{2\,(a'' + c'') + b''} = \frac{\mu''}{2\,(a' + c') + b'} = \frac{i}{Q}$$

Where $$Q = i\left\{2\,(a' + a'' + l' + l'') + b' + b''\right\} + \frac{b'\,b''}{2}$$
$$+ (a'' + l'')\,(a' + l' + b') + (a' + l')\,(a'' + l'' + b'')$$

as can be easily calculated by sustituting for μ and c their known values.

In the second investigation it has been stated why P' and P'' cannot be made maxima separately, and that we could do nothing else but make their sum a maximum. In this case we have to do the same. Hence the question to be solved is reduced to the following :

$$P = P' + P'' = i.\ \frac{E''\,\lambda' + E'\,\lambda''}{Q}$$

is to be made a maximum with respect to the variables a, b, q and r, while they are linked together by two condition equations, namely :—

$$r'\,(a' + c') - q'\sqrt{a'\,b'} = o \text{ balance in Station I}$$

and $$r''\,(a'' + c'') - q''\sqrt{a''\,b''} = o \quad \text{,,} \quad \text{,,} \quad \text{II}$$

This general problem can be solved in exactly the same way as it was in the second investigation. It is however not needed to do this again, since the general solution can be written down from inference, after having solved the special problem for a line which is perfect in insulation.

Suppose that $i = \infty$, or at least very large as compared with $l' + l' = L$, then obviously P' and P'' become identical without condition, namely :—

$$P' = P'' = P = \frac{E}{4}\,\frac{2\,q\sqrt{a} + r\sqrt{b}}{L + 2\,a + b}$$

while the two balance equations become also identical namely :—

$$2\,q\sqrt{a\,b} - r\,(4\,a + b + 2\,L) = o$$

If we substitute the value of r from the balance equation in the expression for P, we get

$$P = E\,q \cdot \frac{\sqrt{a}}{4\,a + 2\,L + b}$$

which has an absolute maximum with respect to a only, namely

$$a = \frac{L}{2} + \frac{b}{4}$$

Substituting this value of a in the last expression for P we get:

$$P = \frac{E\,q}{4} \cdot \frac{1}{\sqrt{2\,L + b}}$$

Whence it follows that P becomes largest for $b = o$, otherwise b remains indeterminate; q on the other hand should be made as large as possible.

If we now put $v = \frac{r}{q}$ and develope its value from the balance equation, we get

$$v = \frac{r}{q} = \frac{1}{2}\sqrt{\frac{b}{2\,L + b}}$$

The solution of the 1st problem of the differential method, when the line is perfect in insulation, is therefore

$$h = d = o$$
$$f = b = w + \beta$$
$$a = \frac{L}{2} + \frac{b}{4}$$
$$v = \frac{1}{2}\sqrt{\frac{b}{2\,L + b}}$$

The absolute value of b is left indeterminate,* and we only know that the smaller it can be made the better.

But to fulfil this best condition $f = b = w + \beta = o$ represents a physical impossibility, since neither β, the internal resistance of constant galvanic cells, can be made zero, not even approximately, nor b, which must have convolutions in order to act magnetically.

The larger $f = b = w + \beta$ becomes, for practical reasons, the more the differential method, even under the best quantitative arrangements as given above, will become inefficient as compared with the double balance.

* Practically, however, it may be said, that b is given; for generally β, the internal resistance of the signalling battery is determined by the nature and number of galvanic cells required for duplex working. We must only remember that b should be made somewhat larger than β, in order to have an adjustable resistance w in the battery branch, which may be used for compensating any variation of the battery resistance, that the equation $f = b = w + \beta$ may be permanently fulfilled.

Now by inference we get for a line with leakage, *i. e*, $i < \infty$

$$\left.\begin{aligned} a' &= \frac{L'}{2} + \frac{b'}{4} \\ a'' &= \frac{L''}{2} + \frac{b''}{4} \\ v' &= \frac{1}{2}\sqrt{\frac{b'}{2\,L' + b'}} \\ v'' &= \frac{1}{2}\sqrt{\frac{b''}{2\,L'' + b''}} \end{aligned}\right\} \text{Approximately.}$$

The above values for a and v are somewhat too large, but in practical application they are quite correct enough.

The physical reason that this solution for the differential method gives an indeterminate result, is simply due to the fact that the force which produces the signals in the differential method is due to the combined magnetic actions of *two* separate coils through which unequal currents pass, instead of to *one* coil, as in the bridge method. On account of $b = f$, it follows that the current which passes through the b coil is only half of that passing through the a coil. Thus, in order to make the most of the arrived currents, b and f should be both equal to zero, or, in other words, placing *all* the convolutions in a and *none* in b must clearly give the greatest magnetic force. Obviously, however, such a solution could not fulfil the balance condition in the sending station.

The value of b should be chosen as small as practicable and its minimum value is β, the internal resistance of the signalling battery. How much larger b should be taken, depends on the absolute variation of β, *i. e*, on the constancy of the resistance of the signalling battery. If the battery is very constant with respect to internal resistance, then b need be only very little larger than β, which determines the adjustable resistance w.

For instance minotto cells can be easily prepared with an internal resistance of 10 B. A. U. per single cell. Their minimum resistance, obtained by working, is never less than 5 B. A. U., and if the zincs are changed from time to time, their maximum resistance will scarcely ever be higher then 10 B. A. U.

Hence to make b about 50% larger than β will suffice, by which, if β is known, the greatest value of w is fixed.

The absolute value of β can be determined from the number of cells which have to be connected up successively, in order to work a given instrument through a given line, when the circuit Fig. 2 is adopted. This absolute value of β will therefore not only depend on the electrical state of the line and the nature of the cells, but also on the absolute sensitiveness of the differential instrument employed.

To make β therefore as small as possible, a sensitive construction of the differential instrument becomes requisite; further cells of high E. M. F. and low constant resistance are best adapted for forming the signalling battery. In order to get the widest limits in the variation of w it is clear that *that* β should be selected which is calculated from the maximum number of cells required to produce the signals with sufficient force. The greatest number of cells is obviously required when the line is at its lowest insulation, in India during the monsoon.

The value $v = \frac{r}{q}$ is what has been termed the mechanical arrangement of the differential instrument.*

If $b = w + \beta$ has been determined by fixing β, then v has its smallest value for L largest, which is the case when the line is perfect in insulation; when the coil a must be closest to the magnetic pole acted upon, and the coil b furthest away from it.

The highest value of v we obtain by substituting the lowest L, *i. e.* when the line is at its lowest insulation; when the coil b must be nearest to the magnetic point acted upon, and the coil a furthest away from it.

Hence the two limits of v being fixed by the known limits between which L varies, the extent of movement of the two coils is also fixed, and consequently, if q is chosen arbitrarily, the construction of the differential instrument is determined. But even q is not quite arbitrary, since we know the form, dimensions and resistance of the coils, which, for instance, in Siemens' polarized relays on any given line, have to produce the magnetism in single circuit to get the signals with engineering safety.

The solution of the 1st problem of the differential method is therefore:

1. Balance in each station must be obtained by a movement of the two acting coils or their armatures, either singly or better simultaneously in the same direction, and *not* by an alteration of the resistances in the branches.

2. If this mode of adjusting balance be adopted, then the solution is:

$$\mathrm{d} = \mathrm{h} = \mathrm{o}$$
$$\mathrm{f} = \mathrm{b} = \mathrm{w} + \beta$$
$$\mathrm{a} = \frac{\mathrm{L}}{2} + \frac{\mathrm{b}}{4}.$$
$$\mathrm{v} = \frac{\mathrm{r}}{\mathrm{q}} = \frac{1}{2}\sqrt{\frac{\mathrm{b}}{2\,\mathrm{L} + \mathrm{b}}}$$

It will now be clear that the given solution fulfils the following essential conditions:

* J. A. S. B., Vol. XLI, Pt. II, p. 148.
Phil. Mag., Vol. XLIV, p. 166.

(i). *Any variation of the resistance in the total system has the least possible disturbing effect on the receiving instrument.*

(ii). *Any disturbance of balance can be eliminated by an appropriate movement of the two acting coils or their armatures, without disturbing balance in the distant station.*

(iii). *Conditional maximum magnetic moment of the receiving instrument.*

(iv). *Conditional maximum current.*

Addendum I.

Here I wish to give some additional explanations and corrections with reference to the 1st and 2nd parts of this investigation.

In J. A. S. B., Vol. XLIII, 1874, Pt. II, p. 20, I have substituted

$$c' = L' + \rho''$$

without stating that this expression for c' is only approximately true. The correct expression for c' is clearly

$$c' = l' + \frac{i\,(l'' + \rho'')}{i + l'' + \rho''}$$

which approximates closely towards $L' + \rho''$ if $l'' + \rho''$ is sufficiently small as compared with i. This for any line in good electrical condition, will always be the case.

At page 9, in the foot note, for "*as nearly as possible equal*" read "*as nearly as possible proportional.*"

At page 20, $\frac{dG}{dg} = L\,(a^2 - g^2) + 2\,a\,g\,(d - g) = o$

should be $\frac{dG}{dg} = L\,(a^2 - g^2) + 2\,a\,(a\,d - g^2) = o$

At pages 19 and 224 after having shewn that

$$a + f = g + d$$

I conclude at once that on account of equation VI ($a\,d - g\,f = o$)

$$a = g = d = f \quad \ldots \quad \ldots \quad \ldots \quad \text{VIII}$$

while mathematically it follows only that

$$a = g$$

and $$d = f$$

These two equalities do certainly not contradict equation VIII but they do not necessitate it.

The additional reason why equation VIII should be chosen follows from the balance condition

$$a\,d - b\,c = o$$

$$\therefore \quad b = \frac{a\,d}{c}$$

Therefore b becomes largest for any given c and any given $(a + d)$, if we put $a = d$.

But b largest is required for two separate reasons:

1. If the immediate balance is disturbed by an alteration of the resistance of one or more of the four branches, which may happen, especially by f, *i. e.*, β (battery resistance) varying, then ρ becomes at once a function of b, *i e.*, an increasing one with b. Thus in order to keep ρ as large as possible, and at the same time as constant as possible, b should be selected largest.

2. Further by making b as large as the circumstances will admit, we clearly have the largest sent and largest received currents, which will be clear without calculation. In fact later on, page 232, it has been shewn that $a = d$ is the condition for the maximum signalling current.

Addendum II.

Since the 3rd February, 1875, the main line from Bombay to Madras had been successfully worked duplicé by means of the "double balance method."

This line is worked direct, *i. e.*, without any translating instruments, and is 797 miles in length; it consists almost throughout of No. 5½ wire B. W. G. (diameter 5¼ m. m.) and is supported chiefly on the Prussian insulator.

The section of this line from Bombay to Callian is exposed to the destructive influence of a tropical sea climate; between Callian and Poona the line passes over the Western Ghâts, the dense fogs during the cold weather and the heavy rains during the South-west monsoon on these hills seriously affect its insulation; from Poona to Sholapore and Bellary, the line runs inland and experiences a climate on the whole favourable for the maintenance of constant and high insulation; between Bellary and Madras, however, the line again comes under the influence of a most unfavourable climate, especially just before and during the continuation of the North-east monsoon, when the atmosphere at a high temperature, is saturated with moisture and salt, leaving conducting deposits on the surface of the insulators.

Consequently during the South-west monsoon the resultant fault is near Bombay, during the hot weather it shifts towards the middle of the line, and in November when the rains set in at Madras and the weather on the Bombay side is clearing up, the resultant fault is situated close to Madras.

By February next, duplex working will therefore have been submitted to a most severe test, applied as it will have been for a whole year to a long line the electrical condition of which is highly variable with respect to season and locality, and its practicability will doubtless again be clearly proved, as has already been the case on the Calcutta-Bombay line, 1600 miles, where under no more favourable climatic conditions, duplex has, for the past twelve months not only fulfilled but surpassed the expectations formed of it. No difficulties have been experienced, and it is believed never will be.

Strange as it may appear from a theoretical point of view, it will nevertheless be found in practice, that a line worked duplicé carries more than double the traffic of the same line worked singly; for it represents two lines carried on different posts far distant from one another, instead of 2 parallel lines on the same posts, and consequently the highly injurious effects of voltaic induction are eliminated.

Further the receiving signallers, not being provided with keys, are unable to interfere with messages during their transmission.

Corrections and repetitions do not necessitate a stoppage of work, for they are obtained in the following manner: the receiving signaller marks with a cross, or underlines the words to be repeated, and places the message by the side of the sending signaller, who calls for the repetitions directly he has finished the message he is transmitting, and during this call the distant station may either send fresh messages or may also call for repetitions; consequently single working need never be resorted to, and the simultaneous exchange of messages and corrections becomes continuous.

The Indian system of receiving (the sounder system which has now been universally recognised as the only right one hand for signalling) thus necessitates constant attention on the part of the receiving signallers, for any inattention on their part at once becomes known to the controlling officer.

X.—*Photography in connection with the Observation of the Transit of Venus at Roorkee, December 9th (Civil)*, 1874.—*By Captain* J. Waterhouse, *Assistant Surveyor General of India.*

(Received July 30th;—Read August 4th, 1875.)

In December last I communicated to the Society a brief account of the proposed arrangements for observing the Transit of Venus at Roorkee, drawn up by Capt. W. M. Campbell, R. E., and although the popular interest in the subject has now somewhat worn off, a description of the operations connected with the application of photography to the observation in India of this very important astronomical event may not be without interest to the members of the Society, and as a record of experience gained, be useful on a future occasion.

Object of Photographic Observations.—Without entering into the consideration of the astronomical problems involved, it may be briefly stated that the object in view in making photographic observations of the Transit of Venus was to obtain a series of images showing, with the utmost attainable accuracy, the exact relative positions of the planet and the sun at carefully noted times during the progress of the Transit at the different stations of observation; so that by combining these photographs, the path of the planet across the solar disc might be accurately determined and the solar parallax be estimated by comparing the paths thus deduced for different stations. It was further proposed to endeavour to secure a graphic time-record of the exact moments at which the internal contacts of the planet and the limb of the sun took place, by means of an arrangement enabling a large number of photographic pictures to be taken on a single plate at intervals of a second or so just about the time of contact. It was anticipated that results of the highest possible value and reliability would be obtained if photographs sufficiently exact to allow of minute micrometrical measurement could be secured, as such photographs would form a permanent and indisputable record, entirely free from the errors and imperfections inseparable from personal observation, and have the further advantage that they might be examined at leisure and, if necessary, carefully compared by several independent examiners. How far these anticipations have been fulfilled still remains to be seen; but as several hundred photographs have been obtained in various parts of the world by different photographic processes and with dissimilar instruments, sufficient data will probably have been gained to test the value of photography for observations of so delicate a nature and, if this is satisfactorily proved, to show by what methods it may most successfully be applied.

The superintendence of the official arrangements for the observation of the Transit in Northern India was entrusted to Colonel Tennant, R. E., who has done so much to further the progress of astronomy and solar physics in this country, and was one of the first to recognise the value of photography as a means of recording the Transit. He selected Roorkee in the N. W. Provinces as his station of observation, partly on account of the great advantages to be gained by the proximity of the Canal Workshops for setting up the observatory and the repair and adjustment of instruments.

Photoheliograph.—It was arranged that photographic observations should form part of Colonel Tennant's programme and that with this object he should be furnished with a photoheliograph by Dallmeyer, of the same construction as those supplied to the English and Russian expeditions. These instruments were on the same principle as the photoheliograph designed by Dr. Warren De la Rue for the Kew Observatory, and consisted of a telescope combined with a photographic camera, equatorially mounted, and driven by clockwork. According to a description given by the maker, the object glass was 4 in. diameter and 60 in. focal length, corrected to combine the chemical and visual foci. The image of the sun formed at the principal focus was about $\frac{1}{2}$ in. in diameter and was thrown on to an enlarging combination by which an enlarged image about 4 in. diameter was projected on to the sensitive photographic plate arranged as in an ordinary camera. A little in front of the enlarging lens was a slide pierced with two circular openings, one fitted with spider-web crosslines and the other with a glass plate ruled with a fine reticule of squares, and capable of adjustment so as to be brought into the focus of the object-glass in order that the cross-wires and reticule might be enlarged and brought to fine focus at the same time as the image of the sun. The pictures could thus be taken with the cross-wires, which served as a reference mark for measurements in connection with the declination and right ascension circles, or with the reticule, by means of which any optical distortion caused by the secondary enlargement of the image could be measured.

The quick exposure of the plates was effected by means of a shutter sliding between the cross-wires and the enlarging lens, in which position the object could be effected with a minimum of motion. This shutter was held at its lower end by a spring and was arranged so that when raised to its full extent, by means of a string attached to its upper end, the passage of the solar rays to the sensitive plate was cut off. This string passed over a pulley on the body of the instrument and had at the end a hook on which a loop of strong cotton thread was attached and, being stretched so as to pass over a conical block fixed on the camera, retained the shutter in its raised position. When the thread was cut, the force of the spring imme-

diately drew down the shutter and allowed a momentary exposure of the sensitive plate to the solar rays during the passage of a slit in the shutter, the width of which could be increased or diminished at will from nil to ·5 of an inch by means of another slide worked by a screw connected with a graduated scale. The rapidity of motion of the shutter could also be regulated by increasing or diminishing the tension of the spring by means of a screw.

When the shutter was down the solar rays were quite cut off; but by a simple arrangement a circular aperture above the exposing slot could be brought into a position concentric with the axis of the telescope, thus permitting the whole bundle of rays to pass uninterruptedly through the camera and enabling the image to be examined for focussing, &c.

The camera of the photoheliograph was constructed to take plates six inches square. The position of the image on the plates was regulated by means of a finder fixed on the outside of the telescope tube and consisting of a lens throwing an image of the sun upon a screen made of talc covered with paper, and adjusted so that when the enlarged image was in its proper position on the ground glass of the camera the finder image just filled a square ruled on the talc screen.*

Janssen Slide.—A repeating arrangement for taking several pictures on one plate, designed by Dr. Warren De la Rue on the principle proposed by the eminent French astronomer M. Janssen, and known as the Janssen slide, also formed part of the equipment. This arrangement having been fully described and figured by Dr. De la Rue,† it will suffice to say that it consists of a circular wooden case about 12 in. in diameter and 2 in. deep, with a removable shutter in front and constructed so as to be fitted on to the camera in the position occupied by an ordinary dark slide. Revolving on a central axis within this case is a metal disc or plate-holder, with 60 radial slots and as many circular spaces racked in its edge, carrying the sensitive plate held between rings strongly electroplated with silver. Outside the case, in front, a second smaller disc revolves just outside the shutter and is provided with a radial opening capable of being opened or closed at pleasure, so as to regulate the exposure by admitting more or less light to the plate through a radial slit cut in the shutter of the slide, about 1 in. long and exactly corresponding in position and width to the sixtieth part of the circumference of the plate. The axis of this exposing disc passes through the case and carries a pin which fits into the slots in the edge of the revolving plate-holder and is turned, from outside the case, by means of a winch arranged with gearing, so that it may be

* The screen originally supplied with the instrument was of parchment, but as this was found to expand and contract with the variations of moisture in the air, it was advantageously replaced by the talc and paper screen.

† Roy. Ast. Soc. Monthly Notices, May 1874.

worked either by hand or automatically by means of clockwork. This axis also carries an ivory ring on the periphery of which is fixed a piece of platinum wire which, as the axis revolves, comes into contact with a strip of platinum fixed on a spring attached to a connector, so that it may be placed in electrical communication with a chronograph and electric clock and thus enable the precise moment to be recorded, when the uncovering of the aperture in the shutter of the slide by the exposing disc exposes a portion of the plate to the sun. As there are sixty slots and the aperture corresponds to the sixtieth part of the circumference of the plate, it is evident that for each entire revolution of the plate-holder sixty distinct images will be impressed on as many separate portions of the plate within an annular space about 1 in. wide round its circumference.

The apparatus is constructed so that the plane of the sensitive collodion film shall exactly coincide with that of the focussing screen of the camera, and in order to adjust the instrument so as to obtain an image of any desired portion of the solar limb or disc, it is arranged that when the sensitive plate is in the proper position for receiving the first image of the sixty, the observer can look from behind, through a series of three red glasses, one of which is in front of the plate, on the exposing disc, and the other two behind it, one on the revolving plate-holder and the other on the wooden case. The three glasses are coincident only in one position, *i. e.*, when the stop, formed by racking the last of the radial slots for only a short distance, is on the right of the axis; and as the stop is on the left of the axis after a complete revolution, the revolving plate-holder must always be reversed through an entire revolution after each operation in order to bring it into the proper position for focussing. While focussing, the sensitive plate itself acts as a focussing screen.

By means of clockwork the rate of revolution of the plate-holder could be so adjusted that the exposures might be made at intervals varying from about half a second to two seconds, but as it was desirable not to expose the separate pictures too rapidly, the rate was set so that the entire revolution might be accomplished in about a minute and a half.

Preliminary trials with Dry Plates.—I received intimation about the middle of August 1874 that, with the concurrence of the Surveyor General, my services were likely to be placed at Colonel Tennant's disposal for the superintendence of the photographic observations. As there appeared to be a general opinion in Europe that a dry process would be most suitable for continuous observations lasting over a period of some hours and would have other special advantages for the purpose, the first thing to be done was to select the process to be used and to gain some experience in working it; and although the weather at that time of the year was most unfavorable to photography and very trying to work in, all the time that could be

spared from my regular office duties was devoted to preliminary trials of dry plates in Calcutta till October, when I joined Colonel Tennant at Roorkee.

It was understood that the English observers were to use the beer-albumen dry process recommended by Captain Abney, R. E., and therefore my first trials were with it; but although the instructions given by Captain Abney were carefully carried out, it was found impossible to obtain the exalted sensitiveness claimed for the plates and, though the pictures obtained had many good qualities, the exposures were so long that I could not but consider the process unsuitable and look for some other by which more sensitive plates could be secured. The beer-albumen process was, however, tried on several different occasions, both in Calcutta and at Roorkee, with different collodions and various samples of beer, but always with the same result.

The cause of the great want of sensitiveness shewn by these plates could not be discovered. Captain Abney says that those who have not succeeded with his process have not used a sufficiently porous collodion; but on this occasion several collodions were used, some containing a large proportion of water, but without any noticeable advantage; though other dry plates taken with the same collodions gave much greater sensitiveness.*

It is possible that the beer used was not quite suitable from containing too large a quantity of chlorides or other substances detrimental to sensitiveness, and that this was probably the case is shown by the fact that a much greater sensitiveness and generally better results were obtained with the mode of working the beer-albumen process recommended by Mr. Davies of Edinburgh, in which a small quantity of nitrate of silver is added to the beer with the effect of throwing down all the chlorides and much of a glutinous substance; but even this modification did not give quite satisfactory results and the idea of using the beer-albumen process for the Transit plates was given up. Although the process has no doubt yielded excellent results in the skilled hands of Captain Abney and others, the uncertain composition of the different liquids known as beer render it undesirable that this substance should be used in the preparation of dry plates which are to serve as a standard for scientific purposes and from which comparable results are expected. For such purposes more certainty and

* I have quite recently tried the beer-albumen process again with samples of collodion yielding good results with other dry processes—but found the plates just as insensitive as they were before. By flowing the films, after washing away the free silver, with a 10-grain solution of pyrogallic acid in beer, then again well washing, and finally flowing the plate with a mixture of glycerine and dilute albumen, plates were obtained giving excellent results with at least ten times more sensitiveness than those prepared by Captain Abney's plan.

uniformity will be attained by the use of materials which are likely to be of nearly the same chemical composition in all parts of the world.

As the beer-albumen process was not found to answer, attention was turned to other dry processes and several different methods were tried with varying results.

At an early stage of the experiments it was found from trials with a rough photoheliograph, constructed in Calcutta for the purpose, that a process which might give very good results for taking views &c. would not answer for the sun and *vice versâ;* and the same was afterwards found to be the case when working with the English photoheliograph.

Among the most promising dry processes tried in these preliminary experiments were the gum-gallic, in which the so-called preservative is composed of a solution of gum arabic and gallic acid, and a process in which the preservative was laudanum, either alone, as a dilute solution in water containing from 16 to 4 per cent. of laudanum, or mixed with gum arabic or gum tragacanth, in order to keep the pictures free from the stains liable to occur when using the laudanum alone. Excellent results for views were also obtained with a filtered mixture of laudanum and very thin arrowroot water. I was induced to use the laudanum from a statement of Prof. Vogel of Berlin, that plates prepared with morphia were more sensitive to the comparatively nonactinic rays from the outer part of the solar disc; and though I did not remark any special superiority in this respect, the laudanum plates were found more sensitive than most of the others tried. Plates prepared with a saturated solution of morphia in water also gave good results.

The addition of nitrate of uranium to the nitrate of silver bath used for sensitising the plates, as recommended by Captain Abney, was found advantageous for most of the dry plates, giving increased sensitiveness and other good qualities. As some doubt has lately been thrown on the advantage of the uranium bath, it may be as well to state that in the ordinary wet process with bromo-iodised collodion I have found that no advantage is gained by the addition of the uranium salt to the nitrate bath, but, on the contrary, there is a great loss of sensitiveness. With dry plates, however, it is different, the gain in sensitiveness is well-marked and the shadows appear cleaner than on plates sensitised in the ordinary bath without the uranium.

Shrinkage of the Collodion films.—When it was first proposed to employ photography in observing the Transit, it was objected that the collodion processes would be unsuitable on account of the shrinkage or contraction the collodion films undergo in drying. De la Rue in 1861 made some very careful experiments, the result of which was to shew that with proper precautions the shrinkage was entirely in the thickness of

the collodion film: more recently, however, Paschen had found this contraction to amount to not less than $\frac{1}{158}$ of the length of the plate with albumenised plates, and to $\frac{1}{2128}$ of unalbumenised plates; in one instance it being so much as $\frac{1}{523}$ of the length and $\frac{1}{618}$ of the breadth of the albumenised plate. Rutherfurd, on the other hand, found that if the plates received a preliminary coating of albumen, the shrinkage of the wet film in drying did not exceed $\frac{1}{4800}''$ and was, on an average, about five times less. Prof. H. Vogel, of Berlin, also made some experiments on the conditions affecting the stability of the collodion film, which proved the value of a substratum as a preventive of contraction of the film and shewed that dry plates were less liable to contraction than wet. Captain Abney and Colonel Stuart Wortley, when experimenting on a dry process to be used for the transit by the English expeditions, also gave this subject their careful consideration and came to the conclusion that with proper precautions the amount of shrinkage would be so small as to be negligible. Notwithstanding this concurrence of testimony as to the possibility of disregarding the contraction of the film, I thought it desirable to satisfy myself as to the suitability in this respect of the various dry processes I was trying, and the plates were therefore tested by a method which I afterwards found was somewhat similar to that followed by Dr. De la Rue, and appeared to have the advantage of entirely avoiding any chance of error from parallax caused by want of absolute contact between the test lines and the collodion film. Several glass plates five inches square were prepared by drawing on them, with a very fine diamond point, diagonal lines through the corners of the plates. With the intersection of the diagonals as a centre, a circle was described 4 in. in diameter, so that it might correspond in size with the solar disc on the plates to be taken during the Transit. These test plates were then coated with the usual albumen substratum and prepared exactly in the same way as the dry plates under trial. They were exposed to light from the back, so that an impression of the engraved lines was obtained through the film. The plates were then developed in the same way as the other plates and when dry, examined under a very powerful micrometer capable of dividing to the $\frac{1}{100000}$ of an inch. To facilitate the examination, a piece of the film was cut away across the lines in different parts of the plate, and the course of the uncovered part of the line compared with the covered part. In no case was any perceptible difference found, except when the substratum had been purposely omitted, or processes used which gave rise to blistering of the film. The only chance of error I could see in this plan was the sticking of the film to the rough surface of the engraved lines; but in the cases where the film blistered it was found that the blistering was more marked on the lines than elsewhere, and so it would appear that the lines did not exert any particular influence on the free motion of the film. I had not

time to go into the subject very thoroughly nor the means of trying other tests.

Arrangements of the Observatory.—I arrived at Roorkee on the 13th October and thus had about eight weeks for preparation. Colonel Tennant had built an observatory with domes for all the observing instruments and had allotted to me a very convenient dark room about ten feet square, attached to the dome in which the photoheliograph had been erected and separated from it by a narrow passage about 7 feet long and 3 feet wide. I had doors placed at each end of this passage, so that communication could pass between the dome and the dark room without letting light into the latter; and in order to avoid the necessity of constantly opening the doors for the passage of the dark slides to and fro, a sort of box opening at both ends and large enough to hold a dark slide was let into the panelling of each of the doors, and the dark slides were thus easily passed backwards and forwards without any risk of letting in light or raising of dust. Double doors were also constructed at the entrance to provide for communication from outside without interruption of the work going on within. Tables and shelves were arranged in the dark room so as to keep all the operations and the necessary chemicals and appliances for each quite distinct; thus there was a table for the nitrate baths and near it, shelves for the collodions and plate boxes. Another table with sink, was set apart for developing and close by, were shelves for the developers and chemicals &c. used for developing. A third table was used for changing dry plates and above it were shelves for the dry plate boxes. Some such system was absolutely necessary in such important operations, and the principle of a place for every thing and every thing in its place was rigidly adhered to.

As it was undesirable to use the dark room in the observatory for the preparation of plates and chemicals or as a store room, nothing was kept in it except the chemicals and apparatus actually required there. A dark room for the preparation of dry plates, testing baths, &c., was fitted up in a house immediately opposite the observatory, and here also all mixing of chemicals, cleaning plates, and other preparatory work was carried on and spare stores kept.

The photoheliograph had been erected by Colonel Tennant before my arrival on an isolated brick pillar in the centre of a circular room 12 feet in diameter, fitted with a revolving observatory dome.

It was arranged that the times at which the several photographs were exposed should be recorded by electricity on a chronograph placed in an adjoining room in electric communication with the standard clock, which also gave the time to a clock-dial placed in the dome.

This was effected by the use of a tappet or make-circuit key, to which Colonel Tennant had very ingeniously fitted a pair of scissors so that the act of cutting the thread to let loose the exposing shutter of the photoheliograph, completed the circuit and the exact time of exposure was thus instantaneously recorded on the chronograph. The Janssen slide was also fitted with arrangements for being placed in electric communication with the chronograph, so that every turn of the winch was recorded at the moment of exposing each picture round the circumference of the plate.

The staff of assistants at my disposal included three European assistant-photographers, Sergeant J. Harrold, R. E., of the Photographic Branch Surveyor General's Office, Calcutta, Lance-Corporal George and Private Fox, of H. M.'s 55th Regiment, who had been thoroughly trained by Colonel Tennant in the ordinary manipulations of the wet collodion process, with three native servants for handing the plates to and fro and performing other menial duties.

Preparatory Work and Drills.—One of the first things to be done before beginning the drills was to examine the whole stock of glass and carefully select about 200 of the best and most free from flaws, which were carefully set aside to be used for the Transit.

The dry plate trials were resumed with the advantage of having a suitable instrument to work with. The beer-albumen and other processes that had been found more promising in Calcutta were tried again, but were found not quite satisfactory with the sun; the tea and coffee processes, which I had not tried in Calcutta, were better and I finally adopted a modification of the coffee process recommended by M. Constant of Lausaune, substituting albumen for gum to avoid the tendency to blistering so common when using gum, and also with the view of lessening photographic irradiation, against which the coffee proved a further protection. These plates were easily prepared and were found fairly sensitive, easily intensified, perfectly clear and free from blurring in the shadows.

The glass plates, having received a thin coating of albumen as a substratum, were coated with collodion and sensitised by a somewhat prolonged immersion in a 40-grain silver bath, then washed in four changes of distilled water and finally immersed in a resensitising solution, or so-called preservative, composed of

Dried albumen	2 grammes
Sugar	12 „
Coffee infusion made by boiling 30 grammes of coffee in 360 C. C. of water	300 cub. cents.
Water.....	300 „ „

and then drained and dried without heat.

As soon as arrangements were sufficiently advanced, preliminary drills were commenced with the object of finding out the best mode of working, in the event of dry plates being used, and after a few trials, it was arranged that instead of developing every twelfth dry plate, as proposed by the English observers, every fifth plate should be prepared by the wet process and developed at once to ascertain if all the adjustments were correct, the necessary alterations in the exposure of the plates being arranged by trials beforehand.

From some cause all the dry plates prepared at Roorkee were covered with spots, some transparent, others opaque and comet-like, and as it was impossible to trace the cause of these spots or to avoid them, even with the most careful precautions, trials were made, about the 17th November, to ascertain if the ordinary wet process could be used instead and, after working a few days, it was found that there was no difficulty in keeping a regular supply of plates every two minutes by the use of four sensitising baths. The superior convenience of working by the wet-plate system and the great saving of time and trouble that would be gained became so manifest that it was definitely decided to adopt it and thenceforth the wet plate drills were carried on daily between the hours of 7 and 12, during which the Transit would take place; as a rule in the early morning and forenoon, alternately, sometimes twice during the same day. Particular attention was given to practising the mounting of the Janssen-slide by signal and again unmounting it and resuming the ordinary plates in the interval.

Although the use of dry plates was said to possess the great advantage of enabling irradiation to be much diminished by the use of albumen in the re-sensitizer and also in reducing the shrinkage of the film to a minimum; as well as great convenience in preparing and developing the plates at leisure free from excitement or hurry, and in facilitating the working of a large number of plates with a small staff of assistants, the substitution of the wet process had many advantages in avoiding the very tedious operations of preparing and developing so large a number of plates, which alone would have taken up about two days before and after the Transit, and more particularly in enabling the state of the work to be seen throughout the Transit and any necessary alterations to be carried out immediately. The manipulations of the wet process were perfectly familiar to all my assistants and by a division of labour they were able to carry on the work with ease and without the slightest confusion.

By giving the films a substratum I hoped to avoid any shrinkage of the collodion in drying and by placing pieces of wet red blotting paper behind the plates to lessen the tendency to irradiation.

My programme of operations having been drawn up and approved by Colonel Tennant, the first rehearsal took place on the 28th November with tolerable success, and several points were noticed as requiring modification.

After further practice, a second full rehearsal took place on the 2nd December, and a final one on the 6th, which was very successful; 120 six-inch plates with 6 Janssens being exposed in the course of the time the Transit was calculated to last.

The preparations for the Transit itself, such as numbering and cleaning glasses, preparing and testing baths, and examining the minor adjustments of the instruments were commenced about a week beforehand.

Unfortunately the weather for a few days before the Transit was very cloudy and most unfavorable for trials of chemicals and testing the focal adjustments of the instrument, which caused some trouble and uncertainty.

Although it was determined to adopt the wet process entirely for the Transit plates it was considered desirable to have a small supply of dry plates prepared in reserve in case of accidents and to be used, if necessary, at times when the supply of wet plates could not readily be kept up. About a dozen of the six-inch and four of the Janssen plates were therefore prepared by the coffee-albumen process, already described, using a highly bromized collodion recommended by Captain Abney for sun pictures, which gave an intense picture with considerable sensitiveness; but owing to the short time between receiving the materials from England and their being used this collodion had scarcely time to ripen properly, and so could not have a fair trial. Captain Abney's formula was—

Thomas' bromized collodion	20 oz.
„ iodized „	20 „
Alcohol s. g., 805	6 to 8 „
Pyroxyline	300 grs.
Water	120 min.

The plates were developed with the strong alkaline developer recommended by Captain Abney.

One of these Janssen plates and four of the six-inch plates were used during the Transit and, with the exception of the spots, were excellent pictures, fairly sharp and dense, free from blurring, and, in some respects, better than many of the wet plates.

Several days before the Transit 120 six-inch glasses were selected from those set aside as the best and were numbered with a diamond in one corner consecutively from 1 to 120. A reserve of about 30 plates was also selected and marked with a cross in one corner. The whole of these plates as well as a dozen of the best circular Janssen plates were then carefully cleaned and coated, on the unmarked side, with an albumen substratum, consisting of the white of one egg and about one drachm of ammonia to a wine-bottle of water, in order to prevent any rising of the film and consequent liability to shrinkage. The plates thus numbered and albumenised were arranged in order in five boxes, hold-

ing two dozen each, with the marked corners running along the upper left hand side of the boxes. Each box was then legibly marked with a distinguishing letter and the numbers of the plates contained in it thus $\frac{A}{1\text{-}24}$. A sixth box containing marked plates was kept in reserve to be used if required, and it was arranged that any plates so used were to be numbered at the time of use with their proper number in order of sequence.

It was also carefully enjoined on the assistants that the utmost care was to be taken to preserve the proper order of sequence of the plates throughout the operations, but that if, by accident, a plate should be left out or any alteration in sequence occur, the officer in charge should be at once informed of it and duly record it. Should any of the plates originally numbered be broken during any of the operations or put aside from any other cause, their places were to be filled up from the marked plates and they were to be numbered in their proper order of sequence.

Arrangements were made for providing four nitrate of silver baths of suitable size for sensitising the six-inch plates and a larger one for the Janssen plates; besides these, two small baths and one large one were kept ready in reserve in case of one of the other baths getting out of order or becoming temporarily unfit for use. The baths used were new and about 45 grains to the ounce (10·2 per cent.).

The collodion used was prepared according to a formula given me by Colonel Tennant as follows:—

Cadmium Iodide,	1	gramme.
Cadmium Bromide,	1	„
Ammonium Iodide,	1	„
Pyroxyline,	4	„
Ether,	110	cub. cents.
Alcohol,	110	„ „

This collodion contained a large proportion of pyroxyline and haloid salts and was selected because it was found to give more density of the film and intensity of image than the ordinary commercial samples. Two pints of it were carefully cleared for use during the Transit.

A reserve supply of a mixture of Thomas' and Rouch's was also used for some of the plates. It was arranged that the collodion should only be used once, so that each plate might be coated with fresh collodion, thus preserving the uniformity of the films and keeping the collodion free from impurities.

An ample supply of developer was also prepared by the following formula:—

Protosulphate of Iron	55	grammes
Sugar	55	„

Glacial Acetic acid	40	cub. cents.
Spirits of Wine.....	30	„ „
Water	1000	„ „

A solution of cyanide of potassium was used for fixing.

It was considered advisable not to intensify the plates, but to obtain the greatest possible intensity from the first development.

As the plates were developed they were placed in a draining rack in order as taken and put aside till after the Transit.

The distribution of duties was arranged as follows :—

I remained at the Photoheliograph to expose the plates at every two minutes and record the times of exposing each plate by the clock dial, which had previously been ascertained to agree with the standard clock, carefully noting any variation in the intervals and any other noteworthy circumstance connected with any of the plates. At every sixth plate, with a few exceptions, the cross-wires were replaced by the reticule.

Sergt. Harrold developed the plates and generally supervised the operations in the dark-room. He was directed to take special care that the plates were arranged in the racks in their proper order of sequence as developed, and to note in writing any variations. He was at once to inform me of any defects in exposure or in the position of the image on the plate.

Corporal George coated the plates with collodion and sensitised them. He was responsible that the plates were taken in the proper order, as numbered and arranged in the boxes, and was ordered to at once report any change. In case of having to pass over any of the marked and numbered plates, he was to properly number the plates substituted for them. In order that the position of the sun's image might be the same on all the plates, he was ordered when coating the plates with collodion to keep the unnumbered side of the plate uppermost, with the numbered corner away from him on his right hand, pouring off the collodion at the near right-hand corner.

Private Fox took the plates out of the baths and placed them in the slide so that the numbers might be at the upper left-hand corner of the slides and the thick collodion at the lower left-hand corner. (This arrangement of the plates when being coated and placed in the slides was observed throughout all drills and practice plates, and answered the purpose perfectly.) He then placed the dark slides in the receptacle in the door from which they were passed into the dome by the man in the passage between the doors. It was also his duty to carry the Janssen slide into the dome, place on and take off the No. 1 counterpoise, which was fixed at the end of the declination axis, and carry the Janssen plates back again for development. In case of there being any delay in a wet plate being ready at the proper time, he was to keep a dry plate in readiness to be sent in instead, notify-

ing the change, and this he was ordered to do at all changes from wet to dry and *vice versâ*.

In order to prevent mistakes and confusion in communicating between the dome and the dark room, it was arranged that all communications should be in writing; supplies of slips of paper with a pencil attached were kept in a convenient position in different parts of the dark room and the dome, and were passed to and fro through the slides in the doors without noise or disturbance of the operations.

Of the three native servants, one remained in the dark room to hand the dark slides backwards and forwards, but when the Janssen slide was used he went into the dome to put on the No. 2 counterpoise, at the object glass end of the telescope; another man remained in the space between the double doors and passed the dark slides in and out through the slides in the doors. The third stood in the dome to hand me the dark slides, hold the loops of thread and hook them on the string attached to the exposing shutter, turn the dome, and give me any other assistance I required.

Corporal George and Private Fox took it in turns to act as orderly of the week and their duties were to open the dome for work, have the water boxes filled at the proper times, uncover the instrument, see that the necessary chemicals and glasses were ready in their places for use, and after work, to have the rooms cleaned, the instrument dusted, and the dome closed.

Two or three days before the Transit I examined all the adjustments of the sliding shutters and the electrical communications and satisfied myself that all were in good order.

As the weather had been cloudy two or three days before the Transit there was some uncertainty as to whether it would be fine or not, but, in the event of its turning out cloudy, I had arranged that the whole operations were to be gone through just as for a drill, so that we should have been in a position to take immediate advantage of any break in the clouds, discretion being of course exercised in altering the uniformity of the intervals between the plates, in order to take advantage of any passing gleam of clear sunshine. Fortunately it was fine and this precaution was not required, but I am sure that it was the only way of making certain of being ready at a moment's notice had the sky been cloudy.

Operations on the Day of the Transit.—After the cloudy weather of the previous two days, it was an agreeable surprise when we awoke on the morning of the Transit to find an almost cloudless sky. All preparations had been completed the night before and we were in our places betimes. As the first contact had been computed to occur at about 7h. 13m. 7s. (mean time) the order for commencing the preparation of the plates was given about 7 o'clock, and the work of the day commenced with the exposure of a Janssen plate for trial of the apparatus. After

this two six-inch plates were exposed and then, about bisection, another Janssen, followed by two more six-inch plates and then a third Janssen for the first internal contact, for the exposure of which a signal was to be given by Colonel Tennant. Owing to the wet plate prepared for this having slipped off the dipper, a dry plate was substituted and the plate was mounted in ample time. While watching the image carefully through the red glass, waiting for Colonel Tennant's signal, I noticed that the planet appeared to have passed well within the boundary of the solar disc, though still attached to the limb by a well and strongly defined ligament, so that the planet and ligament were of a distinct gourd-shape exactly like the appearance of the "black drop" one had been led to expect.* On development the plate showed no sign of any such such gourd-like appearance, except at the 21st picture where the clock-work had dragged, and there an image appeared, the exact counterpart of what I had seen.

After this the regular work with the six-inch plates commenced and went on pretty regularly, at the stated intervals of two minutes between each exposure, till about half-past 9, when there was a break of 15 minutes for refreshment and to change the chronograph paper, &c.

Though this break may appear long, it had been found more convenient to have one long break than two or three shorter ones, on account of the loss of time in stopping and getting under way again. It was arranged that the break should take place either well before or after mid-transit, so as to be sure of pictures being taken about the time of mid-transit.

It was also arranged that when the signal for the break was given, all wet plates under preparation should be exposed and dry plates sent in till all the wet plates had been developed and every thing was ready for opening out the doors. In the same manner after the break, dry plates were sent in until the wet plates were ready. The work then went on as before till the time came for mounting the Janssen for the second internal contact, which was exposed by signal from Colonel Tennant. Two more six-inch plates were then taken, then a Janssen, followed by two more six-inch plates, and last of all a Janssen, about the time of last contact, which was exposed and closed a few seconds before the final contact, thus concluding the work.

The sequence of the plates in the racks was examined and the plates were left to dry till next day and then replaced in the plate boxes.

It had originally been intended that 120 six-inch plates should be taken, as it had been found quite possible to do so at the rehearsals, but as I was perfectly dependent on Colonel Tennant's signals for starting the Janssen plates, I allowed plenty of time so as to make sure of having the

* Colonel Tennant remarks with reference to this—"There is no doubt in my mind that the outer part of the sun is *never* free from the result of outstanding astigmatism. For Janssen plates it should have been specially cared for at the expense of the central portion of the picture."

Janssen plates ready when required, without hurry; and so only two plates were taken between the Janssens instead of four, as had been arranged.

The result of the day's work was 109 six-inch plates taken, but of these two failed entirely, so that only 107 can be counted. These are all fairly clean and free from fog or stains but in many of the plates the images are not so sharp as could have been desired. Though the day was fine and cloudless, there was a good deal of haze and I think the want of sharpness is chiefly due to this and other atmospheric conditions, as the same faults were observed for two or three days after the Transit.

Of the Janssen plates there were five which also were, for the most part, clean, good plates, fairly well defined though not perfectly sharp.

Several of the photographs shew marked irradiation round the planet, and a want of sharpness which may be partly due to the atmosphere of the planet, as the limb of the sun is very much sharper. On some of the pictures distinct streamers are visible round the limb of the planet and proceeding from it. I have not seen anything of the kind mentioned as being observed by other parties, and, as the appearance is not visible on all the negatives, it is no doubt a form of photographic irradiation; but, if not, a comparison of the Roorkee negatives with those taken at other places may throw light on the cause of it.

None of the plates were varnished, as it was considered undesirable to varnish plates intended for future measurement, and also to obviate any chance of the varnished films cracking when removed to England, as is often the case with negatives taken in this country.

With the exception of the want of sharpness of some of the plates, the operations may be considered quite successful as far as the mere photography is concerned. The arrangements described above and the programme of operations answered admirably and I cannot suggest any improvement. Whether the photographs are sufficiently sharp and perfect in other respects to answer the purpose intended still remains to be seen.

General Remarks.—During the course of the preparations a good deal of time had to be devoted to putting some of the instruments into proper working order, in which work I was much assisted by Captain Campbell, who had charge of the operations with the great 36 in. theodolite. Thus for some time, the Janssen plates were found to be fogged and so indistinct as to be almost useless. This was due, partly to reflection of light from the polished surface of the wood-work of the slide and the brass-work of the under surface of the exposing disc, which was partially obviated by covering with dead black varnish all the surfaces capable of reflecting light on to the sensitive plate, and partly to the ruby-red glass fixed in the revolving disc not being perfectly impervious to the actinic rays, but this defect was overcome by substituting a piece of thick ruby-glass for the thin, light-coloured piece originally supplied. Even with these precautions, some white light found

its way on to the plate between the revolving disc and the wooden case, which were at a greater distance apart than appeared necessary, though the entrance of light might have been prevented by fitting the exposing disc with a flange running in a groove cut in the wood-work of the slide or fastened above it. There was also considerable friction about the internal surfaces, which caused a strain on the clock-work and gave a good deal of trouble till the cause had been removed. With the exception of these defects, the slide seemed admirably constructed and adapted for the object in view. It remains, however, to be seen how far this ingenious instrument has answered the expectations of its inventor and those who have adopted it, but if it should be used at the next Transit, it would, I think, be desirable that arrangements should be made for the automatic movement to be continued or distributed at intervals over a much longer period than one minute, as on the present occasion, so that all the phenomena attending the contact may be fully observed and recorded. It is also very desirable that the photographer should not require a skilled observer to watch the time of contact for him. The doing so has a very disturbing effect on a man who is able to make a good observation of contact, and time is also lost in preparing and waiting for a signal.

As far as shewn by the plates obtained at Roorkee the differences between pictures taken a few seconds apart are so slight, and the advance of the planet is so imperceptibly marked, if indeed, there is not sometimes an appearance of retrogression caused by atmospheric tremor, that perhaps little would be lost by taking the pictures at intervals of 4 or 5 seconds instead of at every second.

The mounting of the slide necessitates the alteration of the adjustments of the telescope for taking the six-inch plates, thus stopping all such observations about the critical period and it is therefore most desirable that each operation with the Janssen slide should extend over as long a period as possible. Colonel Tennant tells me that the cusp measures are indefinitely more valuable, if good, than any six-inch plates, which he would *entirely* eliminate. In this case, if it were considered essential that the successive pictures should be taken at intervals of not more than one or two seconds, a second, or even a third, Janssen slide might be provided so that they might be rapidly changed one after the other. If it were feasible to construct the slide so that the plates could easily be changed without removing the whole slide from the camera, it would be better still, as in that case the observations could be carried on at every second or two, and three or four plates exposed in quick succession during five or six minutes about the time of contact, and, if desirable, continued at regular intervals afterwards; but this appears to present considerable mechanical difficulties and an arrangement would be required by which the revolving disc could be at once brought into the proper position

for exposing the successive plates instead of having (as in the present slide) to be reversed through an *entire revolution*, which alone takes nearly half a minute.

The photoheliograph, like all work turned out by Mr. Dallmeyer, was an excellent and perfectly finished instrument, but seemed to me to be scarcely sufficiently firmly mounted for continuous work extending over so many hours, with the constant shaking caused by the insertion and withdrawal of the dark slides, which were much stiffer than they ought to have been. This stiffness of the dark slides was found not to be due to climatic influence, because they did not agree in measurement with the focussing screen which fitted perfectly, and they had to be filed down considerably before they would fit; this defect, due no doubt to an oversight in the maker or to hurry in turning out the instrument, was a serious one, as besides the liability to tremor caused by the frequent alteration of declination, the focus might have been disarranged by the alteration in the thickness of the slides by filing, but there was nothing else to be done under the circumstances.

For my part, speaking merely as a photographer, I should prefer the system adopted by Lord Lindsay and the American parties in which the camera was an immovable fixture and the solar image retained in a constant position by means of a siderostat carefully adjusted to follow the sun. In any case, the slides should be constructed to fit quite easily into their places, and in this respect the dark slides made for the equatorial camera used at Dodabetta for photographing the solar eclipse in 1871, were of a much better pattern than those sent out with the photoheliograph.

Another defect of the photoheliograph was that the hanging counterpoise, placed near the object-glass of the telescope when using the Janssen slide, was found to swing and induce a tremor in the instrument, spoiling the definition of the pictures; it was therefore replaced with a rough, but efficient substitute, in the shape of a canvas bag, the ends of which were filled with shot. This was merely hung over the end of the telescope at the proper balancing point and kept the tube perfectly steady.

As regards the process to be adopted for photographing the Transit of 1882 much will depend on the results obtained by the different methods used in December last as to whether photography can be advantageously employed and, if so, which process is most suitable.

As far as my experience goes, the wet process seems less favourable to perfect sharpness and clearness of the image than the dry, but Colonel Tennant tells me he has lately obtained very superior results by using a pyrogallic acid developer with bromoiodised collodion, in place of the iron development. From experience I have gained in preparing for photographing the recent Eclipse, I believe that great advantages may be obtained by slightly staining the ordinary wet films with orange or red anilin dyes or

by the use of *moist* plates, prepared with bromised or bromoiodised collodion afterwards treated with albumen and glycerine, which I have found very simple to prepare and exceedingly free from all tendency to blurring or irradiation. It is probable, however, that before 1882 the usual modes now in vogue for taking negatives will have been quite superseded by the simpler method of using sensitive emulsions which have only to be poured on to the plates and dried without any further preparation. Great advances have recently been made by Carey Lea, Bolton and others in obtaining such emulsions capable of giving pictures with the same rapidity as the ordinary wet or dry processes and with a perfect freedom from the irradiation or blurring so detrimental in astronomical photography, besides which the perfect simplicity and ease of the operations are a strong recommendation; and I may, I think, safely predict that should photography be used for the next Transit, the emulsion processes will, if not exclusively, be used very extensively; unless, possibly, the superiority of pictures taken on daguerreotype plates or silvered glass films over those on collodion should be incontestably proved or some other better process be discovered meanwhile.

Although the photographic operations connected with the observation of a Transit of Venus present no great difficulties, and are in some respects easier than photographing the total phase of an Eclipse, a great deal of patient careful work is required beforehand to ascertain the best conditions for working with regard to local circumstances, and this the short time at my disposal on the present occasion scarcely allowed me to have, especially as so much time was spent over the dry process, which might, as the event proved, have been well employed in perfecting the wet. It is therefore very desirable that the subject should not be lost sight of between this and the next Transit and that every opportunity should be taken of utilising the experience already gained towards ascertaining the most perfect methods of taking these sun-pictures. It would also be advisable that as many as possible of the observers of the last Transit should also take part in the next.

Although the Transit of 1882 will not be visible in any part of India, much useful preparatory photographic work might be done concurrently with the daily observations of sunspots, now that an instrument is available for taking advantage of the comparatively fine weather enjoyed in this country, particularly at the time of year when the weather in Europe is most unfavourable to such observations; and this would not be the least among the many advantages to Science to be gained by the establishment of a Solar Observatory in this country, which has been so earnestly advocated by Col. Tennant and, it is to be hoped, will soon be an accomplished fact.

XI.—*Descriptions of new Marine* Mollusca *from the Indian Ocean.*

By G. *and* H. Nevill.

(Received July 15th;—Read August 4th, 1875.)

(With Plates VII and VIII.)

The types of the new species of shells described in this paper mostly belong to the family *Pleurotomidæ*, and are all in the collection of the Indian Museum.

Murex (Ocinebra) gibba, Pse.

Latirus gibbus, Pease, Am. J. Conch., 1867, (*Sandwich I.*)
Murex Crosseana, Lién., J. de Conch., 1874, (*Mauritius*).

We have found this shell at Ceylon, the Seychelle, and Andaman Islands; it is nowhere a common shell.

Murex (Ocenebra) fiscellum, Ch. var.

Chemn., Conch. Cab., fig. 1524-5, (*Pulo Condor*).
M. Liénardi, Crosse, J. de Conch., 1868, (*Mauritius*).

We have found both the type form and the var. *Liénardi* at Mauritius, also at Ceylon and Aden the above var. only; a large series of specimens in all stages of growth show that the two forms cannot be retained as distinct species.—The very common *Sistrum undatum* (Ch., fig. 1851-2, Tranquebar) must not be confused with the above, as well pointed out by Chemnitz in his original description, as also by v. Martens (Vorderasiat. Conch., p. 95); we have found the typical form of *S. undatum*, with whitish aperture, at Ceylon, Mauritius, and Natal; var. *Indica*, nobis, (de Blainv. pl. X, fig. 8) at Ceylon, Mauritius, Singapore, Bombay, Andamans, Penang, Arakan, Bourbon, and Seychelles; var. *subturrita* (de Blainv. pl. X, fig. 12) at Mauritius only, where it is rather scarce; the Museum also possesses specimens of var. *margariticola*, Brod. (Conch. Icon., fig. 28) from the N. Coast of Australia: this form differs from var. *Indica* by the fewer, more nodulous ribs, becoming more rapidly obsolete, by its stouter and thicker growth, by the more regular transverse sculpture, and by its more sombre colouration.

Conus Ceylonensis, Brug.

As already surmised by v. Martens (Don. Bism., p. 32), Pease is wrong (Am. J. Conch., 1867, p. 126) in uniting *Conus Ceylonensis*, Brug. with *Conus pusillus*, Ch. (Conch. Icon. fig. 154); both are abundant species at low water on the reefs at Ceylon and the Andamans; the latter species we have also found at Mauritius and the Seychelle Islands. Not only, how-

ever, the shells, but the animals also are quite distinct; the latter in *Conus Ceylonensis* being a bright scarlet throughout, the body minutely, almost imperceptibly streaked with white, the siphon the same, only much more distinctly so; the animal of *Conus pusillus* is, on the other hand, pure white, with a narrow pink rim round the extremity of the siphon and at its base, and the posterior end of the body is also tinged with pink.

DRILLIA LUCIDA, n. sp., Pl. VIII, Fig. 15.

Shell acuminately fusiform, very smooth and glittering; white, slightly and irregularly marbled with pale brown here and there between the ribs and especially behind the outer lip; suture distinct, apex blunt and rounded, almost like that of *Pyramidella* in character; whorls 8 to 9, the two first smooth and embryonal, the others divided with a deeply incised groove beneath the suture, longitudinally, thickly, distantly ribbed; last whorl with 9 ribs, transversely striated at its base, gibbous posteriorly, with a rather considerable smooth space behind the marginal varix (as in Reeve's fig. 199, *Pleur. pudica*, Hinds), next the suture the upper part of the ribs, cut off by the deep spiral groove, have the appearance of a row of granules; columella and aperture smooth, a callous tubercle at junction of outer lip with the former, sinus very deeply excavated.

Long. 8, diam. 3 mil.

H. and A. Adams in their 'Genera of Recent Mollusca' class *Clavatula quisqualis* of Hinds as a *Clathurella*; it would, however, probably be better placed in *Drillia*, as is done with other allied spp. *robusta*, Hinds, &c. *D. lucida* resembles extremely closely the shell from South America figured and described by Hinds as *Clavatula quisqualis* (Voy. Sulph., pl. VI, fig. 5); the Indian species is smaller, with transverse striæ at base of the last whorl, with a row of granules and a deep groove beneath the suture, and with straight instead of oblique ribs. The type is from the Persian Gulf, where it was dredged rather plentifully by Mr. Blanford off Tumb Island and Gwádar; it was also dredged by Mr. Wood-Mason at the Andamans and found by the late Mr. Raban at Pooree in the Bay of Bengal; the specimens from the two last-named localities differ slightly from the type form, being a little more richly marbled with brown (much as in Hinds' figure of his *Clavatula læta*), and having the ribs on the last whorl a trifle more rounded and the penultimate rib in the centre of the back more developed than the others (presenting a varicose appearance).

DRILLIA ACUMINATA, Migh., Pl. VIII, Fig. 14.

P. Bost. Soc., 1845.

Shell fusiform, resembling in shape many small species of Mitra, somewhat smooth and shining, apex sharp and pointed (generally broken off);

bright brown, with a broad white band at the upper part of the whorls, repeated near base of the last whorl, this white band is more vivid and distinct on the ribs than in the interstices; whorls 8, the three first without sculpture, the others longitudinally flexuously ribbed, with a depression beneath the suture, last whorl transversely ribbed at its base, with approximately 12 longitudinal ribs, two of which in the centre of the back are joined together and have a varicose or gibbous appearance; columella and interior of aperture brown, smooth, outer lip sharp, very thin, sinus small.

Long. max. 6¼, diam. max. 2⅓ mil.

Andaman I. and Ceylon, scarce at both places. We have given a fresh figure of this species from an Andaman specimen, as the figure in the Don. Bism. (pl. 1, fig. 1) is scarcely sufficient for satisfactory identification. Typical specimens in the Indian Museum from the Sandwich Islands in no respect differ from Indian Ocean ones.

MANGELIA FULVOCINCTA, n. sp., Pl. VII, Fig. 1.

Shell attenuately fusiform, shining; whorls nine, the first four embryonal and colourless, the third and fourth peculiarly and strongly carinate, the other five longitudinally, varicosely ribbed, seven ribs on the last whorl; under a lens, minutely but regularly transversely striated, striæ more or less obsolete on the ribs; white, with a chestnut-brown band immediately under the suture, more vivid in the interstices than on the ribs themselves, this brown band covers the columella and nearly the whole of the lower half of the last whorl, is also very strongly marked on the lower portion of the outer lip and within the aperture; columella and outer lip smooth, sinus obsolete, canal very short and truncate.

Long. 8, diam. 3 mil.

Type Bombay (Rev. S. B. Fairbank), also Ceylon (nobis), and Pooree (H. H. Raban).

(Coll. Indian Museum and H. Nevill.)

MANGELIA FAIRBANKI, n. sp., Pl. VII, Fig. 2.

We have long hesitated whether this shell should be distinguished from Reeve's *Pl. hexagonalis*, the differences between our shell and the figure in the Conch. Icon. seem however to necessitate it. *M. Fairbanki* can be distinguished by the more open canal, the five or six denticulations within the acute outer lip, the sharp transverse striæ, equally and strongly showing both on the ribs and in the interstices, the striæ distant from one another, only three on each whorl, the middle one slightly the largest, imparting a somewhat angulate appearance to the whorls; the longitudinal ribs are thicker and more rounded than in Reeve's figure; the shell has 8 whorls, the two first embryonal, slightly mammillate;

ever, the shells, but the animals also are quite distinct; the latter in *Conus Ceylonensis* being a bright scarlet throughout, the body minutely, almost imperceptibly streaked with white, the siphon the same, only much more distinctly so; the animal of *Conus pusillus* is, on the other hand, pure white, with a narrow pink rim round the extremity of the siphon and at its base, and the posterior end of the body is also tinged with pink.

DRILLIA LUCIDA, n. sp., Pl. VIII, Fig. 15.

Shell acuminately fusiform, very smooth and glittering; white, slightly and irregularly marbled with pale brown here and there between the ribs and especially behind the outer lip; suture distinct, apex blunt and rounded, almost like that of *Pyramidella* in character; whorls 8 to 9, the two first smooth and embryonal, the others divided with a deeply incised groove beneath the suture, longitudinally, thickly, distantly ribbed; last whorl with 9 ribs, transversely striated at its base, gibbous posteriorly, with a rather considerable smooth space behind the marginal varix (as in Reeve's fig. 199, *Pleur. pudica*, Hinds), next the suture the upper part of the ribs, cut off by the deep spiral groove, have the appearance of a row of granules; columella and aperture smooth, a callous tubercle at junction of outer lip with the former, sinus very deeply excavated.

Long. 8, diam. 3 mil.

H. and A. Adams in their 'Genera of Recent Mollusca' class *Clavatula quisqualis* of Hinds as a *Clathurella;* it would, however, probably be better placed in *Drillia*, as is done with other allied spp. *robusta*, Hinds, &c. *D. lucida* resembles extremely closely the shell from South America figured and described by Hinds as *Clavatula quisqualis* (Voy. Sulph., pl. VI, fig. 5); the Indian species is smaller, with transverse striæ at base of the last whorl, with a row of granules and a deep groove beneath the suture, and with straight instead of oblique ribs. The type is from the Persian Gulf, where it was dredged rather plentifully by Mr. Blanford off Tumb Island and Gwádar; it was also dredged by Mr. Wood-Mason at the Andamans and found by the late Mr. Raban at Pooree in the Bay of Bengal; the specimens from the two last-named localities differ slightly from the type form, being a little more richly marbled with brown (much as in Hinds' figure of his *Clavatula læta*), and having the ribs on the last whorl a trifle more rounded and the penultimate rib in the centre of the back more developed than the others (presenting a varicose appearance).

DRILLIA ACUMINATA, Migh., Pl. VIII, Fig. 14.

P. Bost. Soc., 1845.

Shell fusiform, resembling in shape many small species of Mitra, somewhat smooth and shining, apex sharp and pointed (generally broken off);

bright brown, with a broad white band at the upper part of the whorls, repeated near base of the last whorl, this white band is more vivid and distinct on the ribs than in the interstices; whorls 8, the three first without sculpture, the others longitudinally flexuously ribbed, with a depression beneath the suture, last whorl transversely ribbed at its base, with approximately 12 longitudinal ribs, two of which in the centre of the back are joined together and have a varicose or gibbous appearance; columella and interior of aperture brown, smooth, outer lip sharp, very thin, sinus small.

Long. max. 6½, diam. max. 2⅓ mil.

Andaman I. and Ceylon, scarce at both places. We have given a fresh figure of this species from an Andaman specimen, as the figure in the Don. Bism. (pl. 1, fig. 1) is scarcely sufficient for satisfactory identification. Typical specimens in the Indian Museum from the Sandwich Islands in no respect differ from Indian Ocean ones.

MANGELIA FULVOCINCTA, n. sp., Pl. VII, Fig. 1.

Shell attenuately fusiform, shining; whorls nine, the first four embryonal and colourless, the third and fourth peculiarly and strongly carinate, the other five longitudinally, varicosely ribbed, seven ribs on the last whorl; under a lens, minutely but regularly transversely striated, striæ more or less obsolete on the ribs; white, with a chestnut-brown band immediately under the suture, more vivid in the interstices than on the ribs themselves, this brown band covers the columella and nearly the whole of the lower half of the last whorl, is also very strongly marked on the lower portion of the outer lip and within the aperture; columella and outer lip smooth, sinus obsolete, canal very short and truncate.

Long. 8, diam. 3 mil.

Type Bombay (Rev. S. B. Fairbank), also Ceylon (nobis), and Pooree (H. H. Raban).

(Coll. Indian Museum and H. Nevill.)

MANGELIA FAIRBANKI, n. sp., Pl. VII, Fig. 2.

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it is of an irregular leaden-brown colour, stained with a darker shade on the outer lip and on the columella.

Long. 6, diam. 2 mil.

Type Bombay, probably also Ceylon and Andamans; the specimens, however, from these two last localities are not sufficiently perfect for satisfactory identification. For the type specimens of this and for many other interesting species from the same locality, the late Dr. Stoliczka was indebted to the Rev. S. B. Fairbank.

Mangelia (?) interrupta, Rv.

P. Z. S. 1846.

Daphnella bella, Pse.

Pl. gemmulata, D.

Amongst some hundred specimens in the Museum from the Sandwich I., Mauritius, Bourbon, Ceylon, and Abyssinia, a single Ceylon specimen alone shows minute denticulations just within the outer lip, as in Reeve's figure. A comparison with specimens in the British Museum marked *interrupta*, Rv. first enabled us to identify this species; the genus still seems to us doubtful, perhaps Carpenter (P. Z. S. 1865) is correct in placing it in the *Columbellidæ*. It is common in Ceylon, where it seems to be finer and better marked than elsewhere in these seas. If it should prove to be a pleurotomid, Pease's name *bella* had probably better be employed, as Lamarck and Sowerby have both described distinct shells as *Pleurotoma interrupta*.

Clathurella rugosa, Migh.

Pl. curculio, Nevill, J. R. A. S. (Ceylon Branch), 1869.

Pease is quite wrong (Am. J. Conch. 1871, p. 25) in uniting this species with *C. scalarina*, Deshayes; the short rounded whorls, more produced spire, different character of the sculpture, absence of the second black transverse line on the whorls, amply distinguishing the latter; the former is abundant at Ceylon and Arakan, the latter at Mauritius, Bourbon, and Ceylon.

C. rugosa, var. curculio, nobis, l. c., from Ceylon.

This variety has 12 longitudinal ribs on the last whorl, four transverse keels on the whorls, the two middle ones very prominent, the other two more or less obsolete, suture excavated, only very faintly stained brown, minutely and spirally striated; two transverse brown lines on the last whorl, showing also within the aperture; it does not differ from the type form sent us by Mr. Pease from the Sandwich I., as figured and described in the Don. Bism., except by its greater size.

Long. 8, diam. $3\frac{3}{4}$ mil. (last whorl, long. $4\frac{3}{4}$).

C. RUGOSA, var. FALLAX, nobis.

This is probably the form that induced Pease incorrectly to make *scalarina* a synonym of *rugosa*. This dwarf variety has 9 longitudinal ribs on the last whorl, the four transverse keels are less unequal in size, there is only one brown line on the last whorl and within the aperture (in this respect only does it agree with *scalarina*); the peculiar straight outer lip and consequently contracted aperture, as also the form of the whorls and suture, are the same as in the type form.

Long. 4½, diam. 2 mil. (last whorl, long. 2).

Common at Mauritius and Bourbon; rare at Ceylon.

CLATHURELLA SCALARINA, Desh.

Specimens in the Museum agree exactly with the typical figure (especially as regards the rounded outer lip and open aperture); suture scarcely excavated, spirally minutely striated, six transverse keels on each whorl (the first and last somewhat indistinct), 12 longitudinal ribs on the last whorl (not 15 to 16 as in the original description); apex and suture stained an intense brown, only one brown line on the last whorl and within the aperture.

Long. 6, diam. 2¼ mil. (last whorl, long. 2½).

Abundant at Balapiti in Ceylon; rare at Mauritius.

CLATHURELLA EXQUISITA, n. sp.

We found this shell marked in the British Museum as *Clathurella nebulosa*, Pease, but it differs totally from the shell described under that name (P. Z. S., 1860, p. 143), being of a beautiful pink colour with a white transverse band, not white with interrupted longitudinal brown lines as in Pease's description of *P. nebulosa*; it may rather prove to be a small variety of the shell described and figured by Pease from Paumotus (Am. J. Conch., 1868, p. 219) as *Clathurella canaliculata*; however, even if it should prove so, our name *exquisita* will stand for the species, as Reeve described a totally different shell as *P.* (*Clathurella*) *canaliculata*, P. Z. S., 1848; if the Paumotus shell proves to be distinct from our Mauritius one, as we think it is, we would suggest for the former the name of *Clathurella Peasei*. *C. exquisita* differs from *C. Peasei* by the absence of the dark brown line beneath the transverse white band, by its suture not being coloured brown, by the much greater contraction of the last whorl and the outer lip at their base, thus making a more prominent canal, by the last whorl having only 12 longitudinal ribs instead of 14, finally by its smaller size. We have not thought it necessary to figure this species, as it is one that cannot be mistaken.

Long. 9¾, diam. 4 mil.

Rather scarce at Mauritius.

CLATHURELLA REEVEANA, Desh.

Seems to be the same as a shell figured and described by Pease as *C. tumida* (Am. J. Conch. 1867). This species occurs at Mauritius and at the Andamans, at both of which places it is scarce. *C. Reeveana* and *C. cyclophora*, D. should, we think, form a distinct section of Clathurella, in which should probably be classed *P. subula*, *ægrota*, &c. of Reeve; in Adams' 'Genera' these latter are recorded as Daphnella.

C. cyclophora we found at Mauritius rather sparingly, also at Aden a single specimen of a shell which seems to belong to it, though in too bad a state of preservation for certain identification.

CLATHURELLA SMITHI, n. sp., Pl. VIII, Fig. 13.

Shell minute, angularly fusiform, attenuated, apex round, slightly sinistral; white, tinged with pale brown on the columella and outer lip; whorls seven, acutely angled in the centre, depressedly excavated on the upper half, which is devoid of sculpture; the first two whorls altogether without sculpture, the 3rd and 4th simply acutely keeled in the centre, the others closely reticulated, minute granules formed where the keels bisect one another, longitudinal keels obsolete on the lower half of the last whorl; in some specimens a prominent keel is present immediately beneath the suture of the last two whorls, in most, however, this is obsolete (as in the specimen figured); columella rather strongly twisted, sinus deep, outer lip reflected, transversely striated.

Long. 3½, diam. 1⅓ mil.

Mr. Blanford dredged 30—40 specimens of this minute shell off Gwádar and Tumb Island in the Persian Gulf; it perhaps nearest resembles Reeve's *Pl. concentricostata* (fig. 279), but is quite distinct; we have named it after Mr. E. A. Smith of the British Museum, who has lately described some interesting small shells from the Persian Gulf.

CLATHURELLA APICULATA, Montr., Pl. VII, Fig. 3.

J. de Conch. 1864, p. 264, (*N. Caled.*)

We propose to distinguish the Andaman form under the name of var. *minor*. Ten specimens of this variety were found living at Ross Island under blocks of coral at low water, it can only be distinguished from the type form, which has not yet been found at the Andamans, by its smaller size (long. 4½, diam. 1⅔ mil.). The row of opaque, white spots on the back of the last whorl are very characteristic. It is nearest allied to the next species, *C. Malleti*, which also lives at the Andamans and under precisely similar conditions: the slight but constant differences in shape and sculpture between the two are well shown in the accompanying figures. Dead specimens of *C. apiculata* are fairly abundant in Ceylon, in size closely approximating to the type form (long. 6¼, diam. 3 mil.)

(Coll. Indian Mus., Rev. J. Warneford, and H. Nevill.)

CLATHURELLA MALLETI, Recl., Pl. VII, Fig. 4.

J. de Conch. 1852, p. 254, (*Pacific O.*)

I found seven or eight specimens of this lovely species alive at the Andamans, at Ross Island and North Bay, under blocks of coral at low water; the shell is of the most brilliant purple imaginable; it agrees exactly with the original figure and description. (G. Nevill.)

(Coll. Indian Mus. and Rev. J. Warneford.)

CLATHURELLA PERPLEXA, n. sp., Pl. VII, Fig. 5.

This shell, though in many respects so like *Mangelia Fairbanki*, should probably be classed as a *Clathurella;* whorls 8, the last very short, three first embryonal, the others broadly, somewhat indistinctly longitudinally ribbed, ribs not so straight as in *M. Fairbanki*, but somewhat rounded, especially on the last whorl, three raised transverse striæ on the lower portion of each whorl, the uppermost one almost obsolete, a characteristic raised transverse keel immediately below the suture; uniform ash-color, a shade or two darker in the interstices of the ribs and near the apex; columella, outer margin of the lip and interior of the aperture bright chestnut-brown, columella a little twisted, outer lip very sharp, irregularly undulating, obsoletely granulated just within the aperture.

Long. 6, diam. 2½ mil.

Type Bombay; also found in Ceylon.

(Coll. Indian Museum, and H. Nevill.)

CLATHURELLA NIGROCINCTA, Montr., Pl. VII, Fig. 6.

J. de Conch. 1872, (*N. Caled.*)

The colouration of the last whorl is remarkable: there are five rows of distant elongated nodules, of which the two first rows next the suture are of a leaden colour on a broad black band, the third row of a brilliant orange, the fourth and fifth pure white, these five rows of nodules (coloured in the same way) are then repeated.

About twenty living specimens of this shell were found at the Andamans, on Blair's Reef, Aberdeen, and Ross Island, under blocks of coral at low water.

Long. 9, diam. 4 mil.

CLATHURELLA SINGULARIS, n. sp., Pl. VII, Fig. 10.

Shell elongate, fusiform, sub-conical, apex pointed; white, in the centre of the ribs on the last whorl ornamented with obsolete brown spots; whorls nine, the first four embryonal, smooth, on the fourth traces of convex sculpture only, the last five transversely, regularly, rather broadly, somewhat distantly striated, longitudinally faintly and obtusely ribbed, nine ribs on the last whorl, becoming obsolete towards the base, the last rib next the

outer lip varicose, much more strongly developed than the others; ribs of the 5th and 6th whorls perfectly straight, on the 7th and 8th angulated about the middle, the last whorl angulated at about the 4th or 5th of the transverse striæ; columella straight, smooth, a small tooth-like projection at the commencement of the deep, rounded sinus; outer margin of the lip almost straight, much produced, exceedingly sharp; interior of aperture white, smooth, and shining; under a powerful lens only can be seen a microscopical, regular, longitudinal striation, these striæ are bent in the same way as the last varicose rib and should perhaps be called striæ of growth, they are a trifle more distinct close to the suture.

Long. 8½, diam. 3½ mil.

(Coll. Indian Mus. and Rev. J. Warneford.)

Three or four specimens only of this interesting species were dredged by Mr. Wood-Mason at a considerable depth at the Andamans. In shape and sculpture it resembles most closely *Cythara Delacouriana* of Crosse (J. de Conch. 1872, pl. fig.); the columella and outer margin are, however, both perfectly smooth and the sinus is much more distinct, the spire too is a great deal longer in proportion to the last whorl, in length the last whorl (measured at the back) is 4½ mil., the other whorls altogether only measuring 4 mil. We have felt considerable doubt whether this species is correctly classed as a Clathurella; perhaps it would be better placed with Mangelia.

CLATHURELLA MASONI, n. sp., Pl. VII, Fig. 7.

Shell ovately fusiform, white, remarkably scalariform; six angular whorls, broader at the top than at their base, the first two rounded, smooth and embryonal, the others prominently and regularly, somewhat distantly, transversely striated (four striæ on the 4th and 5th whorls), longitudinally strongly ribbed, ribs pointed and very prominent at their commencement, nine of them on the last whorl; columella and aperture smooth, with a row of regular, rounded granules just within the acute margin of the outer lip, this latter is very broadly reflected and has a longitudinal, somewhat obsolete rib down its centre, this being decussated by seven transverse striæ presents the appearance of a double row of granules; the outer margin where it joins the body whorl is callous and thickened, the sinus very deep and rounded, the aperture small, contracted, as nearly as possible of equal width all the way down from the sinus to the end of the canal. This species agrees remarkably, as regards sculpture and shape of the whorls, with a shell described as *Pl. scalata* by Souverbie (J. de Conch., 1874, pl. VIII, fig. 4); it differs, however, by the totally different character of the aperture and by its fewer whorls.

Long. 4, diam. 2 mil.

Dredged by Mr. Wood-Mason at the Andamans.

CLATHURELLA MARTENSI, n. sp., Pl. VII, Fig. 8.

Shell regularly and conically fusiform, of rather dark brown colour with bright lilac granules; seven rounded whorls, reticulated with very thick somewhat distant ridges, forming at the points of intersection, three rows of large, pearl-like, slightly oblong granules, on the last whorl these three rows of granules are repeated, after the sixth row the shell abruptly becomes contracted, forming an excavated furrow, near the base there are again six rows of granules, but much smaller and more rounded, these give a somewhat angular appearance to the last whorl; the columella is much contorted, or twisted in the middle, of a lilac colour, with a few minute denticulations at its edge; the aperture and the four strong denticulations at its outer edge are also of a lilac colour, the sinus is deep and rounded, the outer lip is bright brown, abruptly contracted near its base, forming a strongly marked canal.

Long. 5, diam. 2 mil.

Tolerably abundant in sand from Balapiti in Ceylon.

(Coll. Indian Mus. and H. Nevill.)

CLATHURELLA ENGINÆFORMIS, n. sp., Pl. VII, Fig. 9.

Shell narrowly elongate, convex, in shape resembling several species of the genus *Engina*, peculiarly attenuated and contracted towards the base, spire pointed; white, banded with a single somewhat irregular yellow band, repeated a little below the middle of the last whorl, some of the granules on this band are yellow, whilst others are white; whorls seven, distantly reticulated with thick, obtuse, longitudinal and transverse keels, the interstices, under a lens, minutely and closely longitudinally striated, the sculpture is very distinct and clearly marked on the last two whorls, but much confused and difficult to trace on the upper ones; as in the preceding species, pearl-like granules are formed where the ridges cross one another, in the present shell however they are more regular in size and more rounded, there are three rows of these granules on each whorl, besides an additional smaller one and some indistinct transverse ridges close to the suture; there are ten longitudinal keels on the last whorl; sinus deep, but rather contracted, bent down rather abruptly; aperture very straight and narrow, suddenly widening a little close to the end of the canal, seven rather large regular granules at the inner margin of the outer lip.

Long. 5½, diam. 2¼ mil.

In sand from Balapiti in Ceylon.

(Coll. Indian Museum and H. Nevill.)

CLATHURELLA LEMNISCATA, Nevill, Pl. VII, Fig. 11.

J. R. A. S. (Ceylon Branch), 1869.

White, with one brown band just below the sutures and with a second one towards the base of the last whorl, the latter fills the excavated furrow and shows also in the interior of the aperture, the columella also is stained brown; whorls seven, distantly latticed with very broad longitudinal and transverse keels, forming oblong granules where they cross one another, there are four of these transverse granulose keels on each whorl, the upper one small and somewhat indistinct, the two middle ones very prominent, the lowest one small, scarcely perceptible, almost hidden by the next whorl; the last whorl has five of these keels, the first smaller than the others, then an excavated furrow as in *Clathurella fusoides*, Reeve, and in *Clathurella Blanfordi*, nobis.

Long. 6½, diam. 2½ mil.

In sand from Ceylon and Mauritius (nobis), Bombay (Rev. S. B. Fairbank), and Gwâdar in Persia (W. T. Blanford).

We give a figure, from a Mauritius specimen, of this widely distributed little species.

(Coll. Indian Museum and H. Nevill.)

CLATHURELLA CONTORTULA, n. sp., Pl. VII, Fig. 12.

Shell globosely conical, somewhat peculiarly twisted or bent, suture distinct; white, with a pink tinge towards the top; apex very obtuse, with a decollated appearance; whorls 6, longitudinally ribbed, ribs thick and prominent, distantly transversely striated, so as to present a granulose appearance; at the base of the last whorl several rows of small granules; columella peculiarly twisted, aperture narrowly contracted, outer lip thick, in the middle bent inwards. This shell seems very close to Reeve's *Pl. obtusa*, the shape however is different, the aperture more contracted, &c.

Long. 5½, diam. 2½ mil.

Abundant in sand from Balapiti in Ceylon.

(Coll. Indian Museum and H. Nevill.)

CLATHURELLA BLANFORDI, n. sp., Pl. VII, Fig. 14.

Shell cylindrically ovate, elongate, sutures rather indistinct, apex sharp and pointed, a beautiful deep mauve colour throughout; whorls 7 to 8, longitudinally and transversely ribbed, ribs very prominent, of equal thickness, forming granules at the points of intersection, towards the base of the last whorl an excavated furrow as in our *C. lemniscata*, &c.; columella short and twisted, aperture moderately wide, contorted, with a rather large sinus, outer lip thickened with two or three granules just within the aperture.

Long. 5¾, diam. 2⅓ mil.

In sand from Annesley Bay in Abyssinia. I have named this prettily coloured little shell after Mr. W. T. Blanford, to whom the Indian Museum is indebted for it, as well as for very many other interesting species from the same locality.

CLATHURELLA ARMSTRONGI, n. sp., Pl. VII, Fig. 13.

Shell pyramidically elongate, angular in the middle of the whorls, very pointed at base, suture distinct, apex very sharp and pointed; colour uniform chocolate-brown; whorls eight, the first two perfectly smooth, the 3rd and 4th with two transverse keels in the centre, the last four obtusely and distantly longitudinally ribbed, transversely regularly striated; columella much contorted or twisted, with a shining callosity which is prominently rugosely granulated as in the genus Cythara; aperture short and much contorted, with a large, prominent, tooth-like tubercle at the junction of the outer lip with the columella and with a remarkably wide, deeply excavated sinus; outer lip thickened, transversely striated, peculiarly and minutely, very closely granulated just within the aperture; in three of the four specimens the columella and margin of the outer lip are stained a brighter brown than the rest of the shell. The above characters will serve easily to distinguish this shell from *Pl. arctata* of Reeve, the only species which, as far as we know, it at all resembles.

Long. 5, diam. 2¼ mil.

The type was dredged by Mr. Wood-Mason at the Andamans in 25 fths. Dr. Armstrong of the Indian Coast Survey has also presented to the Indian Museum three specimens, which he dredged at about the same depth in the Paumben Straits, in these latter the columella and outer lip are stained a bright brown, but there is no other difference from the type form.

CYTHARA GRADATA, n. sp., Pl. VII, Fig. 15.

Shell compressedly, ovately oblong; sutures excavated, apex very obtuse, having a decollated appearance, pure white throughout; whorls six, longitudinally ribbed, ribs continued to the extreme base of the last whorl, transversely very regularly striated, columella almost straight, slightly rugose at its upper part; aperture narrowly contracted, especially towards its base, sinus small; outer lip very thick, regularly rounded, granulated just within the aperture.

Long. 5¼, diam. 2 mil.

Not uncommon in sand from Balapiti in Ceylon (nobis) and Bombay (Rev. S. B. Fairbank).

(Coll. Indian Museum and H. Nevill.)

CYTHARA DUBIOSA, n. sp., Pl. VII, Fig. 18.

We have felt considerable doubt whether the present species is really distinct from the shell described by Reeve as *Mangelia coniformis*, Gray

MS., the greater thickness of shell, straighter outer lip, and less oblique longitudinal ribs seem, however, to distinguish the present form. Shell ovately conical, thick, apex mammillate; white, with a broad brown stain on the back of the last whorls; whorls 7, the first three embryonal, the next three angular, the longitudinal ribs only beginning towards the base of each of them, give the appearance of a row of nodules just above the suture; the last whorl unusually straight and regular, with an excavated shelf at the top, transversely and closely striated, striæ somewhat obscure, peculiarly undulating and interrupted, decussated with somewhat indistinct longitudinal almost straight ribs, commencing at the base of the excavated shelf; regularly and closely denticulated both on the rather widely spreading callosity covering the columella and also just within the margin of the straight outer lip; aperture contracted, much straighter and narrower than in Reeve's figure of *coniformis*.

Long. 7½, diam. 4 mil.

Apparently very scarce, four specimens in sand from Mauritius and one from Port Blair, Andamans.

CYTHARA ISSELI, n. sp., Pl. VII, Fig. 17.

Shell thick, ovately conical, suture very distinct, apex pointed; white, with an orange band in the middle of the whorls, the band repeated on the last whorl, this band is distinct on the longitudinal ribs, but only here and there traceable in their interstices; whorls seven, the first three embryonal (in dead specimens nearly always wanting), the others longitudinally concentrically ribbed, ribs very thick, throughout closely transversely striated; columella nearly straight with a moderate sized callosity, closely covered with distinct granules and transverse rugosities; aperture narrow, widening somewhat abruptly near the base, sinus moderate, outer lip thickly reflected, transversely striated, slightly rounded, a row of large, regular granules just within the aperture.

Long. 7¾, diam. 4 mil. (decollated specimen of four whorls only).

Common in sand from Balapiti, Ceylon.

I have named this shell after M. Issel of Genoa, whose works on the shells of the Red Sea, Persia, and Borneo, afford most valuable aid in determining our Indian Ocean shells.

(Coll. Indian Museum, Rev. J. Warneford, M. Issel and H. Nevill.)

CYTHARA ISSELI, var. CERNICA, (? sp. nov.), Pl. VII, Fig. 16.

Considerably smaller than the type form, the entire, full grown figured specimen being only 6½ in length and 2¾ mil. in breadth; there is apparently no other difference, except that the sinus is a trifle less distinct, and the aperture a little straighter.

Mauritius,—rare.

MARGINELLA (GLABELLA) PICTURATA, Nevill, Pl. VIII, Figs. 8—9.

J. A. S. B. 1874, p. 23.

We have nothing to add to our description of this pretty little shell, which would appear to be very local, as we have only seen specimens from the Mauritius.

MARGINELLA (VOLVARINA) INCONSPICUA, Nevill, Pl. VIII, Figs. 10—11.

J. A. S. B., 1874, p. 23.

The Museum is indebted to the Rev. S. B. Fairbank for specimens of this species from Bombay; the type is from Mauritius, where it is tolerably abundant.

MARGINELLA (VOLVARINA) DEFORMIS, Nevill, Pl. VIII, Fig. 12.

J. A. S. B., 1874, p. 23.

This appears to be a very rare shell, three or four specimens, all from Ceylon, being the only ones we have ever seen.

MARGINELLA ISSELI, n. sp.

We propose to change to *Marginella Isseli* the name of a shell called *M. pygmæa* by Issel (Malac. del Mar Rosso, p. 216), there being already a species of that name described by Sowerby in 1846. This minute species was dredged abundantly by Mr. W. T. Blanford off the coast of Persia in 25 fths.

NASSA OBESA, n. sp., Pl. VIII, Figs. 2—3.

Shell thick, stout, globosely conical, smooth and shining, spire very pointed, apex acute; brown, indistinctly and minutely mottled with white, irregularly stained near the suture with a darker shade of brown, the coloration agrees perfectly with Reeve's fig. 6 (*mutabilis*, L., from the Mediterranean); whorls 10, the three first without sculpture, very small, the others longitudinally, obliquely thickly ribbed; the ribs and their interstices are of about equal thickness, the former are almost, or altogether, obsolete on the back of the last whorl, four or five, however, are always present close to the callous rib behind the outer lip; transversely somewhat distantly grooved, the grooves towards the base of the last whorl and the two or three upper ones more deeply incised than the others and forming two rows of more or less granulose ridges immediately beneath the suture; columella with a moderately large white callosity, slightly rugose, aperture ridged near its margin.

Long. max. (wanting the three first embryonal whorls) 22, diam. max. 14 mil.

Kutch,—rare. Major Godwin-Austen has been good enough to compare this species for us with the British Museum and Mr. Hanley's collections: he

confirms our opinion that it appears to be new, the nearest he could find being Reeve's *algida* (Conch. Icon., fig. 145), from Moreton Bay, Australia; the present species bears a remarkable resemblance in many respects to *N. mutabilis*, its thickness, different sculpture, rugose columella, &c. will, however, distinguish it. At Ceylon and Penang we have found a variety which approaches nearer to *N. algida* than the figured type form from Kutch.

N. OBESA, nobis, var. CEYLONICA.

More acuminate, less globose, suture more distinct; longitudinal ribs on the antepenultimate whorl more or less obsolete, transverse grooves on the last two whorls almost obsolete; callosity on the columella a shade more defined and less rugose.

Long. (perfect specimen) 19, diam. 10 mil.

Ceylon and Penang.

(Coll. Indian Museum and H. Nevill.)

NASSA PERSICA, v. Mart.

Deshayesiana, Iss.

A common shell both at Aden and the Andaman Islands. It is admirably described and figured in a most interesting and important paper by von Martens, published as a separate part of the 'Nov. Conchol.' under the title of 'Ueber vorderasiatische Conchylien.'

COLUMBELLA PARDALINA, Lam.

This most variable species abounds on the reefs at the Andamans, where one of us collected many hundreds of specimens in all stages of growth. Pure white specimens, exactly agreeing with Souverbie's figure, were abundant, another very similar variety also occurs, white with a broad pale yellow band round the last whorl (with or without a few yellow spots on the spire); specimens marked like Reeve's fig. 75 A. and C. are also common, but considerably smaller and more compressed: this last variety may be called *Andamanica*.

Typical form, very common in Ceylon, long. 16½, diam. 9 mil.

Var. *lactescens*, Souv., J. de Conch. 1866, long. 13, diam. 7 mil.

Var. *Andamanica*, long. max. 12¾, min. 10, diam. max. 6½ min. 4¼ mil.

COLUMBELLA (MITRELLA) BALTEATA, n. sp., Pl. VIII, Fig. 4.

Shell small, elongately fusiform, spire about the same length as the last whorl, apex pointed, of a bright red colour; light reddish brown, a single belt of dark red in the middle of the whorls between the ribs, the ribs themselves in their centre are indistinctly white spotted; whorls 7, the upper ones smooth, the others longitudinally ribbed, ribs obsolete near the suture;

transversely indistinctly striated, a groove below the suture of the upper whorls, becoming obsolete near the last whorl; columella simple and twisted, outer lip acute, slightly emarginate at the top, aperture striated within.

Long. 5, diam. 1⅘ mil.

Mauritius. Not common.

ZAFRA POLITA, n. sp., Pl. VIII, Fig. 5.

Shell small, slenderly fusiform, attenuated at both ends, perfectly smooth, glistening spire contorted, nearly but not quite as long as the last whorl; white, with two bands of irregular opaque white flakes on each whorl (four on the last); whorls 6 (the figured specimen has had the first broken off), the last striated at its base, outer lip remarkably thick and bent inwards, making the aperture peculiarly contracted.

Long. 3½, diam. 1⅘ mil.

Mauritius,—rather scarce.

Easily distinguished by the absence of sculpture and by its remarkably contracted aperture from its nearest ally, *Z. ornata*, Pease. *Z. purpurea*, H. Ad. from New Hebrides is also found at Mauritius.

ZAFRA SEMISCULPTA, n. sp., Pl. VIII, Figs. 6—7.

Shell narrowly lanceolate, turreted, spire a little longer than the last whorl, apex pointed; horny-brown throughout; whorls 7, the three first without sculpture, the rest longitudinally thickly ribbed, ribs about twice as broad as their interstices (in this respect our figures are slightly at fault), obsolete on the back of the last whorl, which is transversely striated at its base; a sharply defined callosity covers the columella, outer lip scarcely thickened or reflected, not as long as the columella, slightly emarginate at junction with the last whorl; aperture narrow and contracted, as wide at the top as at the base.

Long. 3, diam. 1 mil.

This species was dredged by Mr. Blanford at Cape Negrais, off the coast of Burma.

SISTRUM VENTRICOSULUM, n. sp., Pl. VIII, Fig. 16.

Shell small, ovately ventricose, very gibbous in the middle, thick, solid, abruptly attenuated at base; spire short, acutely pointed, about half the length of the last whorl; white, here and there stained with pale brown; whorls 7, the first four very small, embryonal, without sculpture, the next has two rows of unequal granules, the lower row somewhat pointed and much the larger; the last whorl widely excavated at the suture, with a row of prominent granules, rounded beneath with distant, somewhat indistinct longitudinal ribs, transversely rather distantly keeled, forming slightly pointed granules where they intersect the ribs, the interstices under a lens very mi-

nutely and closely longitudinally striated; columella with a moderately spread callosity, which is slightly rugose; canal long, not recurved; four denticulations within the aperture, the two upper ones very thick and prominent, outer lip much thickened, slightly emarginate at the upper part.

Long. 5¾, diam. 3½ mil.

Ceylon — Rare.

This is the smallest species of the genus as yet described.

EULIMA ACUFORMIS, n. sp., Pl. VIII, Fig. 1.

Shell very elongate, sharply pointed, white and shining, solid, flexuous; whorls 17, cylindrical, slightly angulate at their base, except the last whorl which is short and rounded; no impressed line at the suture, varices obliquely continuous; aperture oblong, slightly produced in front, rounded at base; columella reflected, outer lip scarcely thickened.

Long. 10, diam. 2¾ mil.

Dredged at the Andaman Islands by Mr. Wood-Mason.

Rare. The above character will easily distinguish this graceful shell from its nearest allies, *E. lactea* and *flexuosa*, A. Ad.

(Coll. Indian Museum and Rev. J. Warneford.)

EULIMA (ARCUELLA) MIRIFICA, Nevill.

J. A. S. B. 1874, (*Mauritius*).

We have lately noticed that H. and A. Adams described a genus under the name of *Bacula*, allied to *Eulima*, (in A. & M. N. H., 1863, Vol. XI, p. 18) founded on a species from China, which they called *striolata*; this shell probably belongs to the same genus as the species from Mauritius, which we described as above; in either case our name for the genus, or sub-genus, will stand, there being a genus *Baculum* described prior to 1863.

MITRA (TURRICULA) CRUENTATA, Ch.

Fig. 1438-9, *from the E. Indies.*

Typical specimens, as admirably figured by Chemnitz, are found at the Nicobars (probably the locality whence the type came) and Andamans; they have two white bands on the last whorl, with 10 to 11 distant, flexuous ribs, nodosely angled at the upper part; the transverse grooves rugose, approximately equally incised, forming tolerably regular and oblong granules where they intersect the ribs.

Long. 19½, diam. 8 mil.

M. CRUENTATA, Ch. var. PROXIMA.

This is the shell from the Philippines figured by Reeve (fig. 126) for *cruentata*, Ch.; it is a form which is often mistaken for Reeve's *M. armillata*; it has 16 ribs on the last whorl, is a trifle less flexuous, and less prominently

angled at the upper part than the type form; the transverse grooves and double white band are similar.

Common at the Andaman I.

Long. 19, diam. 6¾ mil.

M. CRUENTATA, Ch. var. SANDVICHENSIS.

Extremely close to the preceding is the form from Ascension I. (Pacific O.) sent to us by Mr. Pease as "*M. armillata* (?) perhaps *cruentata*, Ch." This variety is recorded in the 'Donum Bismarckianum' as *armillata*, Rv.; from which it differs by the less flexuous ribs and different shape of the whorls, being nearer Reeve's *amanda;* it seems to us to be best classed as a variety of *cruentata*, Ch.: the whorls are not angulate near the suture, the transverse grooves are nowhere rugose but are more or less obsolete in the centre of the last whorl; a groove at the upper part being more deeply incised than the others (in this respect it agrees with *armillata*), gives the appearance of a row of prominent, bisected tubercles just below the suture; there are 21 ribs on the last whorl, which are only very slightly flexuous, it has a single white band only.

Long. 5¾, diam. 6 mil.

M. CRUENTATA, Ch., var. AMANDA, Rv.

Reeve's *M. amanda*, (fig. 318) from the Philippines is only a variety of this protean species. Specimens dredged abundantly by Dr. Stoliczka at Singapore agree exactly with Reeve's typical figure and description. It differs from *cruentata* var. *proxima* by the whorls not being angulate, by a deeply incised groove near the suture, forming a row of oblong tubercles next the suture, by the much greater width of the white bands and by the less vivid orange tinge of the ribs, which are 16 to 20 in number; and from *cruentata* var. *Sandvichensis* by the more regular and rugose transverse striation and by the broad double white bands;—it is in fact intermediate between the two.

Long. 13, diam. 5 mil.

Two specimens from Aden, unfortunately not in good condition, apparently belong to this variety, the ribs are, however, more distant. Reeve's *armillata* (fig. 315) from the Philippines, may perhaps prove also to be a variety of *cruentata*, or it may be a variety of *obeliscus*, Rv.; it seems intermediate between the two.

MITRA (TURRICULA) OBELISCUS, Rv. var. ANDAMANICA.

Pl. VIII, Figs. 19—20.

Shell slenderly fusiform, shining; very dark brown with a single very narrow white band, more distinct on the ribs than in their interstices; whorls 9—10 (as in *M. cruentata* and all its varieties), produced, very slightly

turreted, not angulate at the upper part; 18 flexuous longitudinal ribs on the last whorl, perfectly smooth except near the suture, where they are divided by a groove, interstices transversely regularly grooved; canal short, not recurved, columella and interior of the aperture dark brown.

Long. 14, diam. 4¾ mil.

Dredged by Mr. Wood-Mason at the Andamans.

This shell in many respects resembles Reeve's *M. armillata;* the above characters will, however, easily distinguish it.

MITRA (TURRICULA) RADIUS ?, Rv. (an DÆDALA, var. ?) Pl. VIII. Figs. 17—18.

Shell pyramidically fusiform, pointed, shining; white, with a broad brown band over the lower half of the last whorl and within the aperture, apex brown; whorls 10, turreted, more cylindrical and produced than those of *M. dædala*, Rv. (fig. 281) or *glandiformis*, Rv. (fig. 310); longitudinally flexuously ribbed, ribs slightly thickened near the suture, interstices regularly engraved with transverse striæ; four folds on the columella, the lower one almost obsolete (Reeve gives only two folds to his *M. radius*).

Long. 13½, diam. 4½ mil.

Dredged by Mr. Wood-Mason at the Andamans; rare.

This seems to be doubtfully distinct from *M. dædala* and *glandiformis*, both of which are common shells at the Andamans and at Ceylon; they all appear to run into one another and may prove to be varieties of one and the same species.

MITRA (SCABRICOLA) PRETIOSA, Rv.

P. Z. S. 1846.

Mitra Antoniæ, H. Ad., P. Z. S. 1870, (*Red Sea*).

This species also was lately obtained rather abundantly by Mr. W. T. Blanford in the Gulf of Oman on the coast of Persia, as also was *Turricula* (*Thala*) *casta*, H. Ad. (P. Z. S. 1872, p. 9, from the Red Sea) and a new species very closely allied to the latter.

RISSOINA (?) ABNORMIS, n. sp., Pl. VIII, Fig. 23.

Shell small, thick, shortly fusiform, white, suture distinct; apex remarkably abruptly and truncately sinistral, as in the *Pyramidellidæ;* whorls 6, the two first embryonal, without sculpture, the others longitudinally somewhat thickly ribbed (the figured specimen being rather young, the ribs are less developed than in mature specimens), the last whorl rounded, with about 15 ribs, obsolete towards the base; throughout transversely, closely, somewhat rugosely striated, so as to form minute, indistinct granules where the striæ intersect the ribs; columella strongly twisted at base, covered with a moderately widely spread callosity; aperture small, peculiarly

deeply channelled at base, within showing the transverse striation on the back of the last whorl; outer lip produced, rounded, no sign of any emargination at the upper part, much thickened, transversely striated, with a subgranulose appearance, crenulated at the margin.

Long. max. 3, diam. max. 1⅓ mil.

Mauritius; not uncommon in sand.

This should probably constitute a distinct subgenus of *Rissoina*, distinguished by the very distinct canal, twisted columella and sinistral apex; a shell dredged in Japan by A. Adams and distributed by him as "*Lachesis*, n. sp." is a very closely allied species.

CYCLOSTREMA EBURNEA, n. sp., Pl. VIII, Figs. 21—22.

Shell depressedly orbicular, thick and callous, ivory white and shining, suture distinct; whorls 5, sharply angled a little below the centre; longitudinally obliquely plicated, ribs very massive, slightly wider than their interstices, obsoletely granulated at the angulation; interstices transversely very closely, beautifully and regularly striated, old specimens (as the figured type) are very callous and the transverse striation becomes almost obsolete; a very prominent, thick, transverse, rounded keel at the periphery, sculptured like the whorls; ⅔ of the base sculptured as above, the transverse striation being however more distinct, the remaining ⅓ round the umbilicus is smooth, the sculpture becoming abruptly obsolete; umbilicus moderate, in old specimens partly covered by the thickened columella, aperture irregularly rounded, margins callous and thickened, slightly reflected over the umbilicus, giving a notched appearance to the columellar margin.

Alt. 2¼, diam. 4¾ mil.

Pooree, in the Bay of Bengal. Rare.

This handsome species is like no species of the genus as yet described; it perhaps most resembles the West Indian *cancellata* of Marryat, and it is possible that the specimens from the Philippines recorded in the Thesaurus under that name may prove to belong to our species.

RINGICULA ACUTA, Phil.

Mal. Zeits. 1849, (*Aden*).

R. minuta, H. Ad., (*Suez*).

Both var. *minuta* and the larger typical form are extremely common at Aden, in the Gulf of Oman, and at Gwádar on the coast of Persia, as also at Bombay, Ceylon, and Arakan; an allied form (if not the same) was also obtained by one of us at Natal; the largest adult specimen in the Museum measures long. 4⅓, diam. 3 mil., the smallest long. 1¾, diam. 1 mil.; there are also numerous full-grown specimens of many intermediate sizes. Curiously enough, Dr. Stoliczka obtained this species at Singapore, but not *R. Caron*, Hinds. Dr. Armstrong has presented to the Museum a single speci-

men lately dredged alive in Paumben Straits in 39 faths., which must apparently be referred to *R. acuta*, though it is thicker and more callous than any of the Persian Gulf specimens and the striation is entirely obsolete; owing to its much thicker texture and more developed teeth, the aperture is much more contracted; other specimens may eventually prove this form to belong to a distinct species.

RINGICULA CARON, Hinds.

Voy. Sulph. 1844, (*Malacca*).

This species also was dredged by Mr. Blanford at Gwádar; it is quite distinct in all its characters from *R. acuta*, the peculiar and very different outer lip, slight development of the parietal tooth, and different texture and striation at once distinguishing it.

RINGICULA APICATA, Nevill.

J. A. S. B., 1871, (*Mauritius*).

Lately found by one of us at the Andamans rather abundantly; it is only distinguishable from *R. acuta*, Phil. var. *minuta*, H. Ad. by its smooth, polished appearance, having only three striæ at the base of the last whorl, instead of being striated throughout as in the other species; it is slightly narrower and more contracted, less callous, with the teeth more sharply developed.

RINGICULA ABBREVIATA, n. sp.

Closely allied to *R. Caron*, Hinds; it has the same regular striation throughout and peculiar corrugated or crenulated outer lip, but has only $3\frac{1}{2}$ whorls, the spire being strikingly short and truncated in appearance; there is no tooth within the outer lip, the parietal tooth is strongly developed, the callosity is extremely broadly reflected on the lower part of the columella and is rugose and sub-obsoletely granulose, there are two teeth on the columella, the lower one of which in some specimens is bifid.

Long. 3 (of which the last whorl alone measures $2\frac{1}{2}$), diam. $2\frac{1}{2}$ mil.

Balapiti in Ceylon, rather common.

(Coll. Indian Museum and H. Nevill).

TROCHUS (TALLORBIS) ROSEOLA, Nevill.

J. A. S. B., 1869, (*Ceylon*).

T. (*Euchelus*) *Lamberti*, Souv., J. de C. 1875, (*N. Caled.*)

That M. Souverbie should have overlooked our original description of this remarkable form is unaccountable, the more so that the figure is an excellent one, and that the description, as indeed does the name also, indicates the peculiar colouration of the shell. It may be well to take this opportunity of stating, that we have found in our Indian seas the greater

part of the new marine species described from New Caledonia by M. Crosse and Souverbie; for instance, we had prepared a description of a new *Euchelus* found by one of us alive at extreme low water on a reef at Port Blair, Andaman Islands; on receipt, however, of No. 1 of the Journ. de Conch. for 1875, we found the same species admirably described and figured by M. Souverbie from N. Caledonia, under the name of *Trochus* (*Euchelus*) *fossulatulus*.

TROCHUS SATRAPIUS, v. Mart.

Nov. Conchol. Sup. V, (*Bushire*).

T. (*Clanculus*) *Tonnerrei*, Nevill, J. A. S. B., 1874, (*Aden*).

The specimen described by v. Martens is considerably bigger than any found by us at Aden; in other respects they seem to be exactly similar; the denticulations at the base of the columella and within the outer lip were not sufficiently marked in our figure, though properly recorded in the description. When we published our species the part of the Nov. Conch. containing the above description had not reached Calcutta.

TROCHUS (GIBBULA) HOLDSWORTHANA, Nevill, var.

J. A. S. B., 1871, (*Ceylon*).

Minolia variabilis, H. Ad., P. Z. S., 1873, (*Persia*).

This small variety was dredged tolerably abundantly in the Gulf of Oman by Mr. Blanford. After a close and careful examination we can detect no difference from the type form, except in the considerably smaller size of the Persian Gulf shell; we must, however, state that in this respect we have seen no intermediate specimens. The Museum possesses typical specimens of *G. Holdsworthana* from Penang, as well as from Ceylon.

In a collection of shells, numbering some 600 or 700 species, dredged by Mr. W. T. Blanford off the coast of Persia, and presented by him to the Indian Museum, are specimens of the following interesting shells: a single specimen of a species of our genus *Robinsonia*, perhaps our *R. Ceylonica*; a new species of *Niso* and our *N. pyramidelloides* (the latter was also dredged in the Paumben Straits by Dr. Armstrong); *Rissoina Stoppanii* and *R. Bellardii* of Issel, with ten other species of the genus; *Fossarus Stoliczkanus*, nobis, and three new species of the genus; *Rimula propinqua*, A. Ad.; a new species of *Limaea*, very close to the European species; *Eucharis angulata*, H. Ad. and *Neæra pulchella*, H. Ad., &c.

It may perhaps be well to record here that specimens of *Macrochlamys Geoffreyi*, H. Ad. (P. Z. S., 1868, p. 290) are marked in the collection of

the Jardin des Plantes at Paris, as *Helix nulla*, Fér., *H. setiliris*, Bens. as *H. turbida*, Fér, *H. argentea*, Rv. as *delibata*, Fér. (also Beck, p. 31, No. 6, without description) and a variety of the same as *carinifera*, Fér.,—all from Bourbon; *H. stylodon*, Bens. as *depressa*, Fér., from Mauritius; (compare Prod. No. 314) *H. pedina*, Bens. (A. and M. 1862, from Bombay) as *H. vitrinoides*, Desh. (Mag. de Conch. 1830), "collected at Bombay in 1835 by Dussumier"; and *Hyalimax Maillardi*, Fisch. as *Succinea unguicula*, Val., from Bourbon. There are also specimens marked as *H. ochroleuca*, Fér. (loc. ?): an examination of pl. 30, fig. 1, Hist. des Moll., proved beyond doubt that this name was given to the Mauritian shell described Mr. H. Adams (P. Z. S., 1869) from our specimens as *H. rufozonata*; the Bermuda species must, therefore, receive a new name.

EXPLANATION OF THE PLATES.

Pl. VII.

Fig. 1. *Mangelia fulvocincta*, p. 85.
2. ——— *Fairbanki*, p. 85.
3. *Clathurella apiculata*, Montr., p. 88.
4. ——— *Malleti*, Recl., p. 89.
5. ——— *perplexa*, p. 89.
6. ——— *nigrocincta*, Montr., p. 89.
7. ——— *Masoni*, p. 90.
8. ——— *Martensi*, p. 91.
9. ——— *engineformis*, p. 91.
10. *Clathurella singularis*, p. 89.
11. ——— *lemniscata*, Nev., p. 92.
12. ——— *contortula*, p. 92.
13. ——— *Armstrongi*, p. 93.
14. ——— *Blanfordi*, p. 92.
15. *Cythara gradata*, p. 93.
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5. *Zafra polita*, 97.
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17-18. *Turricula radius ?*, Rv., p. 100.
19-20. ——— *obeliscus*, Rv., var. *Andamanica*, p. 99.
21-22. *Cyclostrema eburnea*, p. 101.
23. *Rissoina (?) abnormis*, p. 100.

XII.—List of Mammalia *collected by the late* Dr. Stoliczka *when attached to the embassy under* Sir D. Forsyth *in Kashmir, Ladák, Eastern Turkestan, and Wakhán, with descriptions of new Species.—By* W. T. Blanford, *F. R. S., F. Z. S.*

(Received July 30th;—Read August 4th, 1875.)

The collections made by Dr. Stoliczka in Kashmir, Ladák, Káshghar, and Wakhán comprise a very fine series of mammalia, the description of which has been entrusted to me by Mr. Hume, who has undertaken the general direction, besides a large share in the details, of a work intended to be a memorial of our late friend. It is of course impossible to supply the place of the naturalist whose collections I shall do my best to describe, for with him has perished much knowledge of the habits and distribution of the animals, and although this want can be partially atoned for by the copious notes he has left behind, much unfortunately can never be replaced. In the present paper I shall merely give a list of the species of mammalia represented in the collections, with short characters of those which appear to be new, reserving all detailed descriptions for the larger work, in which it is intended to illustrate all the novelties and imperfectly known forms as fully as possible.

There is always more difficulty in procuring specimens of mammalia than in collecting terrestrial animals belonging to most of the other classes of vertebrata and invertebrata, and this is especially the case with the larger forms. It is consequently not to be expected that the species represented will be more than a portion of those inhabiting the country. Still the collection is rich in some respects, and especially in kinds of rodents, and it adds largely to our knowledge of the fauna of Western Tibet and Eastern Turkestan. The larger mammals indeed were originally better represented, but after Dr. Stoliczka's death many specimens appear to have been removed from the collection. Such at least was the case with the ruminants. In a private letter which Dr. Stoliczka wrote to me, he told me he had sent 22 skins of wild sheep from Káshghar. Of these only 11, 7 males and 4 females, are now forthcoming, and not one of these has fine horns. There is not a single specimen of *Ovis Poli* from the Pámir, the original locality, although I have reason to believe that Dr. Stoliczka brought away one head at least. Lastly, there are skeletons of wild sheep and ibex in the collection, of which the heads have disappeared. It is highly probable that other specimens besides those of *Ovis Poli* have been similarly made over to private individuals. The value of the collection for scientific purposes has been seriously diminished by its being broken up, and the finest specimens distributed, before it had been examined.

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For convenience the country traversed may be divided into the Kashmir valley, Ladák, the Kuenluen range south of Yárkand (Karakásh valley, Sanjú Pass, &c.), the plains of Eastern Turkestan around Yárkand and Káshghar, the ranges north of Káshghar, being spurs from the Thian-shan range, the Pámir, and Wakhán.

The examination of the bats collected has been undertaken by Mr. Dobson, who will describe them separately.

INSECTIVORA.

1. Erinaceus albulus.—Plains of Eastern Turkestan.

2. Sorex (Crocidura) myoides, sp. nov.

S. parvus, murinus, subtus albescens, pedibus albidis, pilis brevibus sparsis indutis, caudâ supra fuscâ, subtus albescente, setis brevissimis confertim annulatâ, pilisque longiusculis hic inde instructâ, auribus mediocribus, rostro subtus albido. Long. corporis cum capite 2.1, *caudæ* 1.5, *pedis posterioris cum tarso* 0·5, *auris* 0·22 *poll. angl.*

Hab.—Leh, Ladák.

CARNIVORA.

3. Felis lynx.—Skins purchased at Káshghar.

4. F. sp. near *F. pardinus* (*? Chaus caudatus*, Gray).—Skin purchased as Káshghar.

5. F. uncia.—Ladák; Pámir?

6. Canis lupus.—Skins purchased at Káshghar.

7.* C. sp. nov. near *C. aureus* but larger.—Skin purchased at Káshghar.

8. C. (Vulpes) montanus.—Ladák (purchased); plains of Yárkand.

9.* C. (Vulpes), sp. immature.—Skin purchased at Káshghar.

10.* Meles, sp. nov.—Skin purchased at Káshghar.

11. Martes foina ?—Skin purchased at Yárkand.

12. M. sp. (? M. abietum, var.).—Skin purchased at Leh.

13. Mustela vulgaris ? var.—Purchased at Yárkand.

RODENTIA.

14. Pteromys inornatus.—Kashmir.

15. Arctomys aureus, sp. nov.

A. aureo-fulvus, dorso nigro lavato, capite antice fulvescenti-cano, maculo fusco ad rostri extremitatem signato, ventre interdum leviter ferru-

* These species are probably new but it is not thought advisable to propose names on the evidence of imperfect skins.

ginescente, caudâ tertiam partem corporis capitisque æquante, fulvâ, nigro breviter terminatâ ; pilis elongatis corporis omnibus ad basin fuscis. Long. a rostro ad basin caudæ circiter 18 (*in corio dessiccato*), *caudæ vertebrarum* 6, *palmæ* 2, *plantæ fere* 3, *cranii* 3·7 *poll.*

Hab.—Kaskasu pass between Yárkand and Sarikol, east of the Pámir.

This is a much smaller species than *A. caudatus*, which it resembles somewhat in colour, but it is never apparently so ferruginous beneath, nor so black above as are some specimens of the Kashmir marmot. The tail in *A. aureus* too is rather shorter in proportion. It appears to resemble *A. Hemachalanus* (Hodgson *nec* Anderson) but to be larger and different in colour. The skull shews distinctions from all these forms.

16. Arvicola Blythi.

Phaiomys leucurus, Blyth, J. A. S. B. 1863, XXXII, p. 89 (nec *Arvicola leucurus*, Gerbe).

Arvicola *fuscescenti-fulvus subtus isabellinus, caudâ fulvâ, quartam partem totius longitudinis subæquante vel excedente, auribus rotundatis mediocribus, sparsim pilosis, palmis pentadactylis, ungue pollicari parvo obtuso, dentibus molariis similibus iis* A. mandarini, *molario ultimo maxillari postice magis producto, angulo interno postico ejusdem acutiore, dente anteriore mandibulari antice angulo fortiore interno munito. Long. sine caudâ* 4—4·5, *caudæ* 1·25—1·35, *cranii* 1, *auris* 0·4, *plantæ* 0·8 *poll.*

Hab.—Ladák.

The genus *Phaiomys* of Blyth cannot, I think, be separated from *Arvicola*, as the only character of any importance, the presence of a claw on the rudimentary thumb of the forefoot, is found in many *Arvicolæ*, the common water rat, *A. amphibius*, amongst others. The name *A. leucurus* is objectionable in the present case as the species has not a white tail, and the same specific term had been previously applied by Gerbe to a vole inhabiting the French Alps, but considered by Blasius identical with *A. nivalis*.

17. Arvicola Stoliczkanus, sp. nov.

A. *supra læte fusco-rufescens, sive sordide ferrugineus, subtus albus ; vellere molli, longiusculo, ad basin schistaceo, palmis tetradactylis, plantis pentadactylis nudis brevibus, tarsis subtus pilis indutis, auriculis parvis e vellere haud emergentibus, rotundatis, caudâ quintam partem totius longitudinis subæquante, pilis fulvescenti-albidis setosis instructâ ; dente molario maxillari ultimo angusto, intus angulis duobus fortioribus antice, nullis postice, extus quatuor parvulis, duobus antice, ceteris postice, spatio interveniente, munito. Long. a rostro ad basin caudæ (in corio dessicato)* 4, *caudæ* 1, *tarsi* 0·7 *poll.*

Hab.—Nubra valley, Ladák ; Aktágh near Karakoram Pass.

In colour this species approaches *A. russatus* of Radde, but that is said to have the tail tawny above, and the teeth are described as very different. The last upper molar in *A. Stoliczkanus* is peculiarly formed, the anterior portion having two strong salient angles inside, and two very weak ones outside, this is followed by an elongate process with two slight angles outside and none inside, the whole tooth being much elongated.

18. Nesokia Indica.—Kashmir.

19. Cricetus (Cricetulus) phæus, var.—Kuenluen range north of Sanju pass, Pámir, and Wakhán.

20. C. (Cricetulus) fulvus, sp. nov.

C. *peraffinis* Criceto phæo, *sed major atque magis fulvus, arenaceo-fulvus vix cinereus. Long. corporis capitisque* 4·5, *caudæ* 1·4, *auris* 0·75, *tarsi* 0·7 *poll.*

Hab.—Plains of Eastern Turkestan, Pámir, and Wakhán.

Another form of the *phæus* group of hamsters intermediate in size between *C. phæus* and *C. isabellinus.*

21. Mus crassipes ?—Tanksc, Ladák.

22. Mus pachycercus, sp. nov.

M. *affinis* M. Bactriano, *sed minor, caudâ breviore, crassiusculâ, setosâ, supra fusco-fulvus, subtus albidus, auribus ovalibus majusculis, pilosis, Long. (exempli in spiritu vini conservati) a rostro ad basin caudæ* 2·3, *caudæ* 2, *auris* 0·5, *plantæ* 0·65 *poll.*

Hab.—Plains of Eastern Turkestan.

This is apparently the common house-mouse of Eastern Turkestan and differs from *M. Bactrianus* of Afghanistan, Persia, and North-western India, by having a shorter, thicker tail and a differently shaped and larger skull. The colour is sandy brown.

23. Mus sylvaticus, var.—Káshghar; Panja in Wakhán.

24. Gerbillus cryptorhinus, sp. nov.

G. *supra rufescenti-arenaceus, subtus albus, coloris dorsalis ventralisque limite bene notato ;* rostro in lobum semicircularem intus pilis brevibus sparsis indutum, nares obtegentem, desinente ; *caudâ corporis capitisque longitudinem excedente, cum dorso superne fere concolore, sed magis rufescente, nisi apicem versus, ubi nigrescit, subtus pallidiore, pilis nonnullis ad apicem caudæ longioribus nigrescenti-fuscis, auribus mediocribus, ovalibus, extus antice dense pilosis, mystacibus confertis, capitem longitudine parum*

excedentibus, supremis nigris, cæteris albis ; vellere longiusculo, molli, nitido, basin versus ad tergum schistaceo ; palmis subnudis, pilis sparsis indutis, plantis confertissime pilosis ; dente molario ultimo simplici, incisoribus uni-sulcatis. Long. exempli majoris nuper occisi a rostro ad basin caudæ 5·5, *caudæ* 6·25, *auris* 0·75, *pedis posterioris a calcaneo* 1·4 *poll. Long. exempli minoris* 4·5, *caudæ* 5 *poll.*

Hab.—Plains of Eastern Turkestan.

This form is distinguished from all others with which I am acquainted by the peculiar flap at the end of the snout covering the nasal apertures. This flap is semicircular in form, and hairy inside. I can find no description of a similar appendage in any other species, and there is nothing of the kind in *G. Indicus*, *G. Hurrianæ*, or in two undescribed species from Persia and Baluchistan, of all of which I have examined specimens preserved in spirits.

G. cryptorhinus is coloured like *G. meridianus*, but is of the same size as *G. tamaricinus*. From both the above species and from their ally, *G. collium*,* which inhabits western Turkestan, the present species is distinguished by the tail being longer than the body.

Another peculiarity of *G. cryptorhinus* is that the lachrymal bone appears never to be ankylosed to the skull. Consequently the process of the lachrymal which in all true *Gerbilli* projects into the anterior angle of the bony orbit, is frequently absent from the whole bone being lost. This was the case in two skulls which I examined.

25. Dipus lagopus.—Plains of Eastern Turkestan.

26. Lepus pallipes ?—Ladák.

27. L. Tibetanus ?—Nubra valley, Ladák.

28. L. Yarkandensis.

Günther, Ann. and Mag. Nat. Hist., September, 1875, 4, XVI, p. 229.

L. *parvus, affinis* Lepori tolai, *sed multo minor, nusquam niger nec griseus, auribus usque ad apicem concoloribus, haud nigris, arenaceo-isabellinus, fusco plusve minusve ad dorsum lavatus, lateribus lacteis, pectore pallidissime rufo, caudâ albâ, superne fuscâ ; vellere molli, longiusculo, ad basin cinereo. Long. a rostro ad basin caudæ* 17, *capitis* 3·6, *caudæ* 4, *auris* 4·25, *tarsi* 4·25 *poll.*

* For translations of the characters of this and of some other species described in Russian by Severtzoff in his Turkestanskie Jevotnie, I am indebted to the kindness of Dr. Feistmantel. No translations are given in the "Zoological Record," and in the "Archiv für Naturgeschichte" even the names are omitted. It is greatly to be regretted that M. Severtzoff does not, like all the best naturalists amongst his countrymen, describe in a language more generally understood.

Hab.—Plains around Yárkand and Káshghar.

This species approaches *L. tolai*, Pallas, but is much smaller, with proportionally longer ears, and is chiefly remarkable for having no black on the tips of the ears, nor on the tail, and no grey tint on any part of the body.

29. L. Pamirensis, Günther, l. c.

L. supra arenarius vel fusco-isabellinus, infra albus, uropygio albescenti-cinereo ; caudâ superne nigrâ ; aurium marginibus superioribus extus nigris ; pectore pallido rufo ; vellere denso, molli, ad basin, præter ventrali, cinereo ; pilis longioribus ad dorsum nigro-terminatis, intermixtis. Long. a rostro ad basin caudæ circiter 18, *caudæ* 4, *auris a basi anticâ* 5, *ejusdem latitudo* 2·75, *cranii longitudo* 3·5, *tarsi* 5 *poll.*

Hab.—Banks of Lake Sirikul, Pámir.

This is distinguished from the last by being somewhat larger, by having the ends of the ears and the upper part of the tail black, and by its grey rump. It is near to *L. Tibetanus* but differently coloured. The ears in the dry skin measure only 3·6 in. from the orifice and 4·5 from the head outside.

30. L. Stoliczkanus, sp. nov.

L. *præcedenti peraffinis, arenario-fulvus, differt tantum auribus multo longioribus, vellere dorsali nigro lavato. Long. corii desiccati a rostro ad basin caudæ* 17·5, *caudæ (vertebrarum)* 3, *ejusdem cum pilis apicialibus fere* 5, *cranii* 3·5, *auris extus* 5·2, *tarsi* 4·9.

Hab.—Hilly country and Thian Shan mountains north-east of Káshghar.

This is rather darker than the preceding species and has much longer ears. When fresh the latter would probably measure over 6 inches. Both this and the last appear to have longer ears than *L. Lehmanni*, Severtzof, in which they are the same length as the head.

31. Lagomys Ladacensis.

L. Curzoniæ, Stol., J. A. S. B., 1865, XXXIV, Pt. 2, p. 108, nec Hodgson.
L. Ladacensis, Günther, Ann. and Mag. Nat. Hist., Sept., 1875, Vol. XVI, p. 231.

L. *major, pallide cervinus, seu rufescenti-fulvus, dorso in æstate magis rufescente, auribus rotundatis, majusculis, extus ferrugineis, velleris dorsalis dimidio basali nigrescenti-plumbeo, apiciali primum rufescente, tunc demum albescenti-isabellino, pilis nonnullis longioribus nigris ad dorsum intermixtis, ventre pedibusque pallide fulcis, capite antice rufescente, vibrissis supe-*

rioribus nigris, inferioribus albis. Long. tota circa 9, *cranii* 2·25, *auris* 1, *tarsi* 1·5 *poll.*

Hab.—Ladák.

This is the common species of northern and north-eastern Ladák but not apparently of the mountains bordering the Kashmir valley. It is easily recognized by its peculiar pale fawn colour, more rufous in summer. It was first described some years ago by Dr. Stoliczka, who referred it to *L. Curzoniæ*. I had occasion subsequently to shew that the true *L. Curzoniæ* of Hodgson is a different species, and I have just heard from Dr. Günther, whilst this paper is passing through the press, that he has named the present form *Ladacensis*: I have consequently withdrawn the name I had proposed to give it. It is allied to *L. ogotona* by the form of the skull.

32. L. AURITUS, sp. nov.

L. *superne sordide fulvus fusco-lavatus, capite humerisque rufescentibus, auribus magnis rotundatis, pilis isabellinis indutis, vellere molli, pilis basin versus nigrescenti-plumbeis, apices versus in dorso lateribusque isabellinis, fusco-terminatis, subtus albis. Long.* (*in corio dessicato*) *tota circiter* 7·5, *cranii* 1·8, *auris* 1, *tarsi* 1·2 *poll.*

Hab.—Pangong lake, Ladák.

A larger form than *L. Roylei* with much larger ears. The colour in two skins from Lukung on the Pangong lake is smokey brown. The ears are as large as in the last species and must in the living animal be nearly 1½ inches across.

33. L. GRISEUS, sp. nov.

L. *sordide griseus, subtus albus, ad dorsum frontemque leviter rufescenti-lavatus, vellere elongato, molli, ad basin plumbeo-nigro, apices versus in dorso lateribusque griseo, apicibus ipsis nonnullis fuscis; auribus magnis rotundatis, pilis sparsis albidis indutis. Long. in exemplo nuper occiso* 7, *capitis* 1·75, *auris* 1·4, *tarsi* 1·3 poll.

Hab.—Kuenluen range South of Sanju Pass.

I know of no other *Lagomys* which approaches this in colour. It is a peculiar grey, almost the colour of *Chinchilla*. The skulls of the last and present species approach in character to those of *L. Roylei* and *L. rufescens* but still exhibit well-marked differences.

34. LAGOMYS MACROTIS? Günther, l. c.—Kuenluen range?

The above is a wonderfully rich series of *Leporidæ*.

UNGULATA.

35. Sus scrofa, var. nigripes.

Hab.—Thian Shan mountains near Káshghar.

The two specimens, male and female, closely resemble the European wild boar, but the legs are black, and there are some trifling cranial differences, which, although perhaps insufficient to justify specific distinction, are worthy of notice.

36. Ovis Heinsi?—Thian Shan mountains.

37. O. nahura.—Kuenluen range.

38. Capra Sibirica.—Kuenluen range and Thian Shan mountains.

39. Gazella subgutturosa, var. Yarkandensis.

G. subgutturosa *cornibus lyriformibus juxta caput subparallelis, lente divergentibus; facie fusco valde striatâ.*

Hab.—Plains of Eastern Turkestan.

This differs much from the typical form of *G. subgutturosa*, the horns taking a much less open curve, and the face markings being much darker, but as intermediate forms are found in Persia, I do not separate it.

40. Pantholops Hodgsoni.—Ladák.

41. Cervus, sp. (horns only)—? Thian Shan mountains N. E. of Káshghar.

42. Capriolus pygargus? (horns only)—Káshghar?

P. S. *Sept. 28th.*—The number of the Annals and Magazine of Natural History for September, 1875, containing descriptions of several species of hares and *Lagomys* by Dr. Günther, was only received just before the last proof of this paper was passed. Although, under the rules usually adopted in England, the names given by myself would have priority, from having been given in a paper read before the Asiatic Society in August, I have thought it best to withdraw them, and to substitute those given by Dr. Günther, in order to obviate any risk of confusion in the nomenclature.

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No. III.—1875.

XIII.—*On the species of* Marmot *inhabiting the Himalaya, Tibet, and the adjoining regions.*—*By* W. T. Blanford, *F. R. S., F. Z. S.*

(Received July 30th, 1875;—Read August 4th, 1875.)

The distinctions and nomenclature of the Himalayan and Tibetan species of marmot appear to me in need of careful revision. The necessity for investigating the subject during an endeavour to ascertain the name of the Ladák species, and of a new form of which specimens were obtained by Dr. Stoliczka at the Kaskasu pass, on the road from Yárkand to the Pámir plateau, has convinced me that the received synonymy of the two best known species requires reconsideration, and that several of the identifications made by Gray, Blyth, Jerdon, and Anderson are erroneous.

The history of the nomenclature of Himalayan and Tibetan marmots appears to be the following. In 1841,* Mr. Hodgson described a species from the "Kachar" of Nepal and the plains of Tibet under the name of *A. Himalayanus*. In 1843, he redescribed this species and suggested altering the name to *Tibetensis*, and at the same time distinguished a smaller form with a longer tail and somewhat different colouring as *A. Hemachalanus*. From references made at various times to his unpublished catalogue it is probable that *A. Hemachalanus* had originally been called *A. Tibetanus* by Mr. Hodgson, and it appears under that name in the British Museum Catalogue of Mr. Hodgson's collections. In the same year, 1843, Dr. Gray, in the British Museum 'List of specimens of Mammalia', united *A. Himalayanus*,†

* For references see below.

† Under *A. Himalayanus* in this catalogue, after the reference to Hodgson's description, there is added "Griffith, Jour. A. S. B. 1841, 779?" The proper reference is

and "*A. fulvus*, Eversman" to *A. bobac* of Schreber. There is no evidence that these species had ever been compared, and the only specimen stated to exist in the British Museum at the time was said to be from Siberia.

The next addition to the nomenclature was by Jacquemont, who described a marmot from the range north of the Kashmir valley as *A. caudatus*. His description was published, with a figure of the animal, in the appendix by Geoffroy St. Hilaire to Jacquemont's posthumous work, the 'Voyage dans l' Inde,' in 1844.

In the 'Catalogue of the specimens and drawings of the Mammalia and Birds of Nepal and Thibet presented by B. H. Hodgson, Esq. to the British Museum,' the larger or short-tailed marmot is called *A. bobac*, Gmelin, and the smaller *A. Tibetanus*, Hodgson. The same names are preserved in the second edition of the catalogue issued in 1863.

In 1847 the "large Himalayan marmot" was described by Dr. Jameson as *Arctomys Tataricus*. This description appears to have been overlooked by Indian naturalists.

In 1851, Horsfield in his 'Catalogue of the Mammalia in the Museum of the Hon. East India Company' classed both *A. Himalayanus* and *A. caudatus* as synonyms of *A. bobac*.

Omitting several notices of the various Himalayan marmots by travellers, the next noteworthy attempt at discriminating the species was by Adams in 1858. He called the "red marmot" of Kashmir *A. bobac*, and the "white marmot" *A. Tibetanus*. It is evident, I think, that most writers apply the name *A. bobac* to Adams's "white marmot."

Blyth in his catalogue (1863) united all the Himalayan marmots under *A. bobac*, Schreber, giving as synonyms *Mus arctomys*, Pallas (which is the original name of *A. bobac*), *A. fulvus*, Eversman, *A. Tibetanus*, *Himalayanus* and *Hemachalanus*, Hodgson (the last with a note of interrogation, however), and *A. caudatus*, Jacquemont. In a foot note Blyth points out the distinctions between Hodgson's two supposed species, but adds that he cannot satisfactorily discriminate two species in the Society's skins and skulls. Dr. Stoliczka* in 1865 was also disposed to unite the two forms found in the western Himalayas, but he gave no details.

Jerdon, in his 'Mammals of India,' considered that Hodgson was correct in separating *A. Hemachalanus* from the short-tailed form and, consequently,

probably J. A. S. B., X, 1841, p. 978, where mention is made by Dr. Griffith of a marmot, the size of a beaver, found at between 11,000 and 12,000 feet in Afghanistan, at the Hageeguk, Kaloo, and Erak passes. Of this animal no specimens appear ever to have been described, but, as I shall subsequently shew, there is a skull, probably from Afghanistan, in the Society's old collection.

* J. A. S. B. XXXIV, p. 111, note.

distinguished two species; *A. bobac* (with *A. Tibetanus* and *Himalayanus* of Hodgson and *A. caudatus* of Jacquemont as synonyms) and *A. Hemachalanus*. Fitzinger in his 'Versuch einer natürlichen Anordnung der Nagerthiere' enumerates two Himalayan and Tibetan species of *Arctomys*, which he calls *A. Tataricus*, James. (with, as synonyms, *A. Himalayanus*, Hodgs. *A. bobac*, Gray, and *A. caudatus*, Gieb.) and *A. caudatus*, Isid. Geoffr.

In Dr. Falconer's posthumous 'Palæontological Memoirs' there is an excellent description of the common marmot of Western Tibet with a full account of the animal's habits. He calls the species *A. Tibetana*, and in a note by the editor it is apparently identified with *A. Himalayanus*, an identification which, as I shall shew hereafter, is incorrect.

Dr. Anderson in 1871* distinguished two species of marmot from Ladák and the Kuenluen mountains, one of which he identified as *A. bobac* (with *Mus arctomys*, Pallas, *Arctomys fulvus*, Evers., *A. Himalayanus* and *A. Tibetanus*, Hodgs. *A. caudatus*, Jacquemont, *A. bobac*, Gray, Horsfield, Blyth, and Stoliczka, and *A. Tibetanus*, Adams as synonyms), the other with *A. Hemachalanus* (synonyms—*A. bobac* of Adams and partly of Blyth and Stoliczka).

In 1870, MM. Milne-Edwards described *Arctomys robustus* from Moupin in Eastern Tibet. And I may conclude these notices by a reference to M. Severtzoff's work 'Turkestanskie Jevotnie,' in which *A. baibacinus*, Brandt and *A. caudatus*, Geof. are said to be found in Western Turkestan. Unfortunately the work in question is entirely in Russian and several of the identifications are incorrect, so that it is impossible to feel any certainty as to the animal which Severtzoff has identified with *A. caudatus*. I think it improbable that the Kashmir marmot is really found in Russian Turkestan. It is more probable that the species is the *A. aureus* described on a previous page† from the specimens obtained by the late Dr. Stoliczka at the Kaskasu pass between Yárkand and the Pámir.

I may here state at once that I have reason to believe that, besides *A. robustus*, there are not two, but three species of Himalayan or Tibetan marmots, and that a great part of the confusion in the nomenclature is due to this circumstance.

In the synonymy above quoted one name frequently occurs, which appears to me to have been admitted by mistake. This is *Arctomys fulvus*, Eversman. Blyth gives no reference; Gray, in the British Museum Cat. p. 148, gives Griffith, A. K. t. 118, and, as Anderson gives precisely the same,

* The title of Dr. Anderson's paper in the Proceedings of the Zoological Society 'On some rodents from Yárkand' is unfortunate, for only two of the four species described had been obtained in Turkestan territory and not one was from the neighbourhood of Yárkand, whilst all four are found in Ladák.

† Ante, p. 109 of this volume.

I suppose there may be such a name in some editions of Griffith's Animal Kingdom, though I cannot find it in the copy in the Society's library. In any case, I have no doubt the species is really *A. fulvus* of Lichtenstein, described in Eversman's 'Reise nach Buchara,' p. 119. That species is a *Spermophilus* and not a true *Arctomys*,* and, consequently, is distinct from all the Himalayan species, none of which, so far as is known, have cheek pouches.

The next point for consideration is what is *Arctomys caudatus* of Jacquemont. As it is described as having a tail two-thirds the length of the body, it is evidently not *A. bobac*,† to which it is referred by Blyth, Jerdon, and Anderson. It is clearly, on the other hand, the same as the species referred by Anderson to *A. Hemachalanus*. Anderson's specimen agrees pretty fairly with Jacquemont's figure and description; there is more black on the back and tail in the former, and the abdomen wants the ferruginous tint, but neither of these characters is constant. The localities whence the two were procured are close together; the marmot skin obtained by Dr. Henderson and described by Dr. Anderson being from Matayon, just north (on the Dras side) of the Zogi-la‡, between Srinagar and Leh; whilst Jacquemont's type was shot at a place which he called Gombour or Gombur, close to the head of the Sind valley, but on the Indus side of the watershed and in the valley of a stream running into the Dras river.

There is a possibility of a second and smaller marmot being found in the Kashmir ranges, for Vigne, Travels in Kashmir &c., II. p. 230, mentions seeing one, as large as a small fox, on the road from Srinagar to Skardo. The animal which I identify with *A. caudatus* is the size of a very large fox.

A skin just received at the Indian Museum from Dr. Aitcheson at Srinagar agrees with that described as *A. Hemachalanus* by Dr. Anderson, except that the back is blacker. Mr. Lydekker informs me that these skins are precisely like those of all the marmots he saw on the ranges north of Kashmir.

Still, however, I am in no way prepared to admit that Dr. Anderson was correct in identifying the Ladak marmot with Mr. Hodgson's *A. Hemachalanus*. The former is a large marmot, one of the largest known species, the skull measuring 105 mm. (4. 12 inches) or as much as *A. robustus*. Hodgson's *A. Hemachalanus* on the contrary must be a small marmot, the body being only 12 to 13 inches long, and the tail 5¼ to 5½, the corresponding dimensions (taken from skins) of the Ladak marmot being 22 and

* Brandt, Bull. Ac. Imp. Sc., 1844, II, p. 366.

† This has been noticed by MM. Milne-Edwards, Rech. Mam, I, p. 312.

‡ This name has been converted into Tooglen pass in the P. Z. S. 1871, p. 562.

10½ inches.* Dr. Anderson concludes that Mr. Hodgson had never seen an adult of *A. Hemachalanus* and that he drew up his description from immature specimens. I do not think this view is probable. Hodgson was careless in matters of nomenclature, as many naturalists were in his time, but he collected largely and studied the animals he described carefully, as is shewn by the minuteness of his descriptions. I scarcely think, had the specimens he described been half grown, that he would have overlooked the evident immaturity of the skulls, which he must have extracted, for he describes the teeth. Moreover, I think Dr. Anderson must have overlooked Mr. Hodgson's remark that he had kept some of the smaller marmots alive for months, one of them for over a year and a quarter. Surely he would have noted their growth during that period. I cannot say how long a marmot may be in attaining its full growth, but if it requires more than a year, it differs greatly in this respect from most rodents.

There are also, I think, some important differences between the colouration of Hodgson's *A. Hemachalanus* and the Kashmir marmot. The former is described as having the general colour "dark grey with a rufescent tinge which is rusty and almost ochreous red on the sides of the head, ears and limbs, especially in summer. Bridge of nose and last inch of tail dusky brown." In the latter the general colour is more yellow, the whole lower parts and the limbs are ferruginous (there appears to be much variation, perhaps sexual, in the colour of the upper parts), the bridge of the nose is not dark, but the tip is, and at least 3 inches at the end of the tail are black.

It is true that Dr. Anderson mentions his having obtained skins purchased at Darjiling which were undistinguishable from the Ladák marmot.† It is probable that these skins had been brought from upper Sikkim, or Tibet; but if so, and if they are correctly identified, the only conclusion I can come to is that these must be three species of marmots in the Himalayas of Sikkim and Nepal.

A. Tataricus I am unable satisfactorily to identify. The reference in Wiegmann's 'Archiv'‡ runs thus "A supplementary description of the large Indian Marmot has appeared by Dr. Jameson, who has applied to it the name of *Arctomys Tataricus* (Inst. p. 384)." The work referred to is

* The length of the tail in the Ladák specimen is without the hair at the end. In Mr. Hodgson's measurement the hair is, I think, included, although its inclusion is not specified, because it is comprised in the corresponding measurement of the tail of *A. Himalayanus* on the same page.

† Mr. Wood-Mason has had search made for these skins, but owing to so many of the Museum specimens having been packed away pending their transfer to the new building, it has not been possible to find them.

‡ 1848, Pt. 2, p. 155.

probably a French one, L' Institut, at least so I infer from the fact of a paper by Gervais quoted with a similar reference in the 'Archiv' being assigned to this magazine in Carus and Engelmann's 'Bibliographia Zoologica'. At the same time neither Jameson's nor Gervais' paper is quoted in the Royal Society's Catalogue, although L' Institut is included in the works catalogued.

There is a short paper by Dr. Jameson on the Zoology of Chinese Tartary in the Calcutta Journal of Natural History,* in which he briefly mentions a marmot which he observed beyond the Niti pass, and of which he says that it is of a reddish yellow colour and the size of a rabbit. I know of no Himalayan marmot which when adult is so small as a rabbit; the smallest species is *A. Hemachalanus*, and possibly this may have been the animal observed by Jameson, but in Weigmann's 'Archiv' he is said to have described the *large* Indian marmot: of course it does not follow that the species seen by him north of the Niti Pass was the same which he subsequently named *A. Tataricus*. Meantime the identification is of less moment, because in all probability the species named by Jameson was either *A. Himalayanus*, *A. Hemachalanus*, or *A. caudatus*, all of which names have priority over *A. Tataricus*.

But the most important point of all is the identification of the short-tailed Himalayan marmot with *A. bobac*. This apparently was made by Gray without his having examined specimens of *A. Himalayanus*; and Blyth, Jerdon, and Anderson, so far as I know, had never seen examples of the true *A. bobac*, so that I doubt if the species have ever been compared. Pallas (Zoog. Ros. As. I, p. 155) united all the known† Asiatic marmots without cheek pouches to the *Bobac*, which he called *Arctomys Baibàk*, but he described the Kamschatkan race as a well marked variety. Brandt (Bull. Ac. St. Pet. 1844, II, p. 364) separated this Kamschatkan form as a distinct species, which he called *A. Camschatica*, but which he suggested might be identical with the American *Ammonax*, and he indicated another species from the Altai under the name of *A. baibacina*, which, however, he did not describe.‡ Severtzoff quotes this species *A. baibacinus* from western Turkestán. Without attaching much importance to this circumstance for the reasons already mentioned, I think it yet remains to be shewn that the true *A. bobac* of Schreber, *Mus arctomys* of Pallas, is found in Central Asia at all. The name was originally applied to the marmot of Poland and

* Vol. VII, p. 360.

† Of course no Himalayan marmots had been described in 1811 when Pallas's work was first published.

‡ He appears to have described it subsequently in a paper on the vertebrata of Siberia, which I cannot find. It is mentioned by Milne-Edwards in Rech. Mam. p. 311, note.

Galicia, which appears to be a much smaller animal, weighing 8 to 10lbs., the body being 16 inches, the tail 4 inches 4 lines, or including the hair 5' 4" long, whereas in *A. Himalayanus* the head and body measure 22 to 24 inches, and the tail 6¾ with the hair according to Jerdon, 5½ to 6¾ according to Hodgson. Pallas's original measurements of *A. bobac*, which I quote above,* are probably in French inches, which would render the difference rather less, but still it is very considerable.

Pallas's original description of the colour of *A. bobac* runs thus: *Color rostro et circa oculos magis minusve fusco-nigricans, inter mystaces subferrugineus; parotides pallidæ, gula ferruginea, reliquum corpus infra et artus interiore latere ferrugineo-lutescentia; supra gryseus, pilis longioribus nigris, vel fuscis apice gryseo-pallidis magis minusve inumbratus. Cauda basi subtus ferruginea, majore parte lutescens, a medio picea, apice atra.* The animal referred to *A. Himalayanus* does not differ greatly in colour from Pallas's description. MM. Milne-Edwards,† however, point out that *A. bobac* is a very much paler animal than *A. robustus*, which appears closely to resemble *A. Himalayanus*, and may perhaps be the same.

On the whole I think it is far safer for the present to keep *A. Himalayanus* distinct from *A. bobac*. I have not sufficient materials at present to determine whether the short-tailed marmot of the Kuenluen and Ladák is absolutely identical with the type of *A. Himalayanus*, but it appears to correspond fairly and I know of no distinction.

The figure of *A. robustus* in the 'Recherches sur les Mammifères' is much more richly coloured than *A. Himalayanus* is, but the authors of the work point out that the plate is over-coloured. The species are evidently very closely allied and may possibly be identical. The skulls are very similar, the nasals being a little shorter in *A. robustus*, and the point of bifurcation of the sagittal crest further back, but there is a possibility that these differences may be due to age, and it is evident from the state of the teeth that the figured skull of *A. robustus*, although apparently full grown, is younger than that of *A. Himalayanus* which I have compared with it: this skull of *A. Himalayanus* is from one of the skins brought by Dr. Henderson from the Sanju Pass, Kuenluen range. There are, however, some little differences in the form of the zygomatic arch, &c., and especially in the relation of the longitudinal to the transverse diameter, which make me hesitate to consider the two the same.

In trying to throw some light upon this question of the Himalayan marmots, I have examined the following specimens.

I. Four skins with skulls of *A. aureus* from the Kaskasu Pass.

* Glires, p. 113.

† Recherches Mam. p. 311.

II. Three skins of *A. Himalayanus* (the same as examined and described by Anderson) from Kitchik Yilak, close to the Sanju Pass in the Kuenluen range, south of Yárkand ('Lahore to Yarkand,' p. 101).

III. A skin of *A. caudatus* (the same as described by Anderson as *A. Hemachalanus*) from Matayon on the Zogi-la near Drás between Kashmir and Ladák, and a flat skin of the same probably from Kashmir; also a skull of the same brought by Mr. Lydekker from the range north of Kashmir.

IV. The specimens made over by the Asiatic Society to the Indian Museum, three stuffed skins, a skeleton, and two skulls, all enumerated in Blyth's Catalogue*. These require a few words of notice. By both Blyth and Anderson the whole have been referred to *A. bobac* (*i. e. A. Himalayanus*). Two stuffed specimens (one of them young and both with imperfect tails) which were presented by Mr. Hodgson, probably belong to this species. The other specimens are a stuffed skin and the skeleton from an animal brought alive to Calcutta from Sikkim, and two skulls, one presented by Lieut. Brownlow, who probably procured it in the western Himalayas, and the other from the Burnes collection, and, therefore, it may be expected, from Afghanistan. I have carefully examined the three skulls and am convinced that they belong, in all probability, to three different species, that of the skeleton differing widely from both the others in the form of the palate and of the nasal bones, in the length of the sagittal crest and the point of its bifurcation, whilst of the two remaining one is much larger than the other, besides other differences. The skeleton is evidently that of a fully adult animal. It measures from snout to insertion of tail 15 inches along the curve of the back, the tail vertebræ $4\frac{1}{2}$. This is very close to the measurement of *A. Hemachalanus*, and the skin agrees with the description of that species in having the frontal portion of the face dark brown. The fur is short and thin, but it is scarcely probable that the fur of a marmot which had lived for months in Calcutta would retain its original character. I think it highly probable that this specimen really belongs to *A. Hemachalanus*. It certainly does not agree with *A. Himalayanus*.†

The skull presented by Lieut. Brownlow is, I find by comparison, that of *A. caudatus*. The Burnes' collection skull, although somewhat resembling that of the new species *A. aureus*, appears to me to belong to a

* Cat. Mam. Mus. As. Soc., p. 108.

† I should add, that in these specimens, as in all other skins either of birds or mammals, which have been exposed to the light for many years in Calcutta, the colours have faded greatly, and in all the mammals the texture of the fur appears to have changed, becoming much harsher. I think it much to be regretted that small mammals should be mounted at all; as a rule valuable skins and types should be kept unmounted in drawers, and not exposed.

different and probably undescribed species, which should be looked for in Afghanistán. It is very possibly the form mentioned by Dr. Griffith as seen by him at the Hageeguk, Kaloo, and Erak passes,* and also briefly referred to in Sir Alexander Burnes' 'Cabool.'†

It is useless to refer to the various notes by travellers, on the marmots observed by them, in the hope of ascertaining the distribution of the different species, since the external differences are, as a rule, not sufficient to render the brief descriptions given characteristic of any particular kind, and the task of determining the exact range of each species must be left to future research. I shall conclude this paper by giving the names and the synonymy, so far as I have been able to unravel it, of the four species, the existence of which in the Himalayas and the neighbouring ranges to the north-west I consider probable, merely adding that in all probability another species, hitherto undescribed, inhabits Afghanistan. I am quite at a loss to conceive what is the form with large ears represented in Hooker's 'Himalayan Journals,'‡ and which is said to migrate sometimes in swarms from Tibet to Upper Sikkim. Certainly, no known Himalayan marmot approaches this animal in the structure of the ears§.

Section 1.—*Short-tailed marmots having the tail less than one third the length of the head and body.*

1. Arctomys Himalayanus.

A. Himalayanus, Hodgson, J. A. S. B., 1841, X, p. 777.

"*A. Himalayanus* of Catalogue, potius *Tibetensis* hodie," Hodgs., J. A. S. B., 1843, XII, p. 409.

"*A. bobac*, Schreb." *partim*, Gray, List of the specimens of Mammalia in the collection of the British Museum, 1843, p. 148, *nec* Schreber.

"*A. bobac*, Gmelin", Gray, Cat. spec. &c. Mammalia and Birds of Nepal and Thibet presented by B. H. Hodgson, Esq. to the British Museum, p. 23, (1846); *nec* Gmelin.—— Ib. 2nd Edition, p. 12, (1863).

? *A. Tataricus*, Jameson, L'Instit. 1847, XV, p. 384.

"*A. bobac*, Schreb." Horsf. Catalogue of Mammalia in the India House Museum, p. 164, (1851); *nec* Schreber.

"*A. Tibetanus*, Hodgs." white marmot of Europeans, Adams, P. Z. S. 1858, p. 521.

"*A. bobac*, Schreb." *partim* Blyth, Cat. Mam. Mus. As. Soc., p. 108, (1863); *nec* Schreber.

"*A. bobac*, Schreb." Jerdon, Mammals of India, p. 18, (1867), *nec* Schreber.

"*A. Tataricus*, Jameson," Fitzinger, Sitzungsb. k. Ak. Wiss. Wien, 1867, LV, 1, p. 491.

* See note on page 114.

† p. 163.

‡ Vol. II, pp. 109, 170, smaller edition.

§ I cannot help feeling some doubt as to whether the animal figured is a marmot at all.

A. robustus, H. and A. Milne-Edwards, Nouv. Arch. du Musée, VII, Bull. p. 92 (1870).—Recherches sur les Mammifères, I, p. 309, Pl. XLVII, XLIX.

"*A. bobac*, Schreb." Anderson, P. Z. S., 1871, p. 560, *nec* Schreber.

General colouration greyish fulvous, beneath yellow, hair of the back with very short black tips, tail dark brown at the end. Length 22 to 24 inches, tail with hair at the end 5½ to 6¼.

Hab.—Tibet : Ladák : Kuenluen south of Yárkand.

Section 2.—*Marmots with tails one third or more than one third the length of the head and body.*

2. Arctomys Hemachalanus.

A. Hemachalanus. Hodgs., J. A. S. B. 1843, XII, p. 410.

"*A. Tibetanus*, Hodgs.," Gray, Cat. Mam. Birds Nipal, p. 24, (1846)—2nd Edition p. 12, (1863).

"*A. bobac*, Schreber" *partim*, Blyth, Cat. Mam. Mus. As. Soc. p. 108, (1863), *nec* Schreber.

"*A. hemachalanus*, Hodgson," Jerdon, Mam. Ind. p. 182, (1867).

"Colour dark grey with a full rufous tinge, which is rusty and almost ochreous red on the sides of the heads, ears and limbs, especially in summer. Bridge of nose and last inch of tail dusky brown. Length 12 to 13 inches tail (with hair) 5¼ to 5½".*

Hab.—Sikkim and Nepal, in the higher regions of the Himalayas.

3. Arctomys caudatus.

A. caudatus, Jacquemont, Voyage dans l' Inde, Vol. IV, Zoologie, p. 66, Atlas, Vol. II, Pl. 5, (1844).

"*A. bobac*, Schreber," red marmot of Europeans, Adams, P. Z. S., 1858, p. 521, *nec* Schreber.

"*A. bobac*, Schreber," *partim* Blyth, Cat. Mam. Mus. As. Soc. p. 108, (1863), *nec* Schreber.

"*A. bobac*, Schreber," *partim*, Jerdon, Mam. Ind. p. 182, (1867), *nec* Schreber.

"*A. caudatus*, Isid. Geoff.," Fitzinger, Sitzungb. k. Ak. Wiss. Wien, 1867, LV, 1, p. 491.

A. tibetana, Falconer, Palæontological Memoirs, I, p. 583, *nec A. Tibetanus*, Hodgs.

"*A. hemachalanus*, Hodgson", Anderson, P. Z. S. 1871, p. 561, *nec* Hodgson.

Colour rich rufous yellow when adult, more or less black on the back : sometimes the back is black throughout : lower parts with a strong ferruginous tinge ; tail black for the greater portion of its length. Head and body about 25 in., tail with hair 13, or more than half the length of the body.

Hab.—Mountains north of Kashmir : Ladák.

* These are Hodgson's measurements, but I anticipate that the animal grows to a larger size, to judge by the skull, which is as large as that of *A. aureus*.

4. Arctomys aureus.

A. aureus, W. Blanf., ante, p. 106.

On a previous page I described this species very briefly. The following is a fuller account, taken from four specimens, three brought by Dr. Stoliczka and one by Captain Biddulph from the mountains west of Yárkand.

General colour tawny to rich brownish yellow, the dorsal portion conspicuously tinged with black from all the hairs having black tips, but these are far more conspicuous in some specimens than in others; face grey to blackish with a rufous tinge, covered with black and whitish hairs mixed, which are about half an inch long on the forehead, the black hairs more prevalent in some specimens, apparently males, than in others; the middle of the forehead sometimes more fulvous. Just on the nose is a blackish brown patch, and there is a narrow band of short black hairs mixed with white around the lips: sides of the nose paler; whiskers black. Hairs of the back 1¼ to 1½ inches long, dark slaty at the extreme base for about ¼ inch, then yellow, becoming deeper golden yellow towards the extremity, the ends black. In the blackest specimens (? males) the posterior portion of the back wants the black tips. Tail the same colour as the back, except the tip, which is black; the length of the black tip varies, but never exceeds about 2½ inches in the specimens before me, and in three out of the four it is only about an inch: hairs of the tail about 2 inches long, brown at the base. Lower parts rather browner, the hairs shorter and thinner, chocolate brown at the base, without the short woolly under-fur, which is very thick on the back. Feet above yellowish tawny like the sides.

Length taken on the dried skins:

Nose to insertion of tail, ...	16·5 to 18·75
Tail, without hairs at the end, ...	5 to 6·5
Hairs at end of tail, ...	1·5 to 1·75
Fore-foot (palma) to end of toe, without claws, ...	2·05
Mid toe, without claw, measured below, ...	0·8
Claw, measured above, ...	0·6
Hind foot (planta) to end of toe, without claws, ...	2·9
Mid toe, without claw, ...	0·8
Claw of do., measured above, ...	0·52

This is a very much smaller animal than *A. caudatus*, and its tail appears shorter in proportion and with less black. The colour of the lower parts is less rufous and the feet are tawny yellow, not ferruginous as in the larger form. The fur of *A. aureus* too is softer. From *A. Himalayanus* the present species is distinguished by its much longer fur, by being much yellower in tint and less grey, and by its longer tail. It is also much smaller. From *A. Hemachalanus* it may be recognised by its longer tail and richer colouration.

The following are the dimensions of skulls of all the above species in parts of a metre, those of *A. robustus* having been taken from the figures. I also add the measurements of the skull of a specimen of *A. bobac* belonging to the Berlin Museum.

	A. Himalayanus. (Kuenluen).	*A. Himalayanus.* (North of Sikkim).	*A. robustus.*	*A. Hemachalanus.*	*A. caudatus.*	*A. aureus.*	*A. bobac.*
Length from occipital plane to anterior end of nasal bones, ...	·105	·101	·104	·093	·105	·094	·0885
Breadth across widest part of zygomatic arches, ...	·0655	·0675	·065	·061	·066	·057	·059
Do. behind postorbital processes,	·019	·019	·019	·020	·016	·017	·0165
Length of nasal bones, ...	·045	·040	—	·038	·042	·038	·038
Breadth do. behind,	·010	·013	·011	·011	·017	·0105	·0105
Do. do. in front,	·018	·018	·015	·016	·020	·0165	·0155
Length of row of upper molars, ..	·025	—	·025	·024	·0235	·020	·0215
Do. lower jaw from angle to alveolar margin, ...	·069	·070	·069	·064	·074	·066	·0625
Height of do. at coronoid process,	·0425	·039	·037	·036	·041	·035	·036

P. S.—*Oct. 28th.* Some months have elapsed since the above paper was written, and in the meantime, through the kindness of several friends, I have been enabled to add materially to the evidence as to the distinctions of the different species of marmots.

In the first place, I am indebted to Professor Peters of Berlin, who, with great kindness and liberality, has sent a skin and skull of *Arctomys bobac* belonging to the Berlin Museum for examination. In its external characters this animal differs widely from *A. Himalayanus*. It is a sandy-grey animal with a brown wash, without a single black hair on its body, the hairs on the back being dusky at the base, then dirty white, and the tips of the longer hairs on the back and sides being brown. The lower parts throughout shew a ferruginous tinge. The terminal portion of the tail is brown. This skin measures from nose to rump 21 inches, tail 5½; but it is very much smaller than *A. Himalayanus*.

Of course this specimen may have faded and the tips of the hairs may have been black originally, as in Pallas's description, but there is nothing in the character of the skin to render this supposition probable, and if the tips of the hair had become paler, I should hardly have anticipated that they would have done so to precisely the same extent throughout the body. Moreover, the skin before me coincides closely with the figure in Schreber's Säugethiere, Pl. CCVIII, and with Messrs. Milne-Edwards' description.

Professor Peters tells me that the skin sent is from Siberia, and that he has endeavoured for years in vain to procure a Polish or Galician specimen.

Compared with the skins of *A. Himalayanus*, this specimen of *A. bobac*, besides being paler and having brown instead of black tips to the long dorsal hairs, has these hairs much longer and their dark tips more developed, and the fur generally is finer and softer. The skull, with a general similarity of outline, exhibits numerous differences, the most marked being the very much smaller proportional size of the molars in the upper jaw. The crown of the third molar is *A. Himalayanus* measures 6 mm. across, in *A. bobac* only 4·5 mm.

I am also indebted to Dr. Günther for having very obligingly re-examined the types of *Arctomys Hemachalanus* v. *Tibetanus* in the British Museum in order to ascertain if they were adults. He writes to me as follows :

"The skull of the type of *A. Tibetanus* is that of an adult animal, but "this type is the most wretched specimen I have ever handled. It was an "individual brought up in captivity ; size that of a very small rabbit, skin "nearly hairless, claws abnormally long and as sharp as a needle, teeth "carious, incisors malformed. The frontal bones are gone, but I suppose "that they could not have been much arched, and the palate is very shallow, "very slightly concave."

"There is another flat and imperfect skin of this *A. Tibetanus* from "Hodgson's collection. It is somewhat larger than the former specimen, "and is evidently adult, but there is no skull. Taking all the evidence "before me, I believe that this species but slightly exceeded a rabbit in "size. But then what differences in size you observe in our Swiss mar-"mots."

The important point is, of course, to ascertain that Mr. Hodgson's original types were adult. The length of the tail shews that the species is distinct from *A. caudatus*, and the skulls differ very considerably. But some further evidence is forthcoming. Some time after the preceding paper was written the dead body of a marmot was sent to the Indian Museum by Mr. Rutledge. The animal is said to have been originally brought from Bhútán, but it has lived for a long time in captivity, and as usual the skin is in wretched condition and almost hairless. The dimensions, however, agree with those of *A. Hemachalanus*, and when the skull had been cleaned, it proved precisely similar to that of the old skeleton in the Museum, belonging to the animal said to have brought from Sikkim and to have lived for months in the Asiatic Society's compound. Mr. Fraser has also found, amongst the accumulated collections of the Museum, another skin and skull of a young individual, which also had been kept tame.

There is thus evidence of 5 individuals of this species at least, and I

have examined 3 skins and skulls myself. With the evidence before me, I have not the slightest doubt that a small marmot does inhabit the northern parts of Sikkim and Nepal, and that it is quite distinct in structure, colour, and size from the large *A. caudatus* of Kashmir and Ladak. Unfortunately, the Sikkim skins which Dr. Anderson identified with a specimen belonging to the Kashmir species have not been found. It is remarkable that every individual of *A. Hemachalanus* yet examined has been kept in captivity; skins of the wild animal are a great desideratum. The skull of the specimen received from Mr. Rutledge is perfectly well formed and all the teeth are healthy.

Dr. Aitcheson of Srinagar has had the kindness to make enquiries about the marmots of Kashmir, and he has sent me specimens of young *A. caudatus*. As in most young animals, the colours are indistinct, and there is a peculiar immature appearance about the fur. These young specimens can be at once distinguished from *A. Hemachalanus* by their longer tails.

It will be seen that the whole of the additional evidence tends to prove that, exclusive of *A. robustus*, there are three and not two species of marmot in the Himalayas and Tibet, and that neither of these species is identical with *A. bobac*.

Within the last few days, Mr. Mandelli of Darjiling has sent to the Indian Museum a magnificent collection of mammal skins from Sikkim and Tibet, part of which he has presented to the Museum, and he has most liberally allowed me to examine the whole. There is no specimen of *Arctomys Hemachalanus*, but there are two fine skins of *A. Himalayanus*. These coincide very fairly in external characters with those from the Kuenluen, they are a very little greyer in tint and darker on the face, but there can be no hesitation in referring both forms to the same species. The skull of one of Mr. Mandelli's skins has been extracted for me by Mr. Fraser. Although it is near to that of the Kuenluen marmot and to that of *A. robustus*, it differs somewhat from both; its longitudinal and transverse diameters being 101 and 67 millemeters, so that it is decidedly broader in proportion to its length, whilst its height is rather less, and the nasal bones are shorter and less convex. Despite these and other differences, there is a general agreement in details, and I feel disposed to believe that the distinctions are insufficient for separation. Moreover, it is evident that the cranial distinctions already pointed out in the case of *A. robustus* are not greater than those which are found between the two forms of *A. Himalayanus*, and, consequently, that either *A. robustus* must be united to that species, or the Kuenluen marmot must be classed as distinct. I prefer the former view and have adopted it in the preceding synonymy.

Dr. Severtzoff has recently visited London, and I am indebted to Mr. Dresser for obtaining from the Russian naturalist a few notes on some of the

mammals described by him from Western Turkestan. I learn that the species identified as *Arctomys baibacinus* differs from *A. bobac* in being darker above, and more rufous below. It is a mountain species, whilst *A. bobac* inhabits the steppes. Dr. Severtzoff suggests that it may be identical with *A. robustus* (that is, doubtless, with *A. Himalayanus*). As *A. Himalayanus* extends from Eastern Tibet to the Kuenluen, keeping to great altitudes, above the range of almost every other mammal, it is by no means improbable that it may also occur farther to the north.

P. S.—*Nov. 8th.*—In the October number of the 'Annals and Magazine of Natural History' just received, Dr. Anderson has described another marmot from the mountains north of Kábul under the name of *A. dichrous*. From the description this appears to be distinct from *A. aureus* and the other species referred to above, and it is very probably the form indicated by Burnes and Griffith, a skull of which, as already mentioned, exists in the Society's old collection.

XIV.—*Contributions towards a Knowledge of the Burmese Flora. Part* II.—*By* S. Kurz.

(Continued from Vol. XLIII, p. 141.)

RUTACEÆ.

Conspectus of genera.

A. Fruit separating into 2 to 5 distinct 2-valved carpels.

Trib. I. ZANTHOXYLEÆ. Flowers usually polygamous. Disk free, or rarely wanting. Styles basilar or ventral, more or less free. Fruit-carpels coriaceous, the endocarp persistent or separating elastically.

× Leaves opposite or nearly so, rarely intermixed with nearly alternate ones. Unarmed.

Evodia. Stamens 4-5. Leaves often compound, rarely 1-foliolate.

Melicope. Stamens 8. Leaves often 1- rarely 3-foliolate.

× × Leaves all alternate. Often armed.

Zanthoxylon. Petals 3—5, rarely none. Stamens as many. Leaves often pinnate.

B. Fruit a drupe or berry, rarely a capsule.

Trib. II. TODDALIEÆ. Flowers usually polygamous. Disk free. Style single. Albumen usually present.

Acronychia. Petals 4. Stamens 8. Drupe or capsule 4-celled. Erect unarmed trees with 1—3-foliolate leaves.

Toddalia. Petals 2—5. Stamens as many. Berry 4—7-celled. Climbers, often armed, with usually 3-foliolate leaves.

Trib. III. AURANTIEÆ. Flowers hermaphrodite. Petals and stamens free or connate. Style simple. Ovules 1, 2 or more in each cell. Berry often pulpy, with a coriaceous or woody rind. Albumen none.

× *Ovary-cells with* 1 *or* 2 *ovules only.*

+ Style persistent, not jointed at the base.

Glycosmis. Calyx 5-parted or -toothed. Stamens 10, free. Ovules solitary. Leaves pinnately 5-1—or rarely 7-foliolate.

+ + Style jointed at the base, deciduous.

† Leaves pinnate or 3-foliolate.

* Ovules 2 in each cell.

○ Leaves pinnate or pinnately 3-foliolate.

‡ Cotyledons plano-convex, fleshy. Petals imbricate.

Chalcas. Filaments linear-subulate. Unarmed, the flowers in terminal cymes.

Clausena. Filaments dilated at the base. Unarmed, the flowers in panicles or racemes.

‡ ‡ Cotyledons crumpled, leafy. Petals valvate.

Micromelum. Filaments linear-subulate. Unarmed, the flowers in terminal corymbs.

○ ○ Leaves digitately 3-foliolate.

Luvunga. Calyx cup-shaped. Stamens 8 or 10. Armed or not.

* * Ovules solitary in each cell.

Triphasia. Calyx 3-lobed. Stamens 6. Spiny; leaves digitately 3-foliolate; flowers almost solitary.

Limonia. Calyx 4- or 5-lobed or -parted. Stamens 8—10. Armed; leaves pinnate.

† † Leaves 1-foliolate or simple.

Paramignya. Anthers linear-oblong. Disk elongate. Calyx usually cup-shaped. Climbers, armed. Berries without pulp.

Atalantia. Anthers ovate or cordate. Disk cup-shaped. Calyx often irregular. Trees or shrubs, often armed. Berries with vesicular pulp.

× × *Ovary-cells with numerous ovules.*

† Rind of berry leathery. Leaves 1-foliolate.

Citrus. Stamens 20—60, often connate. Trees, usually spiny.

† † Rind of berry woody. Leaves compound. Trees.

Feronia. Ovary 5—6-celled. Leaves pinnate.

Aegle. Ovary 8- to many-celled. Leaves trifoliolate.

Evodia, Forst.

Conspectus of species.

× Panicles small, contracted, usually much shorter than the petioles.

Branchlets 4-cornered and marked with 4 prominent longitudinal lines; leaves 1—3-foliolate, the leaflets sessile; stamens shorter than the petals, ... *E. viticina.*

Branchlets quite terete; leaves 8-foliolate, the leaflets on short petiolules, lively green, .. *E. triphylla.*

× × Panicles corymbose, spreading, as long or longer than the petiole.

Branchlets terete, thick; leaflets shortly petioluled, dark bluish-green, *E. Roxburghiana.*

1. E. viticina, Wall. Cat. 1219; Hf. Ind. Fl. I. 489.

Hab. Tenasserim, Tavoy.

2. E. triphylla, DC. Prod. I. 724; Hf. Ind. Fl. I. 488.

Hab. Frequent in the damp hill-forests, and entering the drier ones, from Martaban down to Tenasserim, at 3000 to 5000 ft. elevation.—Fl. Febr., March; Fr. Apr., May.

3. E. Roxburghiana,* Bth. Fl. Hongk. 59; Hf. Ind. Fl. I. 487.—(*Xanthoxylon triphyllum*, Wight Ic. t. 204; *Fagara triphylla*, Roxb. Fl. Ind. I. 416).

Hab. Tenasserim.

Roxburgh's figure of the fruit in his MS. drawings shews that the size of the carpels and seeds does not differ from that of the plant formerly usually taken for *E. triphylla.*

Melicope, Forst.

1. M.? Helferi, Hf. Ind. Fl. I. 492.

Hab. Tenasserim (or Andamans?) (*teste* Hf.).

Zanthoxylum, L.

Conspectus of species.

* *Cymes axillary, or axillary and terminal. Branches alternate. Leaves pinnate.*

× Rachis of leaves winged. Flowers apetalous.

Leaflets 2—3 in. long, glandular-crenulate; cymes dense, ½—1 in. long; fruit-carpels usually by 4—2, ... *Z. acanthopodium.*
Leaflets coarsely crenate, ½—1 in. long, ... *Z. Andamanicum.*

× × Rachis of leaves not winged. Flowers 4—5-petalous.

Leaflets in 2—3 pairs, glossy on both sides; cymes axillary, ... *Z. Hamiltonianum.*

* * *Cymes terminal. Branches opposite.*

Leaflets glandular-crenate, in 7—10 pairs, ... *Z. Budrunga.*

1. Z. ACANTHOPODIUM, DC. Prod. II. 727; Hf. Ind. Fl. I. 493.

HAB. Ava, hills east of Bhamo.

2. Z. ANDAMANICUM, Kurz MS.

HAB. In the tropical forests of Termoklee island, west of South Andaman.

A very distinct small-leaved species, but the flowers and fruits are unknown.

3. Z. HAMILTONIANUM, Wall. Cat. 7117; Hf. Ind. Fl. I. 494.

HAB. Burma (*teste* Hf.).

4. Z. BUDRUNGA, DC. Prod. I. 728; Hf. Ind. Fl. I. 495. (*Fagara Budrunga*, Roxb. Fl. Ind. I. 447).

HAB. Not unfrequent in the tropical and moister upper mixed forests from Chittagong, Pegu, and Martaban down to Tenasserim.—Fr. Sept.

Doubtful species.

1. *Z. spondiæfolium*, Wall. Cat. 1217; Hf. Ind. Fl. I. 496.

HAB. Amherst (Wall.) *teste* Hf.

Acronychia, Forst.

1. A. CYMINOSMA, F. Muell. Fragm. Phyt. Amstr. I. 27. (*A. laurifolia*, Bl. Bydr. 245; Hf. Ind. Fl. I. 498; *Cyminosma pedunculata*, DC. Prod. I. 722; Wight Ill. t. 65).

HAB. Not unfrequent in the tropical forests of the Andamans; also Pegu and Chittagong.—Fl. RS.

Toddalia, Juss.

1. T. ASIATICA, (*Paullinia Asiatica*, L. sp. pl. 524; *T. aculeata*, Pers. Ench. I. 249; Hf. Ind. Fl. I. 497 (excl. syn. *Zanthox. nitidum*, Wall.) Wight Ill. t. 66; *Scopolia aculeata*, Sm. Icon. ined. sub. t. 34; Roxb. Fl. Ind. I. 616).

VAR. α. ACULEATA, (*T. aculeata*, Pers.), petioles and often also the midrib beneath hooked-prickly; panicles usually smaller and less branched.

VAR. β. FLORIBUNDA, (*T. floribunda*, Wall. Pl. As. rar. III. 17. t. 232), petioles and midrib of leaves unarmed; panicles often more compound.

HAB. Frequent in the tropical forests from Ava and Martaban down to Pegu, up to 3000 ft. elevation.—Fl. June.

N. B.—It is possible that in Wallich's Herbarium *Toddalia* and *Zanthoxylon nitidum*, DC., are mixed, but the Wallichian specimens in HBC., as well as those cultivated in this garden, all belong to DeCandolle's species.

Glycosmis, Correa.

Conspectus of species.

* *Anthers blunt, not gland-tipped.*

O Berries oboval-oblong to oblong, leaden blue.

Petals longer persistent; filaments flat, from a narrower base gradually broader towards the triangular apex; bark pale coloured, ... *G. cyanocarpa.*

O O Berries more or less globular, from watery flesh-coloured to crimson.

Petals very deciduous; filaments from a broader base attenuated upwards; nerves of leaflets prominent above; bark pale coloured, ... *G. trifoliata.*

Petals very deciduous, lanceolate, about 3 lin. long; filaments elongate, filiform; bark brown, ... *G. arborea.*

* * *Anthers gland-tipped.*

Petals longer persistent, about 1½ lin. long; anthers cordate; filaments flat, from a narrower base gradually broader towards the triangular apex; bark white, .. *G. pentaphylla.*

1. G. CYANOCARPA, Spreng. Syst. Veg. IV/2. 161; Miq. Fl. Ind. Bat. I/2. 521.—(*Cookia cyanocarpa*, Bl. Bydr. 136).

VAR. α. GENUINA, flowers in peduncled terminal and axillary panicles, rarely reduced to cymes.

VAR. β. CYMOSA, (*G. tetraphylla*, Wall. and *G. oxyphylla*, Wall. ap. Voigt. Cat. Hort Calc. 139), flowers in short peduncled or almost sessile quite glabrous or rarely rusty tomentose cymes axillary or axillary and terminal, rarely transformed into panicles.

HAB. Var. β. Not unfrequent in the tropical forests of the Pegu Yomah.—Fl. Apr.

2. G. TRIFOLIATA, Spreng. Syst. Veg. IV/2 162; Miq. Fl. Ind. Bat. I/2. 521.

VAR. α. GENUINA, leaves green or yellowish in drying; panicles or cymes shorter, more or less rusty or tawny tomentose; ovary glabrous or tawny pubescent.

VAR. ? β. FUSCESCENS, leaves fuscescent in drying; panicles larger and more compound, quite glabrous.

HAB. Var. α. In Chittagong and Tenasserim; var. β. frequent in the tropical forests all over Burmah from Chittagong, Pegu, and Martaban down to Tenasserim and the Andamans.—Fl. HS.; Fr. RS.

All the specimens of var. β. are in young bud only, and therefore the identification with *G. trifoliata* is doubtful. Those of var. α. are in young bud only and also doubtful; they can equally well belong to *G. insularis.*

3. G. ARBOREA, Corr. in Ann. Mus. VI. 386.; DC. Prod. I. 538. (*Limonia arborea*, Roxb. Corom. Pl. I. t. 85. and Fl. Ind. II. 381).

Var. α. genuina, calyx-lobes acute; ovary sessile; leaves often serrate; panicles peduncled.

Var. β. insularis, calyx-lobes bluntish; ovary usually stalked; leaves entire; cymes small, sessile, rusty-villous.

Hab. Var. β. Common in the tropical forests of the Andamans.—Fl. Febr.; Fr. Apr. May.

4. G. pentaphylla, Corr. in Ann. Mus. VI. 386; DC. Prod. I. 538; WA. Prod. I. 93; Bedd. Fl. Sylv. Madr, Anal. 43. t. 6. f. 6. (*Limonia pentaphylla*, Retz. Obs. V. 24; Roxb. Corom. Pl. t. 84. and Fl. Ind. II. 381; *Limonia arborea*, Bot. Mag. t. 2074).

Hab. Frequent all over Burmah, in the mixed and tropical forests, and more especially in the shade of village-bushes and bamboo-jungles.—Fl. CS.; Fr. HS.

Chalcas, L. (1767) (**Murraya**, L. 1771).

Conspectus of species.

Leaflets 3 to 8; petals nearly ½ in. long, ... *C. paniculata.*
Leaflets 10 to 20; petals about 2 lin. long, ... *C. Kœnigii.*

1. C. paniculata, L. Mant. 1261; F. Muell. in Contr. New Hebrid. 7.—(*Murraya exotica*, L. Mant. 563; Hf. Ind. Fl. I. 502).

Hab. Common in the tropical forests of the Pegu Yomah and Martaban down to Tenasserim and the Andamans.—Fl. HS.; Fr. May, June.

2. C. Kœnigii, (*Murraya Kœnigii*, Spreng. Syst. veg. II. 315; Hf. Ind. Fl. I. 503.—(*Bergera Kœnigii*, L. Mant. 563; Roxb. Corom. Pl. II. t. 112. and Fl. Ind. II. 375; Wight Icon. t. 13; Griff. Not. Dicot. 497. t. 586. f. 3; *Murraya fœtidissima*, T. et B. in Tydsch. Ned. Ind. XXV. 25).

Hab. Rather frequent along choungs in the tropical forests of the eastern slopes of the Pegu Yomah; also Chittagong.—Fl. March.

Doubtful species.

1. *Murraya elongata*, DC. ap. Hf. Ind. Fl. I. 503.

Hab. Ava, Taong-dong (Wall.).

Clausena, Burm.

Conspectus of species.

* *Panicle terminal.*

O Ovary glabrous.

Softly villous; leaves pinnately 5-foliolate; flowers 4-merous, ... *C. macrophylla.*
Inflorescence and leaves glabrous; petiole and rachis terete or nearly so; leaflets usually 7 (5—9), not or hardly oblique; flowers usually 4- rarely 5-merous, *C. heptaphylla.*
Inflorescence and leaves glabrous; rachis more or less winged; leaflets 13—17, oblique; flowers 5-merous, ... *C. Wallichii.*

O O Ovary more or less hirsute or pubescent.

Inflorescence and other parts more or less shortly hirsute or puberulous; rachis terete;

leaflets 15—30, oblique; flowers 5-merous, ... *C. excavata.*

Inflorescence and the tubercled petioles densely and shortly tawny tomentose; leaflets 5—9; young berries densely fascicled-tomentose; flowers 5-merous, ... *C. Wampi.*

* * *Panicles or racemes axillary.*

All parts shortly pilose; leaflets 5 to 17; ovary and the long red berries glabrous; flowers 4-merous, ... *C. suffruticosa.*

1. C. MACROPHYLLA, Hf. Ind. Fl. I. 504.

HAB. Upper Tenasserim, banks of Salween at Trogla.

2. C. HEPTAPHYLLA, WA. Prod. I. 95; Hf. Ind. Fl. I. 504.—(*Amyris heptaphylla*, Roxb. Fl. Ind. II. 248).

HAB. Chittagong; Tenasserim (*teste* Hf.).

3. C. WALLICHII, Oliv. in Journ. Linn. Soc. V. Suppl. II. 35; Hf. Ind. Fl. 505.—(*Cookiæ sp.*, Griff. Not. Dicot. 469. t. 587. f. 2?). VAR. β. LUXURIANS, rachis leafy-winged; leaflets only in 4—2 pairs with an odd one, 4—8 in. long, remaining green in a dried state.

HAB. Var. α. Upper Tenasserim; var. β. rare in the tropical forests of the eastern slopes of the Pegu Yomah. Fl. March.; Fr. Apr.

4. C. EXCAVATA, Burm. Fl. Ind. 87; Hf. Ind. Fl. I. 504.—(*Amyris Sumatrana*, Roxb. Fl. Ind. II. 250; *Amyris punctata*, Roxb. l. c. 251.)

HAB. Frequent in the tropical and moister upper mixed forests, all over Burmah and the adjacent provinces, from the plains up to 2000 ft. elevation. Fl. Apr. May; Fr. June, Jul.

*5. C. WAMPI, Blanco Fl. Filip. 358; Hf. Ind. Fl. I. 505.—(*Cookia punctata*, Sonner. Voy. II. 130. t. 131; Roxb. Fl. Ind. II. 382).

HAB. Cultivated in Chittagong.

6. C. SUFFRUTICOSA, WA. Prod. I. 96. in adn.; Hf. Ind. Fl. I. 506.—(*Amyris suffruticosa*, Roxb. Fl. Ind. II. 250).

VAR. β. PAUCIJUGA, leaflets only in 2 to 3 pairs with an odd one.

HAB. Chittagong, Seetakhoond hills; var. β. not unfrequent in the Eng- and dry forests of the Prome district.—Fl. March.

Micromelum, Bl.

Conspectus of the species.

Tree; petals 2½ lin. long; ovary slightly appressed-pubescent; young berries stalked glabrous, ... *M. pubescens.*

Meagre shrub up to 4 ft. high; petals 2 lin. long; ovary densely tawny hirsute; young berries sessile or nearly so, puberulous, ... *M. hirsutum.*

1. M. PUBESCENS, Bl. Bydr. 138; Hf. Ind. Fl. I. 501.—(*Bergera integerrima*, Roxb. Fl. Ind. III. 376.)

VAR. α. GENUINA, leaves on both sides or at least along the nerves beneath, the petioles, and rachis puberulous.

VAR. β. GLABRIUSCULA, leaves quite glabrous.

HAB. Both varieties frequent in the tropical and moister upper mixed

forests all over Burma from Chittagong and Ava down to Tenasserim and the Andamans.—Fl. Jan. March ; Fr. Apr. June.

2. M. HIRSUTUM, Oliv. in Linn. Proc. V. Suppl. II. 41 ; Hf. Ind. Fl. I. 502.—(*M. Zeylanicum*, Wight in Thw. C. P. 188).

VAR. α. GENUINUM, all parts more or less shortly hirsute or puberulous ; leaflets smaller.

VAR. β. GLABRESCENS, (*Aurantiacea*, Wall. Cat. 8517.) the young shoots only tawny puberulous, all other parts glabrous or nearly so ; calyx shortly 5-toothed, puberulous ; petals puberulous.

HAB. Var. α. Very frequent in the open and dry forests, especially in the Eng-forests, all over Burma from Ava and Martaban down to Tenasserim ; var. β. in Tenasserim from Moulmein southwards (Helf. 535/1).—Fl. March, Apr.

Luvunga, Ham.

Conspectus of species.

Filaments glabrous, more or less connate, ... *L. scandens.*
Filaments glabrous, free ; flowers much smaller, ... *L. eleutherandra.*

1. L. SCANDENS, Ham. ap. Oliv. in Linn. Proc. V. Suppl. II. 43 ; Hf. Ind. Fl. I. 509 ; Bot. Mag. t. 4522.—*Limonia scandens*, Roxb. Fl. Ind. II. 380).

HAB. Burma (Ava ?) ; Chittagong.

2. L. ELEUTHERANDRA, Dalz. in Hook. Kew. Journ. Bot. II. 258 ; Hf. Ind. Fl. I. 509, excl. syn. Bl.—(*Luvunga Tavoyana*, Wall. Cat. 6383).

HAB. Tenasserim, ? Tavoy, (*teste* Hf.)

Triphasia, Lour.

1. T. TRIFOLIATA, DC. Prod. I. 536 ; Hf. Ind. Fl. I. 507.

HAB. Tenasserim, probably wild.—Fl. Fr. ∞.

Limonia, L.

Conspectus of species.

Spiny tree ; leaflets opposite ; inflorescence puberulous ; berries globose, sessile ..*L. acidissima.*
Unarmed shrub ; leaflets alternate ; inflorescence glabrous ; berries ovoid, shortly stalked, ... *L. alternans.*

1. L. ACIDISSIMA, L. sp. pl. 554 ; Hf. Ind. Fl. I. 507.—(*L. crenulata*, Roxb. Corom. Pl. I. t. 86. and Fl. Ind. II. 381).

VAR. β. PUBESCENS (*L. ? pubescens*, Wall. Cat. 6365 ; Hf. Ind. Fl. I. 507), prickles on the branches short, the wings of the petiole narrow, leaflets bluntish, the terminal one long but bluntish acuminate, the petioles and nerves beneath softly puberulous.

Hab. Var. α. Ava, along the Irrawaddi, apparently frequent; var. β. Ava, Taong dong; and Prome hills.

2. L. alternans, Wall. ap. Voigt. Hort. Calc. 139; Hf. Ind. Fl. I. 508.

Hab. Not unfrequent in the upper-mixed, and sometimes in the moist, forests of the Pegu Yomah and Arracan; also Tenasserim, Mergui.—Fl. May.

Paramignya, Wight.

Conspectus of species.

* Petals about 8 lin. long. Calyx largish, cupular, broadly lobed.

Style elongate; calyx and pedicels tomentose, the latter as long or a little longer than the calyx, ... *P. monophylla.*

Style short; calyx and the pedicels glabrous, the latter 1 in. or thereabouts long, ..*P. grandiflora.*

* * Petals 2—4 lin. long. Calyx small, with acute lobes.

O Berries terete.

Young shoots more or less puberulous; style short, hirsute or villous,..*P. Griffithii.*

Glabrous; style very short, like the ovary glabrous, ... *P. citrifolia.*

O O Berries 3—4-angular.

Erect tree, the spines 1—1½ in. long, straight; calyx glabrous, ... *P. angulata.*

1. P. monophylla, Wight Ill. I. 108. t. 42; Hf. Ind. Fl. I. 510.—Hab. Tenasserim, Moulmein district at 5000 feet elevation (*teste* Oliv.).

2. P. grandiflora, Oliv. in Linn. Proc. V. Suppl. II. 42; Hf. Ind. Fl. I. 510.

Hab. Tenasserim, Tavoy.—Fl. Aug.

3. P. Griffithii, Hf. Ind. Fl. I. 510.—(*Citrus scandens*, Geoff. Not. Dicot. 495, t. 587. f. 1).

Hab. Ava, at the serpentine mines of Hookhum valley; Pegu (*teste* Hf.).

4. P. citrifolia, Hf. Ind. Fl. I. 510, non Oliv.—(*Limonia citrifolia*, Roxb. Fl. Ind. II. 579.; *P. micrantha*, Kurz in And. Rep. App. B. 4).

Hab. In the tropical forests of Chittagong and the Andamans.—Fl. June, July.

5. P. angulata (*Citrus angulatus*, Willd. sp. pl. III. 1426; DC. Prod. I. 540; *Limonellus angulosus*, Rumph. Herb. Amb. 110. t. 32; *Limonia angulosa*, WA. Prod. I. 91, in adn.; Miq. Fl. Ind. Bat. I. 2-521; *Atalantia longispina*, Kurz in Journ. As. Soc. Beng. 1872. 295; *Paramignya longispina*, Hf. Ind. Fl. I. 511; *Gonocitrus angulatus*, Kurz in Journ. As. Soc. Beng, 1873. 228. t. 18).

Hab. In the mangrove and tidal forests of Pegu and Tenasserim (also Sunderbuns, Malacca, and the Moluccos).

N. B.—This species has got quite an array of synonyms. I attempted to establish a new genus upon it on account of the angular fruits and absence of pulp, but on examining the fruits of several other *Paramignyas*, I find that they also seem to be pulpless.* *Atalantia missionis*, Oliv. (Hf. Ind. Fl. I. 513, excl. syn. Turcz.) has curiously enough retained its place in *Atalantia*, although habit and generic characters place its beyond any doubt in *Paramignya*, and in habit it approaches very much the above species.

Atalantia, Corr.

Conspectus of species.

× Calyx irregularly lobed, split to the base on one side.

Berries the size of a large pea or small cherry, ... *A. monophylla.*

Berries the size of a wood-apple, ... *A. macrophylla.*

× × Calyx regularly 4-lobed.

Flowers shortly pedicelled, in short racemes, ... *A. caudata.*

1. A. MONOPHYLLA, Corr. in Ann. du Mus. VI. 383; Hf. Ind. Fl. I. 511.—(*A floribunda*, Wight. Icon. t. 1611.; *Limonia monophylla*, Lin. Mant. alt. 237; Roxb. Fl. Ind. II. 378 and Corom. Pl. I. t. 82; *A. puberula*, Miq Ann. Mus. Lugd. Bat. I. 211; *Chilocalyx ellipticus*, Turcz. in Bull. Natur. Mosc. 1863, 588).

HAB. Ava, about Segain, very frequent.—Fl. Octob.

2. A. MACROPHYLLA (*A monophylla* var. *macrophylla*, Oliv. in Linn. Proc. V. Suppl. II 24; Hf. Ind. Fl. I. 512).

HAB. Frequent along the beaches of the Andaman islands; also Tenasserim.—Fr. Apr. May.

3. A. CAUDATA, Hf. Ind. Fl. I. 513?—

HAB. Frequent in the tropical forests of the Pegu Yomah, especially along choungs.

The Burmese plant is a middling-sized tree of elegant appearance but spiny. I have not met either with flowers or fruits and therefore the identification must remain doubtful.

Citrus, L.

Conspectus of species.

× Young shoots and nerves of leaves beneath pubescent or puberulous; flowers and fruits large, ... *C. decumana.*

× × All parts glabrous.

O Style very short.

Flowers small; stamens free; petioles leafy and almost as long and as broad as the blade itself, ... *C. hystrix.*

O O Style as long as the ovary or much longer.

† Petals 8 to 10 lin. long.

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* The berries of *P. littoralis*, Miq., a species nearly allied to *P. angulata*, has pulp, but the dried ones appear pulpless.

Leaves acuminate or acute, the petiole often winged; berries globular, without a knob; filaments cohering by 3—4, ... *C. Aurantium.*

Leaves blunt or nearly so, the petiole not winged; berries oblong to globose, with a knob, the skin usually thick; filaments free or polyadelphous, ... *C. medica.*

† † Petals 3—4 lin. long.

Calyx small; berries globular, sweet or acid, the skin usually thin, ... *C. nobilis.*

*1. C. DECUMANA, L. sp. pl. 1100; Roxb. Fl. Ind. III. 393; Hf. Ind. Fl. I. 516.

HAB. Often cultivated by Burmans, especially in the southern provinces.

2. C. HYSTRIX, DC. Prod. I. 539; Hf. Ind. Fl. I. 515.

HAB. Not unfrequent in the tropical forests of the Martaban hills; also in the adjoining Siamese province Kyouk-Koung; often cultivated in native gardens.

*3. C. AURANTIUM, L. sp. pl. 1100; Hf. Ind. Fl. I. 515.

HAB. Here and there cultivated in villages.

4. C. MEDICA, L. sp. pl. 580; Roxb. Fl. Ind. III. 392; Hf. Ind. Fl. I. 514. excl. var. 4.

VAR. α. GENUINA, Brandis Forest. Fl. 52.; Hf. l. c.

VAR. β. LIMONUM, Brand. For. Fl. 52.

VAR. γ. ACIDA, Brand. For. Fl. 52; Hf. l. c.—(*C. acida*, Roxb. Fl. Ind. III. 390).

HAB. Var. γ. apparently wild in the Khaboung forests of the Pegu Yomah, west of Tounghoo (Brandis); the other varieties only cultivated.

*5. C. NOBILIS, Lour. Fl. Cochin. 569; DC. Prodr. I. 540.; Ker Bot. Rep. t. 211; Andr. Bot. Rep. t. 608 (*Aurantium Sinense*, Rumph. Herb. Amb. II. t. 34; *C. medica* var. 4 *limetta*, Brandis For. Fl. 52; Hf. Ind. Fl. I. 515).

VAR. α. SINENSE, (*Aurantium Sinense*, Rph. l. c.), petioles simple; berries with a sweet or bitter pulp. Sweet lime.

VAR. β. LIMONELLUS, (*Limonellus*, Rumph. l. c. t. 29; *C. limetta*, Wight Ic. t. 958), petioles short, winged; fruits acid. Acid lime.

HAB. Frequently cultivated in villages.

Feronia, Corr.

1. F. ELEPHANTUM, Corr. Act. Soc. Linn. V. 224; Roxb. Corom. Pl. II. t. 141. and Fl. Ind. II. 411; Wight Icon. t. 15.; Hf. Ind. Fl. I. 516.

HAB. In the dry forests of Prome District.—Fl. March, Apr.; Fr. Octob.

Aegle, Corr.

1. A. Marmelos, Corr. Act. Soc. Linn. V. 224; Roxb. Corom. Pl. II. t. 143 and Fl. Ind. II. 579; Wight Icon. t. 16; Hf. Ind. Fl. I. 516; Bedd. Fl. Sylv. t. 161.

Hab. Much cultivated, especially in the Prome district, and said to occur wild in the forests also: I found the tree in those of the Toukyeghat, east of Tounghoo.—Fl. May; Fr. Octob. Nov.

SIMARUBEÆ.

Conspectus of genera.

Trib. I. SIMARUBEÆ. Ovary deeply lobed or the carpels distinct.

* Stamens twice as many as petals.

O Leaves simple.

Samadera. Calyx 3—5-parted. Disk large. Stamens 8—10. Drupe variously winged.

O O Leaves pinnate.

Ailanthus. Calyx 5- cleft. Disk 10-lobed. Stamens 10. Fruit of 1 to 5 samaras.

* * Stamens as many as petals. Leaves pinnate. Carpels drupaceous.

O Styles free or cohering at the base only.

Brucea. Disk 4-lobed. Stamens glabrous. Flowers cymose-racemose.

O O Styles connate. Flowers in panicles.

Picrasma. Disk thick. Stamens pilose.

Eurycoma. Disk none. Stamens glabrous.

Trib. II. PICRAMNIEÆ. Ovary entire, 2—5-celled.

Harrisonia. Calyx 4—5-cleft. Stamens 4 or 10. Ovary 4—5-celled. Leaves pinnate, or pinnately 1—3-folialate.

Balanites. Sepals 5. Stamens 10. Ovary 5-celled. Leaves bifoliolate.

Samadera, Gærtn.

1. S. Indica, Gærtn. Fruct. II. t. 156. fig. inf.; Wight Ill. t. 68; Hook. Icon. Pl. t. 7; Hf. Ind. Fl. I. 519.

Var. α. genuina, peduncles about as long as the leaves; drupes about 2½ in. long, smooth or slightly net-veined; filaments in bud erect.

Var. β. lucida, (*Niota lucida*, Wall. Pl. As. rar. II. t. 168; *Samadera lucida*, Benn. in Hf. Ind. Fl. I. 519; *S. brevipetala*, Scheff. Obs. phyt. 88), peduncles shorter than the leaves; drupes 1½—2 in. long, strongly net-veined; filaments in bud twisted.

Hab. Var. β. Upper Tenasserim, Moulmein.

Ailanthus, Desf.

1. A. Malabaricus, DC. Prod. II. 89; Wight Icon. t. 1604; Bedd. Fl. Sylv. t. 122; Hf. Ind. Fl. I. 518.

Hab. Rather rare in the tropical forests of the Khaboung valley, eastern slopes of Pegu Yomah. Fr. Apr.

Brucea, Mill.

Conspectus of species.

Leaflets coarsely crenate-toothed; drupes about 2 lin. long, ... *B. Sumatrana.*
Leaflets quite entire; drupes about 3—4 lin. long, ... *B. mollis.*

1. B. SUMATRANA, Roxb. Fl. Ind. I. 449; Hf. Ind. Fl. I. 521.

HAB. Tenasserim, Mergui (Griff.)

2. B. MOLLIS, Wall. Cat. 8483; Hf. Ind. Fl. I. 521.

HAB. In the drier and damp hill-forests of Martaban and Upper Tenasserim, at 3000 to 4000 ft. elevation.—Fl. March.

Picrasma, Bl.

1. P. JAVANICA, Bl. Bydr. 248; Benn. in Horsf. Pl. Jav. rar. 197. t. 41; Miq. Fl. Ind. Bat. I/2. 679. t. 28; Hf. Ind. Fl. I. 520.—(*P. Andamanica*, Kurz And. Rep. App. B. IV; Hf. Ind. Fl. I. 520).

HAB. Frequent in the tropical forests from Martaban down to Tenasserim and the Andaman islands; rare in those of the Pegu Yomah.—Fl. March; Fr. Begin of R. S.

Eurycoma, Jack.

1. E. LONGIFOLIA, Jack in Roxb. Fl. Ind. ed. 1. II. 307; Griff. Not. Dicot. 435; Hf. Ind. Fl. I. 521.—(*E. Merguensis*, Planch. in Hook. Lond. Journ. V. 583).

HAB. Forests of Tenasserim from Tavoy southwards; Andamans (*teste* Bennet).

Harrisonia, R. Br.

1. H. BENNETII, Bth. and Hf. Gen. pl. I. 314; Hf. Ind. Fl. I. 519. —(*Lasiolepis paucijuga*, Benn. in Horsf. Pl. Jav. rar. 202. t. 42).

HAB. Very frequent in the dry forests of the Prome district; also in Martaban, Yoonzeleen, 2000 ft. (Brandis).—Fl. Apr.

Balanites, Del.

1. B. ROXBURGHII, Planch. in Ann. sc. nat. 4 ser. II. 258; Hf. Ind. Fl. I. 522.—(*Ximenia Aegyptiaca*, Roxb. Fl. Ind. II. 253; *B. Aegyptiaca*, Wight Icon. t. 274, non Del.).

VAR. β. GRACILIS, branchlets slender and glabrous or nearly so; inflorescence more glabrous than in the normal form and only puberulous, the peduncles and pedicels all very slender.

HAB. Ava; var. β. in the Prome District.—Fl. Apr.

OCHNACEÆ.

Conspectus of genera.

Trib. I. OCHNEÆ. Ovary 2—10-celled, with a solitary ovule in each cell. Albumen none.

Ochna. Stamens indefinite. Drupes 3 to 10, seated on the enlarged torus. Corymbs lateral.

Gomphia. Stamens 10. Drupes 3—5, seated on the enlarged torus. Panicles terminal.

Tetramerista. Flowers 4-merous. Stamens 4. Fruit a coriaceous 4-seeded berry.

Trib. II. EUTHEMIDEÆ. Ovary half 5-celled, with 2 ovules in each cell. Seeds with albumen.

Euthemis. Stamens 5. Racemes terminal.

Ochna, Schreb.

Conspectus of species.

* Styles free at the summit for nearly a line length.

Fruiting sepals erect-conniving; filaments as long or longer than the anthers; tree, ... *O. Andamanica.*

* * Styles united to the apex.

× Filaments as long or longer than the anthers.

Petals usually 5; fruiting sepals reflexed; tree, ... *O. Wallichii.*

Petals 5; fruiting sepals erect-connivent; dwarf shrub, ... *O. fruticulosa.*

× × Filaments almost 4 times shorter than the anthers.

Petals usually 7—8; fruiting sepals erect-conniving; tree, ... *O. squarrosa.*

1. O. andamanica, Kurz in Journ. As. Soc. Beng. 1872, 295.

Hab. Frequent in the tropical forests of the Andamans.—Fl. March; Fr. May, June.

2. O. squarrosa, Roxb. Corom. Pl. I. t. 89 and Fl. II. 643; Wight Ill. t. 69. *(O. lucida*, Lamk. Dicot. IV. 510).

Hab. Ava (Mrs. Col. Burney).

3. O. Wallichii, Planch. in Hook. Lond. Journ. V. 650; Hf. Ind. Fl. I. 524, excl. syn. Colebr. and Kurz. *(O. obtusata*, Wall. Cat. 28051; *O. lucida*, Griff. Not. Dicot. 464).

Hab. Very frequent in the tropical forests of Martaban and Tenasserim; less so along the eastern and southern slopes of the Pegu Yomah.—Fl. March; Fr. Apr. May.

4. O. fruticulosa, Kurz in Journ. As. Soc. Beng. 1872, 295.

Hab. Frequent in the open forests, especially the eng-forests, all over Pegu and Martaban.—Fl. Apr. May; Fr. June, July.

Doubtful species.

1. *O. parviflora*, Griff. Not. Dicot. 464.

Hab. Forests of Moulmein.

Referred by Bennet as a variety to *O. Wallichii*, from which it seems to differ by its smaller flowers. I have not seen a specimen and the reflexed sepals seem to confirm Mr. Bennet's conclusion.

2. *O.? brevipes*, Planch. in Hook. Lond. Journ. Bot. V. 652; Hf. Ind. Fl. I. 525.

Hab. Pegu.

Gomphia, Schreb.

1. G. SUMATRANA, Jack. Mal. Misc. V. 29; Hf. Ind. Fl. I. 525.—(*G. Sumatrensis*, Planch. in Hook. Icon. t. 712; *Ochna crocea*, Griff. Not. Dicot. 463).

HAB. Tenasserim, Mergui, along the sea-coast of the island Madamaca, Pator. (Griff.).

N. B.—Mr. Bennet has a *Tetramerista glabra* var. *sagittata*, based upon *Ancistrocladus ? sagittatus*, Wall. Cat. 1055, a plant which I have not seen, and which on account of its sagittate-based leaves cannot be a *Tetramerista*. He gives Tenasserim as one of the localities for it.

BURSERACEÆ.

Conspectus of genera.

(*In Burmese species the fruit is an indehiscent drupe.*)

GARUGA. Torus broadly filling the urceolate calyx-tube. Calyx 5-cleft.

BURSERA. Calyx small, 4—6-parted. Stamens 8—12, inserted at the base of the annular disk.

CANARIUM. Calyx 3-(rarely 2—5) cleft, valvate. Petals 3—5. Stamens 6—10. Drupes ovoid, more or less 3-angular, with a bony or hard putamen.

Garuga, Roxb.

1. G. PINNATA, Roxb. Corom. Pl. III. t. 208 and Fl. Ind. II. 400; Bedd. Fl. Sylv. t. 118; Hf. Ind. Fl. I. 528.

VAR. *α.* GENUINA, more glabrescent; drupes glabrous.

VAR. *β.* MOLLIS (*G. mollis*, Turcz. in Bull. Nat. Mosc. 1858, 457), more pubescent or villous, the drupes densely villous or pubescent.

HAB. Common in the mixed forests all over Burma from Chittagong and Ava down to Tennasserim and the Andamans, up to 3000 ft. elevation; var. *β.* with the typical form.—Fl. Febr. March; Fr. Begin. of R. S.

Bursera, L.

1. B. SERRATA, Wall. in Trans. Linn. Soc. XV. 362. t. 4.; Hf. Ind. Fl. I. 530.—(*Limonia pentagyna*, Roxb. Fl. Ind. II. 382).

HAB. Frequent in the tropical forests, especially along choungs, of the eastern slopes of the Pegu Yomah and Martaban.—Fl. Apr.

Canarium, L.

Conspectus of species.

* Stipules subulate, entire, very deciduous.

Leaflets serrulate; disk-glands smooth, 6, free, cohering by pairs, ... *C. euphyllum.*

Leaflets entire; disk-lobes 3, hairy, united into a cup, ... *C. Bengalense.*

* * Stipules 2-cleft and pectinately cut, persistent.

Young buds covered by the crimson velvety bracts; leaflets entire and serrate, .. *C. coccineo-bracteatum.*

1. C. EUPHYLLUM, Kurz in Journ. As. Soc. Beng. 1872, 295; Hf. Ind. Fl. I. 535.

HAB. Frequent in the tropical forests of South Andaman.—Fl. June.

2. C. BENGALENSE, Roxb. Fl. Ind. III. 136; Hf. Ind. Fl. I. 534.

HAB. Very rare in the moister upper-mixed forests of the Pegu Yomah.

3. C. COCCINEO-BRACTEATUM, Kurz in And. Rep. App. B. 4. and Journ. As. Soc. Beng. 1872. 296; Hf. Ind. Fl. I. 536.

HAB. Rather rare in the tropical forests of South Andaman.—Fl. May.

N. B.—C. nitidum, Bennet = *C. patentissimum*, Miq.; *C. grandiflorum*, Bennet = *C. Mahassan*, Miq. Besides these Maingay's No. 310 = *C. eupteron*, Miq., and ejusd. No. 307 = *C. rugosum*, Miq.

MELIACEÆ.

Conspectus of genera.

A. Ovary-cells 1—2 ovuled. Seeds not winged.

Trib. I. MELIEÆ. Stamens united into a tube. Albumen thin, fleshy. Cotyledons thin, leafy or plano-convex.

* Capsule loculicidally 5-valved.

MUNRONIA. Calyx-lobes 5, almost leafy. Petals adnate to the elongate staminal tube. Disk tubular, sheathing the ovary. Leaves pinnate or pinnately 3-foliolate.

* * Fruit a drupe.

MELIA. Calyx 5—6-parted. Petals free. Disk annular. Drupes containing a single 1—5-celled putamen. Leaves pinnate or decompound.

CIPADESSA. Calyx 5-toothed. Petals free, short. Disk cupular. Drupes containing 5 horny pyrenes.

Trib. II. TRICHILIEÆ. Stamens united into a tube, very rarely free. Ovary-cells with one or two, rarely more ovules. Albumen none. Cotyledons thick.

* Disk free, tubular or cylindrical. Style usually elongate.

O Leaves pinnate (leaflets 5 or more).

DYSOXYLON. Calyx small, 4- or 5-toothed, opened while in young bud. Petals valvate, free. Ovary 3—5-celled. Capsule pear-shaped, opening loculicidally. Arillus none.

DIDYMOCHITON. Calyx small or large, consisting of 5—7 distinctly imbricate sepals. Petals valvate, adnate to the lobed or toothed staminal tube for nearly ½ of their length. Capsule globose, berry-like, opening loculicidally. Arillus none.

SCHIZOCHITON. Calyx usually campanulate, obscurely 4- rarely 5-toothed, open already in bud. Petals valvate or imbricate, united for ⅓ to nearly ½ of their length with the toothed or lobed staminal tube and appearing tubular. Ovary 3—4-celled. Capsule usually pyriform, opening loculicidally. Arillus complete or incomplete.

O O Leaves pinnately 3-foliolate.

SANDORICUM. Calyx tubular. Petals imbricate. Berry globular, indehiscent.

* * Disk none, or annular or stalk-like, or confluent with the staminal tube. Style usually short or none.

† Anthers included, or almost included in the staminal tube. Seeds arillate.

AGLAIA. Petals 5. Anthers as many. Ovary 1—3-celled. Berry 1—2-celled, indehiscent.

AMOORA. Petals 3—5. Anthers twice as many or more than twice as many as petals. Ovary 3—5-celled. Capsule leathery, opening loculicidally.

† † Anthers exserted or the filaments upwards free.

WALSURA. Petals 5. Berry indehiscent or follicular-dehiscing along the suture. Seeds arillate.

B. Ovary-cells 3- to many-ovuled. Seeds usually winged.

Trib. III. SWIETENIEÆ. Stamens united into a tube. Albumen present or not. Leaves pinnate.

CARAPA. Petals 4 or 5. Ovary-cells with 6 to 3 ovules. Capsule usually large, thick coriaceous, opening loculicidally. Seeds very large, with corky testa, without arillus, not winged.

SOYMIDA. Petals 5. Staminal tube cup-shaped, 10-lobed, the lobes 2-toothed. Disk rather broad. Seeds winged at both ends. Albumen none.

CHICKRASSIA. Petals 4 or 5. Staminal tube cylindrical, 10-crenate. Disk none. Seeds winged below. Albumen none.

Trib. IV. CEDRELEÆ. Filaments free, inserted outside of the disk. Valves of capsule separating from the axis. Seeds many. Leaves pinnate.

CEDRELA. Petals erect. Stamens 4—6. Disk raised or thin. Ovary 5-celled. Capsule opening septicidally. Seeds winged.

Munronia, Wight.

1. M. WALLICHII, Wight. Ill. Ind. Bot. 147; Hf. Ind. Fl. I. 543.—(*Turraea pinnata*, Wall. Pl. As. var. II. 21. t. 119; Bot. Mag. t. 1413; *M. Neilgherrica*, Wight Ill. I. 147. t. 54).

HAB. Rare on shady moist sandstone-rocks in the tropical forests of the central parts of the Pegu Yomah (Toung-nyo choung).—Fl. March.

Melia, L.

Conspectus of species.

* *Leaves simply pinnate. Ovary 3-celled.*

Leaflets entire, ... *M. excelsa.*

Leaflets serrate; drupes small, by abortion one-celled and 1-seeded, .. *M. Azadirachta.*

* * *Leaves twice pinnate. Ovary and drupes 5—8-celled, some of the cells in fruit usually empty.*

× Drupes about ½ in. long, oblong or elliptical.

Leaflets serrate; staminal tube blue or dark lilac, slender, glabrous outside, about 3 lin. long, ... *M. Azedarach.*

× × Drupes large, 1 in. long or longer. Staminal tube white.

Drupes ovate, hardly ½ in. thick, 5 or fewer-celled; staminal tube about 1½—2 lin. long, glabrous outside; leaflets crenate or ultimately entire, ... *M. dubia.*

Drupes twice as large, almost globose-obovoid, 5—8-celled; staminal tube 2 lin. long, woolly at the summit; flowers larger, scurvy-tomentose outside, ... *M. Birmanica.*

1. M. EXCELSA, Jack in Mal. Misc. I. 12; Griff. Not. Dicot. 499; Hf. Ind. Fl. I. 544.

HAB. Tenasserim, Mergui, probably cultivated.—Fl. Decb.

2. M. AZADIRACHTA, L. sp. pl. 550; Roxb. Fl. Ind. II. 394; Griff. Not. Dicot. 500; Bedd. Fl. Sylv. t. 14.; Hf. Ind. Fl. I. 544.—(*Azadirachta Indica*, A. Juss. in Mem. Mus. XIX. t. 13; Wight Icon. t. 17).

HAB. Not unfrequent in the dry forests of Prome District, especially on the higher ridges of the Yomah; also Ava.—Fl. March.

3. M. AZEDARACH, L. sp. pl. 550; Roxb. Fl. Ind. II. 395; Bot. Mag. t. 1066; Wight Icon. t. 160; Bedd. Fl. Sylv. t. 13; Hf. Ind. Fl. I. 544.—(*Melia sempervirens*, Sw. Prod. 67; Roxb. Fl. Ind. II. 395; Bot. Reg. t. 643; *M. sambucina*, Bl. Bydr. 162).

HAB. Prome and Ava, in and around villages, apparently only cultivated, wild in the adjoining Siamese provinces.—Fl. Febr. March; Fr. March, Apr.

4. M. BIRMANICA, Kurz in Journ. As. Soc. Beng. 1874. 183.

HAB. Frequent in the tropical forests of Martaban.—Fl. March, Apr.; Fr. Apr. May.

Cipadessa, Bl.

1. C. BACCIFERA, Miq. in Ann. Mus. Lugd. Bat. IV. b.—(*Melia baccifera*, Roth. Nov. sp. 215; *Ekebergia Indica*, Roxb. Fl. Ind. II. 392; *C. fruticosa*, Bl. Bydr. 162; Hf. Ind. Fl. I. 545; *Mallea Rothii*, A. Juss. in Mém. Mus. XIX. 222. t. 13. f. 6).

VAR. *α.* ROTHII, leaflets coarsely serrate or serrate-toothed.

VAR. *β.* INTEGERRIMA, leaflets all entire.

HAB. Var. *β.* Ava, Taong-dong (Wall.)—Fl. Nov.

Dysoxylum, Bl.

Conspectus of species.

× Flowers in panicles.

Calyx petals and reproductive organs perfectly glabrous, ... *D. binectariferum.*

Calyx petals and staminal tube minutely pubescent, ... *D. procerum.*

× × Flowers in spikes or racemes.

Spikes arising from the trunk or old branches, densely flowered; leaflets opposite or nearly so, pale green, ... *D. cauliflorum.*

1. D. BINECTARIFERUM, Bedd. in Linn. Trans. XXV. 212; Hf. Ind. Fl. I. 546.—(*Guarea binectarifera*, Roxb. Fl. Ind. II. 240; *D. macrocarpum*, Thw. Ceyl. Pl. 60? Bedd. Fl. Sylv. t. 150?).

HAB. Chittagong; forests of South Andaman? (leaves only).—Fl. June; Fr. Febr.

2. D. PROCERUM, Hiern in Hf. Ind. Fl. t. 547.

Hab. Rare in the tropical forests of the southern slopes of the Pegu Yomah; more frequent in those of Tenasserim.—Fl. Decb.

N. B.—D. brevipes, Hiern = *D. costulatum*, Miq., in spite of a slight difference in the indument of ovary and tube.

3. D. cauliflorum, Hiern in Hf. Ind. Fl. I. 549.

Hab. Tropical forests of South Andaman.

Schizochiton, Bl.

Conspectus of species.

* Flowers almost sessile or very shortly and robustly pedicelled.
Leaflets quite glabrous; anthers 6, ... *Sch. dysoxylifolius.*
Leaflets softly pubescent beneath; anthers 6—7, ... *Sch. grandiflorus.*
* * Flowers on slender pedicels.
Young parts and panicle and also the under-surface of leaves pubescent, *Sch. paniculatus.*

1. Sch. dysoxylifolius, Kurz in Journ. As. Soc. Beng. 1871. 49.—(*Chisogeton dysoxylifolius*, Hiern in Hf. Ind. Fl. I. 551).

Hab. Upper Tenasserim, Thounggyeen.—Fl. March.

2. Sch. grandiflorus, Kurz in Journ. As. Soc. Beng. 1872. 296.—(*Chisogeton grandiflorus*, Hiern in Hf. Ind. Fl. I. 552).

Hab. Frequent in the tropical forests of Martaban and Tenasserim.—Fl. March, Apr.

3. Sch. paniculatus, Hiern in Hf. Ind. Fl. I. 552.—(*Guarea paniculata*, Roxb. Fl. Ind. II. 242).

Hab. Burmah, probably Martaban (Brandis); Tenasserim, Tavoy (*teste* Hiern); Ava, on Taong dong (Wall. Cat. 8099. pp. mixed up with *Chickrassia* leaves).

N. B.—Chisocheton holocalyx, Hiern = *Schizochiton patens*, Spreng.

Sandoricum, Cav.

1. S. Indicum, Cav. Diss. VII. t. 202. 203; Roxb. Fl. Ind. II. 392. and Corom. Pl. III. t. 261; Hf. Ind. Fl. I. 553.

Hab. Indigenous in the tropical forests of the southern slopes of the Pegu Yomah and in Tenasserim; much cultivated in Burmese villages.—Fl. Jan.; Fr. Apr. May.

Aglaia, Lour.

Conspectus of species.

* Inflorescence and often also the other parts more or less scaly especially while young.
× Leaflets usually in 2 or 1 pair with an odd one, nearly glabrous.

Leaves pinnately 3-foliolate; panicles short and peduncled; scales of younger parts pale coloured, ... *A. Chittagonga.*

Leaflets in 2 pairs with an odd one; scales of younger parts pale coloured; panicle small sessile, ... *A. Andamanica.*

Leaflets in 2 pairs with an odd one; scales of younger parts rusty brown; panicles ample, about as long to half as long as the leaves, rather long-peduncled, *A. paniculata.*

× × Leaflets usually in 8—5 pairs with an odd one, beneath densely silvery or coppery scaly.

Panicle ample, densely silvery or coppery lepidote; flowers sessile, ... *A. argentea.*

* * Calyx pedicels and usually the whole inflorescence rusty puberulous or tomentose from short stellate hairs.

× Leaflets in 6—8 or more pairs.

Leaflets beneath minutely and indistinctly scaly-tomentose, glabrescent, the lateral nerves all sharply prominent beneath; panicles, etc. rusty puberulous; flowers pedicelled; berries tawny velvety, ... *A. crassinervia.*

Leaflets beneath sparingly fascicled-hairy, petiole panicle and nerves beneath densely rusty tomentose, ... *A. Griffithii.*

× × Leaflets in 1 or 2 pairs with an odd one, rarely 1-foliolate.

Panicles slightly stellately pubescent, soon glabrous; calyx and pedicels glabrous; net-venation conspicuous, ... *A. oligophylla.*

1. A. Chittagonga, Miq. in Ann. Mus. Lugd. Bat. IV. 44.

Hab. Tropical forests of Chittagong and Arracan.

N. B.—Hiern apparently identifies the fruiting specimens No. 13 of Hb. Hf. and Th. with the perfectly different flowering ones collected by Griffith (viz. Nos. 1074 and 1066 Hb. Griff.) which belong to my *Amoora lactescens.*

2. A. Andamanica, Hiern in Hf. Ind. Fl. I. 555.

Hab. Not unfrequent in the tropical forests of the Andamans.—Fr. Febr.

3. A. paniculata, Kurz Hb. 2043.

Hab. Rather rare in the tropical forests of the Pegu Yomah; Tenasserim (Helf. 1036—1037).

4. A. argentea, Bl. Bydr. 170; Miq. in Ann. Mus. Lugd. Bat. IV. 54.

Hab. Rare in the tropical forests of the eastern slopes of the Pegu Yomah.

5. A. crassinervia, Kurz in Hf. Ind. Fl. I. 556.—(*Cupania sp.* Wall. Cat. 8067. B).

Hab. Tenasserim (Helf. 1038).

6. A. Griffithii (*A. minutiflora, β. Griffithii,* Hiern in Hf. Ind. Fl. 557; *Euphoria exstipulata,* Griff. Not. Dicot. 547.

Hab. Tenasserim (Helf. 1039); Mergui (Griff.).

7. A. oligophylla, Miq. Suppl. Fl. Sum. 507 and Ann. Mus. Lugd. Bat. IV. 41.—(*Meliacea Singapureana,* Wall. Cat. 4887).

Hab. Tenasserim (Helf. 1046).

I have only fragments of the Wallichian plant, which so far agree.

A. Roxburghiana, as understood by Mr. Hiern, is a heterogeneous assemblage which, besides the above, includes also the Khasyan *A. undulata*, Miq. Ann. Mus. Lugd. Bat. IV. 44 (= *Milnea sp.* 17. Hf. and Th., referred by Hiern to *A. edulis*).

Amoora, Roxb.

Conspectus of species.

* Petals 3. Anthers 6—8.

× Flowers sessile, spiked, the male spikes forming large panicles.

Leaflets shortly acuminate; fertile spikes simple, many-flowered; male flowers about 4 lin. in diameter, the staminal tube entire at the apex, ... *A. Rohituka.*

× × Flowers pedicelled, cymose or racemose-cymose and panicled.

O Male panicles ample, as long to half as long as the leaves.

Leaflets shortly acuminate, thin coriaceous, the nerves prominent on both sides, the veins and net-venation distinct, ... *A. spectabilis.*

Leaflets blunt, smaller, coriaceous, the nerves above hardly visible and impressed, the veins and net-venation obsolete; fertile spikes few-flowered; flowers about 2 lin. in diameter, the staminal tube slightly 3-toothed, ... *A. cucullata.*

O O Panicles slender, shorter or as long as the petiole.

Leaflets green, conspicuously nerved and net-veined on both sides; flowers long pedicelled; panicle very lax, densely lepidote, ... *A. lactescens.*

* * Petals 5. Stamens 10.

Panicles shorter than the petiole, like the petiole densely lepidote; leaves sparingly lepidote beneath, ... *A. dysoxyloides.*

1. A. Rohituca, WA. Prodr. I. 119; Bedd. Fl. Sylv. t. 132; Hf. Ind. Fl. I. 559.—(*Andersonia Rohituka*, Roxb. Fl. Ind. II. 213; Griff. Not. Dicot. 507. t. 589. f. 3).

Hab. Frequent in the tropical forests of the eastern slopes of the Pegu Yomah, and from Martaban down to Tenasserim, up to 3000 feet elevation.—Fl. Apr. May.

2. A. spectabilis, Miq. Ann. Mus. Lugd. Bat. IV. 37; Hf. Ind. Fl. I. 561.

Hab. Rangoon (*teste* Hiern).

I have seen no Burmese specimens; the original Wallichian tree came from Assam (Gwálpára) and not from Nepal.

3. A. cucullata, Roxb. Corom. Pl. III. 54. t. 258; Hf. and Ind. Fl. I. 560. (*Andersonia cucullata*, Roxb. Fl. Ind. III. 212).

Hab. Forests of Lower Pegu and Tenasserim.—Fl. Sept.

4. A. lactescens, Kurz MS.

Hab. Rather rare in the tropical forests of Martaban, east of Toungoo (Hb. Kz. 1381).

5. A. dysoxyloides, Kurz MS.

Hab. Martaban, Yoonzeleen, at 900 feet elevation (Brandis).

Walsura, Roxb.

Conspectus of genera.

Subg. 1. *EUWALSURA.* Berries indehiscent or only very slowly and incompletely dehiscing along the sutures, usually velvety or tomentose.

* *Panicles densely pubescent. Young shoots and petioles of young leaves puberulous.*

Petals pubescent; filaments flat, at the very broad base somewhat coherent, .. *W. trichostemon.*

* * *Panicles minutely puberulous; leaves and petioles glabrous.*

O Leaves coriaceous or firmly chartaceous.

Leaves beneath usually white-areolate within the net-venation; filaments broadly lanceolate, sprinkled with minute hairs, ... *W. robusta.*

Leaflets uniformly glaucous beneath; filaments linear, densely pubescent; flowers larger, ... *W. hypoleuca.*

O O Leaves thin chartaceous or almost membranous, the net-venation very thin and inconspicuous.

Leaves acuminate, uniformly glaucous beneath; young fruits acuminate, greyish velvety, ... *W. oxycarpa.*

Subg. 2. *HEYNEA*, Roxb. Berries dehiscing along the sutures, usually glabrous. Glabrous or pubescent; leaflets in 3—6 pairs; panicles long-peduncled, ... *W. trijuga.*

1. W. TRICHOSTEMON, Miq. in Ann. Mus. Lugd. Bat. IV. 60.—(*W. villosa*, WA. Prod. I. 120. in adn., nomen nudum; Hf. Ind. Fl. I. 564.)

HAB. Frequent in the eng and low forests from Pegu and Martaban down to Tenasserim; also Ava.—Fl. March, Apr.; Fr. May, June.

N. B.—Wall. Cat. 8113 from Sylhet, which, according to Hiern, differs from the known species of *Walsura*, is *W. tubulata*, Hiern.

2. W. ROBUSTA, Roxb. Fl. Ind. II. 386; Hf. Ind. Fl. I. 565.

HAB. Rather rare in the tropical forests of the eastern slopes of the Pegu Yomah, but frequent in those of Martaban down to Tenasserim and the Andamans.—Fl. May; Fr. July.

3. W. HYPOLEUCA, Kurz in Journ. As. Soc. Beng. 1872. 296 excl. fruct.; Hf. Ind. Fl. I. 564.

HAB. Frequent in the tropical forests of the Andamans.—Fl. May, June.

4. W. OXYCARPA, Kurz MS.

HAB. Not unfrequent in the tropical forests of the Andamans.

5. W. TRIJUGA (*Heynea trijuga*, Roxb. Corom. Pl. III. 56. t. 260. and Fl. Ind. II. 390; Bot. Mag. t. 1738; Hf. Ind. Fl. I. 565.—(*Heynea quinquejuga*, Roxb. Fl. Ind. II. 391).

VAR. *α.* GENUINA, all parts (also the panicle) quite glabrous, or only the young shoots slightly pubescent; leaflets in 3 to 6 pairs.

VAR. *β.* PUBESCENS, (*Walsura pubescens*, Kurz in Journ. As. Soc. Beng, 1872. 397), all softer parts, inflorescence, and under surface of leaves, softly pubescent; leaflets usually in 4 pairs.

Hab. Var. α. Upper Tenasserim ; var. β. rather rare in the tropical forests along the eastern slopes of the Pegu Yomah, and in the Martaban hills, up to 2000 feet elevation.—Fl. Febr. March ; Fr. Apr.

Carapa, Aubl.

Conspectus of species.

Leaflets more or less ovate ; flowers 5-merous, about 2 lin. across, ... *C. Moluccensis.*
Leaflets obovate to obovate-oblong ; flowers 4-merous, about 4 lin. across, .. *C. obovata.*

1. C. Moluccensis, Lam. Encycl. Meth. I. 621 ; DC. Prod. I. 626. (*Granatum littoreum*, Rumph. Herb. Amb. t. 61. ; *Xylocarpus Granatum*, Koen. Naturf. XX. 2 ; A. Juss. in Mém, Mus. XIX. 244 ; Miq. Ann. Mus. Lugd. Bat.).

Hab. Not unfrequent along the rocky and sandy shores of the Andamans, especially along the western side.—Fr. Apr. May.

2. C. obovata, Bl. Bydr. 179. (*Xylocarpus obovatus*, A. Juss. in Mém. Mus. XIX. 344 ; Miq. in Ann. Mus. Lugd. Bat. IV. 62 ; *Xylocarpus Granatum*, Roxb. Fl. Ind. II. 240 ; *Monosoma littorata*, Griff. Not. Dicot. 502. t. 588. f. 3. ; *Guarea oblongifolia*, Griff. Not. Dicot. 503 ?).

Hab. Frequent in the littoral forests, especially the tidal ones, all along the shores, from Chittagong down to Tenasserim and the Andamans.—Fl. June, July ; Fr. Apr. May.

Chickrassia, A. Juss.

1. Ch. tabularis, A. Juss. in Mém. Mus. XIX. 251. t. 22. f. 27 ; Wight Ill. t. 56 ; Bedd. Fl. Sylv. t. 9 ; Hf. Ind. Fl. I. 568.—(*Swietenia Chickrassa*, Roxb. Fl. Ind. II. 399).

Var. α. genuina, leaves and panicles glabrous ; capsules greyish, wrinkled-rough.

Var. β. velutina (*Chickrassia velutina*, Roem. Syn. monog. I. 135 ; Kurz in Journ. As. Soc. Beng. 1873. 65), all softer parts, as well as the panicle, softly pubescent ; capsules black, almost smooth.

Hab. Var. α. Rather rare in the tropical forests of Chittagong and Pegu down to Tenasserim ; also Andamans ; var. β. frequent in the dry forests of Prome and Pegu, here entering also the upper mixed forests.—Fl. Sept.

Soymida, A. Juss.

1. S. febrifuga, A. Juss. in Mém. Mus. XIX. 251. t. 22. f. 26 ; Bedd. Fl. Sylv. t. 8 ; Hf. Ind. Fl. I. 567.—(*Swietenia febrifuga*, Roxb. Corom. Pl. I. t. 17. and Fl. Ind. II. 398).

Hab. Burmah (in Hb. Brandis, without locality, probably Prome).—Fl. March, Apr. ; Fr. Jul. Aug.

Cedrela, L.

Conspectus of species.

* Seeds winged at both ends. Leaflets entire.

Calyx minute, the sepals rounded, hardly ½ lin. long; leaflets usually on long slender petiolules, ... *C. Toona.*

Calyx large, the sepals 1½ lin. long, rather acute; leaflets usually shortly petioluled, .. *C. multijuga.*

* * Seeds winged only below.

Leaflets serrate or serrulate; calyx minute, ... *C. serrata.*

1. C. Toona, Roxb. Corom. Pl. III. t. 238 and Fl. Ind. I. 635; Wight. Icon. t. 161; Brand. Fl. Sylv. 72. t. 14, Bedd. Fl. Sylv. t. 10; WA. Prod. I. 124.—(*C. febrifuga*, Bl. Bydr. 180; Miq. in Ann. Mus. Lugd. Bat. IV. 63; *C. Teysmanni*, Hort. Bog. 133; Miq. l. c.).

Hab. Rather rare in the tropical forests of the Pegu Yomah, frequent in those of Martaban; also Chittagong and Arracan.—Fl. March, Apr.; Fr. Oct. Nov.

2. C. multijuga, Kurz in Journ. As. Soc. Beng. 1872. 297.

Hab. Rather rare in the tropical forests of the eastern slopes of the Pegu Yomah, west of Tounghoo.—Fl. March.

3. C. serrata, Royle. Ill. Him. Pl. 144. t. 25.—(*C. serrulata*, Miq. Suppl. Fl. Sum. 508 and Ann. Mus. Lugd. Bat. IV. 64; *C. longifolia*, Wall. Cat. 1273).

Hab. Ava.

The identification of *C. serrulata*, Miq. (which is the same as Wallich's plant) with *C. serrata*, Royle, is open to future inquiry.

CHAILLETIACEÆ.

Chailletia, DC.

Conspectus of species.

× Nerves and net-venation beneath more or less conspicuous.

Cymes cluster-like and almost sessile; leaves green, cuneately narrowed into a very short petiole, ... *Ch. gelonioides.*

Cymes spreading, peduncled ?; leaves dark-brown in a dried state, ... *Ch. macropetala.*

× × Nerves and net-venation beneath very faint and almost impressed.

Cymes on a peduncle 2—3 lin. long; leaves brown in a dried state, shortly petioled, .. *Ch. Helferiana.*

1. Ch. gelonioides, Bth. and Hf. Gen. pl. I. 341. and Hf. Ind. Fl. I. 570 excl. syn. Miq. (*Moacurra gelonioides*, Roxb. Fl. Ind. II. 70; DC. Prod. XV/2. 227).

Hab. Chittagong.

N. B.—*Ch. Sumatrana*, Miq. has fruits only one-third or one-fourth the size of those of *Ch. gelonioides*, not to mention other points of difference.

2. Ch. macropetala, Turcz. in Bull. Mosc. 1863. 611. (*longipetala*); Hf. Ind. Fl. I. 571.

Hab. Tenasserim, Mergui.

3. Ch. Helferiana, Kurz in Journ. As. Soc. Beng. 1872. 297; Hf. Ind. Fl. I. 570.

Hab. Tenasserim, Tavoy, Moulmein, etc.

OLACINEÆ.

Conspectus of species.

Subord. I. Olaceæ. Stamens as many or twice as many (rarely fewer) as petals and *opposite to them.*

Trib. I. EU-OLACEÆ. Stamens anisomerous, or isomerous. Ovary 2—5-celled at the base, 1-celled at the apex or completely 1-celled, the placenta central with 2—5 pendulous ovules.

* Stamens twice as many as petals, or if fewer, accompanied by staminodes.

Ximenia. Calyx not enlarging after flowering. Stamens all perfect.

Olax. Calyx enlarging and enclosing the fruit. Perfect stamens 3, rarely 5; staminodes 6 or fewer.

* * Stamens as many as petals. Staminodes none.

× Fruiting calyx much enlarged, adnate to the drupe.

Erythropalum. Ovary 1-celled. Tendril-bearing climbers with 3-nerved leaves.

Strombosia. Ovary to near the summit 3—5-celled. Trees with penninerved leaves.

× × Calyx in fruit unchanged.

Anacolosa. Disk in fruit much enlarged, adnate to the drupe and resembling an engrossed adnate calyx. Petals almost. Ovary 1 or imperfectly 2-celled.

Trib. II. OPILIEÆ. Stamens isomerous. Ovary 1-celled with a single ovule. Flowers hermaphrodite.

* *Perianth dichlamydeous, i. e. consisting of calyx and corolla.*

Cansjera. Spikes axillary, without bracts. Calyx inconspicuous, shortly 4-lobed; corolla gamopetalous. Stamens 4, alternating with as many hypogynous scales or glands.

Natsiatopsis. Spikes axillary, without conspicuous bracts. Calyx 4-lobed. Corolla gamopetalous. Stamens 4, free. Staminodes none.

Opilia. Inflorescence while young conspicuously imbricate-bracted. Petals free. Filaments filiform. Staminodes 5.

* * *Perianth monochlamydeous.*

Lepionurus. Inflorescence while young conspicuously imbricate-bracted. Flowers 4-merous. Filaments very short, complanate.

Champereya. Inflorescence with very deciduous minute bracts. Flowers 5-merous. Filaments slender, exserted.

Subord. II. Icacineæ. Stamens as many as petals and *alternating with them.*

Trib. III. EU-ICACINEÆ. Cotyledons small or dilated. Trees or erect shrubs.

* Calyx minutely toothed or lobed. Petals usually glabrous.

Stemonurus. Anthers pendulous. Drupe without fleshy appendage.

Apodytes. Anthers attached at the back above the 2-lobed base. Ovary oblique. Drupe with a fleshy puffy sarcocarp covering only the one half of the nut.

DAPHNEPHYLLOPSIS. Anthers attached to the back. Drupe berry-like. Flowers sessile, in heads.

* * Calyx 5-cleft or the sepals distinct, imbricate.

GONOCARYUM. Flowers unisexual. Drupes dry, woody. Albumen many-lobed.

Trib. IV. PHYTOCRENEÆ. Cotyledons broadly foliaceous or thick-fleshy. Flowers dioecious. Climbers. Fruit drupaceous.

* Stamens alternating with the petals.

× Flowers in heads.

PHYTOCRENE. Filaments longer than the anthers. Albumen deeply lobed. Drupes villous or echinate.

× × Flowers in spikes racemes or panicles.

SARCOSTIGMA. Flowers interruptedly spiked; filaments longer than the anthers. Staminodes none. Stigma sessile. Albumen none.

NATSIATUM. Flowers racemose. Filaments very short, alternating with 5 staminodes. Styles 2. Albumen fleshy.

* * Stamens opposite to the petals.

JODES. Flowers cymose-panicled. Stamens 8, filaments very short. Stigma sessile. Albumen fleshy.

Genus of doubtful position.

CARDIOPTERIS. Sepals and petals imbricate. Fruit dry, winged. Milk-juiced annual twiners.

Ximenia, L.

1. X. AMERICANA, L. sp. pl. 497; Roxb. Fl. Ind. II. 252; Lamk. Ill. t. 257. f. 1—2; Bth. Fl. Austr. I. 391; Hf. Ind. Fl. I. 574.—(*X. subscandens*, Griff. Not. Dicot. 691).

HAB. Not unfrequent along the coasts of the Andamans; also Tenasserim.—Fl. March, Apr.

Olax, L.

Conspectus of species.

× Enlarged calyx in fruit membranous, dry.

Branchlets terete, like the under-surface of the leaves and the racemes, puberulous, .. *O. scandens.*

All parts also the racemes quite glabrous; branchlets angular, ... *O. zeylanica.*

× × Enlarged fruiting calyx coriaceous (fleshy in a fresh state).

Glabrous, the branchlets terete; flowers 4—5 lin. long, ... *O. imbricata.*

1. O. SCANDENS, Roxb. Corom. Pl. II. t. 102. and Fl. Ind. I. 163; Hf. Ind. Fl. 575.—(*Olax obtusa*, Bl. Bydr. 131 ?).

HAB. Rather frequent all over Burmah, from Ava and Chittagong down to Tenasserim, in all deciduous forests, ascending also the pine forests up to 3500 ft. elevation, and occurring equally abundantly in the tidal forests.—Fl. Decb.—March.

2. O. ZEYLANICA, L. sp. pl. 49; Hf. Ind. Pl. I. 576. (*O. acuminata*, Wall. Cat. 6781; Hf. Ind. Fl. 1. 576; *O. sphaerocarpa*, Griff. Not. Dicot. 689).

Hab. Ava, in woods at the Mogoung river (Griff. 797); Khakhyen hills (J. Anderson).—Fl. March.

3. O. IMBRICATA, Roxb. Fl. Ind. I. 164; Hf. Ind. Fl. I. 575.—(*O. Merguensis*, Mast. in Hf. Ind. Fl. I. 576).

Hab. Chittagong; Tenasserim, from Moulmain to Mergui.—Fr. Febr.

Doubtful species.

1. *O. loranthiformis*, Griff. Not. Dicot. 691. t. 645. f. 5.

Hab. Moulmein, on the coast of Madamacan (Griff.).

Erythropalum, Bl.

1. E. SCANDENS, Bl. Bydr. 922; Hf. Ind. Fl. I. 578.—(*Decastrophia inconspicua*, Griff. Not. Dicot 736. t. 613. f. 4.; *E. populifolium*, Planch. in Ann. d. sc. nat. 4 ser. II. 260; Hf. Ind. Fl. I. 578).

Hab. Not unfrequent in the tropical forests of the eastern slopes of the Pegu Yomah, and from Martaban down to Tenasserim.—Fl. Apr.

Strombosia, Bl.

1. S. JAVANICA, Bl. Bydr. 1154, and Mus. Bot. I. 251. f. 47; Hf. Ind. Fl. I. 579.

Hab. Tenasserim (Helf. 818).

Anacolosa, Bl.

Conspectus of species.

Calyx and pedicels densely puberulous; drupe scarlet, thinly velvety, ...*A. puberula.*
Calyx and slender pedicels glabrous, ...*A. Griffithii.*
As preceding, but the fruiting pedicels very thick; drupe an inch long, glabrous, ..*A. crassipes.*

1. A. PUBERULA, Kurz J. A. S. B. 1872. 297; Hf. Ind. Fl. I. 581.

Hab. Rather frequent in the tropical forests of the Andamans.—Fl. Febr. May; Fr. Febr.

2. A. GRIFFITHII, Mast. in Hf. Ind. Fl. I. 580.

Hab. Tenasserim, Mergui (Griff. 821).

Probably only a glabrous form of the preceding; the sepals and petals are not quite glabrous.

3. A. CRASSIPES, (*Stemonurus? crassipes*, Kurz in Journ. As. Soc. Beng. 1872. 298; *Gomphandra? crassipes*, Mast. in Hf. Ind. Fl. I. 587).

Hab. Rare along choungs in the tropical forests of the eastern slopes of the Pegu Yomah.—Fr. CS.

Cansjera, Juss.

Conspectus of species.

× Spikes simple.
Leaves small, oval, notched or blunt, pubescent; spikes very short, solitary, *C. parvifolia.*
Leaves acuminate, opaque; spikes solitary or by pairs, ...*C. Rheedii.*

× × Spikes branched, rarely the uppermost ones almost simple. Leaves acute, glossy above; spikes solitary, ... *C. zizyphifolia.*

1. C. PARVIFOLIA, Kurz in Journ. As. Soc. Beng. 1872. 298; Hf. Ind. Fl. 583.

HAB. Tenasserim (Helf.).

2. C. RHEEDII, Gmel. Syst. I. 280; Wight Icon. t. 1861; DC. Prod. XIV. 519. Hf. Ind. Fl. I. 582 pp.—(*C. scandens*, Roxb. Corom. Pl. II. 1. t. 103 and Fl. Ind. I. 441).

HAB. Not unfrequent in the tropical forests of the Andamans and Tenasserim.—Fl. May.

3. C. ZIZYPHIFOLIA, Griff. Not. Dicot. 360. t. 537. f. 1. (*Olax? Sumatrana*, Miq. Suppl. Fl. Sum. 342).

HAB. Burmah (Griff. 823, most probably Tenasserim).

Natsiatopsis, Kurz.

1. N. THUNBERGIÆFOLIA, Kurz. MS.

HAB. Ava, Khakhyen hills, Ponsee (J. Anderson).—Fl. March. Female flowers unknown.

Opilia, Roxb.

1. O. AMENTACEA, Roxb. Corom. Pl. II. 31. t. 158 and Fl. Ind. II. 87; Wight Ill. t. 40; Hf. Ind. Fl. I. 583.

HAB. Not unfrequent in the mixed dry forests of the Prome District. Fl. March; Fr. Apr. May.

Lepionurus, Bl.

1. L. SYLVESTRIS, Bl. Bydr. 1146; Miq. Fl. Ind. Bat. I. 784.—(*L. oblongifolius*; Mast. in Hf. Ind. Fl. I. 583; *Leptonium oblongifolium*, Griff. in Macl. Calc. Journ. IV. 236 and Not. Dicot. 368. t 536).

HAB. Ava, Khakhyen hills (J. Anderson).—Fl. May.

Champereya, Griff.

1. CH. GRIFFITHIANA, Planch. (*Ch.* sp. Griff. Not. Dicot. 362. t. 537. f. 3).

HAB. Not unfrequent in the tropical forests of the Andaman islands; also Upper Tenasserim.—Fl. Febr.; Fr. Apr. May.

N. B.—Wherever *Lepionurus* may be placed, *Champereya* must accompany it.

Daphniphyllopsis, Kurz.

1. D. CAPITATA, (*Ilex daphnephylloides*, Kurz in Journ. As. Soc. Beng 1870. 72).

HAB. Not unfrequent in the damp hill-forests of Martaban, at 4000 to 6000 ft. elevation.—Fl. March.

An incompletely known genus, but its position in *Olacineæ* is certain. Inflorescence is exactly that of *Ilex sulcata*, while the leaves resemble those of *Daphniphyllum Himalayense*. It is nearest allied to *Mappia*.

Stemonurus, Bl.

Conspectus of species.

× All parts glabrous.

Leaves 2½—5 in. long; cymes leaf-opposite, the peduncle stiff and ½—1 in. long, ..*St. Penangianus.*

Leaves 2—3 in long; cymes slightly puberulous, axillary and peduncled; drupes elliptically oblong, the putamen sulcate, ...*St. Javanicus.*

× × Younger branchlets tawny tomentose; petioles, undersurface of leaves, and inflorescence puberulous or tomentose.

Cymes peduncled, leaf-opposed,.....*St. tomentellus.*

1. St. Penangianus, Miers Contr. I. 90.—(*Gomphandra Penangiana*, Wall. Cat. 7204; Hf. Ind. Fl. I. 587).

Hab. Upper Tenasserim, Moulmein (Lobb) *teste* Masters.

2. St. Javanicus, Bl. Bydr. 649; Miers. Contr. Bot I. 86.—(*Lasianthera Javanica*, Miq. Fl. Ind. Bat. 1/1. 790; *Gomphandra affinis*, Mast. in Hf. Ind. Fl. I. 586).

Hab. Tenasserim.

3. St. tomentellus, Kurz in Journ. As. Soc. Beng. 1872. 298.—(*Gomphandra tomentella*, Mast. in Hf. Ind. Fl. I. 587).

Hab. Burma, probably Tenasserim (Griff. 813).

Apodytes, E. Mey.

1. A. Andamanica, Kurz in And. Rep. App. B. 5. and Journ. As. Soc. Beng. 1872. 298; Hf. Ind. Fl. I. 588.

Hab. Frequent in the tropical forests of the Andaman Islands.—Fl. Febr. to May; Fr. May to July.

Gonocaryum, Miq.

Conspectus of species.

Leaves opaque; drupes obtusely 4—3-angular, acute, ...*G. gracile.*

Leaves glossy; drupes terete, rounded at apex, ...*G. Griffithianum.*

1. G. gracile, Miq. Suppl. Fl. Sum. 343 (1860).—(*Gonocaryum? Wallichii*, Mast. in Hf. Ind. Fl. I. 590).

Hab. Tenasserim (Helf. 817).

The drupes in this species are obtusely angular, but the seeds being all aborted, no stress can, consequently, be laid upon this character, until perfected fruits with seeds become known.

2. G. Griffithianum (*Platea Griffithsiana*, Miers. Contr. I. 97. t. 17; *Platea Lobbiana* Miers. l. c.; *Phlebocalymna Griffithiana*, Mast. in Hf. Ind. Fl. I. 590; *Phlebocalymna Lobbiana*, Mast. l. c.).

Hab. Frequent in marshes of the tropical and swamp forests, from Southern Pegu down to Tenasserim.—Fl. Decb. to March; Fr. R. S.

Phytocrene, Wall.

Conspectus of species.

Male flower-heads usually more tawny, tomentose, on short but very thick pedunclets, numerous in very compound racemes terminating in the young state in short thick tomentose bract-like sterile axes, ... *Ph. gigantea.*

Male flower-heads somewhat smaller and usually greyish, tomentose, on short but slender pedunclets, few (8—5), in simple short racemes terminating in long bract-like greyish-tomentose slender axes, ... *Ph. bracteata.*

1. Ph. gigantea, Wall. Pl. As. var. III. 11. t. 216; Griff. Not. Dicot. t. 490. f. 2; Hf. Ind. Fl. I. 591.

Hab. Not unfrequent along choungs in the tropical forests of the eastern slopes of the Pegu Yomah; more frequent in Tenasserim.—Fl. Febr.

2. Ph. bracteata, Wall. Fl. As. var. III. 12; DC. Prod. XVII. 12; Hf, Ind. Fl. I. 592.

Hab. South-Tenasserim; Mergui (Griff. 830) *teste* Baillon.

The so-called bracts of the male inflorescences in this genus are, in my opinion, only the sterile end-branchings of the partial racemes.

Sarcostigma, WA.

1. S. Wallichii, Baill. in Adans. X. 282; DC. Prod. XVII. 16; Hf. Ind. Fl. I. 594.—(*S. edule*, Kurz in Journ. As. Soc. Beng. 1872. 298; Hf. Ind. Fl. I. 594.)

Hab. Frequent in the tropical forests of the Andaman islands.—Fl. Febr.; Fr. May to June.

Masters says that this species (*S. edule*) is probably only a form of *S. Kleinii*, but in this he is mistaken, for the latter differs by quite glabrous drupes and inflorescences; and he evidently confounds two species under this name. I would suggest to him to compare Maingay's No. 378 from Malaya (of which I have seen only leaves) with *S. Horsfieldii*.

Iodes, Bl.

Conspectus of species.

× Pedicels not woody, slender.

Leaves oblong, not cordate at the base, membranous, the petiole ½—¾ in. long; pedicels slender, about ½ lin. long, ... *I. Brandisii.*

Leaves more or less oval, cordate at the base, coriaceous, the petiole 2—4 lin. long; flowers almost sessile, ... *I. tomentella.*

× × Pedicels thick and woody.

Drupes orange, smooth, above an inch long, ... *I. Hookeriana.*

1. I. Brandisii, Kurz in Journ. As. Soc. Beng. 1872. 298; Hf. Ind. Fl. I. 596.

Hab. Tenasserim, Thoungyeen (Brandis).—Fl. March.

2. I. TOMENTELLA, Miq. Fl. Ind. Bat. I/1. 796.—(*I. ovalis*, Mast. in Hf. Ind. Fl. I. 696, vix. Bl.).

Hab. Upper Tenasserim, Moulmein (Falconer).—Fl. Febr.

3. I.? HOOKERIANA, Baill. in Adans. X 268; DC. Prod. XVII. 24; Hf. Ind. Fl. I. 596.—(*I. Thomsoniana*, Baill. l. c. 270; DC. l. c. 25; Hf. l. c.).

Hab. Chittagong (Hf. and Th.).

Fruits and habit of *Sarcostigma*. An examination of a single ovary already engrossed shewed me a solitary erect basal ovule.

Cardiopteris, Wall.

1. C. LOBATA, Wall, ap. B. Br. Pl. Jav. Rar. 246. t. 49; Hf. Ind. Fl. I. 597.—(*C. hamulosa*, Griff. Dicot. 542. t. 598. f. 1—3; *C. Javanica*, Bl. Rumph. III. 206. t. 177. f. 1. A.).

Hab. Common in all leaf-shedding forests and deserted toungyas, from Ava and Martaban down to Tenasserim.—Fr. C. S.

ILICINEÆ.

Conspectus of genera.

Subord. I. ILICEÆ. Petals present. Flowers hermaphrodite.
ILEX. Stamens 5. Ovary 4—8-celled.

Subord. II. DAPHNIPHYLLEÆ. Flowers apetalous, unisexual.
DAPHNIPHYLLUM. Stamens 5—18. Ovary 2-celled.

Ilex, L.

Conspectus of species.

* *Male inflorescence cymose, the female flowers clustered or solitary.*

Leaves elongate-cuneate-lanceolate, 2—3½ in. long, beneath very opaque and brown; sepals ciliate, ... *I. gaultheriæfolia.*

* * *Female flowers in simple or compound umbellets or cymes.*

O Cymes head-like contracted and small, on a long compressed peduncle.

Glabrous, or the branchlets pubescent, ... *I. Godajam.*

O O Cymes divaricately 2-cleft, on a rather short peduncle.

Cymes once divaricately 2-cleft; leaves large, coriaceous; branchlets pale-coloured, .. *I. macrophylla.*

Cyme twice or thrice dichotomously branched; leaves beneath pale-coloured or glaucescent; branchlets pure white; style stout, distinct, ... *I. cymosa.*

As preceding, but stigma sessile, ... *I. Wallichii.*

1. I. GAULTHERIÆFOLIA, Kurz in Journ. As. Soc. Beng. 1872. 299.

Hab. Tenasserim, Mergui (Griff. 1998).

Dr. Hooker identifies this species with his *I. theæfolia*, but in this he is in error, his new species differing greatly not only in the texture and polish of the leaves, but still more so in the inflorescence, doubly

larger flowers, and very long pedicels (in my species they are only about ½ lin. long).

2. I. Godayam, Coleb. in. Hf. Ind. Fl. I. 604.—(*Prinos Godayam*, Ham. in Wall. Pl. As. rar. III. 38. t. 261.)

Var. α. genuina, shoots, peduncles, and pedicels shortly puberulous; calyx more or less pubescent or densely fringed.

Var. β. sulcata, (*I. sulcata*, Wall. Cat. 4330; Hf. Ind. Fl. I. 604), all parts quite glabrous except the puberulous pedicels; calyx usually puberulous or only minutely puberulous, the lobes sometimes ciliolate.

Hab. Var. β. Not unfrequent in the tropical forests from Martaban down to Tenasserim.—Fl. Febr. Apr.

3. I. macrophylla, Wall. Cat. 4331; Hf. Ind. Fl. I. 604.

Hab. ? Tenasserim (Helfer), and Mergui (Griff. 2012) *teste* Hf.

4. I. cymosa, Bl. Bydr. 1149; Hf. Ind. Fl. I. 605.

Hab. Tenasserim (*teste* Hf.).

5. I. Wallichii, Hf. Ind. Fl. I. 605.

Hab. Tenasserim, Tavoy (*teste* Hf.).

Daphniphyllum, Bl.

Conspectus of species.

Calyx persistent ?; pedicels about ½ in. long, ... *D. majus.*
Calyx deciduous; pedicels about 1—2 lin. long, ... *D. Himalayense.*

1. D. majus, Muell. Arg. in Linn. XXXIV. 76; DC. Prod. XVI/1. 2.

Hab. Upper Tenasserim, Amherst (Wall.). Fl. Febr.

2. D. Himalayense, Muell. Arg. in DC. Prod. XVI/1. 4.

Hab. Not unfrequent in the damp hill-forests of the Martaban hills, east of Toungoo, at about 5000 ft. elevation.

CELASTRINEÆ.

Conspectus of species.

Subord. I. Celastraceæ. Stamens inserted outside the disk. Seeds albuminous.

* Capsule or follicle dehiscent.

× Ovules from the axis of the cells. Leaves opposite.

Evonymus. Petals free. Disk fleshy, broad; capsules 3—5-lobed and -celled.

Microtropis. Petals united at the base. Disk none or annular. Capsule 1-celled, 2-valved.

× × Ovules erect. Leaves alternate.

Celastrus. Ovary free. Capsules 2—4-celled, loculicidal. Seeds arillate. Flowers in panicles or racemes.

Gymnosporia. Ovary confluent with the disk. Capsule 2—3-lobed and -celled. Arillus complete, incomplete or wanting. Flowers in cymes.

KURRIMIA. Ovary free, styles 2. Capsule entire or 2-lobed, 1—2-celled, follicle-like and slowly dehiscing into 1 or 2 valves. Flowers in cymes or racemes, or panicled.

* * Fruit an indehiscent drupe or berry.

ELÆODENDRON. Ovary superior, confluent with the disk; drupe containing an 1—3-celled putamen. Leaves opposite or nearly so.

SIPHONODON. Ovary half-inferior, 5-celled. Berry large, containing many pyrenes. Leaves alternate.

Subord. II. HIPPOCRATEACEÆ. Stamens 3, rarely 2—5, inserted within or on the disk. Albumen none. Leaves opposite.

* Fruit an indehiscent berry, 1—many-seeded. Seeds not winged.

SALACIA. Only genus. Scandent shrubs. Inflorescences axillary. Stamens 3, rarely 2 or 4, inserted within the disk.

* * Fruit capsular or samaroid, dehiscent. Seeds winged.

× Ripe carpels samaroid, 2-valved. Stamens 3, inserted within the disk. Scandent shrubs.

HIPPOCRATEA. Ripe carpels usually 3. Seeds usually winged at the lower end. Inflorescences terminal or terminal and axillary.

× × Fruit a capsule. Erect trees or shrubs. Stamens 5, inserted on the disk.

LOPHOPETALUM. Capsule 3—4-celled and -lobed, loculicidal. Seeds winged all round. Not gland-dotted.

KOKOONA. Capsule 3-celled and -lobed, loculicidal. Seed winged at the upper end only. All herbaceous parts gland-dotted.

Evonymus, L.

Conspectus of species.

Subg. 1. EVONYMUS. Ovules 2 in each cell.

* Flowers solitary or clustered in the axils of the leaves.

Flowers nearly 5—6 lin. across; petals fringed; capsules sharply angular, on ½—1 in. long peduncles; leaves glossy, entire, ... *E. Javanicus.*

Capsules globular, obtusely lobed, very shortly peduncled or almost sessile; leaves green, opaque, ... *E. calocarpus.*

* * Flowers in dichotomous cymes.

× Branchlets terete or nearly so, or somewhat compressed.

Flowers small, usually 5-merous; petals entire; capsules angular; leaves serrulate upwards, ... *E. glaber.*

× × Branchlets sharply 4-cornered or almost winged.

Flowers small, in very slender cymes; capsules small, smooth, ... *E. Griffithii.*

Subg. 2. GLYPTOPETALUM. Ovules solitary in the cells.

Bark red; petals 4, greenish purple, concave-orbicular, without grooves; capsules very rough from scurfy fissures and warts, ... *E. sclerocarpus.*

1. E. JAVANICUS, Bl. Bydr. 1146; Benn. in Horsf. Pl. Jav. var. 130. t. 28; Hf. Ind. Fl. I. 607.—(*E. Bancanus*, Miq. Suppl. Fl. Sum. 513).

HAB. Tropical forests of Tenasserim, from Moulmein southwards.—Fl. March.

2. E. CALOCARPUS, Kurz in Journ. As. Soc. Beng. 1872. 299; Hf. Ind. Fl. I. 609.

Hab. Tenasserim (Helfer 1973).

3. E. glaber, Roxb. Fl. Ind. I. 628; Hf. Ind. Fl. I. 609.—(*E. garcinioides*, Roxb. HBC.; *E. Timorensis*, Laws. in Hf. Ind. Fl. I. 610, non Zipp.).

Hab. Not unfrequent in the tropical forests of Martaban and Tenasserim, rare in those of the eastern slopes of the Pegu Yomah; also Chittagong.—Fl. March, Apr.

4. E. Griffithii, Kurz in Journ. As. Soc. Beng. 1872. 73; Ind. Fl. I. 611.—(*Hippocratea angulata*, Griff. Not. Dicot. 473. t. 581. f. 1).

Var. α. genuina, petioles thick, hardly ¼ lin. long or the leaves almost sessile and obsoletely serrate.

Var. β. dubia, petioles slender, 2—3 lin. long; leaves entire or nearly so.

Hab. Var. α. Ava, on rocks at Loonkarim and Delvi Nempean on the North from Assam (Griff. 1977); var. β. not unfrequent in the damp hill-forests of the Nattoung ranges in Martaban, east of Toungoo, at 6000—7000 ft. elevation.—Fl. Apr. ?

Var. β. will prove a distinct species, but as my specimens are in very young bud only, I am unwilling to establish the species until better material comes to hand.

5. E. sclerocarpus, Kurz in Journ. As. Soc. Beng. 1872. 299.—(*Glyptopetalum sclerocarpum*, Laws. in Hf. Ind, Fl. I. 613).

Hab. Rather rare in the tropical forests around the Kambala toung of the central Pegu Yomah.—Fl. Fr. Febr.

Microtropis, Wall.

Conspectus of species.

× Cymes not much longer than the petiole, robust and crowdedly-flowered. Leaves coriaceous, smooth; capsules ½ in. long, grey, ... *M. garcinifolia.*

× × Cymes much longer than the petiole, lax and dichotomously branched. Leaves smooth, glossy above; peduncle slender, 1—1½ in. long, ... *M. bivalvis.*

Leaves coriaceous, wrinkled especially above, opaque; peduncle ½—¾ in. long, .. *M. longifolia.*

1. M. garcinifolia, Wall. ap. Wight Icon. t. 761.—(*Evonymus garcinifolius*, Roxb. Fl. Ind. I. 628; *M. discolor*, Wall. Cat. 4337: Hf. Ind. Fl. I. 614).

Hab. Rather frequent in the damp hill-forests of Martaban and Tenasserim, at 5000 to 7000 ft. elevation.—Fl. March.

2. M. bivalvis, Wall Cat. 4340; Hf. Ind. Fl. I. 614.—(*Celastrus bivalvis*, Jack.; Roxb. Fl. Ind. ed. 1. II. 399).

Hab. Tropical forests of Tenasserim, from Moulmein southwards.—Fl. Febr. and Sept.; Fr. Octob.

3. M. longifolia, Wall. in Journ. As. Soc. Beng. 1873. 65.

Hab. Tenasserim, from Moulmein District (Dr. Brandis) down to Tavoy (Wall).—Fr. Octob.

The specimens in Brandis' herbarium have smaller and more obtuse leaves.

Celastrus, L.

Conspectus of species.

Panicles slender, terminal; capsules 3-celled with 3—6 seeds, ... *C. paniculatus.*
Cymes robust, forming usually axillary and terminal spurious panicles; capsule 1-celled and 1-seeded, ... *C. monosperma.*

1. C. paniculata, Willd. sp. pl. I. 1125; Roxb. Fl. Ind. I. 621; Wight Ill. t. 72 and Icon. t. 158; Hf. Ind. Fl. I. 617.—(*C. multiflora*, Roxb. Fl. Ind. I. 622; *C. nutans*, Roxb. l. c. 623).

Var. α. genuina, all parts quite glabrous or nearly so.

Var. β. pubescens, (*C. pubescens*, Wall. Cat. 4303), leaves beneath and the petioles pubescent; panicles densely puberulous.

Hab. Not unfrequent in the leaf-shedding forests all over Pegu, especially in the drier parts; var. β. Pegu, Prome hills.—Fl. HS.; Fr. Sept. Octob.

2. C. monosperma, Roxb. Fl. Ind. I. 625; Hf. Ind. Fl. I. 618.

Hab. Ava, Khakhyen hills, Ponsee (J. Anderson).—Fr. March.

Lawson doubtfully gives Pegu as a locality for *C. stylosa*, Wall., but this is very probably a mistake.

Gymnosporia, WA.

Conspectus of species.

Unarmed; leaves oblong-lanceolate to lanceolate, finely acuminate, ... *G. acuminata.*
Unarmed; leaves obversely lanceolate, ... *G. oblanceolata.*
Armed, the spines leaf- and flower-bearing; leaves obovate, blunt to almost notched, .. *G. montana.*

1. G. acuminata, Hf. Ind. Fl. I. 619.

Hab. Ava, Khakhyen hills.—Fl. Apr.

2. G. oblanceolata, Laws. in Hf. Ind. Fl. I. 619.

Hab. Burmah (Griff.) *teste* Lawson.

Barely recognisable by the meagre description given.

3. G. montana, Laws. in Hf. Ind. Fl. I. 621 excl. syn. Lamk.—(*Celastrus montanus*, Roxb. Fl. Ind. I. 620; Wight Icon. t. 382).

Hab. Pegu, without locality (Dr. Brandis), probably Prome?

Kurrimia, Wall.

1. K. robusta, Kurz in Journ. As. Soc. Beng. 1870. 73. (*Celastrus robustus*, Roxb. Fl. Ind. I. 626; *K. pulcherrima*, Wall. Cat. 4334, *nomen nudum*; Hf. Ind. Fl. I. 622).

Hab. Rare in the tropical forests along the eastern slopes of the Pegu Yomah, but frequent in those of Martaban and Tenasserim; also Chittagong.—Fl. Febr.; Fr. Apr. Aug.

Siphonodon, Griff.

1. S. celastrinus, Griff. in Macl. Calc. Journ. IV. 247. t. 14; Hf. in Linn. Trans. XXII. t. 26; Hf. Ind. Fl. I. 629.

Hab. Frequent in the tropical forests of the eastern slopes of the Pegu Yomah and of Martaban.—Fl. Jan. to May.

Salacia, L.

Conspectus of species.

* *Cymes peduncled and dichotomously branched, usually short.*

Branches terete; pedicels thick, 6—8 lin. long; sepals not ciliate; filaments very short, complanate and reflexed, ... *S. longifolia.*

Cymes 4 in. long! divaricate, ... *S. Griffithii.*

Branches marked by decurrent lines and more or less angular; pedicels about 4 lin. long, slender, arising from the globose rusty-bracteoled ends of the cyme-branches; sepals fringed; filaments nearly ½ lin. long, terete and erect, ... *S. tortuosa.*

* * *Flowers springing from an axillary sessile tubercle or wart.*

× Flowers large; petals about 3—4 lin. long.

Pedicels 2—3 lin. thick; leaves large, coriaceous, ... *S. grandiflora.*

× × Flowers minute or small, the petals less than 2 lines long.

† Leaves turning brown or dark-coloured in drying. Filaments very short and complanate.

Branchlets dark-brown, corky-lenticellate; leaves entire; sepals ciliate; ovary cells 2-ovuled, ... *S. verrucosa.*

Branchlets pale-coloured, sparingly lenticellate; leaves serrate; berries as large as a crab-apple, 2—3-seeded; sepals not ciliate, ... *S. Roxburghii.*

† † Leaves turning yellowish or pale green in drying.

O Petals clawed; filaments terete, slender.

Petals about a line long, clawed; pedicels as long or longer than the petiole; berries 1-seeded, ... *S. prinoides.*

O O Petals sessile; filaments very short and dilated.

Pedicels few, short, 1—1½ lin. long, ... *S. flavescens.*

Pedicels numerous, slender, longer than the petiole, ... *S. multiflora.*

1. S. longifolia, Wall. Pl. As. rar. III. 1832. 47. t. 278, non Hf. cujus homonymum in *S. Maingayanam* est mutandum.—(*S. floribunda*, Wight Ill. 1840. I. 134; Hf. Ind. Fl. I. 629).

Hab. Tenasserim, Mergui (Griff. 885/1); Moulmein District (Falconer).—Fr. Jan.

N. B.—Lawson has a *S. Griffithii* (Hf. Ind. Fl. I. 628) to which he ascribes divaricate cymes 4 in. long, but his brief phrase does not enable me to form an idea of the plant. Can it be *S. diandra*, Miq.?

2. S. tortuosa, Griff. Not. Dicot. 471. t. 581. f. 2.

Hab. Tenasserim, from Moulmein District down to Mergui (Griff. 899).—Fl. Jan. to March.

3. S. grandiflora, Kurz in Journ. As. Soc. Beng. 1872. 300; Hf. Ind. Fl. I. 626.

Hab. Tenasserim (Helf. 898).

4. S. verrucosa, Wight Ill. I. 1840. 134; Hf. Ind. Fl. I. 628.—(*S. polyantha*, Korth. Verh. Natuurk. Gesch. Bot. 1839—42. 182; S. sp. Griff. Not. Dicot. 471).

Hab. Frequent in the tropical forests, from Martaban, east of Tounghoo, down to Tenasserim as far as Mergui (Griff. 888).—Fl. Jan. to March; Fr. Apr.

5. S. Roxburghii, Wall. Cat. 4217; Hf. Ind. Fl. I. 627.—(*Johnia salacioides*, Roxb. Fl. Ind. I. 168; *S. membranacea*, Laws. in Hf. Ind. Fl. I. 627).

Hab. Tropical forests of Tenasserim (Helf. 896).

Lawson gives Mergui, Moulmein, and the Andamans as localities for *S. viminea*, Wall. Cat. 7267, while he omits Penang and Malacca (Griff. 900), the original localities. Without seeing Burmese specimens I hesitate to adopt the species as Burmese.

7. S. prinoides, DC. Prod. I. 571; Griff. Not. Dicot. 470; Wight Icon. t. 321; Hf. Ind. Fl. I. 626.—(*Johnia Coromandeliana*, Roxb. Fl. Ind. I. 169; *S. latifolia*, Wall. Cat. 4222; Hf. Ind. Fl. I. 629. pp.)

Hab. Frequent in the tidal forests, all along the coast, from Chittagong and Pegu down to Tenasserim and the Andamans.—Fl. Jan.; Fr. March to June.

This is one of those species that grow under the influence of the sea as well as in the interior of India, where it recurs in the stony drier tracts.

8. S. flavescens, Kurz in Journ. As. Soc. Beng. 1872. 300; Hf. Ind. Fl. I. 625.

Hab. Tenasserim (Helf. 897); Tavoy.

9. S. multiflora, Wight Ill. I. 134; Hf. Ind. Fl. I. 627.—(*S. myrtifolia*, Griff. Not Dicot. 470 ?)

Hab. Tenasserim, Mergui (Griff.).

I have not seen this species.

Hippocratea, L.

Conspectus of species.

× Petals ½—1 lin. long, imbricated in the bud.

Petals about ½ lin. long; leaves glaucous, ... *H. Indica.*

Petals about a line long; leaves turning brown in drying, ... *H. fuscescens.*

× × Petals about 2 lin. long, valvate in the bud.

Flowers outside and inflorescence greyish puberous; carpels linear-oblong, 2—3½ in. long, ... *H. macrantha.*

Petals inside densely greyish hairy, ... *H. Lobbii.*

1. H. INDICA, Willd. sp. pl. I. 193; Roxb. Corom. Pl. II. t. 130 and Fl. Ind. I. 165; Hf. Ind. Fl. I. 624.

HAB. Rather rare in the open forests of Martaban, east of Tounghoo; Tenasserim.—Fl. Apr.

2. H. FUSCESCENS, Kurz in Journ. As. Soc. Beng. 1872. 300.

HAB. Upper Tenasserim, near Moulmein (Falconer).

3. H. MACRANTHA, Korth. Verh. Natuurk. Gesch. Bot. 187. t. 39; Miq. Fl. Ind. Bat. I/2. 599 and Ann. Mus. Lugd. Bat. IV. 153.—(*H. grandiflora*, Wall. Cat. 4213).

HAB. Tenasserim (Helf. 905).

The disk both in the Tenasserim and the Khási hill plant is quite glabrous. The species differs from *H. obtusifolia* greatly in the size and shape of the ripe carpels.

4. H. LOBBII, Laws. in Hf. Ind Fl. I. 624.

HAB. Tenasserim, Moulmain (*teste* Lawson).

Lophopetalum, Wight.

Conspectus of species.

* *Petals fringedly crested or lamellate on the upperside. Disk 5-lobed.*

Flowers nearly ½ in. in diameter; crest of petals fringed, ... *L. fimbriatum.*

* * *Petals naked, in a dried state often turning wrinkled or corrugate on the inner face.*

× Panicles glabrous. Disk smooth, in a dried state often conspicuously wrinkled. Leaves elliptical to ovate.

Panicles brachiate, stiff and squarrose; flowers about 3 lin. in diameter; disk wrinkled, ..*L. Wallichii.*

As preceding but panicles larger and slenderly branched; flowers about 2 lin. across; disk wrinkled, ... *L. littorale.*

Apparently the same as the preceding, but the disk said to be entirely covered with "lobulate warts," ..... *L. celastroides.*

× × Panicles while young covered with a rusty coloured or greyish tomentum.

Leaves lanceolate to oblong-lanceolate; petiole 3—4 lin. long; flowers about 1—1½ lin. across; disk smooth or nearly so, ... *L. floribundum.*

1. L. FIMBRIATUM, Wight Ill. I. 178; Hf. Ind. Fl. I. 615.

HAB. Lower Pegu, Poungleen (Dr. Brandis), and Martaban (Yoonzeleen, &c.) down to Tenasserim, Mergui (Griff.).—Fl. March.

2. L. WALLICHII, Kurz in Journ. As. Soc. Beng. 1872. 299; Hf. Ind. Fl. I. 615.

HAB. Common in the open, more especially in the eng-forests, all over Pegu and Martaban down to Tenasserim.—Fl. Jan. March; Fr. March, Apr.

3. L. LITTORALE, (*Kokoona littoralis*, Laws. in Hf. Ind. Fl. I. 617).

HAB. In inundated low lands of the Pazwoondoung river of Pegu;

in Upper Tenasserim apparently frequent.—Fl. Febr. March; Fr. March, Apr.

Very close to the preceding, but differing by its smaller flowers and in the slenderness of the peduncles and pedicels, as also in its growth in lowlands inundated during rains. Lawson ascribes sublamellate petals to this species, while they are simply longitudinally corrugate in the Burmese specimens, and hence I suspect that he has made up his phrasule (for a description it cannot be called) from Malayan specimens, quite overlooking the fact that Wallich's No. 6520 all came from Burma. He also still ascribes to the genus *Lophopetalum* "rarely winged, arillate seeds" and a "fleshy albumen," all characters which are applicable to the genus if taken in the absolute negative. Wight erroneously included the *Evonymus grandiflorus* in *Lophopetalum* and drew the characters of the seeds from it: whence the confusion which I have already pointed out in Journ. As. Soc. Beng. 1870, p. 73. On account of the dotted vegetative parts and the seeds being winged at the upper end only, I now prefer keeping up the genus *Kokoona* Thw. Lawson has also a *L. celastroides* from Upper Tenasserim and Pegu, the description of which does not enlighten one much as to the characters wherein it differs from the above otherwise than by the lobulate warts of the dried disk.

4. L. FLORIBUNDUM, Wight Ill. I. 178; Hf. Ind. Fl. I. 616.—(*Hippocratea pentandra*, Griff. Not. Dicot. 472).

HAB. Tenasserim, Mergui, in dense forests and along the coast of the island Madamaca (Griff. 1977/2).—Fl. Decb.

Doubtful species.

1. L. FILIFORME, Laws. in Hf. Ind. Fl. I. 616.

HAB. Tenasserim, Mergui (Griff.) *teste* Lawson.

Not seen by me, but hardly belongs to this genus. The cupular disk points to *Hippocratea*, but the number of stamens is not given.

RHAMNACEÆ.

Conspectus of genera.

Trib. I. ZIZYPHEÆ. Drupe containing a solid 1—3-celled putamen, or the fruit a capsule or indehiscent nut. Ovary superior or half-superior. Disk filling the calyx-tube.

* Ovary half-superior or superior. Fruit a nut, dry, coriaceous, 1-celled and 1-seeded, or a capsule. (*Ventilagineæ*).

VENTILAGO. Nut produced into a long terminal wing, indehiscent.

SMYTHEA. Capsule lanceolate or urn-shaped, 2-valved.

* * Ovary superior. Drupe fleshy or dry, with an 1—3-celled hard putamen. (*Zizypheæ genuinæ*).

ZIZYPHUS. Leaves palmately 3—5-nerved.

Berchemia. Leaves penninerved.

Trib. II. RHAMNEÆ. Fruit dry or drupaceous, containing 3 (rarely 2—4) indehiscent or 2-valved cocci. Ovary superior to inferior.

* Ovary superior or half-superior. Drupe fleshy or dry, superior. Disk fleshy, filling the calyx-tube. (*Rhamneæ veræ*).

Sageretia. Flowers in terminal panicles. Leaves opposite or nearly so.

Scutia. Flowers in fascicles or umbellets. Leaves opposite or nearly so.

Colubrina. Flowers in cymes. Leaves alternate.

* * Ovary and fruit inferior, the latter crowned by the calyx-limb. (*Gouanieæ*).

Apteron. Styles 2. Fruit globose, not winged. Flowers clustered, in terminal panicles.

Gouania. Fruit dry, 3-cornered or -winged. Flowers spicate or racemose, panicled.

Ventilago, Gærtn.

Conspectus of species.

× Calyx adnate to the drupe, small and basilar.

Flowers in slender simple or branched racemes; not indistinctly puberous, the wing only 1—1½ in. long. ..... *V. Madraspatana.*

× × Calyx adnate to the drupe for ½—⅔ of its length, and forming there a prominent ring.

O Flowers and fruit more or less yellowish pubescent or tomentose.

Racemose panicles and flowers tomentose; fruits puberulous, the wing 1½—1 in. long, the calyx reaching the middle of the nut, ... *V. calyculata.*

O O Fruits quite glabrous, even when young.

All parts glabrous; nuts about 3 lin. in diameter, the calyx reaching the middle and forming a sharp ring there, the wing rounded at the apex, ... *V. leiocarpa.*

Glabrous? ; nuts nearly ½ in. across, the calyx broad and flat, occupying only the basal part of the nut, the wing shortly acuminate, ... *V. Maingayi.*

1. V. Madraspatana, Gaertn Fruct. I. 223. t. 29; Wight Icon. t. 514; Bth. in Linn. Proc. v. 76; Hf. Ind. Fl. I. 631.

Hab. Tenasserim, Moulmein to Mergui (Griff. etc.) *teste* Bth.

2. V. calyculata, Tul. in Ann. d. sc. nat. 4 ser. VIII. 124; Bth. in Linn. Proc. V. 76; Hf. Ind. Fl. I. 631, excl. syn. *V. macrantha.*—(*Ventilago Maderaspatana*, Roxb. Corom. Pl. I. 55. t. 76 and Fl. Ind. I. 629, non Gaertn.).

Hab. Not unfrequent in the open, especially the eng-forests, and in the dry forests of Prome, Pegu, and Martaban; also Ava; Tenasserim, *teste* Lawson.—Fl. Nov.; Fr. March, Apr.

3. V. leiocarpa, Bth. in Linn. Proc. V. 77; Hf. Ind. Fl. I. 631.

Hab. Tenasserim.

4. V. Maingayi, Laws. in Hf. Ind. Fl. I. 631. (*V.* sp. Griff. Not. Dicot. 492).

Hab. Tenasserim (Helf.); Mergui (Griff.) *teste* Lawson.

Smythea, Seem.

1. S. CALPICARPA, Kurz in Journ. As. Soc. Beng. 1872. 301; Hf. in Ind. Fl. I. 632.

HAB. Tenasserim (Helf. 2026/1).

Zizyphus, Juss.

Conspectus of species.

* Flowers in axillary cymes or clusters.

O Leaves more or less tomentose or pubescent beneath. Drupes sappy, quite glabrous.

Leaves coriaceous, densely fulvous or whitish tomentose beneath, glabrous above; drupe ½—¾ in. long, the putamen 2-celled; erect shrub or tree, ... *Z. jujuba.*

Leaves membranous, above thinly beneath densely silky pubescent; drupe the size of a pea, the putamen 1- rarely 2-celled; erect or scandent shrub, ... *Z. oenoplia.*

O O Leaves glabrous or sprinkled with a few hairs on the nerves beneath.

Leaves green, thin chartaceous; drupes while young tawny tomentose, adult woody, .. *Z. glabra.*

* * Cymes collected into leafy or leafless panicles. Drupes woody.

Leaves glabrous, rigidly chartaceous; drupes glabrous; climber, ... *Z. funiculosa.*

Leaves densely fulvous tomentose or pubescent beneath; drupes glabrous; leaf-shedding tree, ... *Z. rugosa.*

1. Z. JUJUBA, Lamk. Exc. Meth. III. 318; Wight Icon. t. 99; Roxb. Fl. Ind. I. 608; Griff. Not. Dicot. 491; Edgew. in Linn. Proc. VI. 201; Hook. Journ. Bot. I. t. 140; Bedd. Fl. Sylv. Madr. t. 149; Brand. For. Fl. 86. t. 17; Hf. Ind. Fl. I. 632.

HAB. Common in the leaf-shedding, especially the dry and savannah-forests, of Prome and Ava, less frequent in those of the other provinces; also frequently cultivated in and around villages.—Fl. Aug., Sept.; Fr. Octob. to Jan.

2. Z. OENOPLIA, Mill. Dict. No. 3; Roxb. Fl. Ind. I. 611; Hf. Ind. Fl. I. 634, excl. syn. *Z. albens*, Roxb.—(*Z. Napeca*, Roxb. Fl. Ind. I. 613, non L.).

VAR. α. GLABRESCENS, leaves green on both sides, shortly and thinly pubescent. Usually a straggling shrub.

VAR. β. FERRUGINESCENS, leaves tawny villous beneath; usually a lofty climber.

VAR. γ. PEDICELLARIS (*Z. pedicellaris*, Wall. Cat. 4243), as preceding, but cymes longer peduncled and larger, pedicels about 3 lin. long.

HAB. Common all over Burma and the adjacent islands, as well in the leaf-shedding as in the evergreen forests; var. β. is a more southern form, frequent in Martaban, Tenasserim, the Andamans, etc.; var. γ. in Prome.—Fl. Sept. Octob.; Fr. C. S.

3. Z. GLABRA, Roxb. Fl. Ind. I. 614.—(*Z. Horsfieldii*, Miq. Fl. Ind. Bat. I. 643; *Z. venulosa*, Wall. Cat. 4235).

HAB. Frequent in the tropical forests, all over Burmah, from Ava and Chittagong down to Tenasserim and the Andamans.—Fr. C. S.

Prof. Lawson has created not a little confusion as regards this species. Without taking the trouble of studying Roxburgh's description, he based his identification upon Wallich's No. 4242 (doubtfully marked as *Z. glabra*), which is probably a glabrescent form of *Z. rugosa* and has nothing whatever to do with Roxburgh's plant. At the same time he makes quite a mélange of *Z. funiculosa*, to which he refers not only the true *Z. glabra*, but also, apparently, *Z. subquinquenervia*, Miq., from Malacca (Maingay No. 412, a variety with smaller glabrescent drupes),—both species at once distinguishable from it by the axillary cymes.

4. Z. FUNICULOSA, Ham. in Wall. Cat. 4234; Hf. Ind. Fl. I. 636 pp.

HAB. Ava, Khakhyen hills.

5. Z. RUGOSA, Lamk. Enc. Meth. III. 319; Wight Icon. t. 339; Hf. Ind. Fl. I. 636 pp. (*Z. latifolia*, Roxb. Fl. Ind. I. 607).

HAB. Frequent in all leaf-shedding forests, more especially in the open ones, all over Burmah, from Ava and Martaban down to Tenasserim. Fl. March, Apr.; Fr. May.

Doubtful species.

1. Z. TOMENTOSA, Roxb. Fl. Ind. I. 611.

HAB. Chittagong, where it is used for fences.

Berchemia, Neck.

Conspectus of species.

Leaves 2—4 in. long, the petiole ¾—1 in. long; panicle ample, terminal, . . *B. floribunda.*
Leaves 1—1½ in. long, the petiole about 3 lin. long; racemes axillary, ... *B. polyphylla.*

1. B. FLORIBUNDA, Wall. Cat. 4256; Hf. Ind. Fl. I. 637.—(*Zizyphus floribunda*, Wall. in Roxb. Fl. Ind. II. 368).

HAB. Ava, Khakhyen hills (J. Anderson).

2. B. POLYPHYLLA, Wall. Cat. 4259; Hf. Ind. Fl. I. 638.

HAB. Ava, Taong dong (*teste* Lawson).

Sageretia, Brong.

1. S. THEEZANS, Brongn. in Ann. d. sc. nat. 1 ser. X. 360; Hf. Ind. Fl. I. 641. VAR. β. DIOSPYRIFOLIA, Laws. in Hf. l. c. 462.

HAB. Ava.—Fl. Octob.

Scutia, Comm.

1. Sc. MYRTINA, (*Rhamnus myrtinus*, Burm. Fl. Ind. 1768. 60; *Rhamnus circumscissus*, L. f. Suppl. 1781. 152; Roxb. Fl. Ind. I. 603;

Scutia Indica, Brongn. in Ann. d. sc. nat. X. 368; Wight Ill. t. 73; Hf. Ind. Fl. I. 640; *Rhamnus lucidus*, Roxb. Fl. Ind. I. 605).

VAR. α. RETUSA, leaves retuse or blunt.

VAR. β. ACUTIFOLIA, leaves acute.

HAB. Var. β. Tenasserim, along the Attaran river.

Colubrina, L. C. Rich.

Conspectus of species.

Leaves and cymes glabrous, ... *C. Asiatica.*
Cymes and under surface of leaves pubescent, ... *C. pubescens.*

1. C. ASIATICA, Brongn. in Ann. d. sc. nat. 1 ser. X. 369; Wight Ill. t. 74; Hf. Ind. Fl. I. 642.—(*Ceanothus Asiaticus*, L. sp. pl. 284; Roxb. Fl. Ind. I. 615; *Rhamnus acuminatus*, Colebr. in Roxb. Fl. Ind. I. 615).

HAB. Frequent in the beach- and coast-forests along the sea-shore, from Arracan down to Tenasserim and the Andamans.—Fl. Febr.; Fr. March Apr.

2. C. PUBESCENS, Kurz in Journ. As. Soc. Beng. 1872. 301; Hf. Ind. Fl. I. 642.

HAB. Frequent in the open, especially the low forests, all over Pegu and Martaban; also entering the tropical forests.—Fl. March; Fr. Apr. May.

Apteron, Kurz.

1. A. LANCEOLATUM, Kurz in Journ. As. Soc. Beng. 1872. 301; Hf. Ind. Fl. I. 643.

HAB. Upper Tenasserim, Moulmein District (Brandis, Falconer).—Fl. Febr.

Gouania, L.

Conspectus of species.

Leaves glabrous or nearly so, crenate; racemes puberulous, glabrescent: disk glabrous, 5-horned: capsules glabrous, ... *G. leptostachya.*
Leaves velvety above, densely tawny or rusty pubescent beneath, entire; racemes rusty-tomentose; capsules puberulous, ... *G. Brandisii.*

1. G. LEPTOSTACHYA, DC. Prod. II. 40; Wight, Icon. t. 974; Griff. Not. Dicot. 493. t. 585. f. 2; Hf. Ind. Fl. 1. 643.—(*G. tiliæfolia*, Roxb. Corom. Pl. I. t. 98. and Fl. Ind. I. 632).

HAB. Frequent in the mixed forests and in shrubberies along streams and around villages, all over Burma down to Tenasserim.—Fl. Close of R. S. Fr. C. S.

2. G. BRANDISII, Hassk. in Flora 1871. 280, in adnot.—(*G. integrifolia*, Kurz in Journ. As. Soc. Beng 1870. 49, *non* Lamk.).

Hab. Not unfrequent in the tropical forests of Martaban and Tenasserim.—Fr. Febr. March.

This species may eventually turn out to be only an entire-leaved form of *G. Javanica*, Miq., but the flowers are still unknown.

AMPELIDEÆ.

Conspectus of species.

Vitis. Stamens free. Ovary 2-celled, with 2 ovules in each cell. Tendril-bearing climbers.

Leea. Stamens and petals united with the disk. Ovary 3—6-celled, with a solitary ovule in each cell. Erect shrubs or trees, without tendrils.

Vitis, L.

Conspectus of species

Subg. I. Vitis (sens. extens.). Inflorescences branched in the usual way, not dilated and confluent.

§ 1. *Flowers in leaf-opposed or axillary true cymes. Flowers usually 4-merous.* (Cissus.)

O Leaves compound, from simple and pedately 3—9 or more foliolate to digitate, or if simple-leaved jointed with the petiole (1—2-foliolate).

+ Leaves pedately or pinnately foliolate, very rarely spuriously digitate.

† Style short, spreadingly 4-lobed, or the 4-lobed or 4-cleft stigma sessile.

* Style short, spreadingly 4-lobed at the apex. Flowers often unisexual.

Leaves 3-foliolate; berries 1½ in. in diameter; seed obovoid, grooved on the back, the groove with a linear tubercle; stem very warty..... *V. tuberculata.*

Hermaphrodite; leaves coriaceous, 3-foliolate, the leaflets very shortly petioluled, .. *V. assimilis.*

Flowers unisexual; leaves sappy membranous, 3-foliolate to pedately 5-foliolate; cymes short; seeds oblong, smooth,..... *V. oxyphylla.*

* * Stigma sessile, 4-lobed or cleft. Flowers often unisexual.

All parts, also the very short cyme, glabrous; leaves 3-foliolate, sappy herbaceous; pedicels short, cymulose; berries white, pea-shaped,..... *V. angustifolia.*

Very much as the preceding, but cymes very slender and large, puberulous; seeds half-orbicular, broadly and shallowly furrowed above with a long blunt ridge in the furrow, the sides transversely rugate,..... *V. bracteolata.*

Glabrous or the petioles and cyme often puberulous; leaves pedate, or the upper ones often 3-foliolate, sappy coriaceous; berries white, the size of a cherry or smaller; seeds obovoid-oblong, rugulose, broadly and shallowly furrowed on the back, .. *V. lanceolaria.*

Glabrous; leaves pedate, herbaceous-fleshy; pedicels 2—3 lin. long, umbellulate; berries black, the size of a pea, ... *V. serrulata.*

Very much as the preceding, but young shoots and petioles rusty hirsute; leaves spuriously digitate, ... *V. obtecta.*

† † Style simple, entire.

* Leaves all 3-foliolate.

Glabrous; cymes leaf-opposed, glabrous; leaves glaucous beneath, ... *V. semicordata.*

All parts shortly puberulous rarely glabrous; cymes axillary or on axillary shoots, puberulous, ... *V. trifolia.*

* * Leaves pedate.

× Cymes leaf-opposed and spuriously axillary, *i. e.* the cyme terminating an axillary leafy or leafless shoot.

All parts densely puberulous or pubescent, ... *V. Teysmanni.*

All parts glabrous; leaves sparingly pubescent along the nerves beneath, .. *V. Japonica.*

× × Cymes truly axillary, long-peduncled.

Leaflets cuneate-obovate, rather blunt or acute, slightly pubescent along the nerves beneath; seeds triangular with sharp margins, muricate on the back, .. *V. tenuifolia.*

All parts pubescent to almost glabrous; leaflets finely acuminate; seeds hemispherical, smooth, ... *V. pedata.*

\+ + Leaves truly digitate.

All parts puberulous; cymes axillary and terminal on axillary shoots; leaflets 1½—2 in. long; style simple, ... *V. auriculata.*

Leaves glabrous; leaflets 4—6 in. long, fleshy herbaceous; cymes puberulous; berries globose, style simple, bark red, ... *V. erythroclada.*

Leaves glabrous: leaflets 4—6 in. long, coriaceous; cymes almost sessile, very slenderly branched, puberulous; flowers minute, dioecious; stigma peltately 4-lobed, almost sessile; seeds curved-oblong, ... *V. campylocarpa.*

O O Leaves simple or very rarely (in *V. Anamallayana**) the uppermost ones 3-foliolate. Cymes leaf-opposite (except in *V. Wallichii*).

× Branches and branchlets cornered, sometimes almost winged and fleshy.

Branchlets very fleshy, 4-cornered, jointed; leaves small, fleshy, bluntish crenate; cymes simple, ... *V. quadrangularis.*

Branchlets bluntish 5-angular, thick and glossy; leaves remotely bristly toothed, long-petioled, ... *V. pentagona.*

Branchlets sharply 6-cornered; leaves bristly serrate, herbaceous; cymes compound, peduncled or sessile; seeds obliquely obovate, transversely wrinkled on the faces, .. *V. discolor.*

As preceding; leaves shorter petioled, while young appressed hairy on the nerves beneath; seeds smooth, obovate, ... *V. costata.*

× × Branches and branchlets terete or nearly so.

† Cymes axillary; branchlets angular?

Leaves slightly 3-lobed, glabrous, sappy membranous, large; seeds globose, smooth, .. *V. Wallichii.*

† † Cymes leaf-opposed.

Branchlets terete, whitish pruinous; all parts glabrous; seeds smooth, ... *V. repens.*

All parts, especially while young, rusty or tawny tomentose or pubescent, more or less

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* This species is so near to *V. repens* that I should not wonder if it were to turn out to be only an abnormal state of it.

glabrescent; leaves sharply acuminate, never lobed; seeds obovate, shallowly lacunose, ... *V. adnata.*

All younger parts rusty tomentose or pubescent, glabrescent; leaves large, often somewhat 3-lobed, bluntish acuminate, deciduous; seeds obovate, smooth, .. *V. Linnæi.*

§ 2. *Inflorescence a modification of the tendrils, cymose-panicled, racemose or spiked, or more usually the one or both tendril-branches transformed into a panicle. Flowers 4- or more usually 5-merous.* (Eu-Vitis.)

* Flowers pedicelled, in loose or contracted panicles.

† Seeds 2—4 lin. long, shallowly grooved and more or less distinctly radiately furrowed on the back.

× Glabrous or nearly so.

Cymose panicles ample, glabrous, with or without tendrils; pedicels thick, nearly a line long; leaves 3—5-lobed, the lobes usually acute, ... *V. latifolia.*

× × All parts more or less woolly-tomentose.

Branchlets, peduncles and usually the petioles covered with a woolly tomentum intermixed with black spreading stiff hairs; leaves almost glabrous, ... *V. barbata.*

Branchlets, etc. woolly without black hairs; leaves lobed to palmately lobed; panicles usually tendril-bearing, short and rather compact; pedicels very short and thick, .. *V. tomentosa.*

† † Seeds about a line long, longitudinally furrowed on the back, almost smooth, glossy-black.

Branchlets, etc., woolly, without black hairs; leaves tawny woolly beneath, slightly lobed; panicles usually tendril-bearing, woolly, large and lax; pedicels very slender, 1½ lin. long, ... *V. lanata.*

* * Flowers sessile, in spikes, the spikes forming elongate panicles.

Young parts thinly and fugaceously woolly; leaves pedately 5—7-foliolate, glabrous except on the nerves beneath; spikes in very slender panicles, ... *V. Helferi.*

Quite glabrous; leaves digitately foliolate, glaucous green; spikes puberulous, forming 1½—2 ft. long stout panicles, ... *V. polystachya.*

Subg. II. PTERISANTHES, Bl. Rachis of inflorescence leafy expanded and fleshy-membranous, the flowers sessile, unisexual.

Glabrous; leaves simple; a very slender twiner, ... *V. polita.*

1. V. TUBERCULATA, Laws. in Hf. Ind. Fl. I. 656.

HAB. Pegu (*teste* Lawson).

I have not seen this species, and I suspect that it is only a large-fruited, 3-foliolate form of *V. lanceolaria.*

2. V. ASSIMILIS, Kurz in Journ. As. Soc. Beng. 1872: 302.—(*V. lanceolaria* var. 2, *assimilis*, Laws. in Hf. Ind. Fl. I. 660).

HAB. Not rare in the drier hill-forests of the Martaban hills, east of Tounghoo, at 3—4000 ft. elevation.—Fl. March.

3. V. OXYPHYLLA, Wall. Cat. 6035.

HAB. Frequent in the tropical forests of the eastern slopes of the Pegu Yomah and the Martaban hills, east of Tounghoo.—Fl. March.

4. V. LANCEOLARIA, Wall. ap. WA. Prod. I. 128: Wight Icon. t. 177; Hf. Ind. Fl. I. 660, excl. syn. *C. feminea;* Miq. Ann. Mus. Lugd.

Bat. I. 78.—(*Cissus lanceolaria*, Roxb. in Wall. Fl. Ind. I. 430; *V. muricata*, WA. Prod. I. 128; Wight Icon. t. 740).

Var. α. LANCEOLARIA, cymes loose and ample, densely puberulous, the pedicels longer and slender: petioles and petiolules puberulous (*Cissus lanceolaria*, Roxb. l. c.; *V. Hookeri*, Laws. in Hf. Ind. Fl. I. 661?)

Var. β. TUBERCULATA (*Cissus tuberculata*, Bl. Bydr. 189), cymes short and often somewhat compact, less puberulous or glabrous, the pedicels usually shorter and thicker; petioles, &c., all glabrous; berries and seeds usually smaller.

Hab. Both varieties, but more so var. β., common in the tropical forests all over Martaban down to Tenasserim and the Andamans; also along the eastern slopes of the Pegu Yomah; Chittagong.—Fl. Febr. March; Fr. Apr. May.

Var. α. is in my opinion the true Roxburghian plant, while var. β. is Blume's *Cissus tuberculata*.

5. V. SERRULATA, Wall. ap. Miq. Ann. Mus. Lugd. Bat. I. 77. (*Cissus serrulata*, Roxb. Fl. Ind. 1820. I. 114; *Cissus capriolata*, Royle Ill. Him. Pl. t. 26; *V capriolata*, Don. Prod. Nep. 188; Hf. Ind. Fl. I. 659).

Var. α. CAPRIOLATA, all parts quite glabrous.

Var. β. SUBOBTECTA, branches and petioles rusty-pubescent like those of *V. obtecta*, and forming a transition to it, the leaves partially becoming digitate.

Hab. Frequent along mountain-streams in the tropical forests of Martaban, up to 3000 ft. elevation; Ava, Khakhyen hills; Chittagong; var. β. Ava, Khakhyen hills.—Fr. Febr. March.

6. V. OBTECTA, Wall. Cat. 6026; Hf. Ind. Fl. I. 657.

Hab. Ava, Khakhyen hills (J. Anderson).

7. V. SEMICORDATA, Wall. in Roxb. Fl. Ind. II. 1824. 481.—(*V. Himalayana*, Brand. For. Fl. 100; Hf. Ind. Fl. I. 655).

Var. α. SEMICORDATA, Laws. in Hf. Ind. Fl. I. 656.—(*V. semicordata*, Wall. l. c.) young parts, inflorescence, and leaflets beneath, shortly and sparingly hairy.

Var. β. HIMALAYANA, (*V. Himalayana*, Brand. l. c.; *V. Neilgherrensis*, Wight Icon. t. 965; *Ampelopsis Himalayana*, Royle Ill. Him. Pl. 149), all parts quite glabrous, leaflets glaucous beneath.

Hab. Var. β. in the drier hill-forests of the Martaban hills, east of Tounghoo, at about 3000 ft. elevation.—Fl. March.

8. V. TRIFOLIA, L. sp. pl. 293; Bth. Fl. Austr. I. 449.—(*Cissus carnosa*, Lamk. Dict. I. 31; Roxb. Fl. Ind. I. 409; *V. carnosa*, WA. Prod. I. 127; Wight Icon. t. 171; Hf. Ind. Fl. I. 654).

Var. α. GENUINA, all parts shortly greyish pubescent.

Var. *β.* glabrata, all parts glabrous or nearly so.

Hab. Rather frequent all over Burma, especially in rubbishy places, in hedges, and shrubberies, becoming a powerful climber in the forests.—Fl. R. S.

I follow Miquel in adopting Linné's oldest name, which is evidently given in allusion to the trefoil (*Trifolium*).

9. V. Teysmanni, Miq. in Ann. Mus. Lugd. Bat. I. 82.—(*Cissus Teysmanni*, Miq. Suppl. Fl. Sumatr. 516; *V. mollis*, Wall. Cat. 6025; Hf. Ind. Fl. I. 660).

Hab. Chittagong (*teste* Lawson).

10. V. Japonica, Thbg. Fl. Jap. 104.—(*Cissus Japonica*, DC. Prod. I. 632; *Cissus leucocarpa*, Bl. Bydr. 189; Miq. Fl. Ind. Bat. I/2. 663; *V. cymosa*, Roxb. in Wall. Cat. 6017).

Hab. Frequent along mountain-streams and on moist rocks in the tropical forests of the Pegu Yomah, and from Martaban down to Tenasserim; also Ava, Taongdong.—Fl. R. S.; Fr. Jan. Febr.

11. V. tenuifolia, WA. Prod I. 129; Hf. Ind. Fl. I. 660 in part.

Hab. In the mixed forests of the Pegu Yomah and Arracan; also in bamboo-jungles of the Andamans.—Fl. May, June.

Possibly only a more luxuriant form of the preceding species, with more obtuse leaflets and truly axillary cymes.

12. V. pedata, Wall. ap. WA. Prod. I. 128; Hf. Ind. Fl. I. 661. (*Cissus pedata*, Lamk. Dict. I. 31; Roxb. Fl. Ind. I. 413).

Var. *α.* genuina, leaves pedately foliolate, pubescent.

Var. *β.* glabrata, as preceding, but pretty glabrous.

Hab. Var. *α.* frequent in leaf-shedding forests and more especially in hedges and shrubberies of the cultivated alluvial plains; var. *β.* in tropical forests of the Andamans.—Fl. Begin of R. S.

13. V. auriculata, Wall. ap. WA. Prod. I. 129; Wight Icon. t. 145; Hf. Ind. Fl. I. 658.—(*Cissus auriculata*, Roxb. Fl. Ind. I. 411).

Hab. In the mixed forests of the Pegu Yomah; Chittagong.—Fl. Begin of R. S.

14. V. erythroclada, Kurz in Journ. As. Soc. Beng. 2872. 301.

Hab. Not unfrequent in the tropical and other forests along streams of the Pegu Yomah and Martaban east of Tounghoo.—Fl. March.

Amongst the digitate species, this comes nearest to *V. saponaria*, Seem.

15. V. campylocarpa, Kurz in Journ. As. Soc. Beng. 1872. 302; Hf. Ind. Fl. I. 657.—(*Cissus feminea*, Roxb. Fl. Ind. I. 410?; *Panax micranthum*, Wall. Cat. 4938).

Hab. In the tropical forests of the slopes on eastern face of Kambala toung, Pegu Yomah, at 1000—2000 ft. elevation; Ava, Taong Dong (Wall.)—Fl. Nov.; Fr. March.

Dicœcious, remarkable for its minute flowers, and in this respect resembling *V. pubiflora*, Miq. (syn. *V. pedunculariis*, Lawson). Lawson says that it has no tendrils, but in this he is mistaken. I believe it to be Roxburgh's *C. feminea*, but not having seen the female flowers, I hesitate to pronounce its identity with that species. Lawson confidently reduces *C. feminea* to a synonym of *V. lanceolaria*, but the digitate leaves alone forbid a comparison with it.

16. V. QUADRANGULARIS, Wall. ap. WA. Prod. I. 125; Wight Icon. t. 51; Hf. Ind. Fl. I. 645.—(*Cissus quadrangularis*, L. Mant. 39; Roxb. Fl. Ind. I. 407).

HAB. Frequent in wild shrubby and waste places and in the dry forests of the Prome district; also Ava.—Fl. Nov.

17. V. PENTAGONA, Voigt Cat. Hort. Calc. 28; Kurz in Journ. As. Soc. Beng. 1870. 74; Hf. Ind. Fl. I. 646.—(*Cissus pentagona*, Roxb. Fl. Ind. I. 408).

HAB. Not unfrequent in the tropical forests of the eastern slopes of the Pegu Yomah, and from Chittagong and Arracan down to the Andamans.—Fl. Octob.; Fr. Apr. May.

In Journ. As. Soc. *l. c.*, I stated that *Cissus hastata*, Miq. (= *V. hastata*, Miq. Ann. Mus. Lugd. Bat. 1863. I. 85., a species which Lawson 12 years later rechristens *V. sagittifolia*, Laws. in Hf. Ind. Fl. 1875. I. 645) was identical with *V. glaberrima*, Wall. This is an error, which arose from my having solely consulted the Wallichian specimens of *V. glaberrima*, which all happen to be *V. hastata*.

18. V. DISCOLOR, Dalz. in Hook. Kew. Misc. II. 39; Miq Ann. Mus. Lugd. Bat. I. 86; Hf. Ind. Fl. I. 647, excl. syn. *V. costata*.—(*Cissus discolor*, Bl. Bydr. 281; Bot. Mag. t. 4763; *Cissus velutinus*, Linden in Bot. Mag. t. 5207).

VAR. α. DISCOLOR, leaves usually spotted, purplish beneath, on very long petioles (at least the lower ones); cymes peduncled.

VAR. β. SESSILIS, Miq. in Ann. Mus. Lugd. Bat. I. 86, cymes sessile and umbelately branched already from the base.

HAB. Var. α. frequent in the tropical forests and moister bamboo-jungles, from Arracan, the Pegu Yomah, and Martaban down to Tenasserim and the Andamans; var. β. in the Martaban hills, east of Tounghoo.—Fl. R. S; Fr. C. S.

19. V. COSTATA, Wall. Cat. 6011.

HAB. Not unfrequent in the open and the mixed forests of Pegu and Arracan; also Martaban.—Fr. H. S.

20. V. WALLICHII, Kurz in Journ. As. Soc. Beng. 1872. 302, *non* DC. (*Leea cordata*, Wall. Cat. 6819.)

HAB. Ava, Irrawaddi valley at Meaong.

Very near to *V. pallida*, WA., as Lawson has pointed out, but the axillary cymes distinguish it from that species.

21. V. REPENS, WA. Prod. I. 125.; Hf. Ind. Fl. I. 646.—(*Cissus repens*, Lamk. Dict. I. 31; DC. Prod. I. 628; Rheed. Hort. Malab. VII. t. 48; *V. glauca*, WA. Prod. I. 126; *Cissus glauca*, Roxb. Fl. Ind. I. 406; DC. Prod. I. 628; *Cissus glauca*, Roxb. Fl. Ind. I. 406; *Cissus Blumeana*, Steud. Nomencl; Miq. Fl. Ind. Bat. I/2. 605; *Cissus cerifera*, T. et B. in Natuurk. Tydsch. Ned. Ind. XXIV. 324).

HAB. Frequent as well in the tropical as in the moister mixed forests, all over Burma, from Chittagong and Ava down to Tenasserim and the Andamans.—Fl. R. S.; Fr. C. S.

22. V. ADNATA, Wall. ap. WA. Prod. I. 126; Wight Icon. t. 144; Hf. Ind. Fl. I. 649.—(*Cissus adnata*, Roxb. Fl. Ind. I. 405).

VAR. α. GLABRIOR, Miq. in Ann. Mus. Lugd. Bat. I. 87, all parts more glabrous, leaves only along the nerves beneath pubescent.

VAR. β. COMMUNIS, all parts more or less rusty tomentose; leaves above glabrous or puberulous, beneath wholly or only along the nerves tomentose.

HAB. Var. α. rarely in the hill-toungyas of the Martaban hills, at 3000—4000 ft. elevation; var. β. frequent in all leaf-shedding forests and in shrubberies and village-bushes, more especially along choungs, all over Burma and adjacent provinces.—Fl. Close of R. S.; Fr. H. S.

23. V. LINNÆI, Kurz, *non* Wall.*—(*Cissus vitiginea*, L. sp. pl. 117; Roxb. Fl. Ind. 1. 406; *V. repanda*, WA. Prod. I. 125; Hf. Ind. Fl. I. 648).

HAB. Frequent as well in the mixed and open forests as also in shrubberies and grass jungles, all over Burma and adjacent provinces down to Tenasserim.—Fl. H. S. and Close of R. S.; Fr. C. S.

Lawson identifies Roxburgh's *Cissus vitiginea* with *V. lanata*, but he has never formed a clear conception of the difference between the inflorescence of the *Vitis*-section and that of the *Cissus*-section: hence the error.

24. V. LATIFOLIA, Roxb. Fl. Ind. I. 661; WA. Prod. I. 130; Hf. Ind. Fl. I. 652.

HAB. Frequent in the savannahs and savannah jungles, also in shrubberies and village woods, but rather rare in the leaf-shedding forests, all over the Pegu plains, especially in the Sittang valley; also Andamans, in forests.—Fl. Apr. May.

N. B.—*V. vinifera*, L. is often seen cultivated by Europeans, and is said to bear good grapes in Ava.

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* Whose name has to be changed into *Vitis angulata* (*Cissus angulata*, Lamk.). Mr. C. B. Clarke informs me, that my *Vitis spectabilis* is not a climber, but a perfectly erect perennial about 2 ft. high, nearly simple, without tendrils. It grows in the Sikkim Terai only.

25. V. BARBATA, Wall. in Roxb. Fl. Ind. II. 478; Hf. Ind. Fl. I. 651.

VAR. α. GENUINA, leaves only thinly lanate beneath, black hairs numerous and conspicuous.

VAR. β. JENKINSII, leaves entire or lobed, their undersurface as well as the stems densely tawny or rusty woolly-tomentose, black hairs very sparingly interspersed among the tomentum.

HAB. Frequent in the low and lower mixed forests, all over Ava and Martaban down to Tenasserim; var. β. Ava, Taong Dong (Wall. Cat. 5994 B.).—Fl. Apr. May.

26. V. TOMENTOSA, Heyne in Roth. Nov. sp. 157; DC. Prod. I. 634; WA. Prod. I. 130; Wight Ill. I. t. 57; Hf. Ind. Fl. I. 650.

HAB. In deserted toungyas of the Martaban hills, east of Tounghoo, at 3—4000 ft. elevation.—Fl. Fr. March.

27. V. LANATA, Roxb. Fl. Ind. I. 660; WA. Prodr. I. 131; Hf. Ind. Fl. I. 651, excl. syn. *C. vitiginea*, Roxb.

HAB. Not unfrequent in deserted toungyas of Martaban and Tenasserim; also Ava and Chittagong.—Fl. Fr. Febr. March.

28. V. HELFERI, Laws. in Hf. Ind. Fl. I. 662.

HAB. Tenasserim (Helf. 1341).

29. V. POLYSTACHYA, Wall. Cat. 6028; Hf. Ind. Fl. I. 662.

HAB. Tenasserim or Andaman islands, *teste* Lawson.

30. V. POLITA, Miq. in Ann. Mus. Lugd. Bat. I. 95; Hf. Ind. Fl. I. 663.

HAB. Tenasserim, Moulmain (Lobb), *teste* Lawson.

Doubtful species.

1. *V. dubia*, Laws. in Hf. Ind. Fl. I. 661.

HAB. Chittagong? *teste* Lawson.

Not recognisable from the description alone, the more so as Lawson's arrangement, or I should rather call it disarrangement, of the species of *Vitis* is based upon purely technical and more or less variable characters, without reference to natural affinity. Should it really be *Vitis* No. 41 of Hf. and Th. Herb. Ind. orient., as I strongly suspect, it will be a pedately foliolate form of *V. oxyphylla*, Wall.

Leea, L.

Conspectus of species.

× Leaves ample, simple or rarely 3-foliolate.

Leaves simple, large, very glaucous and shortly puberulous beneath; lobes of the staminal tube entire; shrubby, ... *L. macrophylla.*

Leaves simple and pinnately 3-foliolate, hardly glaucescent but minutely puberulous beneath; lobes of the staminal tube notched; shrubby, ... *L. latifolia.*

× × Leaves from simply pinnate to decompound.
O All parts (except the inflorescence in a few species) glabrous.
† Inflorescence with persistent and conspicuous bracts and bractlets.
Slender treelet; flowers sessile or nearly so, crowded, greenish-white,.. *L. compactiflora.*
† † Bracts and bractlets minute, usually already dropped before the flower-buds are properly developed.
* Leaves coriaceous. Flowers greenish-white or green with a purplish hue.
Leaves more or less glaucous, usually linear or lanceolate; lobes of the staminal tube erect, notched; seeds smooth and rounded on the back; undershrub,.. *L. parallela.*
Leaves dark-green, glossy; lobes of staminal tube erect, notched; seeds even and convex on the back; a tree, ... *L. sambucina.*
Leaves dark-green, glossy; lobes of staminal tube reflexed, acuminate; seeds tubercled-keeled, the edges tubercled-ribbed; a large shrub,..... *L. gigantea.*
* * Leaves more or less membranous. Flowers red, orange, or scarlet.
Leaflets 6—8 in. long: inflorescence rusty-tomentose; undershrub, ... *L. lata.*
Leaflets only 2½—4 in. long; inflorescence glabrous or nearly so, undershrub, *L. coccinea.*
O O More or less pubescent or stiff-hairy, at least the nerves beneath.
† Leaves usually simply pinnate.
Leaflets coarsely serrate, acute, roughish pubescent along the nerves beneath; nerves all parallel; petiolules thick and short; stems, petioles, and peduncles curled-winged; bracts and bractlets long, lanceolate-subulate; shrubby, ... *L. crispa.*
Dwarf, all parts robust and densely pubescent or almost tomentose; petioles and petiolules terete; cymes tomentose; bracts minute; undershrub, ... *L. pumila.*
† † Leaves usually 2- or 3-pinnate.
Leaflets coarsely serrate, acuminate, roughish pubescent on the parallel nerves beneath; stems and petioles terete or nearly so; peduncle compressed-cornered; bracts and bractlets small, linear-lanceolate; flowers greenish-white; shrubby, ... *L. aspera.*
All parts stiff-pubescent; leaflets membranous, stiffly pubescent, beneath densely gland-dotted; petioles, &c., all terete; cymes stiff, pubescent; bracts large, broadly ovate, blunt; undershrub, ... *L. æquata.*
Almost glabrous or greyish puberulous; leaves 2—3-pinnate; leaflets puberulous or glabrous, not gland-dotted beneath; bracts and bractlets none; shrubby, *L. robusta.*
Stems, petioles, &c., quite glabrous; leaflets small, sprinkled with white stiff hairs; bracts or bractlets none; undershrub, ... *L. rubra.*

1. L. MACROPHYLLA, Roxb. Fl. Ind. I. 653 (non DC.), Wight Icon. t. 1154? (*L. simplicifolia*, Griff. Not. Dicot. 697. t. 645. f. 1?)

VAR. α. GENUINA, leaves larger and broader, usually somewhat lobed, glaucous and puberulous beneath.

VAR. β. OXYPHYLLA, leaves ovate to ovate-oblong, acuminate, less glaucous beneath or one-coloured, glabrous.

HAB. Var. β. frequent in the mixed forests, especially the upper ones, of Pegu and Martaban.—Fr. C. S.

2. L. LATIFOLIA, Wall. Cat. 6821.

HAB. Prome hills.

3. L. PARALLELA, Wall. Cat. 6828; Hf. Ind. Fl. I. 666.

Var. α. genuina, leaves usually pinnate or occasionally bipinnate, leaflets oblong or oblong-lanceolate, more glaucous; calyx-lobes rotundate.

Var. β. angustifolia, (*L. angustifolia*, Laws. in Hf. Ind. Fl. I. 665), leaves usually 2—3-pinnate, leaflets narrow-linear to linear, very acuminate, calyx-lobes in fruit obtuse, but not rotundate.

Hab. Var. α. Ava, Irrawaddi valley; var. β. frequent in the mixed forests and grass jungles of Pegu, especially the Irrawaddi zone.—Fr. C. S.

4. L. sambucina, Willd. sp. pl. I. 1177; DC. Prod. I. 653; Roxb. Fl. Ind. I. 657; Griff. Not. Dicot. 598. t. 644. fig. 1; Rumph. Herb. Amb. IV. t. 45.—(*L. staphylea*, Roxb. Fl. Ind. I. 636; WA. Prod. I. 132; Wight Ill. t 58. and Icon. t. 78; *L. ottilis*, DC. Prod. I. 636).

Hab. Frequent in the tropical forests of the eastern slopes of the Pegu Yomah, Arracan, and Martaban down to Tenasserim and the Andamans. Fl. March; Fr. May.

Leea sambucina, of the 'Flora of India' (not of authors), is a mélange of species, which Lawson explains, *more Kewensi*, by saying that there are transitional conditions so numerous that the species reduced by him cannot be maintained.

5. L. gigantea, Griff. Not. Dicot. 697. t. 645. f. 3; Kurz in Journ. As. Soc. Beng. 1873. 65.

Hab. Tenasserim, from Moulmein down to Tavoy.—Fl. Aug. Octob.; Fr. Febr. March.

6. L. compactiflora, Kurz in Journ. As. Soc. Beng. 1873. 65.

Hab. Rather rare in the drier hill-forests of the Martaban hills, east of Tounghoo, at about 3000 ft. elevation.—Fl. Apr.

7. L. læta, Wall. Cat. 6831; Kurz in Journ. As. Soc. Beng. 1873. 65.

Hab. Ava (Wall.); frequent in the tropical forests of South Andaman.—Fl. June.

Very likely only a luxuriant form of the following species.

8. L. coccinea, Planch. in Hort. Donat. 6; Bot. Mag. t. 5299.

Hab. Not uncommon in the savannahs and savannah-forests of Pegu, rarely in the diluvial forests of Martaban.—Fl. May June; Fr. Jan.

9. L. crispa, L. Mant. 124; Roxb. Fl. Ind. I. 654; Hf. Ind. Fl. I. 665.—(*L. pinnata*, Andr. Bot. Repos. V. t. 355).

Hab. Frequent in the low and mixed forests of Pegu and Chittagong.

10. L. pumila, Kurz in Journ. As. Soc. Beng. 1872. 302; Hf. Ind. Fl. I. 666.

Hab. Not unfrequent in the eng and low forests of Pegu and Martaban.—Fl. probably May, June.

11. L. aspera, Wall. in Roxb. Fl. Ind. II. 468; Hf. Ind. Fl. I. 665.

Hab. Common in the mixed forests, especially in the upper ones, and in savannahs, all over Pegu.—Fr. Febr.

12. L. æquata, L. Mant. 124; Miq. in Ann. Mus. Lugd. Bat. I. 98.—(*L. hirta*, Hornem. Hort. Hafn. I. 231; Roxb. Fl. Ind. I. 656; Hf. Ind. Fl. I. 668).

Hab. Not unfrequent in the tropical forests of Martaban and Tenasserim, also Andamans.—Fl. June.

13. L. robusta, Roxb. Fl. Ind. I. 655, *non* Laws.—(*L. aspera*, Wall. Cat. 6825; *L. diffusa*, Laws. in Hf. Ind. Fl. I. 667).

Hab. Not unfrequent in savannahs and in open grassy places of the forests of Pegu and Arracan.—Fl. Octob.; Fr. C. S.

N. B.—*L. robusta*, Laws. *non* Roxb. = *L. Sundaica*, Miq.

14. L. rubra, Bl. Bydr. 197; Miq. Fl. Ind. Bat. I/2. 611 and Ann. Mus. Lugd. Bat. I. 96.

Hab. Tenasserim, Attaran (Dr. Brandis).

N. B.—*L. sanguinea*, Kurz in Journ. As. Soc. Beng. 1873. 66 (not of Wall.) is *L. alata*, Edg. It is not a Burmese species, and the locality Ava should be referred to *L. læta*.

SAPINDACEÆ.

A. Seeds with albumen. Stipules present.

Trib. I. STAPHYLEÆ. Flowers regular. Stamens inserted outside the disk. Leaves opposite.

Turpinia. Ovary 3-celled. Fruit entire, indehiscent. Leaves pinnate, or rarely simple.

B. Seeds without albumen. Stipules none.

a. Stamens inserted outside or on the disk. Flowers regular.

Trib. II. DODONÆÆ. Stamens inserted outside the disk. Capsule septicidally dehiscing. Leaves alternate.

Dodonæa. Sepals valvate. Petals none. Ovules by pairs. Leaves usually simple.

Trib. III. ACERINEÆ. Stamens inserted on the disk. Samaras indehiscent. Leaves opposite.

Acer. Petals none or present. Disk annular. Samaras 2. Leaves simple or palmately lobed.

b. Stamens inserted inside the disk, sometimes unilateral.

Trib. IV. SAPINDEÆ. Leaves alternate, or rarely (in *Æsculus*) opposite. Flowers regular or irregular.

* *Fruit or fruit-lobes indehiscent, drupaceous, fleshy or rarely corticate or crustaceous.*

× Fruit entire, 1—4-celled.

O No petals. Flowers polygamously dioecious.

Schleichera. Calyx small, valvate or nearly so. Disk unilateral. Seeds arillate. Leaves abruptly pinnate.

O O Petals present, furnished with scales. Flowers polygamously monœcious.

LEPISANTHES. Flowers regular. Disk regularly annular. Leaves pinnate.

HEMIGYROSA. Flowers irregular. Disk unilateral, cushion-like. Leaves pinnate.

× × Fruit divided deeply or to the base into 3—2 lobes, the lobes often solitary by abortion of the others.

O Flowers irregular. Arillus none.

† Leaves pinnate. Trees.

DITTELASMA. Fruit deeply 1—3-lobed, the lobes drupaceous, globose. Testa bony. Embryo curved. Disk half crescent-shaped.

ERIOGLOSSUM. Fruit to the base 1—3-lobed, the lobes oblong. Testa membranous. Embryo straight. Disk unilateral.

† † Leaves 3—1-foliolate. Shrubs or small trees.

ALLOPHYLUS. Flowers irregular or almost regular, with the place of the 5th petal empty. Sepals orbicular. Petals with scales. Fruit-lobes fleshy or sappy. Racemes simple or compound.

O O Flowers regular.

† Seeds without arillus.

SAPINDUS. Fruit-lobes deeply or to the base separated, by 2—3 or often solitary by abortion, the pericarp crustaceous or coriaceous, smooth. Testa crustaceous or membranous.

XEROSPERMUM. Fruit-lobes separated to the base, by pairs or solitary, the pericarp crustaceous, tubercled. Testa fleshy and pilose within, resembling an arillus.

† † Seeds truly arillate.

NEPHELIUM. Fruit-lobes 1—3, separated to the base, the pericarp coriaceous to crustaceous, smooth to variously tubercled, muricate, and echinate. Seeds entirely enveloped by the arillus.

B { METIA. Fruit-lobes 1—3, separated to the base, the pericarp corticate, smooth. Seeds arillate at the lower end. Hardly different from *Nephelium*.

* * *Fruit a dry dehiscent capsule, the valves from woody to coriaceous and membranous.*

O Ovules solitary in each cell.

× Trees or shrubs. Leaves pinnate. Capsule coriaceous or woody. Flowers regular.

† Petals cucullate, or the blade shorter than the cucullate scale.

SCYPHOPETALUM. Style obsolete. Petals cucullate, without scale.

PARANEPHELIUM. Petals broadly trigonous, smaller than the cucullate scales. Style long. Capsule 3-valved, woody, tubercled or aculeate-muricate. Leaves pinnate, the end-leaflets ternate.

† † Petals flat or nearly so, longer than the scale if present, or the petals minute or wanting altogether.

CUPANIA. Calyx cup-shaped or the sepals distinct. Capsule 3-quetrous or -lobed or didymous.

× × Twining tendril-bearing undershrubs. Leaves twice ternately foliolate. Capsule bladdery-membranous, inflated. Flowers irregular.

CARDIOSPERMUM. Sepals 4, the 2 outer ones small. Petals 4, with basal scales. Disk almost reduced to 2 round or linear glands opposite the lower smaller petals.

O O Ovules by 2 or more in each cell. Trees.

× Capsule membranous or chartaceous. Flowers regular, the sepals free. Leaves pinnate, alternate.

HARPULLIA. Petals without scales, but sometimes with inflexed lobes at the base of the blade. Stigma linear, often twisted. Capsule didymously 2-lobed, chartaceous, not winged. Seeds arillate.

ZOLLINGERIA. Petals with a woolly scale. Stigma 3-toothed. Capsule by maceration of the cell-walls often 1-celled, 3- or rarely 2-winged, chartaceous. Seeds without arillus.

× × Capsule thick or fleshy-coriaceous. Flowers irregular, the calyx tubular or bell-shaped. Leaves digitate, opposite.

ÆSCULUS. Flowers rather showy. Stigma simple.

Turpinia, Vent.

Conspectus of species.

Leaves apiculate to abruptly acuminate; flowers about 2 lin. across; fruits the size of a cherry, firmly fleshy, ... *T. pomifera.*

Leaves almost caudate; flowers minute, about a line across: fruits the size of a small pea, ... *T. montana.*

1. T. POMIFERA, DC. Prod. II. 3; Hf. Ind. I. 698 pp.—(*Dalrymplea pomifera*, Roxb. Corom. Pl. III. 276. t. 279. and Fl. Ind. I. 633; *T. sphærocarpa*, Hassk. Cat. Bog. 228; Miq. Fl. Ind. Bat. I/2. 593).

HAB. Frequent in the tropical forests of Pegu and still more so in those of Martaban and Tenasserim; also Chittagong.—Fl. Febr.; Fr. C. S.

2. T. MONTANA, (*Zanthoxylon montanum*, Bl. Bydr. 248; Miq. Ind. Bat. I/2. 670).

VAR. α. GENUINA, panicles very slender and lax, as long or longer than the leaves, the ultimate branchings almost filiform.

VAR. β. NEPALENSIS, (*Turp. Nepalensis*, Wall. Cat. 4277, *non* WA.; *T. pomifera var. Nepalensis*, Laws. in Hf. Ind. Fl. I. 699), panicles shorter and more compact, stiff.

HAB. Var. β. frequent in the hill-forests, especially the drier ones, and the pine-forests of Martaban, at 3000 to 7200 ft. elevation.—Fl. March.

Dodonæa, L.

1. D. VISCOSA, L. Mant. alt. 228; Hf. Ind. Fl. I. 697.—(*D. angustifolia*, L. f. Suppl. 218; Roxb. Fl. Ind. II. 256; D. dioica, Roxb. l. c.; *D. Burmanniana*, DC. Prod. I. 616; Wight Ill. t. 52; *D. pentandra*, Griff. Not. Dicot. 548).

HAB. Sandy beaches of the sea-shores of Tenasserim, from Amherst to Mergui; also Andamans, Narcondam Island.—Fr. Febr. March.

Acer, Lin.

Conspectus of species.

× Leaves simple, not lobed, with 3-basal nerves.

Leaves usually whitish beneath, the petiole 1—2 in. long; cymes glabrous, branchlets blackish, ... *A. laurinum.*

Leaves one-coloured, the petiole 3—6 lin. long; cymes panicled, glabrous; branchlets pale brown, ... *A. lævigatum.*

× × Leaves 3-lobed and 3-nerved.

Glabrous; lobes of leaves long acuminate, entire, ... *A. isolobum.*

1. A. LAURINUM, Hassk. in Tydsch. Nat. Gesch. X. 138; Miq. Fl. Ind. Bat. I/2. 582.—(*A. niveum*, Bl. Rumph. III. 193. t. 167. B. f. 1; Hf. Ind. Fl. I. 693).

HAB. Frequent in the damp hill-forests of the Nattoung mountains in Martaban; at 4000 to 7000 ft. elevation; Tenasserim; also Ava, Hookhoom valley (Griff.).

2. A. LÆVIGATUM, Wall. Pl. As. rar. II. 3. t. 104; Hf. Ind. Fl. I. 693.

HAB. Upper Tenasserim, Moulmein District (Falconer).

3. A. ISOLOBUM, Kurz in Journ. As. Soc. Beng. 1872. 302; Hf. Ind. Fl. I. 694.

HAB. Frequent in the damp hill-forests of Martaban, at 5000 to 7000 ft. elevation.

Allied to *A. trifidum*, Thbg.

Schleichera, Willd.

1. SCH. TRIJUGA, Willd. sp. pl. IV. 1096; Roxb. Fl. Ind. II. 277; Bedd. Fl. Sylv. Madr. t. 119; Brand. For. Fl. Ind. 105. t. 20; Hf. Ind. Fl. I. 681.

HAB. Common in all leaf-shedding forests, especially the mixed ones, from Ava and Martaban down to Tenasserim.—Fl. March, Apr.

Lepisanthes, Bl.

Conspectus of species.

Leaves quite glabrous, not stiff; racemes short and dense, clustered to almost solitary, axillary; pedicels very robust, about ½ lin. long; petals inside and scale glabrous, .. *L. montana.*

Leaves large and stiff; leaflets slightly puberulous on the midrib beneath, rigid; racemes in larger or smaller axillary panicles; pedicels capillary, 1½—2 lin. long; scale densely white-villous fringed; simple-stemmed, palm-like treelet, .. *L. Burmanica.*

1. L. MONTANA, Bl. Bydr. 238 and Rumph. III. 151; Miq. Fl. Ind. Bat. I/2. 562.—(*L. Browniana*, Hiern. in Hf. Ind. Fl. I. 680).

HAB. Tenasserim, Tavoy and Keloben (Wall.).

2. L. BURMANICA, Kurz MS.—(*L. montana*, Hiern. in Hf. Ind. Fl. I. 679, *non* Bl.).

Hab. Not unfrequent in the tropical forests of the eastern and southern slopes of the Pegu Yomah and in Martaban, up to 2000 ft. elevation.—Fr. Febr. March.

Leaves very similar to those of *L. sessiliflora*, Bl. I fear that I am to a certain degree to blame for Hiern's misidentification of the plant, in having referred Brandis' specimens, as also my own, to Blume's *L. montana*, under which name I also put it down in my preliminary Report on the Pegu forests. It was hardly possible to avoid such mismatchings in a Report which was drawn up in less than 15 months, in which period more than 1000 species had to be named, and keys furnished for the discrimination of the species.

Hemigyrosa, Bl.

1. H. canescens, Thw. Ceyl. Pl. 56. and 408; Hf. Ind. Fl. I. 671. (*Molinæa canescens*, Roxb. Corom. Pl. I. 43. t 60 and Fl. II. 243).

Hab. Tenasserim, from Moulmein southwards.

I cannot lay so much stress upon the irregularity of the corolla or of the disk as to use it as a divisional character: the most naturally allied genera, such as *Hemigyrosa* and *Lepisanthes*, *Dittelasma*, *Erioglossum*, and *Sapindus*, or *Allophylus* and *Schmiedelia*, are forcibly removed from one another, and, indeed, it remains to be shewn whether this character can be upheld even as a generic differential. In *Sapindus trifoliatus*, L., at least, the flowers can as well be regarded as irregular, and the close affinity of this species to *Hemigyrosa canescens* cannot be denied.

Dittelasma, Hf.

1. D. Rarak, Hf. Ind. Fl. I. 672.—(*Sapindus Rarak*, DC. Prodr. I. 608; Bl. Rumph. III. 93. t. 169; *Sapindus polyphyllus*, Roxb. Hort. Beng. 29; Hf. Ind. Fl. I. 685).

Hab. Rather rare in the tropical forests of the Pegu Yomah; Tenasserim, Moulmein district, rare (Revd. Parish).

Erioglossum, Bl.

1. E. rubiginosum, Brand. For. Fl. 108.—(*E. edule*, Bl. Bydr. 229 and Rumph. III. 119. t. 166, Hf. Ind. Fl. I. 672; *Sapindus rubiginosus*, Roxb. Corom. Pl. I. t. 62 and Fl. Ind. II. 282; Griff. 548).

Hab. Frequent in the tropical, rare in the moister mixed forests, from Pegu and Martaban down to Tenasserim and the Andamans.—Fl. March, Apr.; Fr. May, June.

Allophylus, L.

Conspectus of species.

× Rachis of racemes glabrous or nearly so. Bractlets shorter than the pedicels.

Leaflets glabrous, except a tuft of hairs in the nerve-axils beneath; racemes simple; berries the size of a pepper-corn, ... *A. racemosus.*

× × Rachis of racemes more or less pubescent or villous.

All softer parts and leaves pubescent or villous-pubescent; bractlets minute; berries the size of a pepper-corn, ... *A. serratus.*

Rather glabrous, the nerves of the leaves villous above: racemes usually recurved, the bractlets linear-subulate, as long or longer than the pedicels; berries the size of a pea, ... *A. aporeticus.*

1. A. LITTORALIS, Bl. Rumph. III. 124. (*Schmidelia littoralis*, Bl. Bydr. 232; *Ornithrophe glabra*, Roxb. Fl. Ind. II. 267).

HAB. Frequent in the tidal and beach-forests, from Chittagong down to Pegu and Tenasserim; also Andamans.—Fl. Febr. to July.

2. A. SERRATUS, (*Schmidelia serrata*, DC. Prod. 610; WA. Prod. I. 110; *Schmidelia villosa*, Wight Icon. t. 401; *Ornitrophe villosa*, Roxb. Fl. Ind. II. 265).

HAB. Coast-forests from Chittagong and Arracan down to Tenasserim.

3. A. APORETICUS, (*Schmidelia aporetica*, Kurz in Journ. As. Soc. Beng. 1870. 74; *Ornitrophe aporetica*, Roxb. Fl. Ind. II. 264).

HAB. Frequent in the upper mixed forests of Arracan, up to 1200 ft. elevation.—Fl. Fr. Octob.

Hiern makes 2 species of Indian *Allophyli*, viz., those with 1- and those with 3-foliolate leaves, but this character falls to the ground, inasmuch as his *A. zeylanicus* var. 6 *grandifolia* (= *Schmidelia chartacea*, Kurz in Journ. As. Soc. Beng. 1874. 183) has sometimes 1- and 3-foliolate leaves on the same branch. I have not been able as yet to *study* this genus, but I have little doubt but that Hiern's eminently practical conclusions will not stand a scientific test.

Sapindus, Plum.

Conspectus of species.

× Leaves pubescent. Leaves unpaired-pinnate.

All softer parts pubescent; leaflets in 3—4 pairs with an odd one, ... *S. tomentosus.*

× × All parts glabrous.

O Leaves simple.

Leaves cordate at the narrowed base, the petiole very short and thick; anthers yellow; petals emarginate; the scale double, woolly; fruit-lobes the size of a pea, *S. Danura.*

Leaves acuminate or acute at the base, the petiole of the lower leaves long and longer; anthers purple: petals rounded at apex; the scale very short, simple, woolly; fruit-lobes about doubly smaller, ... *S. verticillatus.*

O O Leaves 2-foliolate.

Petiole only about 2 lin. long; leaflets oblong, about 2 in. long, sessile; panicles very slender; fruit-lobes didymous, 1½—2 lin. long, ... *S. microcarpus.*

1. S. TOMENTOSUS, Kurz MS.

HAB. Ava, Khakhyen hills, Mynela (J. Anderson).

2. S. DANURA, Voigt. Cat. Hort. Calc. 94; Hf. Ind. Fl. I. 684, excl. syn. *S. verticillata*, Roxb.—(*Scytalia Danura*, Roxb. Fl. Ind. II. 274; *Euphoria verticillata*, Lindl. Bot. Reg. t. 1059, *non* Roxb.).

HAB. Frequent in the tidal forests of the Andamans, also in those of Pegu and Tenasserim.

In this species abnormal leaves are often observed of a semipinnate and even perfectly pinnate shape. Roxburgh's *Scytalia verticillata* is in my opinion a different plant. Wallich's Cat. 8052 D., from HBC. and hills east of Sylhet, may be taken as the type of it.

3. S. MICROCARPUS, Kurz MS.

HAB. In the adjoining Siamese province of Kanbooree (Teysman); probably also in Upper Tenasserim.—Fr. Apr. May.

Xerospermum, Bl.

1. X. NORONHIANUM, Bl. Rumph. III. 100; Miq. Fl. Ind. Bat. I/2. 552.

HAB. Tenasserim (Helf. 1006).

Mr. Hiern confounds two generically different plants, viz., the true Malayan plant and *Sapindus glabratus*, Wall. (= *Cupania glabrata*, Kurz), from Sylhet and the Khasi hills.

Nephelium, L.

Conspectus of species.

* *Petals none. Calyx toothed.*

O Fruits covered with soft fleshy subulate or angular-conical prickles.

Glabrous; leaflets glaucous or whitish beneath; prickles of the fruit fleshy, long, conically angular, truncate, glabrous, ... *N. Griffithianum.*

As preceding but leaflets broader; prickles of fruit variously curved and incurved, ½—¾ in. long, tawny pubescent at their dilated bases, subulate or rarely 2-cleft, *N. chryseum.*

Leaflets more coriaceous, pale coloured beneath or almost one-coloured; fruits and prickles as in preceding but quite glabrous, ... *N. lappaceum.*

O O Fruits tubercled.

Leaflets very coriaceous, small, the net-venation quite obsolete, the nerves thin and faint; fruit-lobes ellipsoid-oblong, the size of a prune, covered with sharp compressed-tesselate tubercles, ... *N. Litchi.*

* * *Petals present. Calyx cleft to ½ or to near the base.*

Leaflets firmly coriaceous, glaucescent beneath, in drying fuscescent, the lateral nerves thin and slightly prominent; fruit-lobes oblong, shortly muricate, the murices about a line long, sharp, ... *N. rubescens.*

Leaflets thin coriaceous, more or less glaucescent beneath, the numerous (14—20) lateral nerves strongly prominent beneath; fruit-lobes ovoid-oblong, the size of a plum, perfectly glabrous, strongly tubercled as in *N. Litchi*, but not tesselate, ..*N. hypoleucum.*

As preceding but leaflets usually smaller; fruit-lobes globose, the size of a small cherry, obsoletely tubercled or almost smooth, minutely tawny velvety all over, *N. Longanum.*

1. N. GRIFFITHIANUM, Kurz in Journ. As. Soc. Beng. 1872. 303.—(*Sapindacea*, Griff. Not. Dicot. IV. 550. t. 599. fig. 1).

HAB. Ava, Khakhyen hills (Griff. J. Anderson).—Fr. May.

Hiern identifies the above species with *N. mutabile*, Bl., a species which is distinguished at once by its irregularly tubercled fruit-lobes (hence Blume formerly confounded it with *Euphoria Longan*). His description seems to have been drawn up from specimens belonging to two or three different species, but chiefly to *N. chryseum*, Bl. (Maingay No. 449, Griff. 997/1).

2. N. LAPPACEUM, Linn. Mant. I. 125; Hf. Ind. Fl. I. 687.—(*Scytalia Rampoutan*, Roxb. Fl. Ind. II. 271).

HAB. Upper-Tenasserim (Brandis),—cultivated?

3. N. LITCHI, Camb. in Mém. Mus. Par. XVIII. 30; Wight Icon. t. 43; Hf. Ind. Fl. I. 687.—(*Scytalia Litchi*, Roxb. Fl. Ind. II. 269).

HAB. Chittagong, cultivated.—Fl. Febr. to March; Fr. Apr. to June.

4. N. RUBESCENS, Hiern in Hf. Ind. Fl. I. 688.

HAB. Tenasserim (Wall.) *teste* Hiern.

5. N. HYPOLEUCUM, Kurz in Journ. As. Soc. Beng. 1871. 50 and 1874. 183, sub No. 10.

HAB. Rare in the tropical forests along the eastern slopes of the Pegu Yomah, but frequent in those of Martaban, up to 1000 ft. elevation; also cultivated.—Fl. Jan.; Fr. Apr.

N. B.—This species occurs also in Hindostan (Wight 540), Concan (Stocks, &c.), and wild in the sholas of the Pulney hills.

6. N. LONGAN, Camb. in Mém. Mus. Par. XVIII. 30; Hf. Ind. Fl. I. 689.—(*Scytalia Longan*, Roxb. Fl. Ind. II. 170; *Euphoria Longana*, Lamk. Dict. III. 574; Bot. Mag. t. 4096; Bot. Neg. t. 1729; Bedd. Fl. Sylv. Madr. t. 156?)

HAB. Rare in the tropical forests along the eastern slopes of the Pegu Yomah; also cultivated.—Fl. March; Fr. May to June.

Pometia, Forst.

1. P. TOMENTOSA. Bth. and Hf. Gen. pl.; Hf. Ind. Fl. I. 691 pp.—(*Irina tomentosa*, Bl. Bydr. 236; Miq. Fl. Ind. Bat. I/2. 558; *Eecremanthus eximius*, Thw. in Hook. Kew Journ. VII. 272. t. 9; *P. eximia*, Bedd. Fl. Sylv. Madr. t. 157).

HAB. Common in the tropical forests of the Andamans.—Fr. May, June.

Distinguishable at once from *P. pinnata*, Forst., by its small and very differently shaped fruits.

Paranephelium, Miq.

1. P. XESTOPHYLLUM, Miq. Suppl. Fl. Sumatr. 509.—(*Mildea xestophylla*, Miq. Ann. Mus. Lugd. Bat. III. 88).

Hab. Tenasserim, Moulmein District (Falconer).

In HBC. are some leaves from the Khakhyen-hills which apparently represent a second Burmese species of this genus, if they should not be identical with Hiern's *Scyphopetalum*, the description of which is too imperfect to enable one to recognize from it the plant intended. They have the 3 end-leaflets similarly ternate and in texture and nervature are almost the same as the above.

Scyphopetalum, Hiern.

1. S. ramiflorum, Hiern in Hf. Ind. Fl. I. 676.

Hab. Ava, hill-forests of Hookhoom valley (Griff.) *teste* Hiern.

I have not seen this plant, and place it near *Paranephelium* simply by guess. The petals are differently described and the style is said to be obsolete,—characters which would keep it distinct from Miquel's genus.

Cupania, Plum.

Conspectus of species.

Subg. I. Eu-Cupania. Capsules clavate-pyriform, more or less conspicuously 3-lobed or angular, coriaceous.

* *Petals present, furnished with a double scale.*

× Leaves and panicles glabrous.

Leaflets opaque, glaucescent beneath, the nerves thin; rachis narrowly winged upwards, .. *C. Griffithiana.*

Leaflets glossy, one-coloured, strongly nerved and net-veined; rachis terete, *C. glabrata.*

× × Leaflets beneath and panicle shortly tawny pubescent.

Leaflets chartaceous, fuscescent in drying, opaque, ... *C. fuscidula.*

* * *Petals none or minute, without scales.*

Net-venation minute and obsolete; filaments glabrous; leaflets in 2 pairs, *C. Lessertiana.*

Net-venation strong and prominent on both sides; filaments exserted, pubescent; leaflets not fuscescent, ... *C. Sumatrana.*

Net-venation thin but prominent; filaments short, pubescent; leaflets fuscescent, .. *C. Helferi.*

Subg. II. Arytera, Bl. *Capsule nearly to the base divided into 2 divergent lobes, coriaceous.*

Leaflets chartaceous, reddish fuscous beneath, glabrous; panicles tawny puberulous, .. *C. adenophylla.*

1. C. Griffithiana, Kurz (*C. pleuropteris,* Hiern in Hf. Ind. Fl. I. 677, *non* Bl.).

Hab. Tenasserim (Helf. 983).

What Mr. Hiern describes as *C. pallidula* (Maingay 442; Griff. 982) is *C. pleuropteris,* Bl.

2. C. glabrata, Kurz in Journ. As. Soc. Beng. 1872. 303. (*Sapindus glabratus,* Wall. Cat. 8095).

Hab. Rather frequent in the tropical forests along the eastern slopes of the Pegu Yomah and also in Martaban.—Fl. Apr. May.

I do not know what Hiern describes under the above name, but generally, I think, he has my plant under view. *Sapindus squamosus*, Roxb. is *Cupania regularis*, Bl., differing from it (*Sapindacea* 4. Java, Horsfield Coll. is the typical form) in having the petiolules not incrassate.

3. C. FUSCIDULA, Kurz in Journ. As. Soc. Beng. 1872. 302; Hf. Ind. Fl. I. 677.

HAB. Tenasserim (Helf. 993).

4. C. LESSERTIANA, Camb. Mém. Mus. Par. XVIII. 46. t. 3.; Hf. Ind. Fl. I. 678.

HAB. Frequent in the tropical forests of the Andamans; Tenasserim, Mergui.—Fl. May, June.

5. C. SUMATRANA, Miq. Fl. Ind. Bat. I/2. 609; Hf. Ind. Fl. I. 678.

HAB. Rare in the tropical forests of the Central Pegu Yomah; apparently frequent in Tenasserim from Moulmein down to Mergui.—Fr. Apr. May.

6. C. HELFERI, Hiern in Hf. Ind. Fl. I. 679.

HAB. Tenasserim or Andamans (Helf.) *teste* Hiern.

Not known to me, unless No. 982/1 of Helfer's collection be meant.

7. C. ADENOPHYLLA, Planch. in Hf. Ind. Fl. I. 677.

HAB. Tenasserim, from Moulmein to Mergui.

Cardiospermum, L.

Conspectus of species.

Slightly pubescent or glabrous; leaflets often acuminate produced; flowers 1—1½ lin., .. *C. Halicacabum.*

Softly pubescent; leaflets usually short and broad; flowers 2—3 lin., ... *C. canescens.*

1. C. HALICACABUM, L. sp. pl. 925; Roxb. Fl. Ind. II. 292; Wight Icon. t. 508; Bot. Mag. t. 1049; Griff. Dicot. 546. t. 599; Hf. Ind. Fl. I. 670.

HAB. Not unfrequent in waste places, along river banks, &c., of the plains, all over Burma.—Fl. and Fr. H. and R. S.

2. C. CANESCENS, Wall. Pl. As. rar. I. 14. t. 14; Wight Icon. t. 74; Hf. Ind. Fl. I. 670.

HAB. Ava, apparently common.—Fl. Fr. ∞.

Harpullia, Roxb.

1. H. CUPANIOIDES, Roxb. Fl. Ind. I. 645; Hf. Ind. Fl. I. 691 (*Streptostigma viridiflorum*, Thw. in Hook. Journ. Bot. VI. 298. t. 9. A; *H. imbricata*, Thw. Enum. Ceyl. Pl. 56; Bedd. Fl. Sylv. Madr. t. 158).

HAB. Frequent in the tropical forests of the Andamans; Chittagong. Fl. June.

Æsculus, L.

1. A. Assamica, Griff. Not Dicot. 541.—(*Hippocastaneæ* sp., Griff. l. c.; *A. Punduana*, Wall. Cat. 1189, *nomen nudum*; Hf. Ind. Fl. I. 675).

Hab. Damp hill-forests of Upper Tenasserim.—Fl. Apr.

Zollingeria, Kurz.

1. Z. macrocarpa, Kurz in Journ. As. Soc. Beng. 1872. 303; Hf. Ind. Fl. I. 692.

Hab. Not unfrequent in the dry forests of the Prome District, along the spurs of the Yomah.—Fl. probably close of R. S.; Fr. March.

The genus is named in honour of the late H. Zollinger, the author of so many valuable botanical papers, which, owing to their being written in the Dutch language, remain almost unknown to the majority of botanists.

[To be continued.]

XV.—*List of* Reptilia *and* Amphibia *collected by the late* Dr. Stoliczka *in Kashmir, Ladák, Eastern Turkestán, and Wakhán, with descriptions of new Species.*—*By* W. T. Blanford, *F. R. S., F. Z. S.*

(Received Oct. 30th,—Read Nov. 4, 1875.)

The following list of the Reptilia and Amphibia in Dr. Stoliczka's collections is similar to that of the Mammalia already printed in this Journal (*ante*, p. 104), and is similarly published in anticipation of full accounts, which cannot be issued until the accompanying illustrations are ready. It is proposed to figure all new species.

The country traversed by Sir D. Forsyth's mission, to which Dr. Stoliczka was attached as naturalist, may be considered as consisting of the following zoological subdivisions:—hills between the Panjáb and Kashmir, the Kashmir valley, Ladák (the upper Indus valley, extending to the Karakoram), the Kuenluen range south of Yárkand, Eastern Turkestán (comprising the plains around Yárkand and Káshghar), Sarikol (the hilly country between the Turkestán plains and the Pámir and Wakhán).

The collections would, doubtless, have been much larger had not a great portion of the country been traversed in the depth of winter, when the ground was covered with snow, and no reptiles could be seen. None were consequently obtained on the southern slopes of the Thian Shan mountains nor on the Pámir.

The only orders of *Reptilia* represented are those of lizards and snakes. No tortoises were met with.

REPTILIA.

LACERTILIA.

1. Stellio Himalayanus.—Ladák.
2. S. tuberculatus.—Hills between the Panjab and Kashmir.
3. S. Agrorensis.—Jhilam valley, Kashmir.
4. S. Stoliczkanus, sp. nov.

S. *squamis dorsalibus mediis majoribus, haud in lineas regulares ordinatis, obtuse carinatis, lateralibus minoribus, acute carinatis, postice subæqualibus; nonnullis mucronatis circum tympanum, et in fasciculos ad latera colli et supra humeros dispositis; caudalibus carinatis, mucronatis verticillatis, dorsales vix magnitudine excedentibus; stramineus, capite dorsoque posteriore nigro-punctatis, dorso anteriore nigro, stramineo transversim fasciato.*

Hab.—Plains of Eastern Turkestán.

The distribution of the scales on the back is somewhat as in *S. Caucasicus*, but that appears to be a stouter form with far more enlarged scales on the sides, larger tail scales, and a patch of thickened scales in the middle of the abdomen which is wanting in the form now described. The present species may be near *S. Aralensis* (*Agama Aralensis*, Licht. in Eversmann's 'Reise nach Buchara', p. 144), the only other steppe form known, but that species is described as being very differently coloured, as having the toes fringed, and the dorsal scales strongly keeled and pointed.

5. Phrynocephalus Theobaldi.

P. Theobaldi, Blyth, J. A. S. B., 1863, XXXII, p. 90.
P. caudivolvulus, Günther, Rept. Brit. Ind. p. 161, *nec* Pallas.
P. Stoliczkai, Steindachner, Novara-Expedition, Reptilien, p. 23, Pl. I, Fig. 6, 7.
P. caudivolvulus and *P. Forsythi*, Anderson, P. Z. S., 1872, pp. 387, 390.

Hab. Ladák; Kuenluen; Eastern Turkestán; Sarikol.

After going through the various descriptions of *Lacerta caudivolvula* by Pallas, Eversmann, and Eichwald, and comparing their figures with the Tibetan species, I am satisfied that the form originally described by Pallas is different, and that it is probably one of the smooth species like *P. maculatus* and *P. axillaris*, both of which have a habit of coiling their tails, whilst *P. Theobaldi* has never been observed to do so. The markings on the tail in all *Phrynocephali* are very constant and those of the true *P. caudivolvulus* are different from those of *P. Theobaldi*. It is impossible to enter at length into this subject here, but in the full account of the species I shall give my reasons in full for changing the name.*

Although the form called by Dr. Anderson *P. Forsythi* appears distinct at first and is, as a rule, differently coloured on the body, I can find no constant distinction from *P. Theobaldi*.

6. P. axillaris, sp. nov.

P. major, lævis, cauda elongata, pede anteriore in adulto vix femur attingente, squamis omnibus lævibus, caudæ apicem versus exceptis; supra griseus, maculâ rubrâ utrinque post axillam notatus, membris caudaque fasciis fuscis transversis signatis, hac ad medium fusco-annulatâ, nunquam ad apicem nigrâ, subtus albidus. Long. tota poll. 5—6, *caudæ* ⅔ *totius longitudinis subæquante.*

* I should, however, mention that I think there is reason to doubt whether the specimens assigned to *P. caudivolvulus* in the Berlin Museum are rightly named. It was upon Dr. Peters's comparison of Tibetan specimens with the former that Dr. Günther based his identification. At all events, the characters of a specimen from the Berlin Museum described by Dumeril and Bibron differ from the original description given by Pallas.

Hab.—Eastern Turkestán, in the plains.

A large, rather long-tailed species, with the same structure as *P. maculatus* and the same habit of coiling its tail. It is distinguished, when adult, by its limbs being shorter and the toes less fringed, and by colouration. *P. axillaris* has a red spot behind each shoulder so as to be partly concealed by the fore limb when laid back and it never has the tip of the tail black whilst *P. maculatus* always has.

7. Teratoscincus Keyserlingii.—Eastern Turkestan.

8. Gymnodactylus Stoliczkæ.

Cyrtodactylus Yarkandensis, Anderson. P. Z. S., 1872, p. 381.

Hab.—Ladák.

From an examination of Dr. Anderson's type specimen, I have ascertained that it is identical with the species previously described and figured by Steindachner (Rept. Nov. Exp. p. 15, Pl. II, fig. 2). I also think that Dr. Anderson must have been misinformed as to the original locality of the specimen he described, for the species abounds in Ladák, whilst it is replaced by other forms of the genus at Yárkand.

9. G. elongatus, sp. nov.

G. *elongatus, corpore gracili, caudâ attenuatâ, membris exilibus, dorso tuberculis majoribus latis confertis ornato, inter tuberculas squamis rotundis parvulis induto, caudâ subtus scutis majoribus instructâ, verticillatâ serie ultimâ verticilli cujusque ex squamis majoribus carinatis superne et ad latera omnino compositâ, poris præanalibus ad* 5; *griseus transverse fusco fasciatus. Long. poll.* 5, *caudæ* 2.8.

Hab.—Yangihissar, Eastern Turkestán.

A peculiarly elongate form of the group of *G. Caspius*, distinguished from that and all allied species by its slenderness and by the peculiarity of the tail having no spinose tubercles, but only the last row of scales in each ring enlarged and carinate without any intervening small scales.

10. G. microtis, sp. nov.

G. *parum robustus, capite brevi, depresso, meatu auditorio minimo; caudâ attenuatâ, lævi, haud verticillatâ, membris breviusculis; dorso granulato, tuberculis subcarinatis ornato; arenarius, fusco minute punctatus, subtus albescens. Long. tota* 3.2 *poll., caudæ* 1.8.

Hab.—Eastern Turkestán.

A small sandy coloured species with a smooth tail and the back tuberculated. It is remarkable for its very small ear-orifice. It appears to be a house-gecko and was found about old walls. It is probably allied to the species described by Pallas under the name of *Lacerta pipiens*, but that

is said by its describer to have all the back scales granular, and to be marked with angulate cross bands.

11. Eremias Yarkandensis, sp. nov.

E. cæruleo-ocellata, Anderson, P. Z. S., 1872, p. 373, *nec* Dum. et Bib.

E. *gracilis, supra grisea vel olivacea, nigro-maculata, ocellis albidis nigro marginatis utrinque ad dorsum in seriem longitudinalem dispositis; subtus albida; scutis nasalibus haud tumidis, præfrontali unico, a rostrali supranasalibus atque a verticali postfrontalibus longe disjuncto; infra-orbitali ad labrum pertinente; dentibus palatalibus nullis; scutis ventralibus in series longitudinales (potius obliquas)* 14—16, *et in transversas ad* 30 *dispositis; poris femoralibus utrinque* 9—14, *squamis infradigitalibus vix carinatis. Long.* 6 *poll., caudæ* 3.7.

Hab.—Eastern Turkestán.

This species was referred by Dr. Anderson to *E. cæruleo-ocellata* of Dumeril and Bibron, but it appears to me to differ in having the nasal shields not swollen, the dorsal scales closer together, almost without intervening granules, and, I think, in being more slender. *E. cæruleo-ocellata* has the tail scales keeled; as a rule they are smooth in the basal portion in *E. Yarkandensis* but the character is not constant. This species appears more closely allied to *E. multiocellata* Günther and may perhaps be identical, but that form is described as having an azygos shield between the postfrontals, an enlarged shield in the middle of the collar, and 18 rows of scales across the belly. I scarcely think, too, that Dr. Günther would have omitted to mention the absence of tumidity in the nasal shields which distinguishes *E. Yarkandensis* from other forms of the genus.

11*a*. E. Yarkandensis, var. saturata.

E. Yarkandensis *magis infuscata, scuto infra-orbitali diviso, parte superiori a labro discreto.*

Hab.—Valleys of the Kuenluen range, south of Yárkand.

This differs from the type in having the infra-orbital shield divided, and in darker colour. Neither character, however, is quite constant, and there is one dark specimen with the infra-orbital undivided.

12. Eremias vermiculata, sp. nov.

E. *supra grisea, nigro-vermiculata, subtus albida, elongata, gracilis; dorso granulosa, scutis nasalibus tumidis, præfrontali unico a rostrali supranasalibus atque a verticali postfrontalibus longe disjuncto; supra-orbitalibus convexis, omnino squamis minimis rotundis circumdatis; infra-orbitali late ad labrum pertinente, dentibus palatalibus nullis; scutis ventralibus in series* 16—20 *longitudinales (potius obliquas), atque* 36—41 *transversus dispositis; poris femoralibus utrinque* 19—23; *squamis infradigitalibus vix carinatis. Long.* 7·4 *poll., caudæ* 5·1.

Hab.—Eastern Turkestán.

Allied to the last, but more slender with a longer tail and longer limbs. It has more numerous ventral scales and femoral pores, swollen nasal shields, the supraorbital disk surrounded by granules, and different colouration.

13. Eumeces tæniolatus.—Between Mari in the Panjáb and Kashmir.

A single specimen 13 inches long, stouter than the type, and with 23 rows of scales round the body.

14. Mocoa Himalayana.—Mari, Panjáb; Kashmir.

15. M. Stoliczkai (? = *M. Ladacensis*).

Euprepes Stoliczkai and *E. Kargilensis*, Steindachner, Novara Expedition, Reptilian, pp. 45, 46.

Eumeces Ladacensis, Anderson, P. Z. S., 1872, p. 375.

Hab.—Ladák.

I am unable to identify this species satisfactorily with *Eumeces Ladacensis*, Günther, because in not one out of the twenty-four specimens collected does the forefoot reach the end of the snout. Anderson also noticed this Still I think it probable that the two are identical.* *E. Kargilensis* was chiefly distinguished by Steindachner because of its having 4 instead of 5 supralabials before the infraorbital. In some specimens collected there are 4 on one side and 5 on the other.

OPHIDIA.

16. Typhlops porrectus?—Jhilam valley between Mari and Kashmir.

This appears stouter than the type and may be distinct. Only a single specimen was obtained.

17. Compsosoma Hodgsoni.—Kashmir.

18. Ptyas mucosus.—Kashmir.

19. Zamenis Ravergieri.

Coluber Ravergieri, Men. Cat. Rais. p. 69, (1832).

Zamenis caudælineatus Günther, Cat. Col. Snakes, Brit. Mus., p. 104 (1858).

Z. Ravergieri and *Z. Fedtschenkoi*, Strauch, Schlangen des Russischen Reichs, Mem. Acad. Sci. St. Pet. XXI, No. 4, p. 127 (1873).

Hab.—Eastern Turkestán.

The colouration of the three specimens obtained is that of the variety called by Strauch *Z. Fedtschenkoi*, in which the tail is spotted instead of being striped. In describing the specimens found in Persia, I have shewn that the two forms pass into each other.

* The locality of *E. Ladacensis*, Günth. Rept. Brit. Ind. p. 88, rests upon the authority of the Messrs. Schlagintweit, and consequently no reliance can be placed upon its accuracy.

20. Tropidonotus hydrus.—Eastern Turkestán.
21. T. platyceps.—Mari and Kashmir.
22. Taphrometopum lineolatum.—Eastern Turkestán.
23. Vipera obtusa.

V. Euphratica, Martin, P. Z. S., 1838, p. 82.
V. obtusa, Dwigubsky, *teste* Strauch Mem. Acad. St. Pet. XXI, No. 4, p. 221.

24. Halys Himalayanus.—Mari and Kashmir.

AMPHIBIA.

BATRACHIA.

1. Rana cyanophlyctis.—Between Mari and Kashmir.
2. Diplopelma carnaticum.—Tináli between Mari and Kashmir.
3. Bufo viridis.—Kashmir; Eastern Turkestán; Wakhán.
4. B. calamita?—Kashmir.

XVI.—*Notes on a few new Oaks from India.*—*By* S. Kurz.

(With Plate XIV.)

(Received Sept. 30th;—Read Nov. 4th, 1875.)

Some time ago I received, through the kindness of Capt. J. Waterhouse, two acorns collected by Capt. W. G. Hughes, Deputy Commissioner of the hill-districts of Arracan. They were obtained in the hills of Arracan at some 5000 or 6000 ft. elevation and proved interesting, the one as being a full-grown acorn of *Quercus mespilifolia*, a species previously known only from Ava and Prome and which I have hitherto considered (see Flora, 1872, p. 398) to be only a variety of *Q. semiserrata*, but which I must now acknowledge as an entirely distinct species; the other as being a young specimen of a new species of which a full-grown cluster of acorns from Assam exists in the Calcutta Herbarium. I have in vain tried to obtain either flowers or leaves of this species from the Khasya Hills, and, consequently, am compelled to name and describe it solely from the fruit. I have to do the same in the case of to *Q. olla*, another new species from Assam. The figures, however, will, I hope, assist in their future identification. I take this opportunity of giving descriptions of a few other new species collected by myself and others in the Sikkim Himalaya and Burma.

1. Quercus xylocarpus, nov. sp., Pl. XIV, Figs. 5—8.

Fructus per 2—3 in massam irregulariter obovoideam 1—2 poll. in diametro connati; nuces apice tantum liberæ, depresso-globosæ, læves; cupulæ dum immaturæ nuces omnino includentes demum circulariter apertæ et nucis

apicem exponentes, grosse et irregulariter lignoso-muricatæ, glabræ, tuberculis (resp. squamis) brevi-conicis obtusiusculis lineam circiter longis marginem versus minoribus et obsoletis obsolete-multiseriatim obtectæ.

Hab.—Arracan Yomah, east of Akyab, at 4000 to 5000 feet elevation; Assam. (Hughes).

2. Quercus olla, nov. sp., Plate XIV, Fig. 9.

Rami adulti læves, nigri; spica fructifera c. 4 pollicaris, robusta; cupulæ liberæ cum 1—2 parvis abortivis basi adnatis, subturbinatæ, poll. in diametro et circiter ½ poll. altæ, crassissimæ, fulvello-tomentellæ, squamis numerosissimis latissimis atque breviter et abrupte acuminatis multiseriatis obductæ; glans depresso-globosa e cupulâ vix exserta, lævis, nitens, subcapitato-mucronata.

Hab.—Assam (Jenkins).

3. Quercus pachyphylla, nov. sp., Plate XIV, Figs. 1—4.

Arbor 50—60-pedalis, glabra, ramulis nigris, gemmis glabris; folia oblongo-lanceolata, petiolo crasso 2—3 lin. longo suffulta, longe et magis minusve abrupte acuminata, basi inæquali acuta, crasse coriacea, 3—5 poll. longa, costa nervisque circiter 8 utrinque supra impressis subtusque crasse prominentibus percursa; spicæ femineæ crassæ, pruinosæ, 3—4 poll. longæ; flores feminei 2—4- (vulgo 3-) ni; perigonium brunneo-squamatum villosulum; stigmata 3, raro 4, crasse linearia, lin. fere longa, erecto-patentia; pedunculus fructigerus crassus, 2—4 poll. longus; cupulæ maturæ 1–1½ poll. in diametro, crasse coriaceæ, cinereo- v. subgilvo-tomentellæ, squamis lato-ovato-trigonis acutis crassis in series circiter 9—12 indistincte annulatim dispositis, vulgo per 2—3 et plures in massam magis minusve confluentes; glans pollicem circiter lata, depressiuscule hemispherica, bene evoluta e cupulâ fere semiexserta, glabra, nitida, in glomeribus nondum evolutis minus exserta.

Hab.—Frequent in the hill-forests of the Tongloo and Phalloot mountains at 7—8000 ft. elevation (collected also by G. Mann, S. Gamble, etc.)

This species as well as the two foregoing all belong in the vicinity of *Quercus spicata*. *Q. pachyphylla* very much resembles *Q. squamata*, Roxb., a species which in my opinion is incorrectly referred as a synonym to *Q. spicata*.

4. Quercus Falconeri, nov. sp.

Arbor glabra; folia iis *Goniothalami sesquipedalis* simillima, elongato-oblonga, 1½—1 ped. longa, basi acuta, petiolo crasso glabro 3—4 lineali suffulta, breviter acuminata v. apiculata, tenuiter coriacea, utrinque lucida, glabra, nervis numerosis (circiter 20 utrinque) supra impressis, subtus prominentibus,

reticulatione satis obsoletâ; spicæ fructigeræ 1½ ped. circiter longæ, tomentellæ, glandes obovoideo-globosæ, pollicem fere latæ, læves, styloso-apiculatæ, pallide brunneæ et nitidæ, exsertæ; cupulæ concavo-explanatæ, marginibus plus minusve revolutis, crasse coriaceæ, extus ferrugineo-velûtinæ, intus canescenti-sericeæ, liberæ v. rarius basi tantum connatæ, squamis numerosis triangularibus parvis appressis obductæ.

Hab.—Upper Assam (Falconer). Very nearly allied to *Q. Amherstiana*, Wall.

5. Castanea diversifolia, nov. sp.

Arbor 40—60-pedalis, novellis fulvo-pubescentibus; folia valde variabilia, novella chartacea, ovato-oblonga ad ovata, 7—9 poll. longa et 4—4½ poll. lata, petiolo semipollicari pubescenti suffulta, in nervis utrinque parum pubescentia, nervis reticulatione laxâ crassâ et conspicuâ; adulta multo minora, coriacea, elliptico-oblonga, breviter et obtuse acuminata, 4½—6 poll. longa, utrinque pagina v. petiolo et in nervis utrinque puberula et glabrescentia, squamis minutis argenteis destituta; paniculæ magnæ et robustæ, apicibus ramulorum congregatæ dense fulvo v. cinereo-tomentosæ; fructus involucrum 1½ poll. fere in diametro, spinis obtectum; spinæ simplices, strictæ, pubescentes, circa 4 lin. longæ.

Hab.—Common in the drier hill forests of Martaban, at 3,500—5000 ft. elevation.

I describe this species as a *Castanea* connecting *Castanopsis* (including *Lithocarpus*) with *Castanea*. This, of course, is quite a practical division for the differences between all these genera are simply artificial ones.

Explanation of Plate XIV.

Figs. 1—4. *Quercus pachyphylla*, Kurz. Fig. 1, fruiting spike; fig. 2, leaf-branch; fig. 3, female inflorescence; fig. 4, female flowers, somewhat magnified.

Figs. 5—8. *Quercus xylocarpa*, Kurz. Figs. 5 and 6, ripe fruit clusters, from above and from below; fig. 7, unripe, ditto, from Arracan; fig. 8, scales, somewhat magnified.

Fig. 9. *Quercus olla*, Kurz. Acorns, from the side and from above; natural size.

XVII.—*On a new Species of* Tupistra *from Tenasserim.*—*By* S. Kurz.

(Received Sept. 30th;—Read Nov. 4th, 1875.)

From amongst the many fine plants which I owe to the late Dr. F. Stoliczka I have selected for description this new species of *Tupistra*, a genus that has hitherto been supposed to be monotypic. The present species is remarkable for its stiff robust erect spikes, those of *T. nutans* being short,

comparatively slender, and so much decurved that the fruits when ripe are usually buried in the mould of the dark forests in which the plant grows.

Baker, in his Revision of *Asparageæ* (Journ. Linn. Soc., XIV. 581), adds a doubtful species (*T. ? Singapuriana*, Wall.) to the genus. Of this I have seen only a very bad specimen without fruit or flower, but to me it appears a *Hypoxidea* or more likely a species of *Apostasia*. The same author makes *Veratronia*, Miq., a *Palmacea* (from which the fleshy scanty albumen would alone remove it), having evidently overlooked a little note of mine on this genus in the Flora, 1873, p. 224, where I have identified the plant with *Susum anthelminticum* of Blume. In this note I have inadvertedly overlooked *Susum minus*, Miq. Suppl. Fl. Sumatr. 598, which should be added as a synonym to *S. Kassintu*, Kurz.

TUPISTRA STOLICZKANA, nov. sp.

Herba perennis 3—4-pedalis, glabra; folia iis *T. nutantis* similia sed multo majora et latiora, lanceolata, utrinque acuminata, in petiolum 1—1½ pedalem complicatum membranaceo-marginatum decurrentia, 2½—3 ped. longa, 4—5 poll. lata, chartacea; spicæ radicales, circ. 1 ped. altæ, strictæ erectæ, robustæ, pedunculo c. 4 pollicari suffultæ, glabræ; flores sessiles, mediocres, ½—⅔ poll. in diametro, bracteâ latissimâ cucullatâ obtusâ infractâ sustenti; corolla 6-loba, tubus urceolato-campanulatus, limbi laciniæ lineari-lanceolatæ c. 3 lin. longæ, obtusiusculæ, basi ad faucem antheram sessilem oblongam utrinque truncatam 2-locularem gerentes; ovarium ovoideum, 3-loculare; stylus sulcatus, crassus, circ. 1 lin. longus; stigma magnum, convexo-peltatum, lobatum, scabrum; baccæ valde immaturæ ovoideo-globosæ, cerasi magnitudinis.

HAB.—Upper Tenasserim, Moulmein District (Dr. F. Stoliczka).

XVIII.—*Descriptions of new Indian Plants.*—*By* S. KURZ.

(With Plate XV.)

(Received Sept. 30th;—Read Nov. 4th, 1875.)

1. ZANTHOXYLON ANDAMANICUM, nov. sp.

Frutex semiscandens, aculeis sparsis subcurvis brevibus armatus, novellis parce pubescentibus; folia imparipinnata, 2—4 poll. longa, petiolo inermi anguste alato; foliola 3—4-juga cum impari, subsessilia, inæquali-rhomboidea (terminali cuneato-obovato), ½—1 poll. longa, obtusa, membranacea, margine exteriori salvo apicem versus integra, secus interiorem grosse crenata, subtus in costâ parce pubescentia; cætera ignota.—*Andamans.*

2. AGLAIA PANICULATA, nov. sp.

Arbor mediocris, sempervirens, novellis dense fulvo- v. cupreo-lepidoto-puberulis mox glabrescentibus; folia impari-pinnata, glabra, rhachi terete

cupreo-lepidotula glabrescente; foliola vulgo 2-juga cum impari, subopposita, ovata ad ovato-oblonga, petiolulo ferrugineo-lepidoto 2—2½ lineali suffulta, 4—9 poll. longa, coriacea, glabra, opaca, foliolis summis ternatis v. pinnato-remotis; flores minuti, pedicellis gracilibus brevibus ferrugineo-lepidotis, in paniculas amplas ferrugineo lepidoto-tomentosas axillares foliorum longitudine v. paullo breviores dispositi; calyx ferrugineo-lepidotus, lobis latis obtusis; petala semilineam longa, libera; antheræ 5; baccæ ignotae.—*Pegu; Tenasserim.*

3. Amoora lactescens, nov. sp.

Arbor sempervirens, usque 40-pedalis, novellis pallide lepidotis, succo lacteo scatens; folia impari-pinnata, rhachi terete, lepidotula, mox glabrescentia; foliola 3—2-juga cum impari, alterna, oblonga ad lanceolato-oblonga, petiolulis 2—3 lin. longis suffulta, basi acutâ obliqua, acuminata, chartacea, viridia, glabra, 3—5 poll. longa, nervis venisque supra bene conspicuis; flores majusculi, pedicellis curvis argenteo-lepidotis 1—1½ lin. longis suffulti, paniculam axillarem petiolo breviorem laxam sessilem gracilem parce ramosam dense lepidotam efformantes; calyx dense lepidotus; petala 3, lineam circiter longa v. paullo longiora, concavo-rotundata, glabra; antheræ 6; fructus obovoideo-globosi, juniores furfuraceo-lepidoti, cerasi magnitudine.—*Martaban.*

4. Amoora dysoxyloides, nov. sp.

Arbor sempervirens, mediocris, novellis cinereo-lepidotis; folia impari-pinnata, pedem circiter longa, rachi petiolo et costâ subtus dense canescenti-lepidotis; foliola 3-juga cum impari, alterna, oblonga, basi oblique acuta, petiolulis 2—3 lin. longis lepidotis suffulta, subabrupte et obtusiuscule acuminata, tenuiter coriacea, nigrescentia, opaca, subtus sparse et minute argenteo-lepidota; flores parvi, pedicellis brevibus crassis lepidotis suffulta, in paniculam axillarem parvam petiolo multo breviorem dense canescenti- v. gilvo-lepidotam sessilem disgesti; calyx brevis, dense lepidotus, 5-dentatus; petala 5, lineam vix longa, obovato-oblonga, glabra; tubus stamineus glaber; antheræ 10; ovarium ovoideum, pallide hirsutum; stigma sessile, magnum, glabrum.—*Martaban.*

5. Walsura oxycarpa, nov. sp.

Arbor, gemmis fulvescenti-puberulis; folia impari-pinnata, petiolo rachique sparse lenticellatis glabris gracilibus; foliola bijuga cum impari, petiolulis ½—¾ pollicaribus gracilibus suffulta, lanceolata ad oblongo-lanceolata, 3—4½ poll. longa, tenuiter chartacea, longiuscule acuminata, subtus glaucescentia reticulatione tenuissimâ et inconspicuâ percursa; paniculæ fructigeræ gracillimæ et longe pedunculatæ, parce ramosæ, glabræ, foliis breviores; baccæ immaturæ ovato-oblongæ, acuminatæ, ½ poll. longæ, cinereo-velutinæ.—*Andamans.*

DAPHNIPHYLLOPSIS, nov. gen. *Olacinearum.*

Pl. XV, Figs. 1—7.

Calyx 5-lobulatus, accrescens. Petala 5, raro 6—7, cum ovario connata, libera. Stamina perfecta 10, irregulariter v. alternatim longiora. Ovarium inferum, pedicelliforme, disco epigyno majusculo annulari coronatum; stylus perbrevis, simplex. Fructus cum calyce aucto connatus, disco epigyno et calycis lobulis coronatus.—Arbor magna, foliis simplicibus integris. Flores parvi, sessiles, in capitula pedunculata axillaria congesti.

6. D. CAPITATA, (*Ilex daphnephylloides*, Kurz in Journ. As. Soc. Beng. 1870—72).

Descriptioni adde: Flores non pedicellati, sed cum ovario pedicelliformi sessiles; ovarium inferum, cum calyce connatum, parce pubescens, apice disco epigyno glabro crasso annulari obscure lobato terminatum; baccæ immaturæ obovoideæ, c. 3 lin. longæ, parce pubescentes.—*Montes Himalayæ Sikkimensis et Martabaniæ*, 5—7000 *ped. s. m.*

NATSIATOPSIS, nov. gen. *Olacinearum.*

Pl. XV, Figs. 8—9.

Flores fertiles ignoti; masculi: calyx 4-fidus, parvus. Corolla tubulosa, apice 4-loba. Stamina 4, libera, cum corollæ lobis alterna; filamenta longa, lata; antheræ lineari-oblongæ. Ovarii rudimentum dense hispidum.—Herba perennis, volubilis, scabra, foliis alternis cordato-ovatis palmatinerviis. Flores in spicas vulgo geminas axillares graciles dispositi; bracteæ deciduæ.

7. N. THUNBERGIÆFOLIA, nov. sp.

Herba perennis, volubilis, scabro-puberula; folia cordato-ovata v.-oblonga, 5—6 poll. longa, petiolis 2—2½ poll. longis suffulta, breviter acuminata, supra scabra, subtus dense pubescentia, a basi 7-nervia; flores masculi brevissime pedicellati, 2 lin. circiter longi, in spicas ternas v. saepius geminas axillares laxas elongatas tomentellas disgesti; calyx parvus, 4-fidus, pubescens; corolla gamopetala, tubulosa, extus appresse pubescens, 4-loba, lobis brevibus reflexis; stamina 4, cum corollae lobis alterna, filamenta libera, lato-linearia; ovarii rudimentum hemisphericum, dense fulvo-hispidum.—*Ava.*

8. MIQUELIA CANCELLATA, nov. sp.

Frutex volubilis, ramis tortuoso-striatis; folia oblongo-lanceolata, basi attenuata, petiolo circiter pollicari suffulta, 4—5 poll. longa, acuminata, rigide coriacea, lucida, subtus exigue puberula glabrescentia nervis et reticulatione crassis prominentibus percursa; drupæ (pericarpio deprivatæ) obovato-oblongæ, margines versus compressiusculæ, pollicem circiter longæ, elegan-

tissime at grosse cancellatæ; semen solitarium, endocarpio crustaceo conforme sed minus, cancellato-nervosum, pendulum. *Malacca* (Maingay No. 376).

Descriptio e specimine valde fragmentario confecta.

9. Ilex Sikkimensis, nov. sp.

Arbor mediocris, glabra, ramis crassis, gemmis ample squamatis; squamæ lato-ovales, obtusissimæ, c. ½ poll. longæ, glabræ, lato scarioso-marginatæ; folia larga, oblonga, basi in petiolum ½—1 pollicarem crassum attenuata, obtusiuscula, 5—6 poll. longa, repando-serrulata, coriacea, glabra; cymæ fructiferæ densæ, breves, robustæ, e perulis axillaribus v. supra foliorum cicatricibus ortæ, glabræ; baccæ globosæ, piperis grani magnitudine, læves, luteæ, pedicellis strictis c. 3 lin. longis suffultæ, stigmate sessili peltato-4-lobo coronatæ, 4-pyrenæ; pyrenæ trigonæ cum dorso convexo sublæves.—*In sylvis montanis subtemperatis Himalayæ Sikkimensis, alt.* 7—10000 *ped. s. m.* Fr. Oct.

Aff. *I. odoratæ*, gemmis maximis et drupis luteis 4-pyrenis jam distincta.

10. Gymnosporia Thomsoni, nov. sp.

Arborea, glabra, spinis nudis rectis armata, ramulis lenticellatis; folia lanceolata ad oblonga-lanceolata, petiolo gracili 2—3 lin. longo suffulta, 2—5 poll. longa, tenuiter acuminata, crenato-serrulata, membranacea, glabra, in sicco fuscescentia v. nigrescentia; flores parvi, 5-meri, pedicellis gracillimis 1—2 linealibus, cymas a basi fasciculato-ramosas pollice vix longiores axillares v. supra foliorum delapsorum axillis ortas efformantes; petala lin. circiter longa; capsulæ pisi majoris magnitudine, lato-obovatæ, acutiusculæ, lævis, vulgo ultra medium bivalvato-dehiscentes, 2—1-loculares et 2—1-spermæ.—*Sikkim Himalaya alt.* 2—5000 *ped. s. m.*; *Bootan, montes Dewangaree* (Masters) Fl. Apr. Fr. Sept. Oct.

Sub eodem nomine cum *Celastro monosperma* ex herb. Kewensi distributa.

11. Gymnosporia Gibsoni, nov. sp.

Frutex spinis crassis rectiusculis longis folii- et florigeris, armatus, novellis puberulis; folia obovata, petiolo 1—1½ lin. longo suffulta, apiculata ad obtusa, 1—2½ poll. longa, obsolete crenata, membranacea, in sicco brunnescentia, subtus puberula, supra glabra; cymæ fructigeræ folio paullum breviores, e spinis v. earum axillis ortæ, puberulæ, glabrescentes, graciles, pedunculatæ, dichotomo-ramosæ; capsulæ immaturæ glabræ, obpyriformes, vulgo 3-lobatæ et 3-loculares, ⅓ poll. longæ, 3-valvatæ, loculis monospermis.—*Bombay Presidency* (Dr. Gibson).

12. Lophopetalum fuscescens, nov. sp.

Arbor glabra; folia oblonga, petiolo 1—1½ pollicari suffulta, breviter acuminata, basi obtusa, integra, 4—8 poll. longa, coriacea, opaca, subtus

rubido-fuscescentia, nervis confertiusculis 14—16 utrinque; cymæ rigidæ, brachiatæ, in paniculam terminalem glabram consociatæ; pedunculi 1½—2 poll. longi, ramuli ultimi breves compresse 4-goni; flores parviusculi, pedicellis gracilibus lineam circiter longis suffulti, confertiusculi; calycis lobi breves, lati, rotundati; petala ovata, obtusiuscula, lin. longa, coriacea, margine lato membranaceo in alabastro induplicato aucta, cæterum nuda, in sicco in centro elongato-trigono-corrugata; discus indistincte 5-lobulus, in sicco rugulosus; stamina 5; filamenta longiuscula.—*Singapore.*

13. Salacia Jenkinsii, nov. sp.

Scandens ?, glabra; folia petiolo 2—3 lin. longo suffulta, oblonga ad elliptico-oblonga, 5—7 poll. longa, apiculata v. abrupte et obtuse acuminata, basi obtusa v. rotundata, obsolete crenata, chartacea, glabra; flores majusculi, pedicellis c. ½ pollicaribus suffulti, cymas dichotomas glabras in paniculam elongatam terminalem v. in summorum foliorum axillis sitam dispositam formantes; sepala lato-ovata, ½ lin. longa, glabra; petala imbricata, obovata, obtusa, lineam longa v. longiora, glabra; stamina 3; filamenta subulata, lata, plana, recurva, ½ lin. longa; discus urceolatus, ovarium fere totum includens.—*Assam* (Jenkins).

14. Salacia platyphylla, nov. sp.

Frutex alte scandens, glaber; folia ovalia v. elliptico-ovalia, petiolo ¾—⅞ pollicari suffulta, obtusiuscule acuminata v. rarius apiculata, basi rotundata, integra coriacea, 4—6 poll. longa, opaca; flores majusculi, viridiusculi, pedicellis circa semipollicaribus lævibus crassiusculis suffulta, perplures e tuberculis axillaribus v. supra foliorum delapsorum cicatricibus orti; calycis lobi brevissimi et latissimi, integri, glabri; petala subvalvata, obovata, 1½ lin. longa, glaberrima; discus magnus et crassus, glaber; stamina 3; antheræ minutæ; filamenta plana, deorsum latiora, reflexa, in floribus sterilibus (?) lineam fere longa, in floribus fertilibus valde abbreviata; baccæ magis minusve globosæ, cerasi maximi magnitudine, coccineæ, læves, 2-spermæ; semina semi-convexiuscula, ¾ poll. longa, obsolete et grosse rugosa.—*Nicobars.*

Ex affinitate *S. reticulatæ.*

15. Hippocratea Nicobarica, nov. sp.

Frutex alte scandens, glaberrima ramulis sparse et minute lenticellatis; folia petiolo 3—4 lin. longo crasso suffulta, elliptica ad elliptico-oblonga, 5—6 poll. longa, basi obtusa, obtuse repanda, apiculata, coriacea, nitida, glauca; flores lutescentes, parvi, pedicellis 2½—3 lin. longis suffulti, in cymas dichotomo-ramosas pedunculatas vulgo ternas terminales dispositi; bracteæ et bracteolæ minutæ, acutæ; calycis lobi parvi, ovati, acuti, ciliati; petala rotundata, imbricata, ½ lin. vix longa; discus convexus in marginem planum 5-gonum explanatus, ovarium fere totum includens; stamina 3, parva, subsessilia.—*Nicobars.*

16. Vitis costata, Wall.

Humilis, prostrata v. scandens, ramulis 6-gonis, junioribus parce appresse hirsutis; folia simplicia, petiolo brevi 1—2½ lin. longo suffulta, ovato- v. subcordato-lanceolata, acuminata, repandocrenulata, basi rotundata v. subcordata, succoso-membranacea, concoloria, 4—6 poll. longa, subtus in nervis rectis parallelis prominentibus parce appresse hirsuta; flores ...., in cymas parvas strictiusculas oppositifolias v. in ramulorum extremitatibus paniculatim dispositas collecti; pedunculus circ. ½ pollicaris et ramificationes strictiusculi, juniores appresse hirsutuli; baccæ piperis grani magnitudine, pedicello subnutante 2—3 lineari sursum incrassato suffultæ, obovoideæ.—*Pegu; Martaban; Prome.*

17. V. neurosa, nov. sp.

Scandens, lignosa, glaberrima; cirrhi firmi, simplices?, oppositifolii; folia digitato-5-foliolata, glaberrima, etiam in sicco glauco-viridia, petiolo 2—3 pollicari suffulta; foliola oblonga, lateralia obliqua, petiolulis crassis 3—5 lin. longis suffulta, basi obtusa v. acuta, irregulariter et grossiuscule serrata, obtusiuscule acuminata, 3—4 poll. longa, coriacea, nervis et reticulatione utrinque (subtus magis) conspicua; flores parviusculi, cymulosi, pedicellis 2—3 linealibus suffulti; cymulæ elongato-pedunculatæ, cymam iterato umbellatam glabram pedunculo circiter 2 pollicari basi bracteato axillari suffultam efficientes; calyx truncatus; ovarium ovoideum, in stylum crassum apice patenter 4-lobum attenuatum; baccæ oblongæ, ½ poll. longæ, glabræ, 1—3 spermæ; semina oblonga, v. si 2 v. 3, semi-v. trigono-oblongæ, 4—6 lin. longæ, dorso leviter longitudinaliter depressæ.—*Khasya montes, alt.* 3—4000 *ped. s. m.* (*Vitis* No. 44, Hf. and Th.).

18. V. Vicaryana, nov. sp.

Gracilis, glabra; folia tripinnatisecta ad ternatisecta, 2—3 poll. longa, pinnæ inferiores vulgo 5- superiora 3-foliolata; foliola petiolulis capillaribus ½ lin. vix longis (terminali petiolulo usque ad ½ poll. longo) suffulta, parva, ½—¾ pollicaria, ovata ad lato-ovata, grosse crenato-repanda, acuta, rigide chartacea, glabra, in sicco supra nigrescentia subtus fuscescentia; paniculæ furcato-cymosæ, oppositifoliæ, pedunculo pollicari suffultæ; flores etc. omnes delapsi.—*Deyrah Dhoon* (Capt. Vicary, 1833).

Species elegantissima ex affinitate *V. Cantoniensis.*

19. Sapindus tomentosus, nov. sp.

Arbor? pubescens, habitu *Erioglossi* etc.; folia paripinnata cum rhachi et petiolulis tomentella; foliola 4—3-juga, 4—5 poll. longa, 2—3 poll. lata, inæquali ovato-oblonga, basi inæquali acuta, breviter petiolulata, acuminata v. acuta, integra, chartacea, supra nervis puberulis exceptis glabra, subtus dense tomentella; panicula tomentella, terminalis; sepala oblongo-lanceolata,

acuta, extus pubescentia; petala elongato-cuneata, basin versus villosula; lamina obovata medio squamâ bifidâ intus dense lanuginosâ aucta; filamenta longe pilosa; stylus sub fructu juvenili simplex, continuus; drupæ immaturæ pedunculatæ, bilobæ, lobo altero abortivo, stylo acuminatæ, monospermæ, basi intus dense lanuginosæ, monospermæ; semen erectum; radicula linearis, recta.—*Ava, montes Khakhyen.*

20. Sapindus microcarpus, nov. sp.

Frutex v. arbor?, ramulis novellis parce hirsutis; folia bifoliolata, petiolo 1—2 lin. tantum longo parce hirsuto glabrescente suffulta; foliola oblonga ad lineari-oblonga, basi obliquâ acuminata, 2—3½ poll. longa, obtusiuscula v. subretusa, integra, coriacea, glabra utrinque prominenter reticulata; flores parvi, glabri, pedicellis ½ lin. longis suffulti, paniculas subsessiles graciles pubescentes mox glabras terminales et axillares efformantes; baccæ vulgo profunde 2-lobæ v. abortu unilobæ, lobis obovatis divergentibus 1½—2 lin. longis glabris.—*Siam.* (Teysmana).

21. Pometia macrocarpa, nov. sp.

Arborea, glaberrima; folia pinnata, longa; foliola inferiora tantum adsunt inæquali oblongo-lanceolata, basi rotundata, brevissime et crasse petiolulata, acuminata, 3—4 poll. longa, remote et obsolete repanda, coriacea, supra lucida, nervis lateralibus numerosis crassis in pagina superiori immersis percursa; flores parvi, pedicellis capillaribus glabris c. 2 lin. longis suffulti, fasciculati, fasciculi racemosi in paniculas crassas subglabras collecti; calycis lobi minute ciliolati, glabri; stamina 5; ovarium parce hirsutum glabrescens; baccæ corticatæ, ellipsoideæ, ovi gallinacei magnitudine, glaberrimæ, monospermæ, cortice crasso; semen ovoideo-oblongum, ultra pollicem longum, basi breviter arillatum.—*Malacca* (Maingay No. 413).

22. Dalbergia stenocarpa, nov. sp.

Arbuscula, novellis aureo- v. fulvo-sericeis; folia pinnata, breviuscule petiolata, 5—8 poll. longa; foliola 9—13, alterna, elliptico-oblonga ad elliptica, petiolulo 1½—2 lin. longo sericeo-puberulo suffulta, basi subobliqua acuta, 1—1⅔ poll. longa, retusa cum mucrone minuto, chartacea, subtus glaucescentia et parce (præcipue secus nervos) pilosula; paniculæ fructigeræ puberulæ, pedunculo circa pollicari suffultæ, axillares, folio multo breviores; flores..., pedicelli 1 lin. circiter longi, puberuli; calyx 1 lin. longus, appresse fulvo-hirsutus, dente superiore brevissimo obtuso, infimo longissimo subulato; legumina 1—2 poll. longo et circa 2 lin. lata, linearia, in stipitem longum gracilem sensim attenuata, plana, brunnea, tenuiter coriacea, obtusa v. stylo terminata, laxe et indistincte venosa, 1—5-sperma, suturâ exteriori vulgo rectâ interiore sinuosâ v. leviter curvatâ.—*Sikkim, Pankabári* (S. Gamble). Fr. Aug.

Leguminum structurâ et indole ad *D. Sissoo*, ex habitu autem ad *Dalbergiam lanceolariam* accedens.

23. Fragaria Sikkimensis, nov. sp.

Perennis, estolonifera, acaulis, rhizomate crasso verticali v. obliquo; folia trifoliolata, petiolo parce piloso 2—3 pollicari suffulta; foliola elliptica ad obovato-elliptica, lateralia subobliqua, grosse crenato-serrata, obtusa, ½—1 poll. longa, brevissime petiolulata, crasse membranacea, utrinque pilis sparsis albis rigidis adspersa; scapi solitarii foliis paullulo breviores, uniflori, parce pilosi; calycis lobi 10, spatulato-obovati, acuti, alterni breviores et angustiores, nervosæ, apicem versus dentati, 2—3 lin. longi, parce pilosi v. subglabræ, piloso-ciliati; cænanthium cylindrico-oblongum, glabrum, ½ poll. longum. *Sikkim-Himalaya*, in pascuis alpinis 10—15000 ped. s. m.

24. Rubus Fockeanus, nov. sp.

Prostratus et longe repens, caulibus filiformibus parce hirsutis surculosis; folia trifoliolata, iis *Fragariæ* haud absimilia, petiolo 1—2 pollicari parce piloso suffulta; foliola ovalia ad rotundato-ovalia, breviter petiolulata, obtusa, ½—1 poll. longa, irregulariter duplicato-serrata, subplicata, secus nervos parce appresse hispidula, lateralia obliqua; flores solitarii, ramulos breves annuos unifoliolatos terminantes, pedunculo villosulo parce et minute glandulo-hispido poll. fere longo suffulti, majusculi; calycis laciniæ ovatæ, acuminatæ, 3 lin. circiter longæ, extus subglabræ, intus tomentellæ; stamina glabra, erecta?; drupeolæ perpaucæ, 1—½ lin. longæ, coccineæ, lucidæ. In pascuis alpinis, *Sikkim-Himalaya*, e. g. in jugis Singalilah, 12—14000 ped. s. m.

Explanation of Plate XV.

Figs. 1—7. *Daphniphyllopsis capitata*, Kurz.—Fig. 1, flowering branch, nat. size; fig. 2, flower, the petals removed; fig. 3, flower, from below; fig. 4, the same from above; fig. 5. fruiting inflorescence, nat. size; fig. 6. berry, nat. size; fig. 7. upper part of berry, shewing the persistent crown formed by the calyx-limb and epigynous disk.

Figs. 8—9. *Natsiatopsis thunbergiæfolia*, Kurz.—Fig. 8. flowering branch, nat. size; fig. 9, flower, with opened corolla, shewing stamens and ovary-rudiment.

XIX.—*Note on* (i) Elachistodon Westermanni, (ii) Platyceps semifasciatus, *and* (iii) Ablepharus pusillus *and* Blepharosteres agilis.—*By* W. T. Blanford, *F. R. S.*

(Received Nov. 9;—Read Dec. 1, 1875.)

§ I.—A young snake was recently presented to the Indian Museum by Mr. G. Shillingford, of Purneah, and Mr. Wood-Mason, the Curator, asked me to determine it. For a long time I was unsuccessful, for the specimen presents the peculiarity of a pit behind the nostril, scales much like those of a *Bungarus*, except that the subcaudals are divided, and no poison fang; but after a good deal of research I at last identified the specimen with *Elachistodon Westermanni*, Reinhardt, Oversigt K. Dansk. Vid. Selsk. Forh. Kjobenhavn, 1863, p. 210 (Gunther, Rept. Brit. Ind., Appendix).

This snake is admirably figured in the original paper, and a remarkable character not mentioned in Dr. Gunther's description is shewn in the figure. This character consists in the presence of a post-nasal pit.

A loreal pit has been found in two other genera of harmless snakes, both West African; one *Bothrolycus* belonging to the *Lycodontidæ*, (Günther, P. Z. S., 1874, p. 444, Pl. LVII, fig. B), the other *Bothrophthalmus* belonging to the *Colubridæ*. In *Elachistodon* the loreal shield is united to the nasal above and a suture runs from the edge of the pit to the labials below. In the original description the nasal was said to lie between two shields and the loreal was considered to enter the orbit, but there is certainly no suture above the nostril in the Purneah specimen and, considering the presence of the pit, I think that the lower præocular is not the loreal and that the homologies of the shields are as I have suggested.

From the character of the scales I am inclined to refer *Elachistodon* to the *Dipsadidæ*, and the dentition as described by Reinhardt agrees with this view, the posterior maxillary teeth being grooved. The following is a description of the specimen obtained.

Head scarcely broader than the neck, flat above, body somewhat compressed, tail rather short, pupil vertical, body surrounded by 15 rows of smooth scales, those on the sides as broad as long, the dorsal row enlarged, hexagonal, much broader than long. Nostrils lateral, each in a single shield, which contains a deep pit behind the nostril, the shield is divided below the pit, the suture running forwards to below the nostril and then downwards. Both palatine and maxillary teeth are present, but the specimen is too small for their characters to be made out. Ventrals 210, subcaudals in 65 pairs, anal undivided. Length 8¾ inches, of which the tail is 1·4.

Head-shields normal except that there is no separate loreal, this being united with the nasal above. Rostral twice as broad as high, just reaching the upper surface of the head. Anterior and posterior frontals equal in

been removed. Such a bed of transported material would again be found at this point, if large snow beds, or small glaciers were to be formed on the slopes of the Shillong peak, where the Umshirpi takes its rise, so as to produce a greater aqueous action, and sudden rushes of water. Yet I did not consider myself quite justified in attributing such appearances to more than the former greater intensity of aqueous action alone, especially on so low a latitude as 25° 30'.* However, during my last expedition into the same range further east, where it rises to nearly 10,000 feet, it was highly interesting to find the most unmistakeable signs of former considerable glacial action. By any one who has traversed a glaciated region, the slightest evidence of such action is at once detected, which to the uninitiated eye might escape notice, but the moraines of the Burrail are of such dimensions, and so partake of all the characters of glacial action having once been in full force, as to strike the most unobservant as being peculiar. Rounding the base of the Burrail on the direct road from Sámágúting towards Munipur, after passing the village of Suchéma under the curiously shaped and conspicuous scarp of Sú-vé-nú-chi-ká, descending into the deep valley of the Zubza, on viâ Jotsáma and Phésáma, Kigwéma is reached, and shortly after coming in view of this last village, the path leads up the steep terminal slope and on to the level surface of the old moraine, on which our camp was soon pitched at an elevation of 5000 ft. The imagination could picture the time when the deep valley at the back, above which towered the cliffs and peak of Japvo (the point we had to ascend and observe from), was filled with the ice that had pushed and carried the large blocks of stone and earth forward. The summit of Japvo, a trigonometrical station, is 9,890 ft. above the sea, and the mean height of this eastern part of the Burrail, which here takes a bend to the south, is about 9,000. The Tertiary rocks, which first begin to rise above all the surrounding country near Asálu, dipping S E, continue, with a gradual elevation of the base of the series for 50 miles, until they attain their highest elevation near Japvo; the south-easterly dip changes gradually round to west, and presents a precipitous face at right angles to the direction of the main watershed:—the continuity of the Burrail as a high range is thus reduced suddenly from 9,000 to 5,000 feet, and the much older contorted clay shales and schists on which the Tertiary rocks unconformably rest are exposed. Along this east face there are several deep gorges, their streams joining the Zullo, which rises under the peaks of Ténépú and Khunho. Across the low saddle of the older series, which has a breadth of 5 miles, the newer rocks again come in, with a reversed dip, at Tellizo, and its base rises again towards the N E,

* Dr. Wm. Hooker has noticed the glacial features in the Atlas Mountains; and Palgrave again south of the Caspian in lat. 36°.

forming with that strike the Kopamedza range. This sudden depression in the range, marked by the removal of the Tertiaries, stretches far away to the south, into the depression of the valley of Munipur, which is in fact the continuation of the same great lateral axis of elevation. The high N N E, S SW ridge of Tertiary sandstones, rising 7000—8000 feet, bounds the valley of Munipur for 80 miles, and marks its eastern boundary, coming in again at the Máphitel ridge, which bounds the valley on the east.

It is in the gorges draining to the Zullo river that the best examples of glacial action are to be seen, the moraine in the Gaziarurh being the largest. The tributaries of the Mazierh ravine under Japvo are numerous, and fall very suddenly from the ridge above; descending from the peak into the gorge, just below where they unite, and leaving the more confined part, and proceeding down the valley, the first signs of ice-action consist of narrow irregular terraces; until arriving at a lateral ravine at the north side of the valley, where a clearly defined small moraine projects out into the main valley of the Mazierh, to the level surface of its moraine, and would (when the glacier existed) have formed one of those little side lakes, so often seen in glaciated ground, just above the point of junction with a lateral and main glacier. Passing this side ravine, the path led along the flat surface of the moraine for half a mile, which widened gradually as the valley opened, and we then descended 200 feet into the bed of the stream. Enormous blocks shew out on the sides of the even-cut slope at an angle of 45°, and also lie near and in the bed of the present stream, the face of the slope being here very straight. The sketch (Pl. X) taken looking up the valley and one of the lateral moraine (Pl. XII, Fig. 1) will elucidate this feature. Just in a direct line opposite Kigwemah, the moraine ends at 4 miles from its source, with a terminal slope of 45°, and the stream descends rapidly to join the Zullo about 7 miles further down. The débris composing this mass of transported material having been derived from Tertiary sandstones all more or less soft, which have quickly broken up and become disintegrated, much of it must have been reduced to a state of mud and sand long before it arrived at Kigwemah, and hence it is that these moraines of the Naga Hills differ from those of the Himalaya and Alps, where the rocks are of various kinds, and often extremely hard, retaining their angular forms after travelling for a great distance. The level surface of the Mazierh moraine is now cultivated and terraced for the rice irrigation, and the sub-angular blocks and stones that formerly covered the surface have been used to build the walls of the terraces; the former distribution on the surface has thus been effaced, yet here and there collections of stones too large and heavy for removal by man still remain to shew that they moved down in the usual continuous line.

Proceeding south from Kigwémah, and reaching the next gorge at Zakameh, the scenery near it is most lovely, and the old moraine features

are very well displayed. At the point where the stream, the Gaziarurh, leaves the gorge, the broad flat expanse commences and extends down the valley for quite 1½ miles. After proceeding down and crossing it, the view from the next spur on the other side was most striking: the broad sweep of old moraine a quarter of a mile broad (terraced for cultivation) comes bending round to join the smaller one from the Kurúrurh; the two glaciers must have once met here, and the terminal cliff would have been just below the junction; the elevation is here 5,100 ft.* I give a sketch of the moraine on Pl. XIII. The views on all sides were lovely, especially that up the gorge of the Gaziarurh: the soft hazy rays of light cast by the sun, setting behind the high range on the west, brought out in most lovely grey tones the receding steep spurs that bounded the glen.

Towards the upper part of the Zúllo near where the Kaburhi joins it, traces of old terraces of transported material are observable, and huge blocks of sandstone are seen here and there, all in the same level, resting on the clay shales (one of these blocks at about 4,800 ft. measured 20 × 18 × 12 = 4,320 cubic feet), and it is from among these transported blocks that the Nagas of Sopvomah select the monoliths and dolmens they erect in the villages along the crest of the ridge above, which is of clay shales.

Crossing the main watershed at its lowest part, we descend gradually to the head of the Barak valley, the physical aspect of which well deserves notice (Pl. XI). The river, here 3,800 ft. above sea level, flows with a very serpentine course through a broad level belt about ¼ to ½ a mile in breadth, the greater part of which is or has been under rice cultivation. There are scarcely any trees on the hill slopes, and those few that exist are confined to patches on steep slopes bordering the river, where it bends in under the hills. Alluvial terraces are well developed both in the main valley and lateral branches. Under the village of Gnámih, the main accumulation of these deposits terminates, and below this they occur, now on one side of the valley, now on the other, extending into the narrow gorge of the river still further down where it takes a sharp loop-like bend of 6 miles, and it is evident that they once filled this gorge to a height of 130 feet; little, however, of the deposit is now left. In the more open part above, the upper level of the terraces is about 120 feet above the present level of the Barak, and they consist of strong coarse conglomerates and clay. The age of these

* This altitude may be considered very low, when we know that the extension of similar action is not seen much below 4000 ft. in the N. W. Himalaya, on a more northern latitude; but there is every reason for supposing that during the last glacial period the general distribution of land and water was nearly the same as at the present time, and that the amount of moisture borne from the south and south-west must have then been very great, producing an enormous snow-fall deepening the valleys and forcing the glaciers to a lower level.

deposits there is every reason for supposing to be the same as that of the Japvo moraines, the result of a powerful river action, due to a heavy winter snow-fall,—all the main sources of the Barak lying in lateral valleys of the Kopamedza ridge at an elevation of 7—8,000 feet.

The character of the valleys that drain away through Munipur and eventually into the Irawadi, is intimately due to former effects of climate, during the period the changes I have above described were going on. These valleys and Munipur have at one time presented the appearance of a chain of lakes, now dry, the only remnant in Munipur itself being the Loglak Lake, now of small dimensions; a description of one such tributary valley will suffice for all,—and I am informed by Dr. J. Anderson that like characters are to be seen in the country towards Yunan. On the water-parting of the Irawadi and Súrmah, one looks down on the Khongba flowing with sharp bends through a broad almost level valley. The steep slopes from the Kouprú ridge on the west terminate some two miles from the base of those on the east, and a very gradual nearly level surface of water-worn detritus covers the intermediate ground, through which run four streams from the ridge above-mentioned.

The valley on the east is bounded by a low ridge of only some 300 feet above its bed, which gives off to the east spurs rising to 1000 feet. Further down the valley, 6 miles from the watershed at Kaital-Mambi, a collection of detritus (mostly angular) forms a terrace about 50 feet above the stream, and is the termination of the long talus given off by the deep ravines on the flank of the Koupru peak, which here rises to feet some feet higher than the ridge to its north. This talus extends close up to the eastern side of the valley and undoubtedly at one time abutted on its eastern spurs forming a lake above, subsequently drained by the stream cutting its way round their present base, a process which would have commenced directly the formation of talus from Koupru ceased with the change into present climatic conditions.

A sketch (Pl. XII, Fig. 2) of the Kaital-Mambi lake bed from the watershed is given in illustration of the above features.

XXI.—*Note on a large Hare inhabiting high elevations in Western Tibet.*—*By* W. T. Blanford, *F. R. S.*

(Received. Nov. 8;—Read Decr. 1, 1875.)

In the list of mammals obtained by Dr. Stoliczka in Ladák, Eastern Turkestan, &c. (ante, p. 109), I included a hare from Ladák under the name of *L. pallipes*, but as I felt doubtful of the identification I added a note of interrogation to the name. I have since, in a collection of skins very kindly sent to me for examination by Mr. Mandelli of Darjiling, found one young and two adult specimens of a hare with an ashy grey rump, corresponding very much better with the figure and description of *L. pallipes* given by Hodgson (J. A. S. B., 1842, XI, p. 288, Pl. 3). This hare is doubtless the kind inhabiting the portions of Tibet immediately north of Sikkim, and seen by myself in Sikkim close to the frontier at the Kongra Lama pass (J. A. S. B., 1872, XLI, p. 34). It differs in several respects from the large hare of Ladák and Western Tibet, referred first, I believe, by Blyth in his 'Catalogue of the Mammals in the Museum of the Asiatic Society,' p. 131, and subsequently by myself to *L. pallipes*. The hare from Western Tibet is a larger form with proportionally shorter and differently coloured ears, the fur is less woolly, the colouration more rufous on the back, and less ashy on the rump, the dark band on the anterior surface of the ears is much less distinct and the posterior outer surface shews far less white, and the tarsi are clad with longer and denser hair. I propose to name this Western Tibetan hare, from the extremely elevated regions which it inhabits,

Lepus hypsibius, sp. nov.

L. *major, rufescens, nigro-adumbratus, subtus albus, uropygio fuscescenti-griseo, caudâ floccosâ, omnino albâ, vellere dorsali densissimo subcrispato, auribus breviusculis, capitem longitudine parum excedentibus, antice extus fusco rufescentibus, postice albescentibus vel albis. Long. corporis cum capite in corio dessicato ad* 24 *poll., tarsi* 5, *auris a capite* 4.5, *cranii* 3.6.

Hab.—*In vallibus altissimis planitiebusque provinciæ occidentalis Tibetanæ Ladak dictæ.*

Description taken from a specimen collected by Dr. Stoliczka at Kium in the Changchenmo valley, 15,500 feet above the sea, in October. Colour rufous brown more or less mixed with black on the back, dusky ashy on the rump, lower parts white with a slight rufescent tinge. Fur long, woolly rather curly and thick; on the anterior portion of the body the hairs are about 1¼ inches long, ashy at the base, further back the basal portion becomes creamy white, beyond the middle of each hair there is a blackish ring, then a pale brown one, the extremity being black. Towards the rump, the hairs are

fully two inches long, and for the most part ashy grey throughout, a few only having short black tips. On the sides the hair is rufous brown, except at the base, where it is ashy, on the lower parts white with a slight rufous tinge throughout. On the neck the hairs are rufous brown, those on the back of the neck having ashy tips; on the breast they are paler rufous. Head brown, whitish round the eyes, whiskers partly black, partly white; inside surface of ears brown in front, whitish behind, the brown hairs having short black tips, no distinct dark band in front. Extreme tip of ears black, the colour only running a short distance down each margin. Ears inside clad, towards the tip and posterior margin, with buff hairs, a brown band near the hinder margin, which is buff. Tail white throughout. Limbs chiefly white, a brownish band running down the anterior portion of the fore legs.

The skull measures 3·63 inches long from the occipital plane to the front of the incisor teeth, and 1·73 broad across the widest portion of the zygomatic arches.

This hare appears to be found throughout a considerable tract in Western Tibet. The specimen in the Asiatic Society's collection was presented by Captain Smyth, but has no precise locality. This species is probably the *L. oiostolus* of Adams, P. Z. S., 1858, p. 520. I do not think it is the *L. oiostolus* of Hodgson, for a young specimen of *L. pallipes* agrees much better with Hodgson's description, and the ears in the former are said by Waterhouse* to be coloured like those of *L. Tibetanus*. This is not the case in *L. hypsibius*.

XXII.—*On new or little-known species of* Phasmidæ, *with a brief preliminary Notice of the Occurrence of a Clasping Apparatus in the Males throughout the Family.*—*By* James Wood-Mason.

(Recd. Decr. 10th, 1875;—Read Jan. 5th, 1876.)

(With Plates XVI & XVII.)

Lonchodes Westwoodii.

♀ *Bacillus Westwoodii*, Wood-Mason, J. A. S. B., Vol. XLII, 1873, p. 51, pl. V. figs. 1, 2; P. A. S. B., July, 1873, p 149, and A. & M. N. H., 4th Ser., 1873, Vol. XII, p. 348.

♂. Body and limbs, especially the anterior pair, of excessive tenuity; the average width of the former not exceeding three-fourths of a line. Antennæ filiform, 22-jointed, all but as long as the five basal abdominal segments taken together. Head a complete miniature of that of the female,

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♂. Body and limbs, especially the anterior pair, of excessive tenuity; the average width of the former not exceeding three-fourths of a line. Antennæ filiform, 22-jointed, all but as long as the five basal abdominal segments taken together. Head a complete miniature of that of the female,

* Rodentia, p. 62.

being similarly armed with two minute spiniform tubercles. Meso- and metathorax dilated at the insertion of the legs. Abdomen exactly half the length of the body; terminal dorsal segment strongly carinate, its posterior and inferior angles produced into slender deflexed processes in contact at their tips only, which, like the sides of the resultant hiatus, are beset with minute spinules; terminal ventral segment pointed, carinate below for its posterior two-thirds. Legs simple except for the presence of minute representatives of the triangular spines seen near the apex of the femora in the opposite sex; their relative length 1, 3, 2.

Total length, 3 in. 4 lin.; head, 1½ lin.; proth., 1½ lin.; mesoth., 9 lin.; metath., 7½ lin.; abd. 16½ + 4 = 20½ lin.; antennæ, 14 lin.; fore femora, 17, tibiæ, 20½, tarsi, 6 = 43½ lin.; inter. femora, 11, tibiæ, 12, tarsi, 4 = 27 lin.; post. femora, 13, tibiæ, 16, tarsi, 4½ = 33½ lin.

Hab. The above description is taken from a specimen preserved in alcohol captured on South Andaman by Mr. A. de Roepstorff.

Lonchodes Austeni, n. sp.

♂. In size, thickness, and armature like the *Acanthoderus Wallacei* of Westwood, but without the lateral spines and with a longer head and more prominent eyes; antennæ long and setaceous; head, pro- meso- and metanotum with a few minute granules, especially on the edges of the two last named; meso- and metathorax carinate above and below; the mesonotum, both divisions of the metanotum, and the abdominal segments armed with an erect spine at their extreme hinder ends, the abdominal spines gradually decreasing in size backwards so as to become almost imperceptible tubercles on the two penultimate segments; terminal ventral and dorsal abdominal segments much as in *L. luteoviridis*. Intermediate and posterior femora with two minute spines near the apex below; relative length of the legs 1, 3, 2, the posterior being very little shorter than the anterior pair.

Female unknown.

Total length, 2½ in.; head, 1¾ lin.; proth., 1½ lin.; mesoth., 7½ lin.; metath., 4¾ lin.; abd., 12 + 3 = 15 lin.; antenn., 20½ lin.; fore fem. 10 lin., tibiæ, 12 lin.; interm. fem. 7½, tibiæ, 8 lin.; post. fem. 9 lin; tibiæ, 12 lin.

Hab.—Dikrang Valley, Assam; collected during the Dafla Expedition, by Major H. H. Godwin-Austen, after whom I have much pleasure in naming it.

Phibalosoma Westwoodii, n. sp.

♀ Very closely allied to *P. Cantori*, from which it differs in the great development of the lateral lobes of the 6th dorsal abdominal segment, and in the form of the head, the occipital region of which is broad, high, and convex, and surmounted by two rounded tubercles of very unequal size

that of the right side being by far the larger; minute scale-like rudiments of tegmina and wings.

Total length, 9 in. 4½ lin.; antennæ, 1 in. 7½ lin.; head, 7 lin.; prothorax, 5½ lin.; mesothorax, 1 in. 9½ lin.; metathorax, 1 in. 3½ lin. abdomen, 4 in. 1 lin. + 1 in. 2½ lin. = 5 in. 3½ lin.; breadth of 6th abd. segment at base, 3½ lin., of the same at apex, 8½ lin.

Male unknown.

Hab. Nazeerah (Foster) and Samaguting (J. Butler), Assam.

I have much pleasure in naming this gigantic insect after my friend and former teacher Professor Westwood, Hope Professor of Zoology in the University of Oxford.

Lopaphus Iolas, Westw.

♂ *Necroscia Iolas*, Westw., Monograph of Phasmidæ, p. 145, pl. xix, fig. 2.

♀. Much stouter than the male, about the same size and thickness, and relative proportions as *Bacteria Baucis*, but with the mesothorax narrowed in front; head, and pro- and mesonotum with scattered granules; legs armed as in the male; tegmina in the form of small closely appressed overlapping scales; not the faintest trace of wings; terminal dorsal abdominal segment and operculum much as in *Bacteria Baucis* and *Lonchodes Bootanicus*.

Total length, 4 in. 6¾ lin.; head, 2½ lin.; proth. 2¾ lin.; mesoth., 13 lin.; metath., 5½ lin.; abd., 2 in 2¾ lin. + 5 = 2 in. 7¾ lin.; antenn., 3 in. 5 lin.; tegmina, 2 lin.

The following are the admeasurements of a specimen of the male:

Total length, 3 in. 2 lin.; head, 1½ lin.; proth., 1¾ lin.; mesoth., 8 lin.; metath., 4 lin.; abd., 18½ + 3½ = 22 lin.; antenn., 2 in. 9 lin.; tegmina, 2¾ lin.; expanse of wings, 2 in. 11 lin., or reaching as far as to the apex of the 4th abdominal segment.

Hab.—Johore, in the Malay peninsula, and Sinkieb Island, off the N. E. coast of Sumatra, where the specimens were taken by my native collector. Professor Westwood's *Necroscia Iolas* was from Malacca.

Were it not for the presence of wings in the male and of rudimentary tegmina in the female, this species would have to be placed next to *Lonchodes porus*, Westw., the female of which will, I feel confident, prove to be either *Lonchodes Bootanicus* or *Bacteria Baucis*, or at any rate some closely similar form. It is placed, provisionally, in the genus *Lopaphus*, because the nearest winged ally of the female is indubitably the *Lopaphus brachypterus* of De Haan; but it might also have been ranged with the *Phibalosomas*, the females of some of which have minute scale-like rudiments of organs of flight, in the shape of mere adnate processes of the dorsal integument of the meso- and metathorax.

PHYLLIUM SICCIFOLIUM.

Having never met with a specimen of this species in the numerous collections that have been submitted to my inspection since my arrival in this country, but having received one from Mauritius, I am forced to the conclusion that it is confined to Mauritius and some of the neighbouring islands, and that the specimens from Java, Timor, and New Guinea referred to it by De Haan have, as Westwood has suggested, been incorrectly determined. The latter author states that "in the Hopeian collection at Oxford there is one from the collection of Latreille with the locality "Seychelles" attached to it in his handwriting": the locality now given thus corroborates that of the celebrated French entomologist.

PHYLLIUM CELEBICUM, DeHaan, Pl. XVI.

Some time ago I received, through the kindness of the hon'ble Ashley Eden, to whom the Indian Museum has many times been indebted for valuable specimens, two examples—the one an adult female, the other a pupa of the same sex,—of a species which I have been unable to distinguish from the above, the adult specimen only appearing to differ from De Haan's typical one from the island of Celebes in the greater length of its tegmina and wings, but in the latter respect very nearly agreeing with a specimen from Manilla in the Hope Collection at Oxford.

The following are the admeasurements of Mr. Eden's adult specimen:—

Total length, 3 in. 3 lin.; head, 3½ lin.; proth. 2¾ lin.; mesoth., 3½ lin.; metath., 4¾ lin.; abd., 1 in. 7 lin. + 6 lin. = 2 in. 1 lin.; width of 3rd abd. segm. at middle, 1 in. 3 lin.; do. of 6th at base, 1 in. 2½ lin.; do. of same at apex and of 7th at base, 8½ lin.; length of wings 1 in. 7½ lin., or reaching to apex of 5th segm.; do. of tegmina, 2 in., or nearly to apex of 6th; width of do. 8 lin.; width of post. lobe of ant. fem. 3¾ lin.; do. of ant. lobe, 2¼ lin.

HAB.—Karen country, Burmah.

The fourth abdominal segment of the pupa is biocellated, as in the male, but not the faintest trace of these ocelli is detectible in the perfect insect.

PHYLLIUM WESTWOODII, n. sp., Pl. XVII.

♀. Legs all similar to those of *P. siccifolium*; wings reaching as far as to a little beyond the second abdominal segment; the tegmina to the apex of the sixth; mesothorax granulated above and below and at the sides; abdomen gradually widening from the base to the angulation which occurs a little beyond the middle of its third segment; from this point narrowing, at first very gradually, at last somewhat more rapidly to the apex of the 6th so that its sides are slightly and regularly arcuate; its three terminal segments forming together a triangular mass, the sides of the seventh

slightly concave; the operculum reaching almost to the apex of the basal third of the terminal dorsal segment.

♂. Legs all exactly as in the female; the antennæ, which are tomentose, as long as the wings, and composed of 26 very distinct joints, all produced into a point below at apex, when laid back reach quite as far as to the apex of the 4th abdominal segment; the tegmina extend to the middle of the 2nd, the wings to the apex of the 7th abdominal segment. Abdomen, at first very slightly and gradually, then more suddenly widening to a little beyond the middle of the 3rd segment; thence maintaining the same width to apex of 4th, whence at first very gradually and afterwards more suddenly narrowing to its extremity, the sides being slightly arcuate; a faintly marked pair of ocelli on the posterior half of 4th segment; the three terminal ventral segments carinate below, the last of them broadly rounded at the tip and barely reaching the level of the end of the basal third of the terminal dorsal one.

♀. Total length, 4 in.; head, 4 lin.; proth., 3¼ lin.; mesoth., 5½ lin.: metath., 6 lin.; abdom., 2 in. + 7½ lin. = 2 in. 7½ lin.; breadth of 3rd segm. abdom. at angulation 20 lin.; do. of 6th at base, 1 in. 4 lin.; do. of 6th at apex, 10½ lin.; width of post. lobe of ant. fem 3 lin.; do. of ant. lobe, 2¼ lin.; length of tegmina, 2 in. 7 lin., width of do. 10 lin.; length of wings, 1 in. 2 lin.

♂. Total length, 2 in. 9 lin.; head, 2 lin.; proth., 1⅜ lin.; mesoth. (measured below), 3¼ lin.; metath. (measured below), 4½ lin.; abd., 1 in. 5½ lin. + 4¾ lin. = 1 in. 10¼ lin.; breadth of do. at base 4 lin.; of 3rd segt. at angulation, 8½ lin.; of 5th at apex 7½ lin.; of 6th at apex 5 lin.; length of tegmina, 10½ lin.; of wings, 2 in.; of antennæ, 2 in.

All the above measurements are taken from alcoholic specimens.

Hab.—The female from South Andaman, where it was captured by Captain Protheroe on his dining table, so that the females of this species must possess some considerable powers of flight. The insect which I confidently believe to be the male of this species was taken by Mr. W. Davison, near Pahpoon, about 150 miles north of Moulmein, in the Salween country. The acquisition of a male from Port Blair or of a female from Burmah will alone decide whether these two insects have been legitimately paired or not.

The female differs from that of *P. siccifolium* in having tolerably well-developed wings instead of minute scale-like rudiments of such, in the shape of the abdomen, in which three instead of two segments go to form the triangular termination, and by its less strongly serrated mesothorax; and from that of *P. Celebicum* in the form of the external lobes of the fore femora, which are semioval instead of angulated, and notably in the form of the abdomen; in which latter point the male differs most conspicuously from that of the same species.

I take this opportunity of stating that the terminal dorsal abdominal segment in the males of all the species belonging to this family of Orthopterous insects with the exception of those of the genus *Phyllium* is modified to serve as a more or less efficient clasping apparatus. In its simplest form, this consists of a number of very minute highly indurated dark brown spinules developed upon the under surface of the segment near its hinder margin (*Bacillus hispidulus*, W-M., etc.); very frequently, however, the whole segment is so profoundly modified as to constitute a regular forceps (most species of *Lonchodes*, *Phibalosoma hypharpax*, *Podacanthus Typhon*, etc.), the arms of which are in contact throughout their length and beset internally with interlocking teeth, or in contact and spined at their extremities only; these extremes of simplicity and specialization being connected by every conceivable gradation. In correlation, the anal cerci, which are invariably straight in the females, are curved and decussated. But neither has this condition of the anal cerci been hitherto recognized as appertaining exclusively to the male sex, nor have the structures to which a prehensile and retentive function is now for the first time assigned been interpreted, although both have been figured and described in numerous species by Professor Westwood and others.

INDEX.

☞ Names of new genera and species have an asterisk (*) prefixed.

Ablepharus agilis, 209
„ Brandtii, 209
„ pusillus, 208
Acer isolobum, 183
„ laurinum, 183
„ lævigatum, 183
Achatina balanus, 43, 46
Acronychia, 128
„ cyminosma, 130
Aegle, 129
„ marmelos, 138
Aglaia Andamanica, 146
„ argentea, 146
„ Chittagonga, 146
„ crassinervia, 146
„ Griffithii, 146
„ oligophylla, 146
* „ paniculata, 146, 199
Ailanthus, 138
„ malabaricus, 138
Allophylus aporeticus, 185
„ littoralis, 185
„ serratus, 185
„ *Zeylanicus* var. *grandifolia*, 185
*Alycæus sculpturus, 8
Amoora cucullata, 147
* „ dysoxyloides, 200
* „ lactescens, 147, 200
„ rohituca, 147
„ spectabilis, 147
Anacolosa crassipes, 153
„ Griffithii, 153
„ puberula, 153
Ancistrocladus? sagittatus, 141
Antilope bezoartica, 19
„ cervicapra, 19, 20
Apodytes Andamanica, 155
Apteron lanceolatum, 169
*Arctomys aureus, 106, 123
„ bobac, 124
„ caudatus, 122
„ dichrous, 127
„ hemachalanus, 122, 124
„ himalayanus, 121
„ *robustus*, 122
Arcuella, 98
*Arvicola Blythi, 107
* „ Stoliczkanus, 107
Atalantia, 129
Atalantia, caudata, 136
„ macrophylla, 136
„ monophylla, 136
Bacillus Westwoodii, 215
Bacula, 98
Balanites 138
„ Roxburghii, 139
„ „ var. gracilis, 139
Berchemia floribunda, 168
„ polyphylla, 168
Blepharosteres, 209
Brucea, 138
„ mollis, 139
„ Sumatrana, 139
Bufo calamita?, 196
„ viridis, 196
Bulimus cerealis, 45
„ Samavænsis, 45
„ vermiformis, 45
Bursera serrata, 141
Canarium bengalense, 142
„ coccineo-bracteatum, 142
„ euphyllum, 142
„ *grandiflorum*, 142
„ Mahassan, 142
„ *nitidum*, 142
„ patentissimum, 142
Canis sp. 106
„ lupus, 106
„ (Vulpes) sp. 106
„ „ montanus, 106
Cansjera parvifolia, 154
„ Rheedii, 154
„ zizyphifolia, 154
Capra ægagrus, 15
„ *bezoartica*, 18
„ *Blythi*, 12
„ Caucasica, 12
„ Falconeri, 17
„ *Jerdoni*, 12
„ Sibirica, 112
Capreolus pygargus?, 112
Carapa Moluccensis, 149
„ obovata, 149
Cardiopteris lobata, 157
Cardiospermum canescens, 189
„ halicacabum, 189
Carychium scalare, 41
*Castanea diversifolia, 198

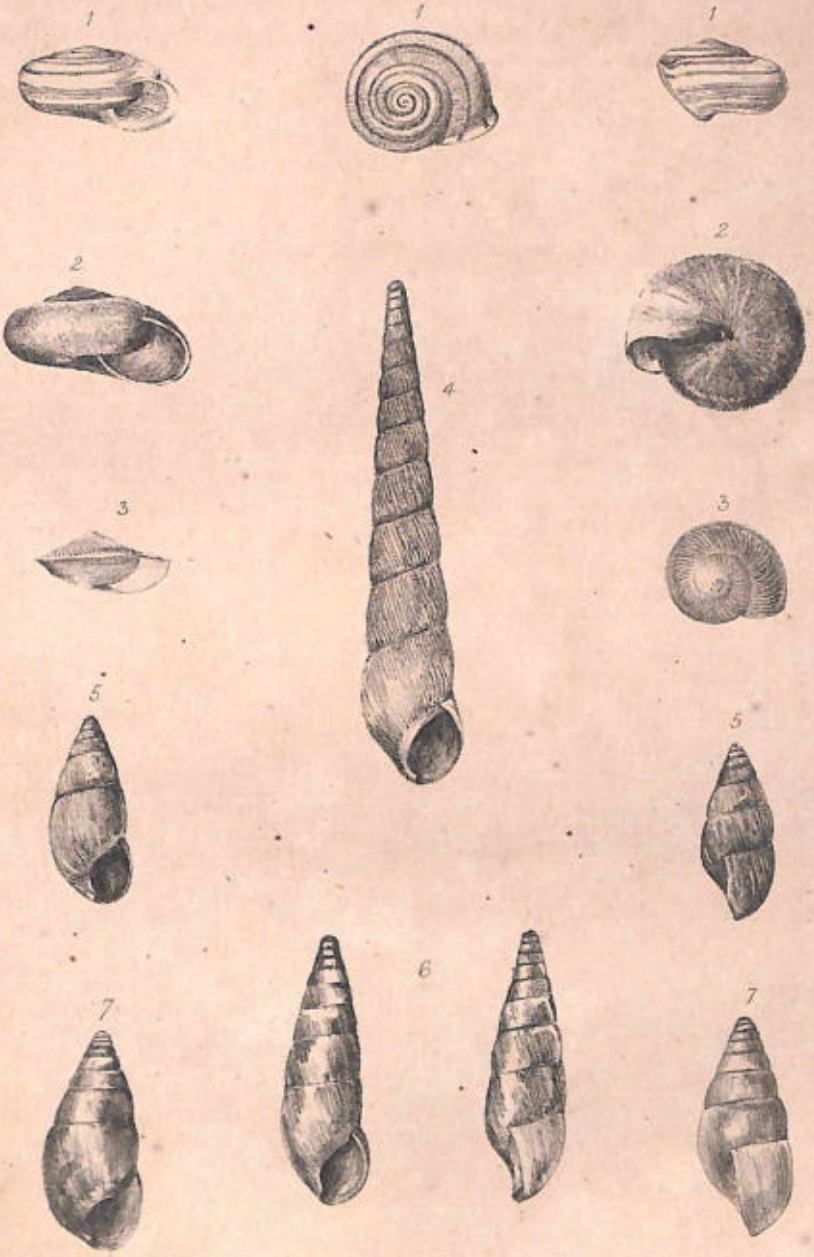
Cedrela multijuga, 150
„ serrata, 150
„ toona, 150
Celastrus monosperma, 161
„ paniculatus, 161
„ „ var. genuina, 161
„ „ var. pubescens, 161
Chalcas 128
„ Kœnigii, 132
„ paniculata, 132
Chailletia gelonioides, 150
„ Helferiana, 151
„ macropetala, 151
Champereya Griffithiana, 154
Chickrassia tabularis, 149
„ „ var. genuina, 149
„ „ var. velutina, 149
Chisocheton holocalyx, 145
Cipadessa baccifera, 144
„ „ var. integerrima, 144
„ „ var. Rothii, 144
Cissus vitiginea, 176
Citrus, 129, 136
„ aurantium, 137
„ decumana, 137
„ Hystrix, 137
„ medica, 137
„ „ var. acida, 137
„ „ var. genuina, 137
„ „ var. limonum, 137
„ nobilis, 137
„ „ var. limonellus, 137
„ „ var. Sinense, 137
Clathurella apiculata, 88
* „ Armstrongi, 93
* „ Blanfordi, 92
* „ contortula, 92
„ cyclophora, 88
* „ enginæformis, 91
* „ exquisita, 87
„ leminiscata, 92
„ Malleti, 89
* „ Martensi, 91
* „ Masoni, 90
„ nigrocincta, 89
* „ perplexa, 89
„ Reeveana, 88
„ rugosa, 86
„ rugosa, var. curculio, 86
„ „ „ fallax, 87
„ scalarina, 87
* „ singularis, 89
* „ Smithi, 88
Clausena 128, 132
„ excavata, 133
„ heptaphylla, 133
* „ macrophylla, 133
„ suffruticosa, 133
„ „ var. paucijuga, 133
„ Wallichii, 133
„ „ var. luxurians, 133
„ Wampi, 133
Cœcilianella Isseli, 43
Cœlostele, 41
„ sp. 44
„ scalaris, 42, 44
Coluber (*Platyceps*) *semifasciatus*, 208
Colubrina Asiatica, 169
„ pubescens, 169
Columbella pardalina, 96
„ „ var. Andamanica, 96
„ „ var. lactescens, 96
* „ (Mitrella) balteata, 96
Compsosoma Hodgsoni, 195
„ *semifasciatum*, 208
Conus sp. 112
„ Ceylonensis, 83
„ pusillus, 83
*Craspedotropis fimbriatus, 7
*Cricetus (Cricetulus) fulvus, 108
Cupania adenophylla, 189
„ fuscidula, 189
„ glabrata, 186, 188
„ Griffithiana, 188
„ Helferi, 189
„ lessertiana, 189
„ *pallidula*, 188
„ pleuropteris, 188
„ regularis, 189
„ Sumatrana, 189
*Cyclostrema eburnea, 101
Cyrtodactylus Yarkandensis, 193
*Cythara dubiosa, 93
* „ gradata, 93
* „ Isseli, 94
„ „ var. cernica, 94
*Dalbergia stenocarpa, 205
*Daphniphyllopsis, 201
„ capitata, 154, 201
Daphniphyllum Himalayense, 158
„ majus, 158
Daphnella bella, 86
*Diplommatina convoluta, 9
* „ Burtii, 8
„ Sherfaiensis var. 9
„ tumida, var. 9
Diplopelma Carnaticum, 196
Dipus lagopus, 109
Dittelasma Rarak, 184
Dodonaea viscosa, 182
Drillia acuminata, 84
* „ lucida, 84
Dysoxylum binectariferum, 144
„ cauliflorum, 145
„ costulatum, 145
„ procerum, 144
Dysoxylum brevipes, 145
Elachistodon Westermanni, 207
Eremias cæruleo-ocellata, 194
* „ vermiculata, 194
* „ Yarkandensis, 194
Eremicas Yarkendensis, var. saturata, 194
Erinaceus albulus, 106
Erioglossum rubiginosum, 184

Erythropalum scandens, 153
Eucharis angulata, 103
*Eulima acuformis, 98
„ (Arcuella) mirifica, 98
Eumeces Kargilensis, 195
„ *ladacensis*, 195
„ taeniolatus, 195
Eurycoma 138
„ longifolia, 139
Evodia 128, 129
„ Roxburghiana, 129
„ triphylla, 129
„ viticina, 129
Evonymus calocarpus, 159
„ glaber, 160
„ Griffithii, 160
„ „ var. dubia, 160
„ „ var. genuina, 160
„ Javanicus, 159
„ sclerocarpus, 160
Felis, sp. 106
„ lynx, 106
„ uncia, 106
Feronia, 129
„ elephantum, 137
Fossarus Stoliczkanus, 103
*Fragaria Sikkimensis, 206
Francesia, 41
„ scalaris, 42, 44
Garuga pinnata, 141
„ „ var. genuina, 141
„ „ var. mollis, 141
Gazella subgutturosa, var. Yarkandensis, 112
Geostilbia Caledonica, 43, 46
*Gerbillus cryptorhinus, 108
*Glessula Burrailensis, 3
* „ Butleri, 4
* „ illustris, 3
* „ orthoceras, 2
Glycosmis 128, 131
„ arborea, 131
„ „ var. genuina, 132
„ „ var. insularis, 132
„ cyanocarpa, 131
„ „ var. cymosa, 131
„ „ var. genuina, 131
„ pentaphylla, 132
„ trifoliata, 131
„ „ var. fuscescens, 131
„ „ var. genuina, 131
Gomphia Sumatrana, 141
Gonocaryum gracile, 155
„ Griffithianum, 155
Gonocitrus 136
„ *angulatus*, 135
Gouania Brandisii, 169
„ leptostachya, 169
*Gymnodactylus elongatus, 193
* „ microtis, 193
* „ Stoliczkae, 193
Gymnosporia acuminata, 161
*Gymnosporia Gibsoni, 202
„ montana, 161
„ oblanceolata, 161
* „ Thomsoni, 202
Halys himalayanus, 196
Harpullia cupanioides, 189
Harrisonia, 138
„ Bennetti, 139
*Helicarion Brunneum, 5
* „ Nagaense, 5
„ „ gigas, 6
* * „ Shillongense, 4
„ „ var. 5
„ solidum, 6
Helix (Nanina) atricolor, 2
* „ „ Shisha, 2
* „ delibrata, var. fasciata, 1
Hemigyrosa canescens, 184
Hippocratea fuscescens, 164
„ Indica, 164
„ Lobbii, 164
„ macrantha, 164
Ilex cymosa, 158
Ilex daphnephylloides, 154
„ Godayam, 158
„ „ var. genuina, 158
„ Gualtheriæfolia, 157
„ macrophylla, 158
* „ Sikkimensis, 202
„ Wallichii, 158
Iodes? Brandisii, 156
„ Hookeriana, 157
„ tomentella, 157
Kurrimia robusta, 161
*Lagomys auritus, 111
* „ griseus, 111
„ Ladacensis, 110
„ macrotis? 111
Latirus gibbus, 83
Leea alata, 180
„ aspera, 179
„ æquata, 180
„ compactiflora, 179
„ coccinea, 179
„ crispa, 179
„ gigantea, 179
„ latifolia, 178
„ læta, 179
„ macrophylla, 178
„ „ var. genuia, n178
„ „ var. oxyphylla, 178
„ parallela, 178
„ „ var. angustifolia, 179
„ „ var. genuina, 179
„ pumila, 179
„ robusta, 180
„ *robusta*, 180
„ rubra, 180
„ sambucina, 179
„ *sanguinea*, 180
„ sundaica, 180
*Lepus hypsibius, 214

Lepus oiostolus, 215
„ pallipes ? 109
„ Pamirensis, 110
* „ Stoliczkanus, 110.
„ Yarkandensis, 109
Limonia acidissima, 134
„ „ var. pubescens, 134
„ alternans, 135
Limicolaria Bourgignati, 45
Lepionurus sylvestris, 154
Lepisanthes Burmanica, 183
„ montana, 183
*Lonchodes Austeni, 216
„ Westwoodii, 215
Lopaphus Iolas, 217
„ brachypterus, 217
Lophopetalum filiforme, 165
„ fimbriatum, 164
„ floribundum, 165
* „ fuscescens, 202
„ littorale, 164
„ Wallichii, 164
Luvunga, 128
„ cleutherandra, 134
„ scandens, 134
*Mangelia Fairbanki, 85
* „ fulvocincta, 85
„ interrupta, 86
Marginella (Glabella) picturata, 95
*Marginelli Isseli, 95
„ (Volvarina) deformis, 95
„ „ inconspicua, 95
Mustela vulgaris ? var. 106
Martes abietum ?, var. 106
„ foina ? 106
Meles, sp., 106
Melia Azedarach, 144
„ Azadirachta, 144
„ Birmanica, 144
„ excelsa, 144
Melicope, 128
„ Helferi, 129
Micromelum, 128
„ hirsutum, 134
„ „ var. genuinum, 134
„ „ var. glabrescens, 134
„ pubescens, 133
„ „ var. genuina, 133
„ „ var. glabriuscula, 133
Microtropis bivalvis, 160
„ garcinifolia, 160
„ longifolia, 160
Minolia variabilis, 103
*Miquelia cancellata, 201
Mitra *Antoniæ*, 100
„ (Turricula) cruentata, 98
„ cruentata, var. proxima, 98
„ cruentata, var. Sandvichensis, 99
„ „ „ amanda, 99
Mitra (Turricula) obeliscus, var. Andamanica, 99
„ (Turricula) radius, 100
„ (Scabricola) pretiosa, 100
Mocoa himalayana, 195
„ Stoliczkai, 195
Munronia Wallichii, 143
Murex *crosseana*, 83
„ (Ocinebra) fiscellum, var. 83
„ „ gibba, 83
„ *Lienardi*, 83
* Murraya 132
„ elongata, 132
Mus crassipes ? 108
* „ pachycercus, 108
„ sylvaticus, var. 108
Nassa *Deshayesiana*, 96
* „ obesa, 95
„ obesa, var. Ceylonica, 96
„ Persica, 96
*Natsiatopsis, 201
* „ thunbergiæfolia, 201
„ „ „ 154
Necroscia Iolas, 217
Neæra pulchella, 103
Nephelium Griffithianum, 187
„ hypoleucum, 187
„ lappaceum, 187
„ litchi, 187
„ longan, 187
„ rubescens, 187
Nesokia Indica, 108
Niso pyramidelloides, 103
Ochna Andamanica, 140
„ brevipes, 140
„ fruticulosa, 140
„ parviflora, 140
„ squarrosa, 140
„ Wallichii, 140
Œsculus assamica, 190
Olax godayam, var. sulcata, 158
„ imbricata, 153
„ loranthiformis, 153
„ scandens, 152.
„ Zeylanica, 152
Opilia amentacea, 154
Ovis Heinsi ?, 112
„ Nahura, 112
Pantholops Hodgsoni, 112
Paramignya 129
„ angulata, 135
„ citrifolia, 135
„ grandiflora, 135
„ Griffithii, 135
„ monophylla, 135
Paranephelium xestophyllum, 187
*Parmarion rubrum, 6
Phaiomys leucurus, 107
Phibalosoma hypharpax, 220
* „ Westwoodii, 216
*Phrynocephalus axillaris, 192
„ *caudivolvulus*, 192

Phrynocephalus *Forsythi*, 192
„ *Stoliczkai*, 192
„ Theobaldi, 192
Phyllium Celebicum, 218
„ siccifolium, 218
* „ Westwoodii, 218
Phytocrene bracteata, 156
„ gigantea, 156
Picrasma, 138
„ javanica, 139
Platyceps semifasciatus, 208
Pleurotoma curculio, 86
„ *gemmulata*, 86
Podacanthus Typhon, 220
*Pometia macrocarpa, 205
„ pinnata, 187
„ tomentosa, 187
Pteromys inornatus, 106
Ptyas mucosus, 195
Pupa cœnopicta, 45
„ fallax, 45
*Quercus Falconeri, 197
* „ olla, 197
* „ pachyphylla, 197
* „ xylocarpus, 196
Rana cyanophlyctis, 196
Rhinoceros Indicus, 10
„ leptorhinus, 11
„ Sondaicus, 10
„ tichorhinus, 11
Rimula propinqua, 103
*Ringicula abbreviata, 102
„ acuta, 101
„ apicata, 102
„ caron, 102
„ *minuta*, 101
*Rissoina abnormis, 100
„ Bellardii, 103
„ Stoppanii, 103
Robinsonia Ceylonica, 103
*Rubus Fockeanus, 206
Sageretia theezans, 168
Salacia flavescens, 163
„ grandiflora, 163
* „ Jenkinsii, 203
„ longifolia, 162
„ multiflora, 163
* „ platyphylla, 203
„ prinoides, 163
„ Roxburghii, 163
„ tortuosa, 162
„ verrucosa, 163
Samadera, 138
„ Indica, 138
„ „ var. genuina, 138
„ „ var. lucida, 138
Sandoricum Indicum, 145
Sapindus danura, 186
„ *glabratus*, 186
* „ microcarpus, 205, 186
„ *squamosus*, 189
* „ tomentosus, 204, 186
Sarcostigma Wallichii, 156
Scutia myrtina, 168
„ „ var. acutifolia, 169
„ „ var. retusa, 169
Schizochiton dysoxylifolius, 145
„ grandiflorus, 145
„ paniculatus, 145
„ patens, 145
Schleichera trijuga, 183
Schmidelia chartacea, 185
Scyphopetalum ramiflorum, 188
Scytalia verticillata, 186
Siphonodon celastrinus, 162
*Sistrum ventricosulum, 97
Smythea calpicarpa, 167
*Sorex (Crocidura) myoides, 106
Soymida febrifuga, 149
Stellio agrorensis, 191
„ himalayanus, 191
* „ Stoliczkanus, 191
„ tuberculatus, 191
Stemonurus javanicus, 155
„ Penangianus, 155
„ tomentellus, 155
Stenogyra gracilis, 45
Strombosia Javanica, 153
Sus scrofa, var. nigripes, 112
Taphrometopum lineolatum, 196
Teratoscincus Keyserlingii, 193
Tetramerista glabra, vas. sagittata, 141
Toddalia, 128
„ asiatica, 130
„ „ var. aculeata, 130
„ „ var. floribunda, 130
Triphasia, 129
„ trifoliata, 134
Trochus (Clanculus) *Tonnerrei*, 103
„ (Euchelus) fossulatulus, 103
„ *(Euchelus) Lamberti*, 102
„ (Gibbula) Holdsworthana, var. 103
„ Satrapius, 103
„ (Tallorbis) roscola, 102
Tropidonotus hydrus, 196
„ platyceps, 196
*Tupistra Stoliczkanus, 199
Turpinia, montana, 182
„ „ var. genuina, 182
„ „ var. nepalensis, 182
„ pomifera, 182
Typhlops porrectus ?, 195
Ventilago calyculata, 166
„ leiocarpa, 166
„ Madraspatana, 166
„ Maingayi, 166
Vipera *Euphratica*, 196
„ obtusa, 196
Vitis adnata, 166
„ „ var. glabrior, 176
„ „ var. communis, 176
„ angulata, 176
„ assimilis, 172

Vitis auriculata, 174
„ barbata, 177
„ „ var. genuina, 177
„ „ var. Jenkinsii, 177
„ campylocarpa, 174
„ costata, 175, 204
„ discolor, 175
„ „ var. discolor, 175
„ „ var. sessilis, 175
„ dubia, 177
„ erythroclada, 174
„ feminea, 175
„ hastata, 175
„ Helferi, 177
„ Japanica, 174
„ lanata, 176, 177
„ lanceolaria, 172, 175
„ „ var. lanceolaria, 173
„ „ var. tuberculata, 173
„ latifolia, 176
„ Linnaei, 176
* „ neurosa, 204
„ obtecta, 173
„ oxyphylla, 172, 177
„ pallida, 176
„ pedata, 174
„ „ var. genuina, 174
„ „ var. glabrata, 174
„ *pedunculuris*, 175
„ pentagona, 175
„ polita, 177
„ polystachya, 177
„ pubiflora, 175
„ quadrangularis, 175
„ repens, 176
„ *sagittifolia*, 175
„ semicordata, 173
„ „ var. semicordata, 173
„ „ var. Himalayana, 173
„ serrulata, 173
„ „ var. capriolata, 173
„ „ subobtecta, 173
„ spectabilis, 176
Vitis tenuifolia, 174
„ Teysmanni, 174
„ tomentosa, 177
„ trifolia, 173
„ „ var. genuina, 173
„ „ var. glabrata, 174
„ tuberculata, 172
* „ Vicaryana, 204
„ vinifera, 176
„ Wallichii, 175
Walsura hypoleuca, 148
* „ oxycarpa, 200, 148
„ robusta, 148
„ trichostemon, 148
„ trijuga, 148
„ „ var. genuina, 148
„ „ var. pubescens, 148
„ tubulata, 148
Xanthoxylum, 128, 129
„ acanthopodium, 130
„ Andamanicum, 130, 199
„ Budrunga, 130
„ Hamiltonianum, 130
„ spondiœfolium, 130
Xerospermum, noronhianum, 186
Ximenia Americana, 152
*Zafra polita, 97
* „ semisculpta, 97
Zamenis *caudalineatus*, 195
„ Ravergieri, 195
„ ventrimaculatus, 208
Zizyphus funiculosa, 168
„ glabrus, 168
„ jujuba, 167
„ œnoplia, 167
„ „ var. glabrescens, 167
„ „ var. ferruginescens, 16.
„ „ var. pedicellaris, 167
„ rugosa, 168
„ tomentosa, 168
*Zollingeria, 190
„ macrocarpa, 190



SPECIES
or
HELICIDÆ.
N E. FRONTIER. BENGAL.

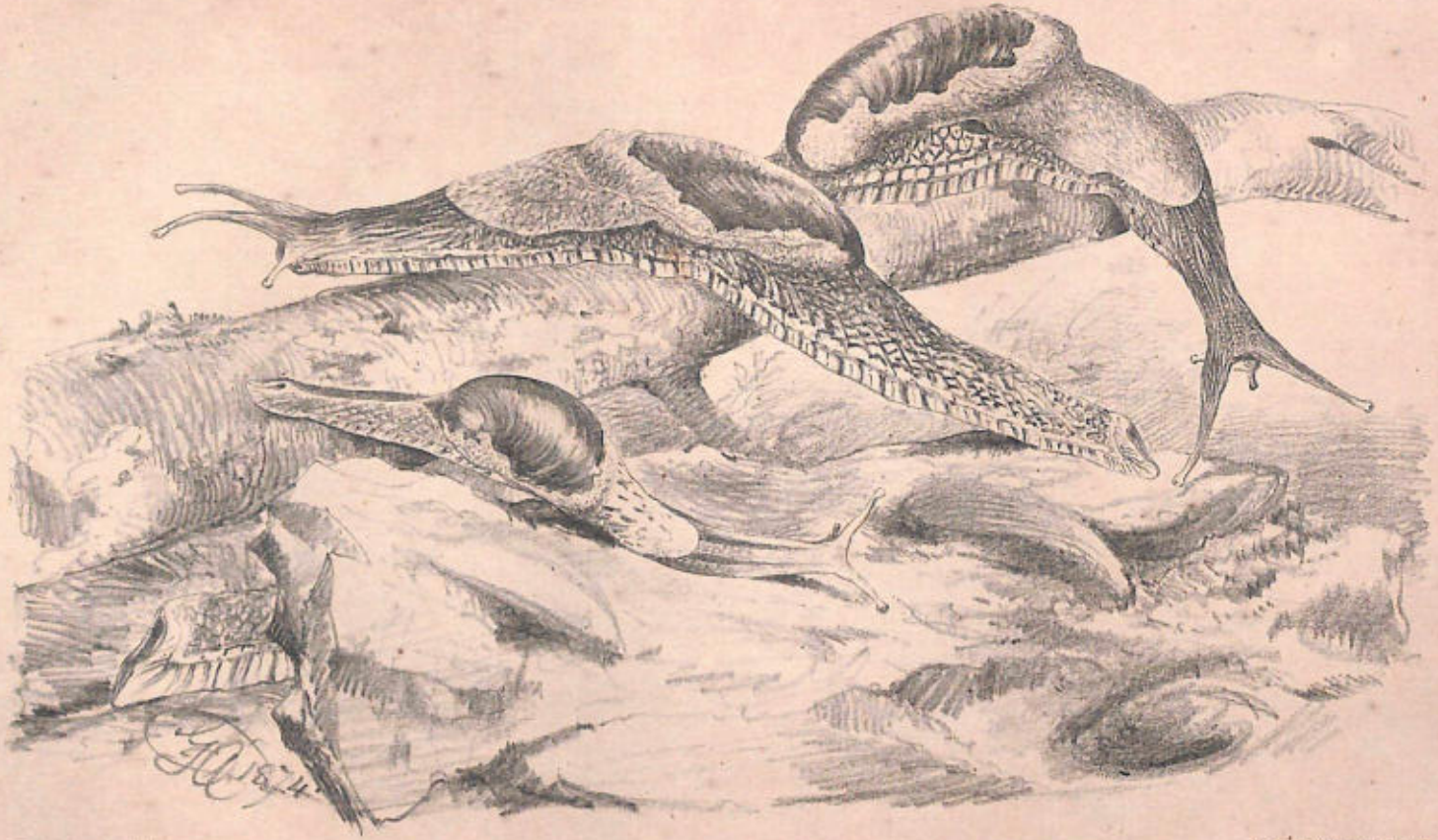
Godwin-Austen del.

Maclure & Macdonald Lith.

Godwin-Austen del.

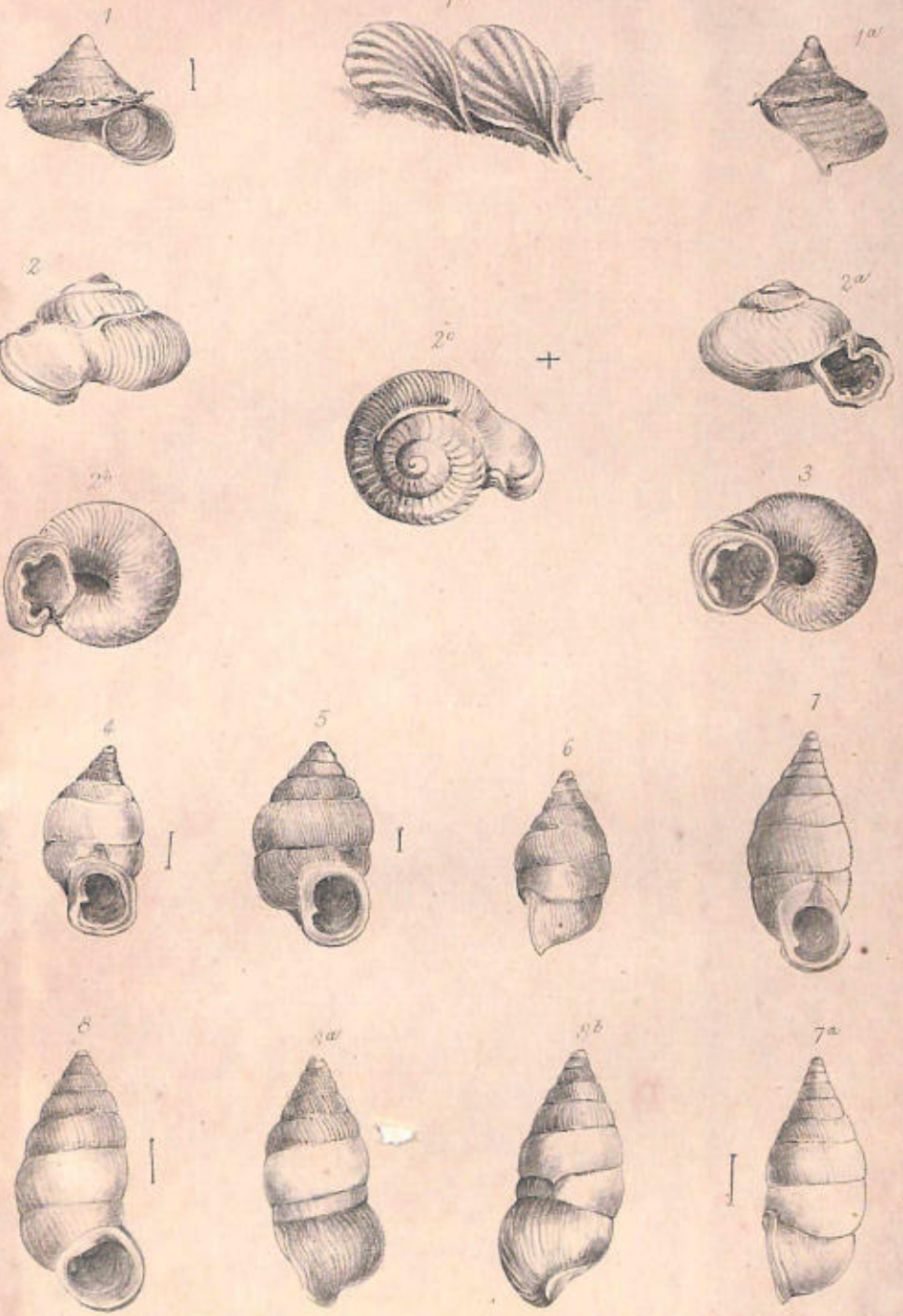
SPECIES
OF
HELICIDÆ, &c.
N. E. FRONTIER, BENGAL.

Mackrow & Macdonald Lith.



Godwin-Austen, del. Maclure & Macdonald, imp.

HELICARION GIGAS, nat size.
" " var. minor.



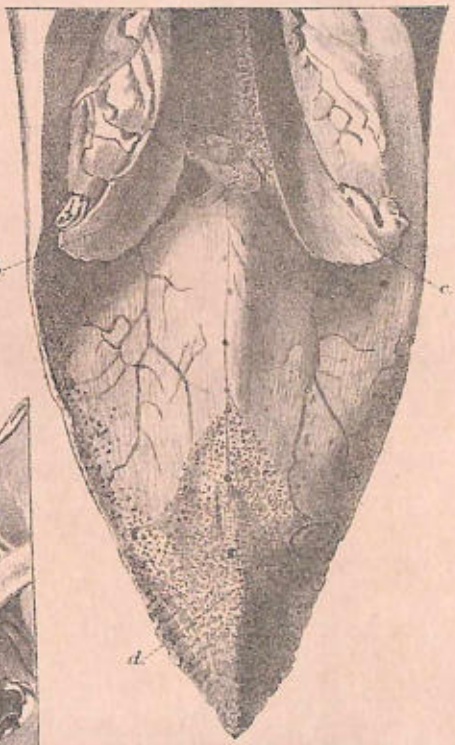
Godwin-Austen, del.

Mackinlay & Mansfield, imp.

SPECIES OF
CRASPEDOTROPIS, ALYCÆUS, & DIPLOMMATINA
NÁGA HILLS & ASSAM.

5.

6.



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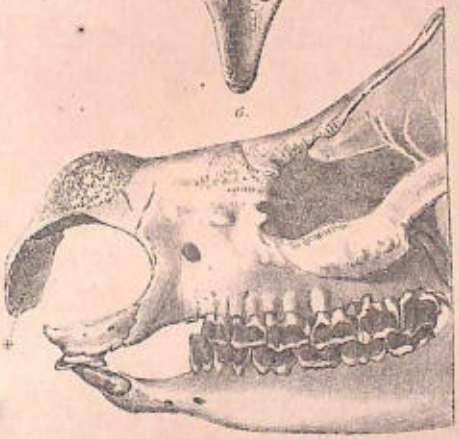
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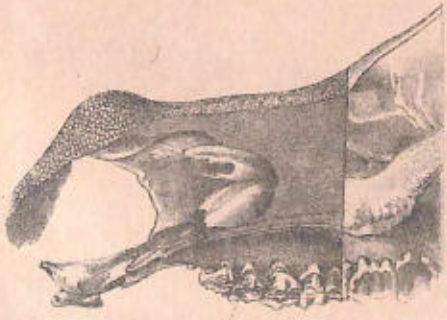
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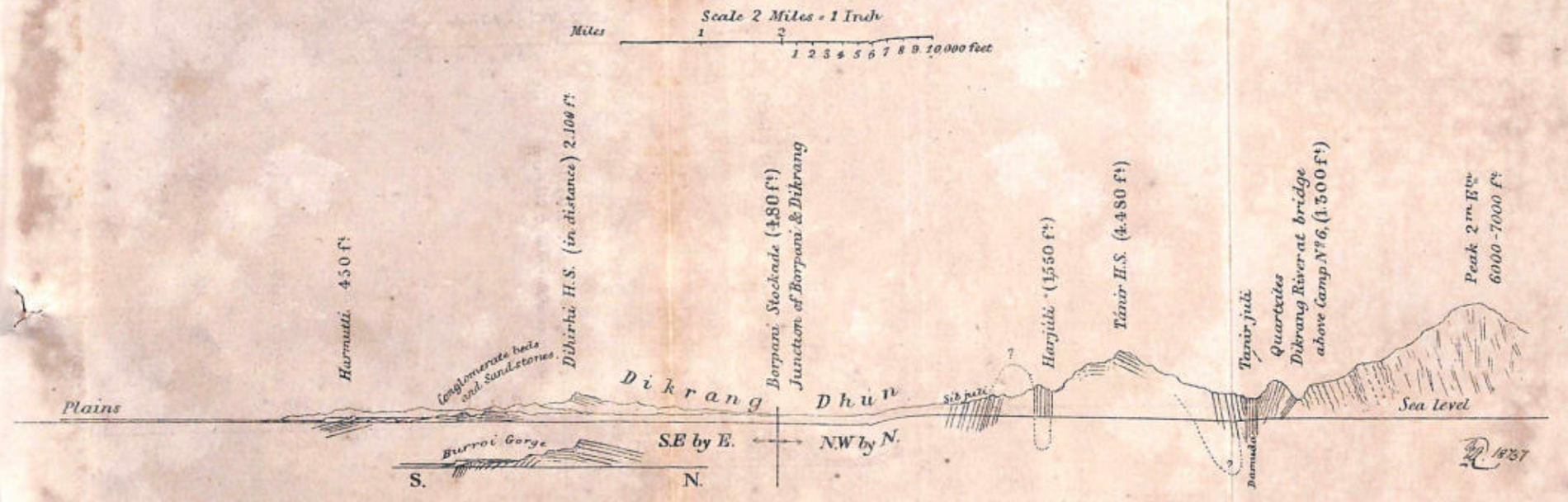
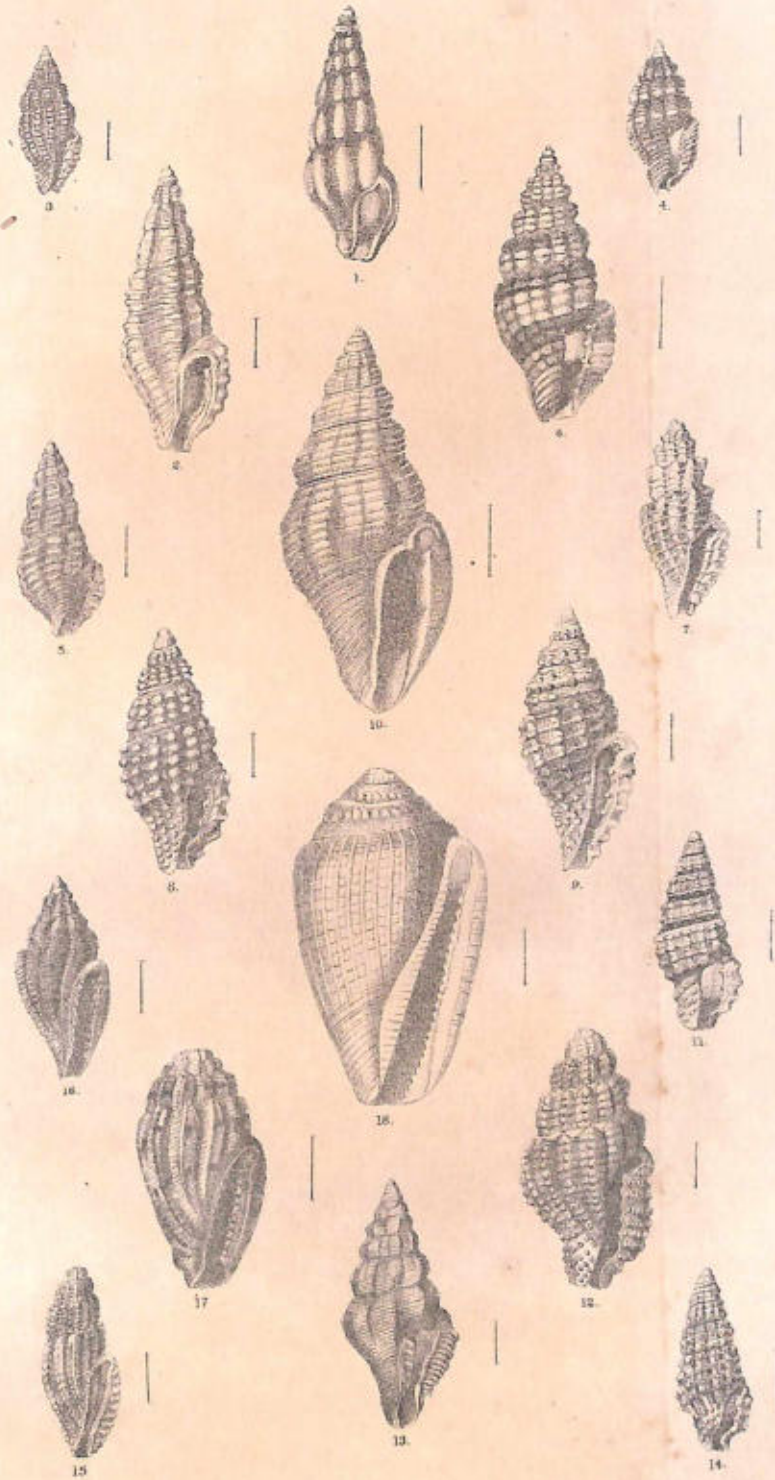
J. Schaumburg, Lith.

RHINOCEROS SONDAICUS.



SECTION THROUGH THE OUTER DAFLA HILLS.

Photozincographed at the Surveyor Generall's Office Calcutta.



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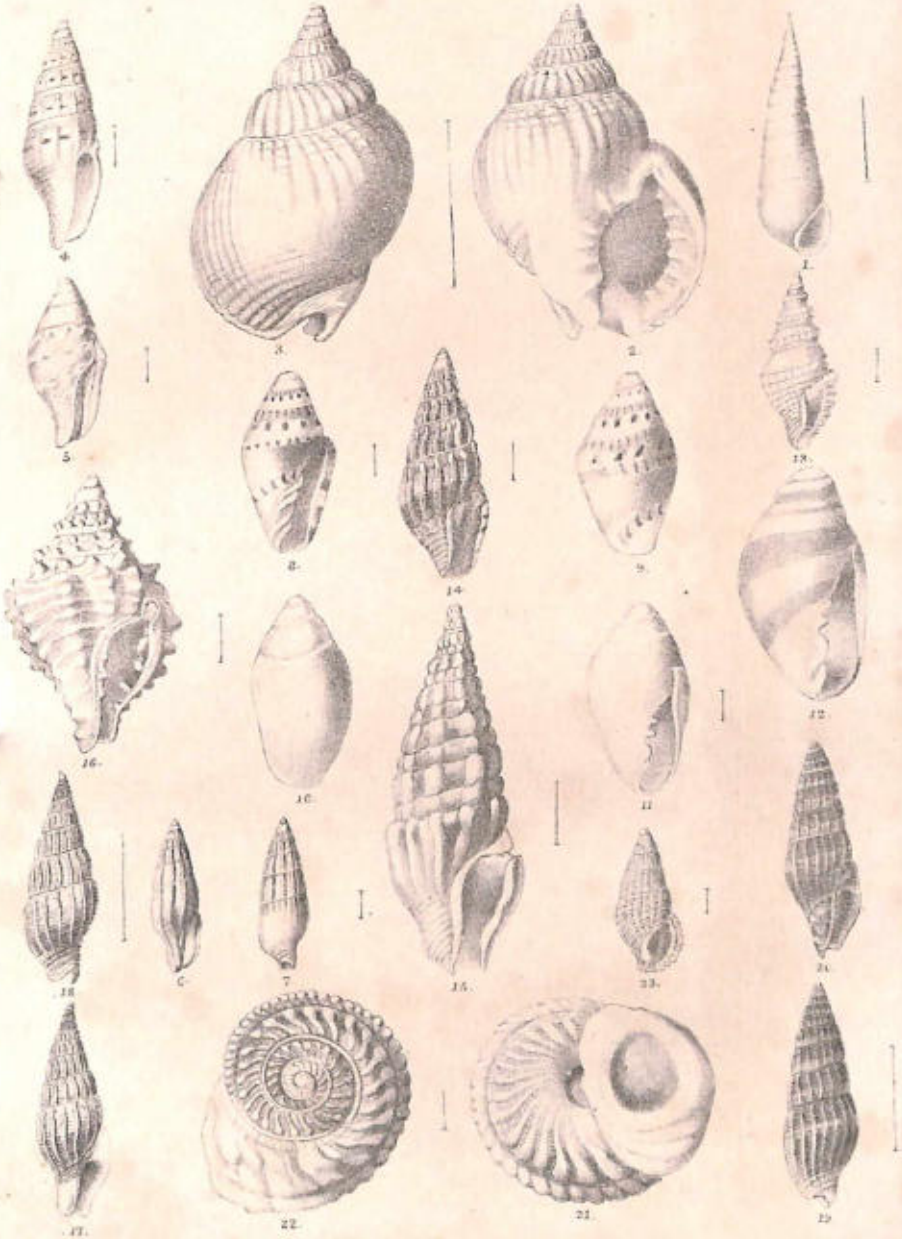


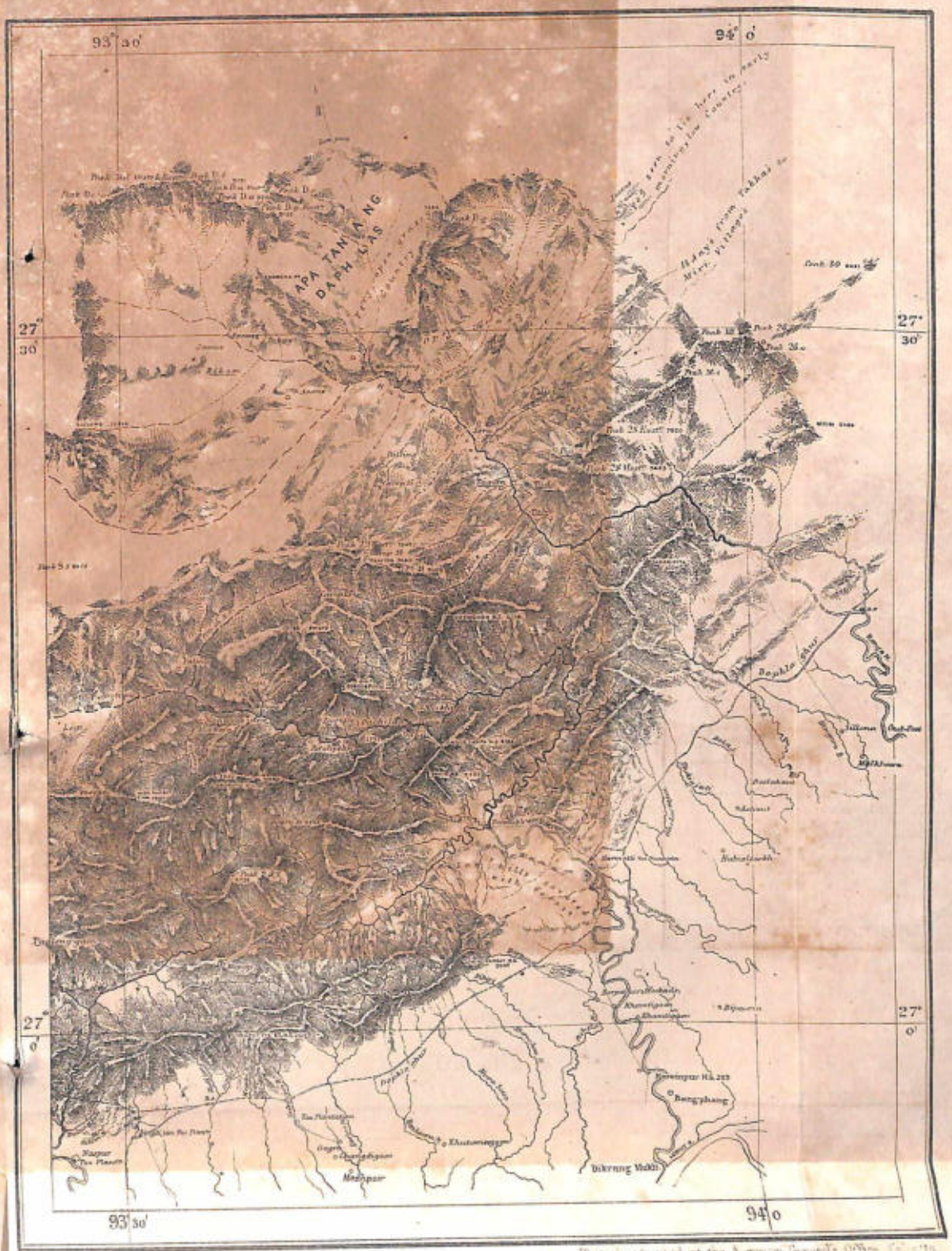
J. Schaumburg Lith.

S. Sedgfield Lyth: Calcutta.

1-4 QUERCUS PACHYPHYLLA. 5-8. Q. XYLOCARPA. 9. Q. OLLA.

S. Sudyfield. Lith: Calcutta.

1-7. DAPHNIPHYLLOPSIS CAPITATA.
8-9. NATSIATOPSIS THUNBERGIÆFOLIA.



Photozincographed at the Surveyor General's Office, Calcutta.

MAP OF PART OF THE DAFLA HILLS

Illustrating Major Godwin-Austen's paper on the Geology of the Dafla Hills.

Photozincographed at the Surveyor Gene

MAP OF PART OF THE DAFLA HILLS

Illustrating Major Godwin-Austen's paper on the Geology of the Dafla Hills.

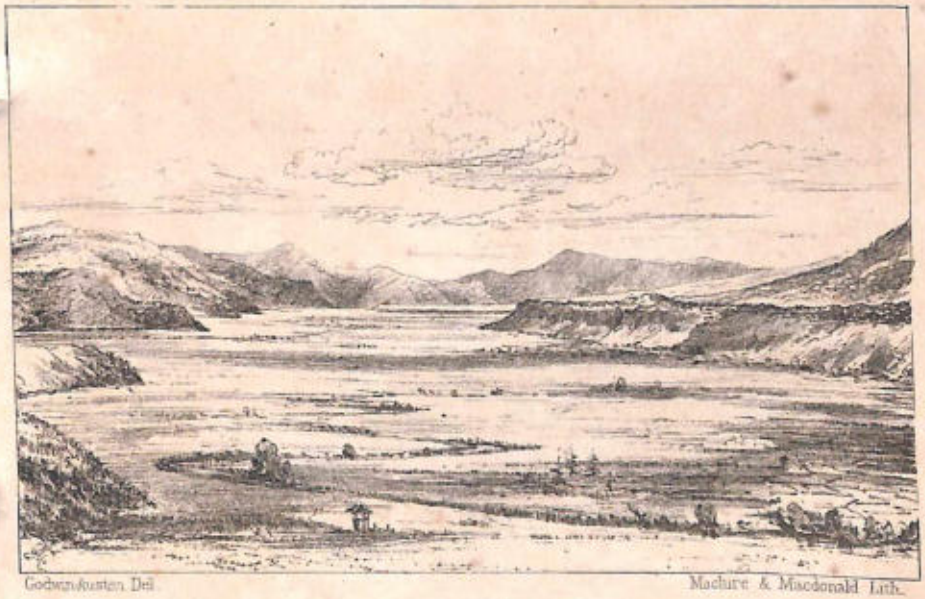
Lithographed at the Surveyor General's Office Calcutta.

MORAINE IN MAZIERH RAVINE, NAGA HILLS.

Photolithographed at the Surveyor General's Office, Calcutta.

ALLUVIAL TERRACES---HEAD OF BARAK VALLEY.

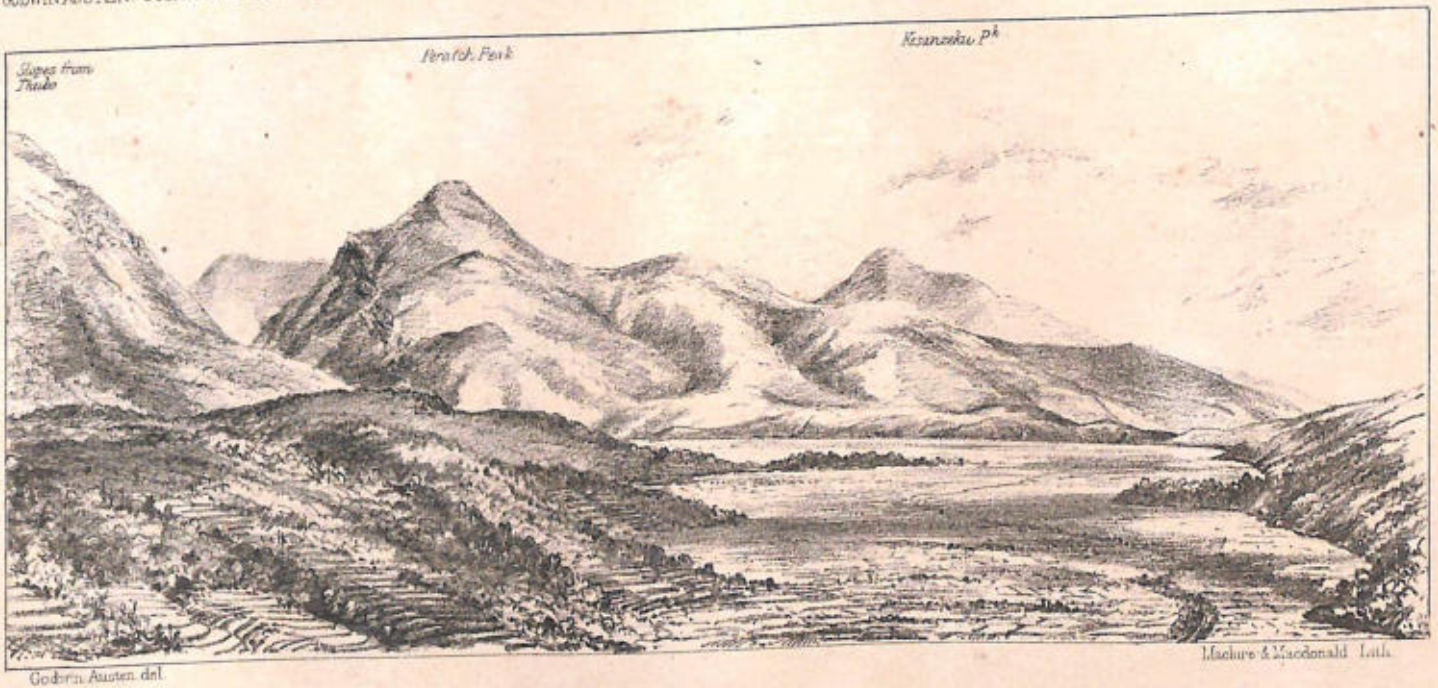
(Fig 1) LATERAL MORAINE. MÁZIERH RAVINE. NÁGÁ HILLS.



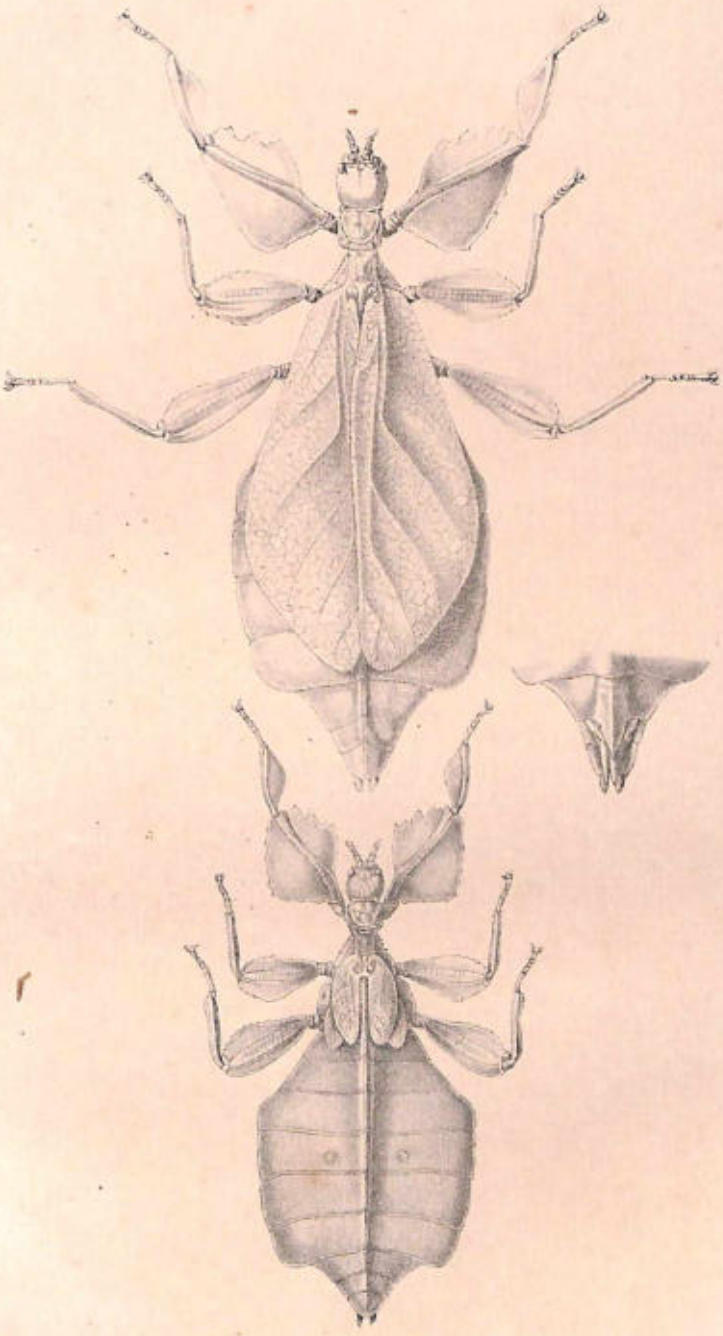
Godwin-Austen. Del. Machure & Macdonald Lith.

(Fig 2) LOOKING DOWN THE KHONGBA VALLEY. MUNIPUR. (Old Lake Bed)

GODWIN-AUSTEN. Journ. Asiat. Soc. Bengal. Vol XLIV. Part II. 1875.

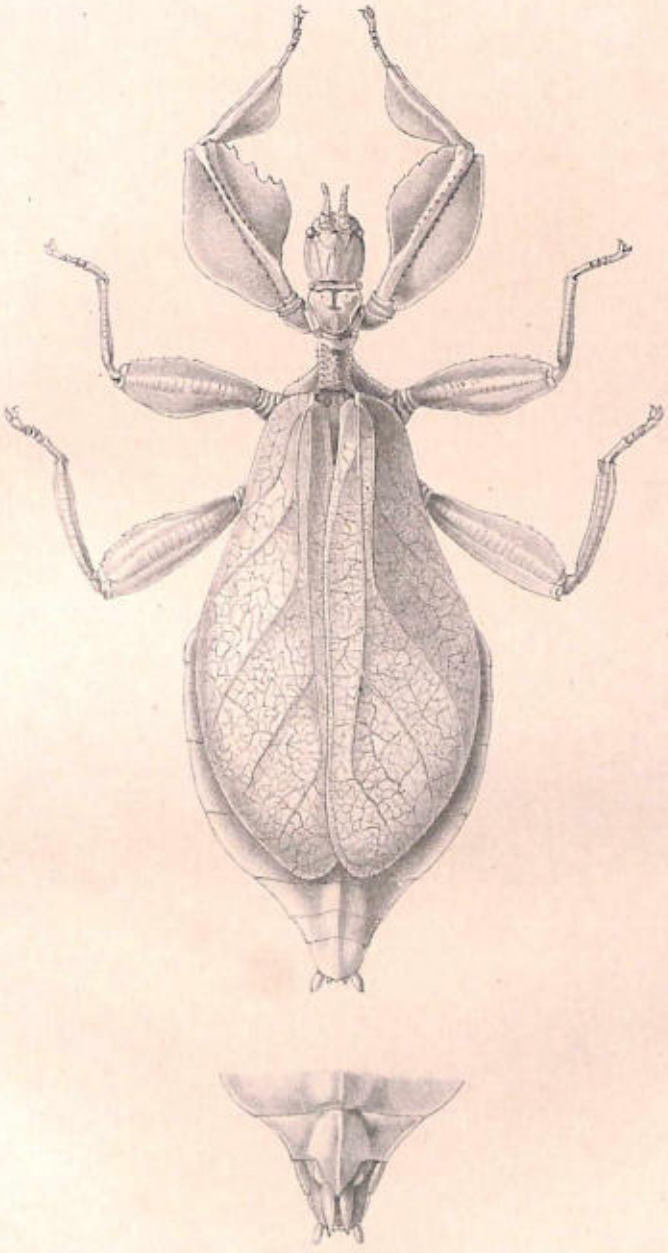


GÁZIA RURH MORAINE, near ZÁKÁMÉH. NÁGÁ HILLS.



J. Schaumburg, Lith:

PHYLLIUM CELEBICUM ♀



J. Schaumburg, Lith:

PHYLLIUM WESTWOODII.♀

Yours ever most truly,

C. P. Krauth

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

PART II. EXTRA NUMBER. AUGUST, 1875.

CATALOGUE OF MAMMALS AND BIRDS OF BURMA.

BY THE LATE

E. BLYTH,

C.M.Z.S.; HON. M.B.O.U.; HON. M. ASIAT. SOC. BENGAL; CORR. M. ROY. ACADEMY OF TURIN, OF ROY. NORWEGIAN, AND OF BATAVIAN SOCIETY OF SCIENCES; CORR. M. ACAD. NAT. SCIENCES OF PHILADELPHIA, AND NAT. HIST. SOC. OF THE MOSELLE DEPARTMENT.

WITH A MEMOIR, AND PORTRAIT OF THE AUTHOR.

HERTFORD:

PRINTED BY STEPHEN AUSTIN AND SONS.

1875.

INTRODUCTION.

The Catalogues which follow occupied the late Mr. Blyth during the last three years of his life. Sir A. Phayre, K.C.S.I., now Governor of Mauritius, had requested him to undertake a sketch of the Natural History of Burma, which should form a chapter in a work on that country then under preparation. The MS. when obtained from Miss Blyth, after her brother's death, proved to constitute a more elaborate paper than Sir Arthur's purpose required. Blyth, as was his wont, had gone into the subject *con amore*, and had poured out all he knew of the Mammal and Avi-fauna of Burma. An Introductory Note, apparently not quite completed, accompanied the Catalogues, and reserving this as sufficient probably for his object, Sir Arthur handed over the rest of the MS. to me, suggesting that the pages of this Journal would be the most appropriate place for such a paper.

This suggestion was one in which I cordially concurred; but the late Dr. Stoliczka, the able editor of Part II. of the Journal, was far away in Kashgar, and Dr. Anderson, of the Indian Museum, was in England. There might be a difficulty, in their absence, in passing this roughly written MS. through the press in Calcutta. Here, on the contrary, the most competent editorial aid offered; and having received the kindest assurances from Lord Walden, Dr. Anderson, and Dr. Dobson, I addressed the President of the Society, and proposed that the Catalogues should be published in London. This proposal was at once assented to, with a due expression of thanks on the part of the Council of the Society, both to Sir A. Phayre and to the gentlemen just named, whose respective shares in this publication will be explained in the sequel.

More than one obituary notice of Blyth and his scientific labours, by competent and kindly pens, has already appeared in the columns of those Journals to which he had been in the habit of contributing. This seems

a fitting place for collecting in a brief memoir such particulars as are obtainable of his early life, and such as I can myself supply of his long career in our Society's service. My personal acquaintance with him commenced on my return to India from furlough in 1848. He had then been Curator of our Museum for seven years, and my official connexion with the Society, combined with a taste for his pursuits, brought me into frequent and close relations with him. Of the incidents of his pre-Indian life some knowledge has been obtained from his sister, who has kindly given me access to such of his letters as are in her possession.

The carbon print which accompanies this memoir has been prepared by the Autotype Company from a photograph taken of Blyth when he visited Dublin some ten years ago. It has been kindly contributed to me by Miss Blyth and her relative Mr. R. Loder, of High Beeches, Crawley, Sussex.

Edward Blyth was born in London on the 23rd December, 1810. His father was of a Norfolk family, and from him the son appears to have inherited both his taste for nature and the retentive memory for which he was so remarkable. Blyth's father died in 1820, leaving four children, whose care and education now devolved on the widow, a Hampshire lady, who at once sent Edward, the eldest boy, to Dr. Fennell's school at Wimbledon. Here the boy seems to have made unusual progress in his books, but the school reports describe him as of truant habits, and as being frequently found in the woods. He left school in 1825, and his mother seems at first to have intended him for an University career, and ultimately for the Church, but at Dr. Fennell's suggestion she sent her son to London to study chemistry under Mr. Keating, of St. Paul's Churchyard. He did not, however, long persevere in this study, being dissatisfied with his instructor's mode of teaching. His enthusiasm for Natural History pursuits disinclined him for any ordinary employment, and on coming of age he embarked the little means he had in a druggist's business at Tooting. To this he seems to have given little personal attention. The management of the business was left to another, while Blyth devoted all his time to the study which engrossed his thoughts. "Never," says his sister, "was any youth more industrious; up at three or four in the morning, reading, making notes, sketching bones, colouring maps, stuffing birds by the hundred, collecting butterflies, and beetles—teaching himself German sufficiently to translate it readily, singing always merrily at intervals." He took a room in Pall Mall, to have readier access to books, and passed much of his time in the British Museum, in which, or in some kindred institution, he tried hard to find employment.

Naturally the Tooting business did not thrive under such fitful manage-

ment. Blyth soon found himself in serious difficulties; such literary work as offered itself in his own special line of study supplied him with but precarious means. In the Introduction to his edition of White's 'Selborne,' which bears date from Lower Tooting, 1836, he alludes to the anxieties which then surrounded him, though "his mind," he adds, "cleaves to its favourite pursuit in defiance of many obstacles and interruptions, and eagerly avails itself of every occasion to contribute a mite to the stock of general information." Young as he was, Blyth had at this time earned for himself a reputation as a diligent and accurate field observer, and he corresponded with many of the leading naturalists of the day. He seems to have been a contributor to both Loudon and Charlesworth's series of the Magazine of Natural History from 1833 till his departure for India, and in one of his papers of the volume for 1838 he proposed a new arrangement of Insessorial birds. Rennie enlisted him as a writer in the "Field Naturalist," and he was associated with Mudie, Johnston, and Westwood, in an illustrated translation of Cuvier, which was published by Orr and Co. in 1840. Blyth undertook the Mammals, Birds, and Reptiles in this work, adding much original matter of his own, which is inclosed within brackets. A new and enlarged edition of the work appeared in 1854, with important additions to the Molluscs and Fishes by Dr. Carpenter.

The Proceedings of the Zoological Society from 1837 to 1840 contain a few papers read by Blyth at their meetings. One of these, on the Osteology of the Great Auk, observes on the distinctive characters of Auks and Penguins. In another he draws attention to peculiarities in the structure of the feet of the Trogons. But the most important of these contributions was his Monograph of the genus "Ovis," read in 1840.* He here describes fifteen species of Sheep, including the then newly discovered *O. poli*, from Pamir. At the same meeting he exhibited drawings and specimens of the Yak, Kashmir Stag, Markhur, Himalayan Ibex, and other Indian ruminants, his remarks on which show the attention which he had already begun to give to the Zoology of India.

Just at this time our Society had obtained from the Court of Directors a grant for a paid Curator of its Museum, which had grown into a collection beyond what was manageable by the honorary office-bearers who had

* Proc. Zool. Soc., July 28. This was an "Amended List" of species, of which he had enumerated nine in a summary Monograph in the previous February. This paper was reprinted in Taylor's Mag. of Nat. Hist. in 1841, and again with additional matter in J.B.A.S. vol. x. pt. 2, p. 858.

hitherto looked after it. The labours of Hodgson, Cantor, M'Clelland, and others, had filled it with valuable Zoological specimens, which with important fossil and other contributions were falling into great disorder. Prof. H. H. Wilson, then our honorary agent in London, was asked to select a competent man to undertake the general charge of the Museum, and the appointment was offered to and accepted by Blyth, then in weak health, and professionally advised to seek a warmer climate. Provided with passage and outfit by the Court of Directors, the latter arrived in Calcutta in September, 1841. His letter to Mr. H. Torrens, published in our Society's Proceedings for that month (vide Journ. Vol. X. Pt. 2, p. 756), expresses the diffidence with which he entered on the charge of the Mineral Department of the Museum; but of this duty he was largely relieved in the following year on the appointment of Mr. Piddington to all the Departments of Economic Geology. He still retained the custody of the Palæontological specimens.

One of the duties impressed on him by our then President, Sir E. Ryan, was that of furnishing monthly reports at the Society's meetings; and in October, 1841, he accordingly submitted the first of that long series of useful reports which appear in our Proceedings with scarcely any intermission for the next twenty years. Each of the monthly issues of this Journal for the remainder of 1841 contains a paper by Blyth. In the first of these, 'A general review of the species of True Stag,' etc., he committed himself to an opinion, shared with him by Ogilby, regarding Hodgson's *Cervus affinis*, which, as Jerdon has pointed out (Mamm. p. 252), he did not recant till 1861.

Many of Blyth's reports fill from fifteen to twenty pages, and his remarks on the various contributions which reached him were just what were wanted by the field observers who supplied them. The active correspondence which he set on foot with these and with sportsmen, all more or less naturalists, throughout India, encouraged their useful pursuits, and brought him a large accession of specimens. He received in July, 1846, the thanks of the monthly meeting of our Society for his exertions "in opening out new channels of scientific intercourse." * He had already found it necessary to apply for assistance in his Museum duties, but the Society had not the means of supplementing the Government grant beyond the small allowance which they gave him for house rent. Had Blyth been less devoted to the special service in which he had engaged, there were not wanting to him opportunities of finding far more remunerative employment in other

* J.B.A.S. xv. p. 51.

quarters. The Dutch authorities in Java seem to have about this time made him a very tempting offer.

The Proceedings of the Zoological Society for 1841 and 1842 contain two letters from Blyth, of which one was written on the voyage out to India,* and the other shortly after his arrival.† The latter contained remarks on various species of birds found in India and Europe. Nothing from his pen appears in the Calcutta Journal of Natural History, of which the publication had just commenced when he reached India, and which was brought to a close in 1847. He found time, however, to send home several papers for the Annals of Natural History in 1844–48, as will be seen in the List appended to this Memoir, in which I have endeavoured to collect the titles of all his published writings.

The unpleasant episode in regard to the publication of the Burnes Zoological drawings with Dr. Lord's notes had occurred before I joined the Society. The materials, which consisted of certain wretched figures by a native artist, and some descriptions of already well-known species, the Afghanistan localities of which were alone new, had been made over to us by the Government before Blyth became our Curator. The lithographer's death had brought the work to a stand, and when inquiry was made in 1844, the notes which were to furnish the letterpress were not forthcoming. Blyth's explanation of his share in their disappearance will be found in our Proceedings of October, 1844.‡ This was followed by a controversy with Mr. Torrens,§ then our Secretary; and the financial embarrassments of the Society soon afterwards necessitated the abandonment of the publication. Of the fourteen coloured copies of the completed plates, I possess one, and I quite agree with Blyth that their issue would have brought ridicule on the Society.

The heavy outlay incurred on this undertaking, and on the publication of Cantor's Chusan drawings, was unfortunately the cause, not only of the embarrassments just noticed, but of a temporary estrangement between the Philological and Physical classes of our members. Funds which had been assigned by the Government for furthering Oriental literature had no doubt been appropriated to other objects. Blyth came in for a share of this discontent on the part of the Orientalists, and some Naturalists also complained that he was enriching the Mammal and Bird departments of the Museum at the expense of those of the shells, fossils, and insects. The want, too, of a Catalogue of the collections had been long felt, and the

* P.Z.S. 1841, p. 63.
† *idem.* 1842, p. 93.
‡ J.B.A.S. xiii. pt. 2, p. 51.
§ *idem.* xiv. pt. 2, p. cvi.

Curator had been repeatedly urged to supply it. The Council refers to his delay in performing this duty in their Report* of 1848, while commending "his regularity of attendance and remarkable industry." His application for increased pay and a retiring pension was referred to the Society at large with the following guarded remarks:—"It must be admitted that for any scientific man capable of discharging the duties on which Mr. Blyth is employed, and of performing them with activity and zeal, for the advancement of science, etc., the [monthly] salary of 250 rupees is a very inadequate compensation. But the Council cannot but regard the present as an inauspicious period to address the Honourable Court in furtherance of any pecuniary claim. The diversion of the Oriental grant to so large an amount as has but lately been brought to notice, cannot be regarded with indifference by them, nor can it have disposed them to entertain with much favour any fresh demand on their munificence preferred by the Society." The application was then referred for report to the Natural History Section, and notwithstanding the stout struggle made on his behalf in the Section, their report was unfavourable to Blyth's claims, which were finally negatived at the July† meeting in 1848.

In the following year Blyth published his Catalogue of Birds, which had in fact long been ready for issue in a form which would have satisfied the Council. It had been constantly kept back for the Appendices, Addenda, and "Further Addenda," which disfigure the volume, and seriously detract from its value as a work of reference. This habitual reluctance of his to part with his compositions till he had embodied in them his latest gained information is conspicuous throughout his contributions, and it is in fact partly due to this habit that these Burman Catalogues form a posthumous publication.

Blyth availed himself of every opportunity which offered of escape from his closet studies to resume his early habits of field observation. Frequent mention will be found in his reports of the little excursions into the country which he thus made, and of the practical results obtained from them. The geniality of his disposition and the large store of general information at his command insured him a warm welcome in all quarters. One of his favourite resorts was Khulna, on the edge of the Jessore Sunderbuns, where the indigo factory of an intelligent and untiring observer‡ offered him a favourable station for field pursuits.

* J.B.A.S. xvii. pt. 1, p. 10. † J.B.A.S. xvii. pt. 2, p. 122.

‡ Our common friend Robert Frith, whose name is of frequent occurrence in the Curator's reports.

Several contributions from Blyth on his special subject will be found in the pages of the different sporting Journals which have appeared in Calcutta. He was on the regular staff of the 'Indian Field.' In the 'India Sporting Review' he published a sketch of 'The Osteology of the Elephant,' and a series of papers on 'The Feline Animals of India.' For the 'Calcutta Review' he wrote an article on the 'Birds of India.' It gives the results of his latest experience on the subject of the communication made in 1842 to the Zoological Society, which has been noticed above, and shows that of 353 species of birds admitted by Yarrell into the English avifauna, no less than 140 are found in India.

In 1854 Blyth was married to Mrs. Hodges, a young widow whom he had known as Miss Sutton, and who had lately come out to join some relatives in India. This step on his part necessarily aggravated the embarrassments entailed on him by his inadequate income, and on completing his fourteenth year of service in 1855, he memorialized the Court of Directors for an increased salary and for a pension "after a certain number of years' service." In the second paragraph of his memorial he observes, "that however desirous the Asiatic Society might be of augmenting your memorialist's personal allowances, the ever-increasing demands on its income, consequent on the extension of its collections among other causes, altogether disables it from so doing." On this memorial being submitted to the meeting* of May, 1856, it was agreed to forward the document to Government, "with the expression of the high sense entertained by the Society of the value of Mr. Blyth's labours in the Department of Natural History, and of its hope that the memorial may be favourably considered by the Honourable Court."

The extract just given will show, in Blyth's own words, that he had no complaints to make of our Society's treatment of him. Mr. A. Hume, who seems to have first joined our Society in 1870, has gone somewhat out of his way in his 'Rough Notes'† to do justice to Blyth's merits as Curator, at the expense of older members. The language used is in Mr. Hume's characteristic style, and is as offensive as the charge brought against the Society is unjust. The same charge is implied in the use of the words "neglect and harshness" in the "In Memoriam" with which vol. ii. of 'Stray Feathers' opens, and which, with this exception, describes with much truth and feeling the life-long struggle in India, as at home, which Blyth's

* J. B. A. S. xxv. 237.

† See note to 'My Scrap Book or Rough Notes on Indian Oology and Ornithology,' No. 1, p. 181.

scientific ardour supported him in maintaining against the most depressing obstacles.

That nothing came of this memorial is due probably in some measure to the movement which commenced in 1857 for transferring our collections to an Imperial Museum, but mainly to the great convulsion which shook our empire in that year. I find no record in our Proceedings of any reply having been made to our recommendation, and the negociations for the foundation of the new museum were not resumed for some three years.

Blyth made a short tour in the N.W. Provinces in July, 1856. He spent some six weeks in Lucknow, Cawnpore, Allahabad, and Benares. Oude had just been annexed, and the sale of the Royal Menagerie at Lucknow had been determined on. The tigers were the finest caged specimens in the world, and to one who understood their value in the European market, the inducement to buy and ship the animals was irresistible. A German friend joined in the speculation, and found the necessary funds. Blyth was to do the rest, and as no competitors offered, he bought the bulk of the collection for a trifle. Eighteen magnificent tigers were sold at 20 rupees (£2) a head! Some casualties occurred on the passage down the river; but his collection, when exhibited in Calcutta, contained sixteen tigers, one leopard, one bear, two cheetas, three caracals, two rhinoceroses, and a giraffe, which carried a saddle and was daily ridden. Difficulties unfortunately occurred in finding ships for the transport of the animals, and their detention in Calcutta caused further casualties and heavy charges, which his partner would not face. The speculation collapsed, but one of the tigers which reached England realized £140.

In December, 1857, Blyth had the misfortune to lose his wife. His short married life had been of the happiest, and the blow fell heavily on him. His letters to his sister for the early months of 1858 are painful to read. The shock proved too much for him, and brought on a serious attack of illness; it threatened paralysis of the heart, and he seems to have been subject to partial returns of similar attacks for the rest of his life. His health too suffered much from the isolation imposed on him by his straitened means, and from want of proper exercise. Some distraction for his thoughts was luckily afforded at this time by the opening up of a new fauna in the Andaman Islands, which Dr. Mouatt had been sent to report on before their occupation as a penal settlement. To this Report Blyth contributed an interesting chapter on the Zoology of the Islands, so far as it was then known.

The China expedition of 1860 was considered both at home and in India a good opportunity for obtaining information regarding the natural history of

North China. Blyth's name was put forward as that of a naturalist readily available and eminently qualified for the post of naturalist to the expedition. Replying to Lord Canning's objections that scientific observations in a hostile country would have to be carried on at much personal risk, our Council,* while urging the importance of the mission in a scientific point of view, stated on Blyth's behalf that "he was quite willing to encounter the danger, whatever it might be." The application, however, failed: no naturalist was appointed. This result was to be regretted, as it affected Blyth personally, for his health was failing, and the sea-voyage, with the stimulus afforded by so interesting a mission, would have been most beneficial to him, and would probably have averted the utter breakdown which was now at hand. It is doubtful whether he was equal to the more laborious task which he offered to undertake in the following year, when the scientific expedition into Chinese Tartary was projected by the Government.

Blyth was a staunch adherent of Darwin's views, and an opportunity of thus declaring himself offered at our November meeting in 1860, when Mr. H. Blanford read his paper on the well-known work of Dr. Broun on the laws of development of organized beings. The value attached by Darwin to Blyth's observations is shown by the frequent reference made to them, more especially in his 'Animals and Plants under Domestication.' His first citation of Blyth in the latter work describes him as an "excellent authority," and the many quotations that follow in these interesting volumes show how carefully he read and noted all that fell from Blyth, even in his contributions to sporting journals.

In 1861 Blyth's health fairly gave way, and in July of that year a second memorial was submitted to Government† with a view to obtaining a reconsideration by the Secretary of State for India of his claims to a pension. Lord Elgin, the new Viceroy, took up the subject warmly, and pressed it on the attention of the Home authorities as a special case:‡ "the case," as he observed, "of a man of science who had devoted himself for a very small salary to duties in connexion with the Asiatic Society, a body aided by and closely identified with the Government of India, from which the public have derived great advantage." After describing Blyth as "the creator of the Natural History Museum, which has hitherto supplied the place of a public museum in the Metropolis of India, and which will probably soon be made over to Government as part of a national museum," and referring to the

* J. B. A. S. xxix. p. 82. † J. B. A. S. xxxi. 60.

‡ *Idem.* xxxi. 430.

importance of Blyth's labours in zoology in maintaining and extending the character and standing of our Society, this dispatch concludes thus: "His Excellency in Council considers, therefore, that if under such circumstances Mr. Blyth should, after twenty years' service, be compelled to retire from ill health, brought on very much by his exertions in pursuit of science, it would not be creditable to the Government that he should be allowed to leave without any retiring pension."

Meanwhile, Blyth was only enabled to remain at his post by the facilities which the Council afforded him of making short successive visits to Burma. He was for some five months in that province, from which, and more especially from the Yonzalin River, he communicated several interesting letters. His camp life there agreed with him, and he had kind friends like Phayre, Fytche, and Tickell to associate with and take care of him. His return to Calcutta was always attended by a relapse, and the hot season of 1862 brought him to a state for which there was no alternative but instant departure for Europe. As yet, however, no orders had been received from home in regard to the pension. It was clear that for these it would not do to wait, and the Council* under the emergency gave Blyth a year's leave on full pay. He had hardly gone when the expected reply was received, and this, notwithstanding the Viceroy's strongly expressed opinion, proved† an unfavourable one. Eventually‡ a pension of £150 a year was conceded, owing, I believe, mainly to the untiring efforts made in London on Blyth's behalf by the late Sir P. Cautley and Dr. Falconer.

By the end of 1864 our Society's negociations with the Government for the transfer of its collections to the Indian Museum had been brought to a successful close, and at the November meeting the following just tribute was paid to our late Curator in the form of a resolution, which, on the Council's proposition, was carried unanimously:—

"On the eve of transferring the zoological collections of the Society to Government, to form the nucleus of an Imperial Museum of Natural History, the Society wishes to record its sense of the important services rendered by its late Curator, Mr. Blyth, in the formation of those collections. In the period of twenty-two years during which Mr. Blyth was Curator of the Society's Museum, he has formed a large and valuable series of specimens richly illustrative of the ornithology of India and the Burmese Peninsula, and has added largely to the Mammalian and other vertebrate collections of

* The Council's action in anticipation of the vote of a meeting was cordially approved at our annual meeting of 1863, but was protested against as illegal by Mr. Oldham.

† J. B. A. S. xxxii. 32.

‡ J. B. A. S. xxxiii. 73.

the Museum; while, by his numerous descriptive papers and catalogues* of the Museum specimens, he has made the materials thus amassed by him subservient to zoological science at large, and especially valuable to those engaged in the study of the vertebrate fauna of India and its adjoining countries."†

Blyth was elected an Honorary Member of the Society in the following year. The Museum was now under a Board of Trustees, and a new Curator, better paid, and with all the prospective advantages of a Government official, had taken charge of it. Writing to me from Malvern, in June, 1865, Blyth says: "I had always a presentiment that my successor in the Museum would be more adequately remunerated, beginning with just double what I had after more than twenty years' work, with an additional £50 yearly, and house accommodation! How very much more could I have accomplished with such an income!" With this mild explosion he brushed off discontent, and strove to make the most of his small means. His letters to me, and these were frequent up to the time of my leaving India in 1868, were full of his own special subject; some of them are published in our Society's Proceedings.

In January, 1864, Blyth visited Dublin, where he read two papers before the Royal Irish Academy. The first of these was 'On the True Stags or Elaphine division of the genus *Cervus*,' and does not appear to have been printed *in extenso* in the Academy's Proceedings.‡ His other paper, 'On the Animal Inhabitants of Ancient Ireland,' was published at length in the Academy's Proceedings§ of January 25th. What the extraordinary bones were which he exhibited at the meeting, and which he referred to as "probably Tibetan," was not explained in any of his letters.

At a meeting of the Geological‖ Society of Dublin, he made some remarks on a paper of Professor Haughton's 'On Geological Epochs,' and expressed his concurrence in Dr. Carte's identification of the bones of the Polar Bear discovered in Lough Gur, in County Limerick. On further examination, however, these bones have been pronounced by Mr. Busk to be indistinguishable from those of *Ursus ferox*.

The question of zoological distribution will be found to have been treated by Blyth, in a paper which he contributed to 'Nature' in 1871

* Blyth's Catalogue of Mammalia was published in 1863, its last sheets being carried through the press by his friend Jerdon.

† J. B. A. S. xxxiii. 582.

‡ Vol. viii. Jan. 11, 1864, p. 458.

§ *Id. qu. sup.* p. 472.

‖ Proceedings G. S. D. for January 13, 1864, Journ. p. 173.

(March 30). He had been led to consider it while drawing up the introductory chapter which was to preface these catalogues, for in a letter to me dated 15th July of that year he refers to this MS. as follows:—

"I suppose that Phayre showed you my sketch of what I conceive to be the true regions and sub-regions of S. E. Asia, and I expected that he would have modified somewhat my notions with regard to the provinces into which I venture to divide the *Indo-Chinese sub-region*, but he seems to have assented to them altogether. Only yesterday I received the 'Proceedings of the Asiatic Society' for April and May last, and the 'Journal of the Asiatic Society of Bengal,' Part II., No. 1, 1871, and in p. 84 of the 'Proceedings' I find some remarks by Stoliczka which quite confirm my views, only that I think that, with regard to the extension of the Malayan fauna into India, he should rather have said *Southern* India, because the African affinities of Central and Northern India, inclusive of the Siwâlik Deposits, are of ancient date, as shown by the occurrence of *Bos namadicus* in Central India, which is barely separable from the European *B. primigenius* (a type of *Bos* which is elsewhere only known from Europe), and by the presence of giraffes and of antelopes of African type in the Siwâlik Deposits. I have such an enormous mass of valuable facts to deal with, that I gave over making them public in driblets at the meetings of the Zoological Society; and I have now time and undisturbed leisure to treat of them in a work which I am preparing on 'The Origination of Species,' a subject upon which I think I can throw some light."*

As pointed out in a note, Blyth's 'Austral-Asian region' is generally the same with Dr. Sclater's 'Indian region,' *minus* Hindustan proper, or the plains of Upper India east and south of the north-west desert—the Dukhun or table-land of the Peninsula with the intervening territory, inclusive of the Vindhyan Ghats—the Coromandel Coast and the low northern half of Ceylon—all of which Blyth places in his Ethiopian region. What remains of India after this large deduction Blyth distributes through three sub-regions, viz. the Himalayan, Indo-Chinese, and Cinghalese. India cannot, he argues, be treated as a natural zoological province: it is a border-land in which different zoological regions meet, and one, therefore, "of extraordinarily complex zoological affinities." Burma of course falls within his Indo-Chinese sub-

* Among the papers left by Blyth is one headed 'Origination of the Various Races of Man,' which he may have intended to form part of the book here referred to. It contains nothing original, but brings together numerous points of resemblance and contrast observable in the several groups of the order Primates.

region, which extends southward as far as Penang and Province Wellesley, where his Malayan sub-region commences.

The interest which Blyth had always taken in the Rhinoceros group was revived by the safe arrival at the Zoological Gardens of the Chittagong individual, the *Ceratorhinus crossei* of the present Catalogue. In his paper contributed to the 'Annals' in 1872, he argues against Gray's assignment of this species to *Rhinoceros sumatrensis*, and in favour of its identity with the fine Tavoy specimen shot by Col. Fytche, and figured in this Journal, vol. xxxi. p. 156. Blyth's conjecture that the Arakan Hills is one of the habitats of this species is borne out by the letter in which Capt. Lewin, the superintendent of the Hill Tracts of Chittagong, first reported to me in 1867 the capture of the animal.* After giving her measurements, which were then 6 feet from crown of head to root of tail, and 4 feet 2 inches in height, and otherwise minutely describing her horns, Capt. Lewin adds: "You are mistaken I think in supposing that she has come from the Tenasserim Provinces —the two-horned species is found in my hills. I have seen one alive, and several of my men have seen a dead one."

In the Journal of Travel and Natural History, No. 2,† of 1868, will be found a letter from Blyth in explanation of some remarks which he had made at the Zoological Society on the occasional shedding or loss by violence of rhinoceros' horns, followed by their renewal. In this he takes the opportunity of pointing out the tendency which some species have to develope a rudimentary horn on the forehead, and argues for the possible explanation in this manner of cases of three-horned rhinoceroses being reported by travellers.

The connexion which Blyth established, first with 'Land and Water,' and later with the 'Field,' gave him interesting literary occupation; and the 'Naturalist' columns of both these journals abound in scraps by 'Zoophilus,' which did real service to the advancement of scientific truth. No pen so ready as his to expose current fallacies or sensational announcements in works of travel of the results of loose and careless observations. Very many of his 'scraps' are worthy of being collected and preserved, for such use as we see they have been turned to by Mr. Darwin. These columns occasionally contained more elaborate papers, such as the series in the 'Field' for 1873, on 'Wild Animals dispersed by human agency,' and 'On the Gruidæ or Crane family.' This monograph, for such it amounts to, was

* The date of capture is erroneously given, both by Mr. Blyth and by Dr. Anderson in his cited communication to the Zoological Society.

† Page 130.

its writer's last utterance. He had long been ailing, and in the autumn of this year he became very ill, and went to Antwerp for a change. On his return he called on me, feeling, as he said, better, though complaining of great prostration. He seemed full of what he had seen in the Antwerp Zoological Garden, where he thought he had found another new species of Rhinoceros. This was our last interview. Though nursed by a tenderly-attached sister, his weakness increased, and he died of heart disease on the 27th of December, within a day or two of his 63rd birthday.

More competent authorities than I can pretend to be have done justice to the high intellectual powers which Blyth displayed from the outset of his career as a naturalist; to the wonderful capacity and accuracy of his memory, which, unassisted by any systematic notes, assimilated the facts once stored in it, and enabled him readily to refer to his authority for them; to his great power of generalization, and to the conscientious use which he made of it. Abundant proof of the high respect with which his opinions were always listened to, and of the careful consideration given to them even where they were not accepted, is to be found in the published works of his brother naturalists. No higher testimony to his habitual scientific caution need be adduced than that of Mr. Darwin, but it is equally borne by Jerdon throughout his published writings. Gould* refers to him as "one of the first zoologists of his time, and the founder of the study of that science in India." I confine myself here to putting on record the tribute of an old and intimate friend, to the excellent qualities of heart possessed by Blyth. The warmth and freshness of his feelings which first inspired him with the love of Nature clung to him through his chequered life, and kept him on good terms with the world, which punished him, as it is wont to do, for not learning more of its wisdom. Had he been a less imaginative and a more practical man, he must have been a prosperous one. Few men who have written so much have left in their writings so little that is bitter. No man that I have ever known was so free as he was from the spirit of intolerance; and the absence of this is a marked feature in all his controversial papers. All too that he knew was at the service of everybody. No one asking him for information asked in vain. Among the many pleasurable reminiscences of my own long residence in India, few are more agreeable than those which recall his frequent Sunday visits to me.

The Society are largely indebted to the three able Naturalists who have lent their aid to the publication of these Catalogues. That of the Mammalia, with the exception of the Bats, was revised by Dr. Anderson last

* 'Birds of Asia,' Pt. XXVI. *Trochalopteron blythii.*

year, before he was summoned to India to join the second expedition to Yunan. Dr. Dobson, of the Royal Victoria Hospital of Netley, has edited the Catalogue of the order *Chiroptera*, the study of which he has long specially cultivated. In both cases the notes and additions of the editors are inclosed within brackets, and bear their respective initials. One or two notes added by myself are signed 'Editor.' All unsigned notes and citations of references are those of the author of the Catalogues.

The Catalogue of Birds will be found, under Lord Walden's able and conscientious treatment, to be a complete list of the Burmese species, 660 in number, as ascertained to date. His editorial notes and additions, which embrace the latest information afforded by his fine collection, are inclosed in brackets, and largely enhance the value of the Catalogue. Blyth's MS., for the species enumerated in it, has been scrupulously adhered to, obvious errors of orthography having alone been corrected, and localities being added where the habitats were doubtful when he wrote. On this last point I quote Lord Walden's own words:

"The names of the localities added are given on the authority of Mr. "Davison, Mr. Oates, Major Lloyd, Captain Feilden, and Lieutenant Ward- "law Ramsay, whose initials will be found attached. My endeavour has "been to include those localities which, while within the range, are not "specified by Mr. Blyth. All Major Lloyd's and Lieutenant W. Ramsay's "specimens and some of Captain Feilden's have been identified by me. Mr. "Hume is responsible for the accurate identification of those obtained by "Mr. Davison and Mr. Oates, and although that gentleman, in most "cases, adopts the faulty nomenclature of Mr. G. R. Gray's Hand List, I "believe I have succeeded in correctly interpreting his meaning."

A. GROTE.

LONDON, *August* 27, 1875.

List of Mr. Blyth's published papers in the Journal of the Asiatic Society of Bengal and other Journals, with the necessary references.

Curator's Reports, read at the Society's Monthly Meetings.

Report for September, 1841, read by his predecessor, Mr. Piddington, on the occasion of Mr. Blyth's first introduction to the meeting of the 6th October, X. 836.

Report for October, 1841, X. Pt. 2, 917.

,, November, 1841, X. Pt. 2, 936.

Report for January, 1842, XI. Pt. 1, 95.

„ February, 1842, XI. Pt. 1, 129.

„ April, 1842, XI. Pt. 1, 444.

„ June, 1842, XI. Pt. 1, 585.

„ July, 1842, XI. Pt. 2, 788. The two Appendices to this Report monograph the Asiatic Drongos and Quails.

„ August, 1842, XI. Pt. 2, 865. Treating mainly of Reptilia.

„ September, 1842, XI. Pt. 2, 880.

„ October, 1842, XI. Pt. 2, 969.

„ November, 1842, XI. Pt. 2, 1202.

„ February, 1843, XII. Pt. 1, 166. To which is appended a revision of all previous reports, beginning with some interesting observations on Asiatic Simiadæ.

„ November, 1843, XII. Pt. 2, 925. This is entitled the "Monthly Report for December, 1842," but it contains Addenda, which cover the whole intervening period. It is very full and interesting, especially in its comments on collections from Darjeeling.

„ May, 1844, XIII. Pt. 1, 361. Further appendix to the above report for December, 1842. It describes the Mynahs and Babblers.

„ November, 1846, XV. p. xcix.

„ February, 1847, XVI. Pt. 1, 209.

„ March, 1847, XVI. Pt. 1, 385.

„ April, 1847, XVI. Pt. 1, 502.

„ May, 1847, XVI. Pt. 1, 603.

„ June, 1847, XVI. Pt. 2, 725. Describing the Quadrumana in the Society's Collection.

„ July, 1847, XVI. Pt. 2, 863. Describes the Sciuridæ in the Society's Collection, and gives Addenda to previous Reports.

„ August, 1847, XVI. Pt. 2, 992. With Supplement. Describes the Hornbill group.

„ December, 1847, XVI. Pt. 2, 1271. Remarks on the different species of Pangolins.

„ January, 1848, XVII. Pt. 1, 82.

„ March, 1848, XVII. Pt. 1, 247.

„ April, May, and June, 1848, XVII. Pt. 1, 559.

„ January, 1849, XVIII. Pt. 1, 80.

„ June, 1850, XIX. 426.

„ July, 1850, XIX. 490.

„ September, 1850, XIX. 497.

Report for October, 1850, XIX. 561.

„ January, 1851, XX. 108. (Arrear Reports of 1849.)

„ February, 1851, XX. 213.

„ August, 1851, XX. 443.

„ April, 1852, XXI. 341–358.

„ May, 1852, XXI. 433.

„ May, 1853, XXII. 408.

„ September, 1853, XXII. 580.

„ October, 1853, XXII. 589.

„ February, 1854, XXIII. 210. Appends a short note to his paper on Orangutans in Vol. XXII.

„ October, 1854, XXIII. 729. Describes in a note the series of Indian and Tibetan Foxes in the Society's Museum.

„ February, 1855, XXIV. 178.

„ March, 1855, XXIV. 187.

„ April, 1855, XXIV. 252. Reports on Rüppell's contributions from Abyssinia, and mentions Tickell's and Frith's discoveries of Adjutants' nests.

„ May, 1855, XXIV. 359.

„ July, 1855, XXIV. 469. Enumerates in a note the series of smaller Squirrels in the Society's Collection.

„ October, 1855, XXIV. 711. Is mainly given to notices of Theobald's contributions of Reptiles and other specimens from Tenasserim provinces.

„ August, 1856, XXV. 439. Remarks in a note on the two supposed wild types of the Domestic Cats of India.

„ May, 1857, XXVI. 238.

„ July, 1857, XXVI. 284.

„ October, 1857, XXVI. 314.

„ December, 1857, XXVII. 81. Subjoins in a note a synopsis of the species of *Palæornis* with their synonyms.

„ May, 1858, XXVII. 267. Describes Dr. Liebig's contributions from the Andaman Islands, and numerous Siluroid and other Fishes obtained in the neighbourhood of Calcutta.

„ February to May, 1859, XXVIII. 271. Further observations on Andaman collections. A note elucidates the series of Flying Squirrels.

„ September, 1859, XXVIII. 411. Reports on Tickell's contributions from Tenasserim.

Report for March, 1860, XXIX. 87. Reports on Swinhoe's contributions from Amoy and Formosa; on Cape specimens from Layard; and on further collections from the Andaman Islands.

,, April and May, 1860, XXIX. 447.

,, May and June, 1860, XXX. 90. Reports on collections from China, the Philippine Islands, and Cape of Good Hope.

,, July, 1861, XXX. 185. Comments on Stags and Staghorns. This report first announces his new conclusions in regard to *Cervus affinis*.

,, February, 1862, XXXI. 331. Reports on collections from British Burma, and enumerates in a note the ascertained species of Sciuridæ in that province.

,, February (continued), 1863, XXXII. 73, 451. Reports on collections from Burma and Port Blair. In a note are enumerated the Testudinata of the Burmese provinces so far as then ascertained.

Letter from Blyth, December 2, 1864, XXXIV. Pt. 2, 48. Comments on Milne-Edwards's Monograph of the Chevrotains.

,, No date. On *Inuus Assamensis* and Indian Rats and Mice, XXXIV. Pt. 2, 192.

,, September 17th, 1865, XXXIV. Pt. 2, 279. Refers to his forthcoming Comments in the Ibis on Jerdon's 'Birds of India.' Concludes with an enumeration of the species of *Arboricola*.

,, No date. XXXV. Pt. 2, 156.

Communications to the Journal of the Society. The papers marked with an asterisk were reprinted in the Annals of Natural History.

1841. General review of the species of true Stag, or Elaphoid form of *Cervus*, comprising those more immediately related to the Red Deer of Europe. X. Pt. 2, 736.

Monograph of the species of Wild Sheep. X. Pt. 2, 858.

Description of another new species of Pika (*Lagomys*) from the Himalaya. X. Pt. 2, 816.

Ditto of three Indian species of Bat, of the genus *Taphozous*. X. Pt. 2, 971.

1842. Notes on various Indian and Malayan Birds. XI. Pt. 1, 160.

Notice of the predatory and sanguivorous habits of the Bats of the genus *Megaderma*, with some remarks on the blood-sucking propensities of other *Vespertilionidæ*. XI. Pt. 1, 255.

1842. Monograph of the species of Lynx. XI. Pt. 2, 740.

Descriptive notice of the Bat described as *Taphozous longimanus* by General Hardwicke. XI. Pt. 2, 784.

Monograph of the Indian and Malayan species of *Cuculidæ*, or Birds of the Cuckoo family. XI. Pt. 2, 897 and 1095.

1844. Notes of various Mammalia, with descriptions of many new species—Pt. 1, Primates. XIII. Pt. 1, 463.*

Additions to and annotations on Hodgson's *Leiotrichine* Birds of the Sub-Himalaya, with a synopsis of the Indian *Pari* and Indian *Fringillidæ*. XIII. Pt. 2, 933.

1845. Notices and descriptions of various new or little-known species of Birds. XIV. Pt. 1, 173; XIV. Pt. 2, 546; XV. Pt. 1, 280; XVI. Pt. 1, 117–428.

Description of *Caprolagus*, a new genus of Leporine mammalia. XIV. Pt. 1, 247.*

Drafts for a Fauna Indica—No. 1, *Columbidæ*. XIV. Pt. 2, 845.*

1846. Notes on the Fauna of the Nicobar Islands. XV. 367.

1847. Some further notice of the species of Wild Sheep. XVI. Pt. 1, 350.

1849. Note on the *Sciuri* inhabiting Ceylon, and those of the Tenasserim provinces. XVIII. Pt. 1, 600.

A supplemental note to the Catalogue of the Birds in the Asiatic Society's Museum. XVIII. Pt. 2, 800.

1850. Description of a new species of Mole (*Talpa leucura*, Blyth). XIX. 215.*

Remarks on the modes of variation of nearly affined species or races of Birds, chiefly inhabitants of India. XIX. 221.

Conspectus of the Ornithology of India. XIX. 229—319, 501.

1851. Notice of a collection of Mammalia, Birds and Reptiles procured at or near the Plateau of Cherra Punji, in the Khasia hills north of Sylhet. XX. 517.

Report on the Mammalia and more remarkable species of Birds inhabiting Ceylon. XX. 153.

1853. Remarks on the different species of Orangutan. XXII. 369.

Notes and descriptions of various Reptiles new or little known. XXII. 639.

1854. Monograph of the Indian species of *Phylloscopus* and its immediate affines. XXIII. 479.*

1855. Memoir on the Indian species of Shrews. XXIV. 24.*

Report on a Zoological Collection from the Somali country. XXIV. 291.

1855. Further remarks on the different species of Orangutan. XXIV. 518.

1857. Description of a new Indian Pigeon akin to the 'Stock Dove' of Europe, with notices of other *Columbinæ*. XXVI. 217.*

1859. On the different animals known as Wild Asses. XXVIII. 229.*

On the Great Rorqual of the Indian Ocean, with notices of other Cetals, and of the *Syrenia* or Marine Pachyderms. XXVIII. 481.

1860. On the flat-horned Taurine Cattle of S.E. Asia, with a note on the races of Reindeer, and on Domestic Animals in general. XXIX. 282—376.

Report on some Fishes, received chiefly from the Sitang river and its tributary streams, Tenasserim provinces. XXIX. 138.

The Cartilaginous Fishes of Lower Bengal. XXIX. 35.

1862. Memoir on the living Asiatic species of *Rhinoceros*. XXXI. 151.

Further note on Elephants and Rhinoceroses. XXXI. 196.

Ditto on Wild Asses and alleged Wild Horses. XXXI. 363.

1863. Memoir on the Rats and Mice of India. XXXII. 327.

List of communications to the 'Ibis.'

I. p. 464. 1859. Letter stating the occurrence of *Catarractes pomarinus* in Moulmein, with remarks on the Zoology of the Andamans.

II. p. 323. 1860. Note on Edible Birds' Nests. His letter, from which extracts are also published, mentions his new Cassowary, *C. uno appendiculatus*.

III. p. 268. 1861. Note on the Calcutta Adjutant, *Leptoptilus argala*.

IV. 1862. Among his letters extracted from in this Vol., the last (p. 385), on Jerdon's new Birds from Upper Burma, is the most interesting.

V. 1863. Catalogue of the Birds of India, with remarks on their Geographical Distribution. Part I. *Scansores* and *Raptores*.

Note on the genus *Pyrrhula*.

His letter extracted from at p. 117 of this Vol. announces Tytler's last Andaman discoveries, *Hæmatornis Elgini*, etc.

VI. 1864. His letter at p. 411 remarks on the distinct characters of the *Bucconidæ* and *Capitonidæ*, which he had pointed out so far back as 1838.

New Series. I. 1865. A few identifications and rectifications of Synonymy.

II. 1866. The Ornithology of India. A Commentary on Dr. Jerdon's 'Birds of India.'

III. 1867. The same paper continued.
The Ornithology of Ceylon. A supplement to Dr. Jerdon's 'Birds of India.'

IV. 1868. Extracts from letters only.

VI. 1870. Notes relating chiefly to the Birds of India; being Comments on the Collections of the Leyden Museum, which Blyth had visited in 1869.

Third series. II. 1872. Letter commenting on Hume's observations on *Haliætus albicilla*, and on Khasia Birds in the India Museum.

Communications to 'Annals of Natural History.'

1843. First series. XII. pp. 90, 165, 229. List of Birds obtained in the vicinity of Calcutta, with remarks on their habits.

1844. XIII. p. 113. Further notice of the species of Birds occurring in the vicinity of Calcutta.

XIII. p. 175. Description of some new species found in the neighbourhood of Calcutta.

XIV. pp. 34–114. Further observations on the Ornithology of the neighbourhood of Calcutta, with notes by H. E. Strickland.

1847. XX. p. 382. Critical remarks on the republication by Mr. Strickland of Karl Sundevall's paper on the Birds of Calcutta.

XX. p. 313. Critical remarks on J. E. Gray's Catalogue of Hodgson's Collections.

1848. Second series. I. p. 454. Corrections of ditto.

1871. Fourth series. VIII. p. 204. On the supposititious *Bos* (?) *pegasus* of the late Col. C. Hamilton Smith.

1872. X. p. 399. On the species of Asiatic two-horned Rhinoceros.

I find on reference to the Index published in 1872 of the Proceedings of the Zoological Society, that besides exhibiting and remarking on Horns and other specimens at its meetings, Blyth contributed the following papers:—

1861. Notes on some Birds collected by Dr. Jerdon in Sikkim.
Letter on *Rhinoceros crossii*, Gray.

1863. Synoptical List of the species of *Felis* inhabiting the Indian Region and the adjacent parts of Middle Asia.

1864. Notes on sundry Mammals (*Chevrotains*, Asiatic Civets, and the Unicorn Goat of Tibet).

1866. Ditto on African Buffalos.

1867. Remarks on an Indian Quail (*Rollulus superciliosus*).

Notes on three Asiatic species of Deer, viz. *Rucervus duvaucelli*, *R. schomburgki*, and *Panolia eldi*.

1869. Notice of two overlooked species of Antelope (*Bosclaphus major* and *Strepsiceros imberbis*.

On the Hybrid between the Chamois and the Domestic Goat.

Contributed to Journal of Travel and Natural History.

1868. No. 4. Review of Layard's 'Birds of South Africa.'

ERRATA.

"No. 1. 1875," had been introduced into the upper corners of some of the earlier pages, which were printed off before the oversight was discovered.

p. 24. "Order Secundates" omitted in the heading over the words "Sub-order Carnivora."

p. 52, note. For "P.Z.S. 1873," read "1872."

Catalogue of the Mammals and Birds of Burma.—*By the late* Edward Blyth, *C.M.Z.S.*

Sub-kingdom VERTEBRATA.

Class MAMMALIA.

Order *PRIMATES.*

Sub-order Cheiropoda.

Tribe CATARRHINI.

Fam. **Hylobatidæ.**

Gibbons, or Long-armed Apes.

1. Hylobates hoolock.

Simia hoolock, Harlan; *H. scyrites* and *H. choromandus*, Ogilby. *Myouk Ulwai-gyen*, Arakan; also *Too-poung*, of the Arakanese, Tickell.

The White-browed Gibbon inhabits the hill-forests from the basin of the Bráhmáputra to that of the Irawádi.

2. H. lar.

Homo lar, L.; *Simia longimana*, Schreber; *S. albimana*, Vigors and Horsfield; *Pithecus variegatus*, Geoffroy (*nec* Kuhl); *H. entelloides*, Is. Geoffroy; *H. pileatus*, Gray.

The White-handed Gibbon bears the same native name as the preceding species, and inhabits the hill-forests of the Tenasserim provinces, Malayan peninsula, Siam, Cambodja, if not also Hainan, and probably the South of China.

According to Dr. Anderson, two species of Gibbon occur in the vicinity of Bhamo;† but I cannot help suspecting that mere differences of colour were so regarded, especially as one of them, mentioned as a light-coloured species, is indicated from native report only. Black examples of *H. hoolock* and *H. lar* have been figured from life by Dr. Sclater;‡ and

* An asterisk prefixed denotes that the species was obtained by Sir A. P. Phayre.

† "Report of Expedition to Western Yunan viâ Bhamo," by J. Anderson, M.D., pp. 256, 271, 273.

‡ P. Z. S. 1870, p. 86, pl. v.

three differently coloured individuals, representing what I consider to be varieties of *H. lar* from Cambodja, by the name *H. pileatus*, have also been figured by Dr. Gray.* The dubious *H. pileatus* is supposed by Mr. Swinhoe to be the particular kind of Gibbon which inhabits the Chinese island of Hainan, and he also reports the alleged existence of a black species of long-armed Ape in the country West of Canton.† The variations of colour of *H. hoolock* and *H. lar* I have elsewhere described;‡ and I have seen examples of *H. lar* from the Malayan peninsula corresponding to the figures assigned to the supposed *H. pileatus*.

Both the White-browed and the White-handed Gibbons vary exceedingly in shade of hue, from black to sullied white and pale fulvescent; the two sexes equally of *H. lar*, but the females only, so far as I have seen, of *H. hoolock*. The males of the latter would appear to be constantly black, the females rarely so, at least in Assam, though according to Colonel Tickell both sexes of it are always black in Arakan. A pale specimen from Sandoway has nevertheless been recorded.§ In the opinion of Col. Tickell the Gibbon of Arakan is different from that inhabiting the forests and hills of Káchár, Manipur, and Assam, "or, if the same," the latter "is so strongly modified as to be larger and stouter, with a totally different call, and subject to vary the same as *H. lar*, which *H. hoolock* in Arakan is not."‖ I remember seeing a pair of tame Hoolocks, about full-grown, at Akyab, at a time when I had long been familiar with the animal, which is not rarely brought to Calcutta from the Gáro and other hill-ranges bordering upon the valley of the Bráhmáputra; and I failed to perceive the slightest difference in voice or any other particular.

Whatever the rest of the colouring may be, *H. hoolock* has constantly a broad white frontal band either continuous or divided in the middle; while *H. lar* has invariably white hands and feet, less brightly so, in some, and a white ring, encircling the visage, which is seldom incomplete. Some of both species are variegated or parti-coloured; and the pale examples of *H. lar* constitute the supposed *H. entelloides*.¶ Whether the two anywhere inhabit the same forests, and what the limits of the range of either of them may be, has yet to be ascertained, but the habits which Tickell and I have detailed may be considered to have generic application.**

* P. Z. S. 1861, p. 136, pl. xxi.
† *ibid.* 1870, pp. 224, 615.
‡ J. A. S. B. xvi. pp. 729, 730.
§ *ibid.* xiii. p. 464.
‖ *ibid.* xxxiii. p. 196.
¶ Archives du Museum, tom. ii. p. 532, *t.* 1.
** J. A. S. B. xiii. p. 464, and Tickell, *ibid.* vol. xxxiii. p. 196.

According to Dr. Theodore Cantor,* the *H. variegatus*, Kuhl (*nec* Geoffroy, = *H. agilis*, Fr. Cuvier, = *H. rafflesii*, Geoffroy, = *H. leucogenys*, Ogilby), is also an inhabitant of the Malayan peninsula, though less numerous there than *H. lar*; *H. variegatus* occurring elsewhere for certain only in Sumatra, where it inhabits, together with *H. syndactylus* (*Simia syndactyla*, Raffles, *Siamanga syndactyla*, Gray), the Siamang or Pouched Gibbon. Helfer even states that the latter species has been found in the southern parts of the Tenasserim provinces, as high as the 15th deg. N. lat.† Cantor, however, does not include it in his "List of Mammalia inhabiting the Malayan Peninsula;" ‡ but Mr. Wallace asserts that it "is not uncommon in some parts" of that peninsula.§ This, it may be suspected, is a mistake, arising probably from the circumstance that—as Sir T. Stamford Raffles remarks—"*Samang* or *Siamang* is the name given to certain tribes of aboriginal inhabitants of the Malayan peninsula." ‖ The Siamang Ape, there is reason to believe, is quite peculiar to the island of Sumatra, where only Mr. Wallace actually observed it; and the fact that in other species of Gibbon the second and third digits of the foot are occasionally connected, may have deceived Helfer and others into the supposition that such animals represented the veritable *H. syndactylus*.

The Siamang is distinguished from all other Gibbons, not only by its much greater size, but by its possessing an inflatable laryngeal sac. Mr. Wallace remarks of it that "it moves much more slowly than the active *Hylobates*" (*H. agilis*, F. Cuvier), "keeping lower down on trees, and not indulging in such tremendous leaps; but it is still," he adds, "very active, and by means of its immense long arms, five feet across in an adult about three feet high, can swing itself along at a great rate." In all of the species of Gibbon the thumbs of both the hands and feet are separated from the other digits to the base of the metacarpal and metatarsal bones; a character which is distinctly represented in no published figure that I know of, nor am I aware that it occurs in any other quadrumana, with the exceptions of the allied lemurian genera *Indris* and *Propithecus*. It also is not generally understood that the long-armed Apes are true bipeds when on the ground, applying the sole flatly, with the pollux widely separated from the other digits; the hands are held up to be out of the way, rather than for balancing, and this even when ascending a flight of steps, as I have seen repeatedly, but they are ever ready to seize hold

* J. A. S. B. xv. p. 173. † *ibid.* vii. p. 858. ‡ *l.c.* p. 173.
§ "Travels in the Malay Archipelago," i. p. 134. ‖ Tr. Lin. Soc., xiii. p. 242.

of any object by which the animal can assist itself along, even as a human being commonly grasps a banister when ascending a stair-case. Upon the forest trees, however, the Gibbons swing themselves about or forward by means of their upper limbs only, with extreme facility and grace, and at a marvellous rate of speed when duly exerting themselves, taking the most astounding hand-leaps in rapid and continuous succession when in full career. They are further remarkable for their exceedingly loud shouting cries, not unmusical in tone, which are often uttered in concert, and differ more or less in the different species.

Dr. Gray separates the Siamang from *Hylobates*, and expresses a suspicion that all the rest may prove to be local varieties of one species. I am familiar with four of them in the living state, and I consider these to be sufficiently well distinguished to rank as species. No one who knows the two could well confound a white-browed with a white-handed Gibbon, and their voices differ considerably. To the best of my recollection, that of *H. variegatus* also differs very appreciably from these; and the voice of *H. leuciscus*, which is peculiar to Java, I do not remember to have heard. Of the Bornean *H. concolor* (*Simia concolor*, Harlan, *H. harlani*, Lesson), I have only seen mounted skins, and it is most nearly akin to *H. variegatus*, if indeed separable from it; and *H. funereus*, Is. Geoff., is another alleged species inhabiting the "Solo" or Sulu Archipelago.* Living specimens of both of the latter require to be compared with living specimens of *H. variegatus*.

Fam. Papionidæ.

Monkeys with simple stomach, and provided with cheek-pouches; inclusive of the African Baboons.

*3. Inuus leoninus.

Inuus leoninus, Blyth, Catalogue of the Mammalia in the Museum of the Asiatic Society of Bengal, 1863, p. 7, No. 14; *Macacus nemestrinus*? var., J. A. S. B. vol. xiii. p. 473; *I. arctoides*? *ibid.* vol. xvi. p. 731; *M. andamanensis*, Bartlett, P. Z. S. 1869, p. 467 and fig.; 1870, pp. 220, 663, and pl. xxxv., p. 598. *Myouk-la-hoing*, Arakan; *Myouk-me*, Tenasserim, Mason.

The Long-haired Pig-tail Monkey was originally described from two skins without skull or other bones attached, which were transmitted to Calcutta from Arakan by the author of the present paper. One was that of a particularly fine male, with hair on the fore-quarters from four to five inches long, and the tail-tuft of a deep ferruginous colour,

* Archives du Muséum, tom. v. p. 532, pl. xxvi.

which also tinged the fore-quarters. The other was that of a small young animal, rather pale in colour. It does not appear to be a common species, and chiefly inhabits the limestone mountains from the North of Arakan to an undetermined distance southward. In the Malayan peninsula, it is replaced by the nearly allied *I. nemestrinus*, the well-known Short-haired Pig-tail Monkey of the Malay countries, which is a likely species to inhabit also the southern Tenasserim provinces. Both of them are highly docile,* and the manifold performances of "Jenny," the so-called Andaman Monkey, that lived for some time in the London Zoological Gardens, will be remembered by very many visitors. A fine male has since lived in the Regent's Park collection. In Sumatra the short-haired species is commonly trained to gather cocoa-nuts, as noticed by Raffles, and recently by an American traveller, Mr. A. S. Bickmore.†

The long-haired species distinctly tends to connect the Malayan Pig-tail Monkey with the series of Rhesus-monkeys; and one of these, *I. sancti-johannis*, Swinhoe, inhabiting the islets near Hongkong, is described to be "like a Rhesus with a very short tail." Another Chinese species, *I. lasiotus*, Gray,‡ was described and figured as tail-less; but it is a common practice among Chinamen to deprive Monkeys of their tails, as was found on *post-mortem* examination to have been effected in the present instance, and the animal was otherwise like a Bengal Rhesus-monkey, only much larger. There is reason to believe that it inhabits the province of Tse-Chuen, whence probably it ranges southward into Hainan, in which island a Rhesus-like Monkey was obtained by Mr. Swinhoe, who regarded it as identical with the Bengal species. Another monkey of the same group inhabits Formosa, *I. cyclopis*, Swinhoe,§ small and dark in colour. Then, besides *I. erythræus*, (*Simia erythræa*, Schreber, *S. rhesus*, Audebert), of Bengal and Upper India, there are *I. pelops*, Hodgson, in the Himalaya, and *I. assamensis* (*M. assamensis*, M'Clelland, = *M. problematicus*, Gray, = *M. rhesosimilis*, Sclater, P. Z. S. 1872, p. 495, pl. 25), originally described from Assam, and since obtained from the Bengal Sundarbáns.‖ It

* [This remark seems applicable only to the females and young, for the adult males are well known to be very fierce. A full-grown *M. nemestrinus* is nearly as large and formidable as an ill-conditioned mastiff.—J.A.]

† "Travels in the East India Archipelago" (1868), p. 478.

‡ P. Z. S. 1868, p. 60, pl. vi.; also Sclater, *ibid.* 1871, p. 221.

§ P. Z. S. 1862, p. 350, pl. xlii.; 1864, p. 711; 1870, p. 615, and woodcut.

‖ "Supposed new Monkey from the Bengal Sundarbáns," J. Anderson, M.D., P.Z.S. 1872, pp. 529–533, figure of skull and skull of *M. rhesus*.

is only quite recently that the distinctions of these animals have become tolerably understood. Even another of them has been described by M. Adolphe Milne-Edwards as *M. tchiliensis*,* from "Tche-ly," which, to judge from the published figure of a female, is not unlikely to prove identical with *I. pelops*.† So far as known, the Pig-tailed Monkeys are the only representatives of the sub-group in the Indo-Chinese and Malayan countries; but another and kindred sub-group, indeed hardly separable, that of the Stump-tail Monkeys, has at least one Indo-Chinese representative.

4. Inuus speciosus.‡

Macacus speciosus, F. Cuvier, Mamm. Lithog.; *nec apud* Temminck, Faun. Japon. t. 1; *M. arctoides*, Is. Geoffroy, Zoo. de Voy. de Belanger, 1830; Mag. de Zool. 1833, Mamm., t. 2; *M. brunneus*, Anderson, P. Z. S. 1871, p. 628; 1872, p. 628, pl. xii.

The brown Stump-tail Monkey, described by M. Isidore Geoffroy St.-Hilaire from Cochin-China, and since obtained in Káchár, and by Dr. Anderson in the Kákhyen hills to the East of Bhamo.

There are several nearly-allied species of Monkey with very short naked tail, and one in Japan in which the same kind of tail is fully clad. The latter was identified by Prof. Temminck with the *Macaque à face rouge*, *M. speciosus*, F. Cuvier, but it is not probable that the French zoologist should have obtained the Japanese species, and his figure applies much better to the present one, which he is far more likely to have received from Cochin-China. In this case the Japanese monkey might bear the name of *I. fuscatus*, formerly applied to it in the Leyden Museum. Together with living specimens of *I. speciosus*, as here recognized, there was received at the London Zoological Gardens a very similar monkey which, at first sight, appeared like a rufous individual of the same, but on minute comparison of the living animals it was adjudged to be different, and has been figured and

* Recherches sur les Mammifères, p. 227, plates 32, 33.

† [*M. tchiliensis* is apparently the same monkey described by Dr. Gray (*l.c.*) as *M. lasiotus*.—J.A.]

‡ [Dr. Murie has identified a Macaque that lived in the Zoological Society's Garden, London, as an example of *M. speciosus*, F. Cuv. and Geoff. St.-Hil., and he has pointed out certain structural characters which separate it from a monkey which he has regarded as *M. arctoides*, Geoff. St.-Hil. This last-mentioned specimen had been described by Dr. Anderson as a new species under the name of *M. brunneus*. *M. arctoides* was characterized by Geoff. St.-Hilaire as "une espèce très distincte de la précédente (*M. speciosus*) par ses longs poils plusieurs fois annelés de brun et de roux-clair, . . ." and he also says that the black-faced *M. maurus* is separated by its uniformly brown hair from *M. arctoides*, which has well annulated hair, whilst *M. brunneus* has its hair of a uniform colour.—J.A.]

described as *Macacus rufescens*, Anderson.* A second specimen of it has since been received. Its habitat is unknown. Another allied species, brown, with hair upon the head much lengthened, constitutes the *M. melanotus*, Ogilby;† habitat also unknown, as the assigned habitat of Madras cannot be accepted. M. Fred. Cuvier likewise figures *M. maurus* (*M. inornatus*, Gray, Proc. Zool. Soc. 1866, p. 202, pl. xix.), a dark and black-faced Monkey of the same group, which is believed to inhabit Borneo; and *M. ochreatus*, Ogilby (*M. ocreatus* apud Sclater, Proc. Zool. Soc. 1870, p. 383, pl. lxxxii., and *M. fuscatus*, Schinz, apud Gray), is believed to come either from Celebes or one of the Philippines. The *Synopithecus niger* apud Gray (*M. niger*, Desm.), formerly supposed to inhabit Celebes, would appear now to be a Philippine species. There is much yet to be learned respecting the exact habitat, or the geographical range, of all of these various stump-tailed Monkeys. One of great size, *M. tibetanus*, Ad. Milne-Edwards,‡ has recently been described to inhabit "the coldest and least accessible forests of Eastern Thibet," and this one has the short tail clad as in the Japanese species.

*5. Macacus cynomolgus.

Simia cynomolgus, L.; *Macaque* of Buffon; *M. carbonarius*, F. Cuv., Mamm. Lithog.; Blyth, J. A. S. B. xvi. p. 732; *M. aureus*, Is. Geoff., Arch. Mus. tom. ii. p. 566, Bélanger's Voyage, Atlas, f. 2, golden rufous variety; *Cercopithecus cynosurus* apud Helfer. *Myouk-ta-nya*, Arakan.

Two mounted skins of the Crab-eating Monkey in the British Museum, erroneously marked from "India," represent the Burmese type, very inferior in colour, without any yellowish tinge, and having no trace of crest on the vertex; the face blackish in the living animal, with strongly contrasting white eye-lids, as in the African Monkeys known as Mangabeys. As seen alive together with the ordinary crested race of the Malayan peninsula and islands (*Aigrette* of Buffon, *Simia aigula*, L., *S. fascicularis*, Raffles, *M. cristatus*, Gray, founded on an albino!), there is considerable contrast of appearance, although the skulls are not distinguishable;§ the face of the latter is much less dark, and the colouring of the upper parts is mostly yellowish. The Philippine race (*M. palpebrosus*, Is. Geoff.) resembles it, but is considerably darker in hue; and a living specimen received from Siam in the London Zoological Gardens is like the Philippine race, but with the face as pale as in *M. radiatus* of Southern India. Another monkey of the kind recently examined,

* P. Z. S. 1872, pp. 204, 495, and pl. xxiv. † *ibid.* 1839, p. 31.

‡ Recherches sur les Mammifères, p. 244, plates 34, 35.

§ The skulls of two adults from Arakan are described in J. A. S. B. vol. xiii. p. 474.

from an unknown locality, is brightly tinged with yellowish above, but has no trace of crest on vertex, the hair of the crown lying very flat, and the face is but slightly infuscated. *M. carbonarius*, F. Cuv., is asserted to be from Sumatra; and upon a casual individual variety from Pegu M. Is. Geoffroy founded his *M. aureus*, which he elsewhere states to inhabit Sumatra and "vraisemblement Java." Moreover, according to M. Bélanger, the orange-coloured *M. aureus* is commonly to be purchased in Calcutta, which decidedly is not the case. Major Berdmore sent the skin of a young example of the same occasional variety from Mergui; but it can be safely asserted that there is no established race of such a colour, like the Patas monkey, *Cercopithecus ruber*, of Abyssinia. *M. philippinensis*, Is. Geoff.,* is founded on a crestless albino, which has assuredly no claim to be regarded as a peculiar species. Another figure of a mature albino given by Crawfurd in his "Embassy to Siam and Cochin-China," one of a couple of such animals he saw at Bangkok, well represents the Burmese race without a trace of top-knot. The Monkeys of this type are so commonly conveyed about from port to port, not only in European but in native vessels, that erroneous localities are apt to be assigned to specimens; but it is certain that no long-tailed Monkey of the group with fully haired forehead inhabits the region westward of the Bay of Bengal. How far northward of Akyab the *M. cynomolgus* extends its range has yet to be ascertained, but it may be safely averred that there is no such animal in the Bengal Sundarbáns. The corresponding Indian sub-type, exemplified by *M. radiatus* of S. India, brown with pale face, and *M. pileatus* of Ceylon, rufous with dark face, has a semi-nude forehead and longish hair on crown radiating from a centre. This sub-type does not occur eastward of the Bay of Bengal, though a living specimen of *M. radiatus* was sent from Formosa by Mr. Swinhoe,† who then—mistaking it for his subsequently described *Inuus cyclopis*—believed that it inhabited the camphor forests of the interior of that island. In his "Catalogue of the Mammals of China, inclusive of those of Formosa,"‡ he makes no reference to such a species. Upon certain of the Nicobar Islands the Aigrette Monkey has been probably introduced, as, according to the Abbé de la Caille, it was in the Mauritius by the Portuguese. There it had become numerous in the last century, and its habits, in a state of freedom, as observed upon that island, are described in Grant's "History of the Mauritius," published in 1801. In all probability the present Philippine race is not indigenous to that great archipelago.

* Arch. du Museum, ii. p. 568, t. 33.

† J. A. S. B. xxix. note to p. 88.

‡ P. Z. S. 1870, p. 615.

Fam. **Colobidæ.**

Long-tailed Monkeys, which have no cheek-pouches, the stomach sacculated, and which subsist to a considerable extent on green foliage.

*6. Presbytes cristatus.

Simia cristata, Raffles; *Semnopithecus pruinosus*, Desmarest; *S. phayrei*, Blyth, J.A.S.B. xvi. p. 733; *S. argentatus*, Bl., MS., Horsfield's Catalogue, No. 8. *Myouk-huyo*, Arakan.

The Silvery-leaf Monkey inhabits Arakan, Tenasserim provinces, Malayan peninsula, Sumatra, Banka, and Borneo.

Of a somewhat glistening or silvery dark ash colour, with white underparts; a conspicuous crest on the vertex, and long whisker-tufts, which conceal the ears on a front view; face leaden black, contrasting with pinkish flesh colour on the mouth and lips, extending to the lining of the nostrils, besides which a large semi-circular mark of a paler and more livid tint occupies the inner half of each orbit. Three small living young sent from Ramri Island by Captain J. R. Abbott were quite similar in colouring to the adults, showing no trace whatever of rufous; but *P. cristatus* is described to have the young bright rufous, as in some of the allied species, and certainly the figure assigned to the young of *P. cristatus* in the great Dutch work by Professor Temminck and Dr. S. Müller, represented of a rufous colour, and with ears conspicuously visible on a front view of the face, can hardly refer to the Arakan species, which nevertheless appears to be true *P. cristatus*. Writing of *P. obscurus* and *P. melanopus* (*P. albo-cinereus* apud Schinz), in the Malayan peninsula, Dr. Cantor remarks that "both attain to the same size, have in common the shape of the body, the white marks on the face, and the general distribution of colour;" while of *P. cristatus* he states that "the whitish colour on the eyes and mouth is present, though less distinct than in the preceding two species."* Those markings, however, could not be more conspicuously so than in the three young examples from Ramri already noticed, one of which is now mounted in the India Museum, London.

A species is referred to *P. albocinereus* by Dr. Anderson, as being "common on the banks of the Tapeng;"† and *P. albocinereus* of the Malayan peninsula *apud* Schinz and Cantor must bear the name *P. melanopus*, Geoff. (*Semnopithecus siamensis*, S. Müller, = *S. nigrimanus*, Is. Geoffroy, = *S. cinereus*, Gray, and the young *S. dorsatus*, Waterhouse). It occurs commonly in collections from Malacca, and as it has been received from Siam, it is likely to occur in the Tenasserim provinces. One distinguishing character

* J. A. S. B. xv. p. 175. † "Report of Expedition," etc., p. 271.

of it is that it has two lateral radiating centres of hair upon the crown, the hair meeting and being pressed upwards between them. The small young resemble the adults, excepting that their colours are more strongly contrasted.

7. Presbytes obscurus.

Semnopithecus obscurus, Reid, P. Z. S. 1837, p. 14; *S. leucomystax*, Tem.; *Simia maura* apud Raffles; *S. albocinereus*, Is. Geoffroy; *S. halonifer*, Cantor; probably *S. maurus* apud Helfer; ? *S. sumatranus*, S. Müller, apud Schinz; *S. cristatus* in the Atlas to "Voyage au pole sud," t. 3. *Myook-myet-gwen-phyoo* (Mason).

The Dusky-leaf Monkey is the most common species of the genus in the Malayan peninsula, from which its range extends at least to the province of Mergui, where it was obtained by the late Major Berdmore. It has also been received from Siam, and is likewise an inhabitant of Sumatra, if not also of Borneo. The adults are blackish, with hair upon the nape lengthened and conspicuously whitish. The newly born young are of a vivid golden-ferruginous colour, which soon changes to dusky-ash, and is continued latest upon the tail.* This may be the species which Mason refers to as being "found, in considerable numbers, in the interior" of the Tenasserim provinces; but, he adds, "it is not so numerous as the other Monkeys and the Gibbons." He also remarks that "the large flowers of the *Dillenia*, and many others, are much sought after by these monkeys as food."

8. Presbytes chrysogaster.

Semnopithecus chrysogaster, Lichtenstein; *S. potenziani*, C. L. Bonaparte, apud Peters, P. Z. S. 1866, p. 429.

The mounted skins of an adult female and young, procured by Helfer somewhere in the Tenasserim provinces, are in the Berlin Museum. By the courtesy of Professor W. Peters I have been favoured with coloured drawings of those specimens. The mature animal has the upper parts, limbs, and tail blackish, the hairs ferruginous on the basal half; slight band crossing the forehead, cheeks, front, throat, and front of neck, sullied white; rest of the lower parts deep and bright ferruginous, which tinges the inner side of the limbs; face colourless, or pinkish white. Young wholly pale ferruginous, somewhat darker on the hands and feet. There is a slight compressed crest on the vertex, but no distinct whisker-tufts, or lengthened hair on the nape. It is highly probable that some adults are wholly ferruginous, as happens with *P. maurus* in Java (the so-called *S. pyrrhus*, Horsf., = *S. auratus*, Geoff.), and with *P. melalophus* in Sumatra,

* J. A. S. B. xvi. p. 734.

the so-called *P. nobilis*, Gray; while it is likely that there is a melanoid phase of *P. rubicundus* of Borneo.*

Before seeing the coloured drawings sent by Professor Peters, I suspected that *P. chrysogaster* would prove identical with *P. pileatus*, Blyth,† which is common in the hills bordering on Sylhet and those of Tippera and Chittagong, and the old males of which are deeply tinged with ferruginous on the lower parts. Females and young have the lower parts white or but faintly tinged with ferruginous, and the rest of the coat is of a pure grey, the face black, and there is no crest, but the hairs of the crown are so disposed as to appear like a small flat cap laid upon the top of the head. The old males seem always to be of a deep rust colour on the cheeks, lower parts, and more or less on the outer side of the limbs; while in old females this rust colour is diluted or little more than indicated. A mature male which I possessed alive was an exceedingly gentle animal, and the species is akin to *P. maurus* of Java, though so different in colouring. It is likely to occur in the northern part of Arakan.

9. Presbytes barbei.

Presbytes barbei, Blyth, J. A. S. B. xvi. p. 374.

This species is closely allied to, if not identical with, *P. femoralis*, Horsfield (=*P. chrysomelas*, Tem.), of the Malayan peninsula and Sumatra, the female of which is figured of a brown colour by MM. Temminck and S. Müller; but adults of both sexes described as *P. barbei*, from skins, minus the skull, procured in the interior of the Tippera hills, were black. The colour is probably variable. According to Cantor, the face during life is intense black, except the white-haired lips and the chin, which are of a milk-white colour. It is another likely species to occur in the Indo-Chinese region; and from the Malayan peninsula Dr. Cantor gives four species of this genus, viz. *P. cristatus*, *P. femoralis*, *P. obscurus*, and *P. melanopus*; while the remarkable and very handsome *P. nemæus* was observed plentifully in Cochin-China by Crawfurd, whence also has lately been described and figured *P. nigripes*, Ad. Milne-Edwards.‡ M. Milne-Edwards, jun., has also figured and described *Rhinopithecus roxellana*, a very remarkable animal of this group from the same forests of Eastern Tibet as are inhabited by *Macacus tibetanus*.

* In the Calcutta Museum there is a brown specimen of the common *P. cephalopterus* of Ceylon.

† J. A. S. B. xii. p. 174, xiii. p. 467, xvi. p. 735.

‡ Nouv. Arch. du Mus., tom. vi., Bulletin p. 7, t. 1.

Sub-order LEMURIA.

Fam. **Nycticebidæ.**

*10. NYCTICEBUS TARDIGRADUS (J. 10).

Nyceticebus tardigradus, F. Cuv., *N. bengalensis*, Geoffroy; "Sloth" of Anglo-Indians, and doubtless, therefore, "the little *Bradypus*" of Helfer.* *Myouk-moung-ma*, "Monkey's concubine," Mason.

The Slow Loris is generally diffused, but from its habits not much observed. The range of this genus extends to Eastern Bengal, and I have been assured, on good authority, that it inhabits the island of Préparis, though it has not been met with either in the Andaman or Nicobar Islands. Vosmaer's figure (1770) of his "Bengaalschen Luiaard" very well represents the race inhabiting Sylhet and Arakan. In Malacca it is more deeply coloured; and M. Ad. Milne-Edwards separates that of Siam and Cochin-China by the name *N. cinereus*.†

Sub-order PLEUROPTERA.

Fam. **Galæopithecidæ.**

11. GALÆOPITHECUS VOLANS.

Lemur volans, L.; *Vespertilio admirabilis*, Bontius; figured in Marsden's "History of Sumatra," pl. ix. *Myook-hloung-pyau*, i.e. embryo-monkey flying, Mason.

The range of the Cobego, a very remarkable but common Malayan animal, extends certainly to Mergui, where skins of it were procured by Major Berdmore; but Mr. Dunn states that he possessed a living specimen that was obtained about one hundred miles up the Koladyne river, which flows from the North into Akyab harbour! He was moreover positive about the correctness of the identification.‡ According to Sir T. Stamford Raffles, writing in 1820, "this animal, the *kuburg* of the Malays, is too well known to require description. It usually hangs from the branch of a tree suspended by its four hands. . . . . Mr. Marsden's figure gives a very good idea of this animal."§ Mr. Wallace remarks that "it is sluggish in its motions, at least by day, going up a tree by short runs of a few feet, and then stopping a moment as if the action was difficult. It rests during the day, clinging to the trunks of trees, where its olive or brown fur, mottled with irregular whitish spots and blotches, resembles closely the colour of mottled bark, and no doubt helps to protect it. Once,

* J. A. S. B. vii. p. 859.

† Ann. Sc. Nat. 1837, vii. p. 161, Nouv. Arch. de Museum, iii. Bulletin p. 9, pl. 3.

‡ P. Z. S. 1863, p. 370. § Tr. Lin. Soc. xiii. p. 248.

in a bright twilight," he adds, "I saw one of these animals run up a trunk in a rather open space, and then glide obliquely through the air to another tree, on which it alighted near its base, and immediately began to ascend. I paced the distance from one tree to the other, and found it to be seventy yards; and the amount of descent at not more than thirty-five or forty feet, or less than one in five. This I think proves that the animal must have some power of guiding itself through the air; otherwise in so long a distance it would have little chance of alighting exactly upon the trunk. Like the *Cuscus* of the Moluccas, the *Galæopithecus* feeds chiefly on leaves, and possesses a very voluminous stomach and long convoluted intestines. The brain is very small, and the animal possesses such remarkable tenacity of life, that it is exceedingly difficult to kill it by any ordinary means. The tail is prehensile, and is probably made use of as an additional support when feeding. It is said to have only a single young one at a time, and my own observation confirms this statement, for I once shot a female, with a very small blind and naked little creature clinging closely to its breast, which was quite bare and much wrinkled, reminding me of the young of marsupials, to which it seemed to form a transition. On the back, and extending over the limbs and membrane, the fur of these animals is short, but exquisitely soft, resembling in its texture that of the Chinchilla."* Raffles, however, states that it produces two young at a time, and Mr. A. Adams, who accompanied Sir E. Belcher in the exploring voyage of H.M.S. "Samarang," found two young in one which he dissected. He observed this animal "both in Borneo and Basilan in a wild state. It is crepuscular," he adds, "and hangs suspended during the day to the under surface of boughs in the tops of high trees. When it moves, it seems to shuffle and scramble among the leaves, and sometimes drops suddenly from its elevated position. It feeds on leaves, and the stomach of one I examined was filled with the remains of the foliage of *Artocarpus* and other trees. At Sarawák I had a living Cobego in my possession, which was procured on the occasion of felling some trees, in the top of one of which the animal was suspended. It was very inactive on the ground, and did not attempt to bite or resist."† "In several shot on the hill at Pinang," remarks Dr. Cantor, "the stomach" contained vegetable matter, but no remains of insects. In confinement, plantains constitute the favourite food, but deprived of liberty the animal soon pines and dies."‡

* Wallace's "Travels in the Malay Archipelago," vol. i. p. 135.

† Notes, etc. (1848), p. 265. ‡ J. A. S. B. xv. p. 178.

According to Horsfield, the Cobego "lives entirely on young fruits and leaves; those of the cocoa-nut and of *Bombax pentandrum* are its favourite food, and it commits great injury to the plantations of these, which surround the villages of the natives" of Java. In that island it is "confined to particular districts, where it is met with chiefly on isolated hills, covered with a fertile soil, and abounding with young luxuriant trees, the branches of which afford it a safe concealment during the day. As the evening approaches, it leaves its retreat, and is seen in considerable numbers making oblique leaps from one tree to another; it also discovers itself by a croaking, harsh, disagreeable noise. If an individual is forced from its usual abode, it advances by slight awkward leaps, until it meets with an object on which it can ascend by its claws."

This animal occurs in Siam, and is probably far from rare in the valley of the Tenasserim river. By some zoologists it is referred to the order or sub-order *Insectivora*; although, it would seem, to no extent an insect-eater, according to all trustworthy observation.

Order CHIROPTERA.

Tribe HARPYDIA.

Harpies or Roussettes; Frugivorous Bats which do not hybernate, and are peculiar to warm climates. They have no American representatives.

Fam. Pteropodidæ.

*12. Pteropus medius (J. 12).

Pteropus medius, Temminck, Monog. i. p. 176; *Pteropus edwardsii*, Geoffroy, Ann. Mus. xv. p. 192 *partim*, apud Peters. *Len-hwai* or *Len-wet*, Mason.

The common Indian Roussette, or "Flying-fox."

Some of the larger species of this genus are by no means well defined apart, if really differing to an extent which should be regarded as specific. Prof. Peters has elaborately monographed the genus *Pteropus*,* and subsequently the rest of the family,† of which he recognizes ten genera. He admits twenty-six species, with two sub-species, of *Pteropus* as then known to him. The ordinary Indo-Chinese Roussette is the same as the Indian one, and wherever found varies to some extent in colouring, the back being more or less

* "Bericht der Akademie zu Berlin," May 27th, 1867.

† *ibid.* Dec. 19th, 1867.

pale and the lower-parts more or less suffused with black or wholly fulvous; but in the Southern Tenasserim provinces it seems to grade into the more deeply-coloured *P. edulis* of Peron and Lesueur, as figured in Horsfield's "Zoological Researches in Java," which is recognized as distinct by Professor Peters, who refers to it *P. edulis et javānicus*, Desm., *P. edulis, funereus, et pluto*, Tem., *P. nicobaricus** and *Pachysoma giganteum*, Fitzinger. It is probable, therefore, that the latter, if truly distinct, should be recognized as an inhabitant of the Tenasserim provinces; but I suspect that it will be found to grade into the other.

13. CYNONYCTERIS AMPLEXICAUDATA (J. 13).

Pteropus amplexicaudatus, Geoff., Ann. and Mus. xv. p. 96; Peters, in P. Z. S. 1871, p. 513; *P. leschenaultii*, Desmarest; *P. seminudus*, Kelaart.

Tenasserim provinces, Siam, Amoy, Formosa, S. India and Ceylon, Malay countries to Timor, Moluccas, Philippines.

14. EONYCTERIS SPELÆA.

Eonycteris spelæa, Dobson, Journ. As. Soc. B. 1873, p. 204; *Macroglossus spelæus*, Dobson, J. A. S. B. xl. pl. x. fig. 3, 4, p. 261.

Tenasserim, Siam.

The habit of resorting to caves implied by the specific name of this kiodote has not, that I am aware of, been previously remarked of any of the family, but is likely to be common to sundry of the smaller *Pteropodidæ*. [Specimens of *Cynonycteris amplexicaudata* have since been obtained by Mr. W. T. Blanford, in the Némakdun Salt Caves, Kishm Island, in the Persian Gulf.] †

[15. MACROGLOSSUS MINIMUS.

Steropus minimus, Geoff. Ann. du Mus. xv. p. 96 (1810); *Steropus rostratus*, Horsf. Zool. Research. in Java (1825); *Macroglossus minimus*, Temminck, Monogr. Mammal. ii. p. 96; Horsf. Cat. Mamm. Mus. E. I. Comp. p. 29; Blyth, Cat. Mamm. Mus. As. Soc. Beng. No. 57; Dobson, J. A. S. B. 1873, p. 205.

A specimen in the Indian Museum, Calcutta, was obtained by Major Berdmore in 1858, in the valley of the Sitang river, Tenasserim province. This, the smallest species of frugivorous bat, has a rather wide distribution, extending from the Himalaya to North Australia.]

* [*Pteropus nicobaricus*, Dobson, J. A. S. B. 1873, p. 198. Quite distinct from both *P. edulis* and *P. medius*.—G.E.D.]

† [Dobson in P. A. S. B. May, 1873, p. 110.]

*16. CYNOPTERUS MARGINATUS (J. 14).

Vespertilio marginatus, B. H.

A common and very generally diffused species, inhabiting, it would seem, everywhere that bananas grow in S.E. Asia and its islands.

Its flight is particularly light and buoyant, and is performed by rapid movement of the wings, as it hovers around a fruit-tree, being quite unlike the slow winnowing motion of the wings of the larger "Flying-foxes." Both, however, travel to vast distances in the course of a night's foraging.* The neck and sides of this Bat are often strongly tinged with bright ferruginous, which would appear to indicate full maturity.† It is an extraordinarily voracious feeder, and will devour more than its own weight at a meal, voiding its food apparently but little changed while still slowly munching away. Of the guava, though a soft, mellow fruit, it swallows only the juice, opening and closing its jaws very leisurely in the act of mastication, and rejecting the residue. A pair have now been living for some time, and have reared a young one, in the London Zoological Gardens, where also the larger species of this family thrive and propagate freely. A species from the Andamans is described as *C. brachysoma*, Dobson.‡

Tribe SPECTRA.

Insectivorous Bats chiefly, which hybernate where the temperature is low. *Len-no*, Mason.

Sub-tribe PACHYURA.

Thick-tailed Bats; the tail more or less protrusile and sheathing within the interfemoral membrane; the wings long and narrow, and contracting with a double flexure.

Fam. **Noctilionidæ.**

Thick-tailed Bats.

17. TAPHOZOUS THEOBALDI.

Taphozous theobaldi, Dobson, P. A. S. B. 1872, p. 152; *T. saccolaimus* of Burma, *passim*.

Tenasserim provinces.

* *vide* Hutton, P. Z. S. 1872, p. 693.

† [I have observed this in adult females only, and believe it to be a secondary sexual character, like the epaulets in *Epomophorus*.—G. E. D.]

‡ J. A. S. B. xl. p. 260.

18. T. LONGIMANUS (J. 31).

Taphozous longimanus, Hardw. Trans. Lin. Soc. vol. xiv. tab. xvii. p. 525.

Rangoon.

This animal is pale fulvescent when young, and becomes gradually blacker with age; the very old being somewhat of a deep black, but with base of fur white.

19. T. MELANOPOGON (J. 32).

T. melanopogon, Tem.

[The Indian Museum possesses a specimen of an adult male of this species (with the characteristic black beard well developed), received from Amherst, in Lower Burma.]

Other species are sure to occur in Burma, and very probably the *Cheiromeles torquatus*, Horsfield, a large naked bat akin to *Taphozous*, with a narrow collar of hair, and the pollux somewhat opposable, which was procured by Finlayson in Siam, and also inhabits Malacca, Borneo, and Java. It emits a highly offensive odour. *Cheiromeles* conducts to *Nyctinomus* (see *Dysopes*), and of this genus *N. plicatus* may be confidently looked for, and to the south probably the darker race described as *N. tenuis*, Horsfield, which occurs in the Malay Peninsula. Also *Nyctinomus johorensis*, Dobson,* from Johore in the Malay Peninsula. Of a larger species, *N. insignis*, Blyth,† which Mr. Swinhoe identifies with the African *N. ruppellii*, and which should therefore occur in other parts of Southern Asia, he remarks, "I have often, on a cloudless evening, at Amoy, seen these Bats flying along high in the air, being easily distinguished by the narrowness of their wings. When irritated," he adds, "the creature has a habit of exposing its tail, and of sinking its eye into the socket and thrusting it out again. The membrane extending from the tail to the legs is wrinkled, and covers the tail like a glove, so as to slip up or down as the creature wishes to expand or contract its interfemoral wing, or, in nautical language, to shake out or take in reefs."‡ In *Taphozous* the tail withdraws entirely within the membrane.§ [I have compared the specimen labelled *N. insignis* in the

* P. A. S. B. Jan. 1873, pp. 22, 23; Nyctinomus (Chærephou) johorensis, J. A. S. B. 1874, p. 144.

† Cat. Mam. Mus. As. Soc. Bengl. No 87.

‡ P. Z. S. 1870, p. 619–690.

§ A classification of the genera of *Chiroptera*, by Prof. W. Peters, is published in the *Monatsbericht der Königl. Akademie der Wissenschaften zu Berlin*, May 22nd, 1865,

Indian Museum, Calcutta, with *N. cestonii*, Savi, of Southern Europe, and can find no difference whatever. That specimen was sent from Amoy by Mr. Swinhoe, and may therefore be safely assumed to be identical with the specimen referred by him to *N. ruppellii*.—G.E.D.]

[Mr. Blyth has followed the example of other Zoologists in placing *Rhinopoma* next *Megaderma*. Although connected with *Megaderma* through *Nycteris*, I believe that this genus is much more allied to *Taphozous*, and should therefore be classed with the *Noctilionidæ*.—G.E.D.] *

Sub-tribe Leptura.

Bats with ample wings, which contract with double flexure; the tail (when present) slender and fixed in the interfemoral membrane.

Fam. **Megadermatidæ.**

20. Rhinopoma hardwickii (J. 30).

Rhinopoma hardwickii, Gray.

India, Indo-Chinese, and Malayan countries.

p. 256. In this classification his fifth family, Brachyura, comprises *Mysticina*, *Noctilio* *Taphozous*, *Emballonura*, *Diclidurus*, and *Furia*; and his sixth family, Molossi, is composed of *Molossus* (seu *Nyctinomus*) and *Cheiromeles*. They seem to range better as two subfamilies of *Noctilionidæ*, *Cheiromeles* having so much affinity with *Taphozous*. Prof. Peters recognizes in all six families of Bats, which are named by him as follow:—1. Pteropi = *Pteropodidæ*.—2. Megadermata = *Megadermatidæ* (comprising *Rhinopoma*, *Megaderma*, *Nycteris*, and *Nyctophilus*, all foreign to America).—3. Rhinolophi = *Rhinolophidæ* (also foreign to America).—4. Vampyri = *Vampyridæ* (with four subfamilies, exclusively American).—5. Brachyura.—6. Molossi.—7. Vespertiliones = *Vespertilionidæ* (with fourteen genera). In *Bericht der Akademie zu Berlin*, 1871, p. 301 *et seq.*, the same zoologist has supplied a monograph of the *Rhinolophidæ*, in which he recognizes twenty-nine species of *Rhinolophus*, twenty-four of *Phyllorhina*, and as a third genus only one known species, the *Cælops Frithii*, nobis.

* [I do not agree with the author in placing *Rhinopoma* in the same family with *Megaderma*. *Rhinopoma* is, in my opinion, closely related to *Taphozous*. Its connexion with that genus is shown in the peculiar frontal depression, in the projecting muzzle and valvular nostrils, in the weak and deciduous upper incisors, in the form and folding of the wing, in the production of the tail beyond the interfemoral membrane, and even in the microscopical structure of the hair. Further, the species of these genera show remarkable similarity in their habits, and in them an enormous deposit of fat is heaped up about the root of the tail immediately before the hybernating season. Similar deposits of fat have not been observed by me in any other genera of Chiroptera.—G.E.D.]

21. MEGADERMA SPASMA.

Megaderma spasma, L.; *M. horsfieldi*, Blyth, Catal. No. 60; Horsfield's Catal. No. 39.

Tenasserim provinces.

The true *M. spasma* inhabits Ceylon and the Malayan countries generally; and the Indian *M. lyra* can hardly but occur in Arakan and Pegu, as it has been obtained at Amoy and in Formosa. The Bats of this genus are highly predatory, and Col. McMaster records that at Rangoon one killed on successive occasions two canary-birds. *Nycteris javanica*, Geoff., inhabits the Malayan peninsula, and should be looked for in the Tenasserim provinces.

Fam. **Rhinolophidæ.**

Sub-fam. RHINOLOPHINA.

Horse-shoe Bats.

22. RHINOLOPHUS CŒLOPHYLLUS.

Rhinolophus cœlophyllus, Peters, Proc. Zool. Soc. 1866, p. 426, and pl. 35.

Obtained by the late Lieut. Beavan in the valley of the Salween.

23. R. LUCTUS (J. 17).

Rhinolophus luctus, Temminck.

Indo-Chinese and Malayan countries, India (to lower region of the Himalaya), China, Philippines.

According to Captain Hutton, "this fine species commences its flight rather early in the evening, and does not soar high, like the smaller Bats in general, but remains below at about from twenty to thirty feet from the ground, wheeling with a somewhat heavy and noiseless flight around buildings and large trees in search of beetles and other insects. Indeed," he adds, "I think it may be truly said of all the larger species of" insect-eating "Bats, that they hawk for prey in the lower regions of the atmosphere, while nearly all the smaller ones ascend; and the reason is, that while the flies and minute insects are in the higher regions, the large beetles and other large insects, of which the smaller Bats could make no use, are found below among the branches of the trees. *R. luctus* appears usually to dwell in pairs, and does not associate in communities like some of the smaller species of its genus—though in a large cavern, affording ample room for them to dwell apart, several pairs may sometimes be found. I have taken them from the roofs of outhouses, and in wide caves in limestone rocks; but they appear to fly only in the warmer months of summer,

remaining (at least such is the case at Másuri) in a semi-torpid state during the winter. It is possible, however, that in the warmer south-eastern climates of Sikhim and the Khásia hills they may be active likewise in the winter," as where winter is unknown.*

24. R. AFFINIS (J. 21).

Rhinolophus affinis, Horsfield, Zool. Res. Java, pl. 8, fig. A. B.

Indo-Chinese and Malayan countries; also Malabar and Ceylon, and not uncommon at Másuri, at an elevation of about 5000 to 6000 feet.†

"Like the preceding" (*R. luctus*), remarks Capt. T. Hutton, "this species is early on the wing, and may be seen in the evening twilight coursing slowly round the trees in search of insects, crunching the hard-winged beetles as it flies, with a sharp crackling sound. It flies so low as to be easily caught in a common butterfly net."

25. R. ROUXI (J. 22).

Rhinolophus rouxi, Temminck, Monog. ii. p. 306.

India, with Ceylon; Indo-Chinese countries; China.

26. R. PUSILLUS.

Rhinolophus pusillus, Temminck; *R. pusillus*, Dobson, Proc. As. Soc. B. 1872, p. 155.

Burma.

As a matter of course, other species remain to be observed. *R. minor*, Horsf.; originally described from Java and common in the Malay countries, is also common at Másuri, at from 4000 to 6500 feet elevation.‡

Sub-fam. PHYLLORHININA.

27. PHYLLORHINA DIADEMA.

Rhinolophus diadema, Geoff.; Peters, in Proc. Zool. Soc. 1866, p. 426; *R. nobilis*, Horsfield, also Cantor; *Hipposideros lankadiva*, Kelaart.

Indo-Chinese and Malayan countries, Moluccas and Philippines, Ceylon.

The allied *P. armiger*, Hodgson, *H. diadema* apud Cantor, nec Geoffroy, and *H. swinhoii*, Peters, *olim*, must needs also occur, as it inhabits the Lower Himalaya, Ceylon, Malacca, and S. China (Amoy). Hutton remarks of it that, "like *Rhinolophus affinis*, this species may frequently be heard during its flight cracking and crunching the hard wings of beetles, which in the

* P. Z. S. 1872, p. 695. † Hutton, *l.c.* p. 696. ‡ Hutton, *l.c.* p. 698.

evening hours are usually abundant among the trees. The teeth are strong, and the *tout-ensemble* of its aspect is not unlike that of a bull-dog."*

[28. P. MASONI.

Phyllorhina masoni, Dobson, J. A. S. B. 1872, p. 338.

This fine species, very similar to *P. diadema*, but differing from it in the form of the concave front surface of the transverse nose-leaf, which is divided into *two cells only* by a single central longitudinal ridge, has been found at Moulmain, and the single type specimen is in the Indian Museum, Calcutta. Closely allied to it, but much smaller, is *P. nicobarensis*, Dobson, from the Nicobars.†]

[29. P. LARVATA.

Phyllorhina larvata, Horsfield; Zool. Researches in Java.

Prome, Burma.‡

Extremely variable in the colour of the fur.]

[30. P. SPEORIS (J. 26).

Vespertilio speoris, Schreb. Säugeth. Suppl. Atlas.

A specimen of this species was found by me among several specimens of *P. larvata* collected by Dr. Anderson at Prome, Burma, during the first expedition to Yunan.—G.E.D.]§

31. P. BICOLOR.

Rhinolophus bicolor, Temminck, Monog. ii. p. 18, t. 32, fig. 9, 10; *Hipposideros fulvus*, Gray, Peters, Proc. Zool. Soc. 1871, p. 513, *vide* Dobson in P. A. S. B. 1872, p. 155.

P. bicolor inhabits the Malayan countries and Philippines, and was obtained by Hutton in the Deyra Doon and hills up to 5500 feet.

According to Mr. Dobson, the golden-coloured specimens examined proved to be pregnant females exclusively. Examples so coloured occur in several species both of *Rhinolophus* and *Phyllorhina*.‖

* *vide* P. Z. S. 1872, p. 701. † [J. A. S. B. 1871, p. 263.]

‡ [*vide* Dobson in P. A. S. B. 1872, p. 155.]

§ [The specimens preserved in the Indian Museum, Calcutta, corresponding to Catal. no. 77 (old coll.), are undoubtedly examples of *P. larvata*, Horsf.—G.E.D.]

‖ Cantor remarks, of two individuals of *Rhinolophus affinis*, "the male is reddish-brown above, light greyish brown beneath; the female is above golden-fulvous, which becomes lighter on the lower-parts."—J. A. S. B. xv. p. 181.

Others doubtless remain to be discovered in the Indo-Chinese countries, inclusive of *Cælops frithii* (J. 29).

32. Asellia stoliczkana.

Asellia stoliczkana, Dobson; P. A. S. B. May, 1871, p. 106; J. A. S. B. vol. xl. p. 263; *Phyllorhina trifida*, Peters; P. Z. S. June, 1871, p. 513.

Specimens were obtained by Dr. F. Stoliczka and Mr. F. Day at Penang.

Fam. Vespertilionidæ.

Ordinary Bats.

*33. Nycticejus luteus (J. 43).

Nycticejus luteus, Blyth, J. A. S. B. vol. xx. p. 157; *Scotophilus heathii*, apud Swinhoe, P. Z. S. 1870, p. 619.

Arakan, and probably the rest of British Burma, unless far to the southward. "Very common in Canton in April and May." *

*34. N. temminckii (J. 44).

Vespertilio temminckii, Horsfield.

Generally diffused, except probably at high elevations. One of the most abundant of Bats throughout India up to the base of the Himalaya, as well as in the Indo-Chinese and Malayan countries, and the South of China.

35. N. castaneus (J. 45).

Nycticejus castaneus, Gray.

This species or race, which merely differs from the last in having the under-parts nearly or quite as deeply coloured as the upper-parts, has been obtained at Dacca, although chiefly a Malayan race or variety. Jerdon refers to it as inhabiting Burma. Others are likely to occur, especially of small size, and not improbably the large and singularly adorned *N. ornatus* which has been received from the Khásia hills.

[I believe both *N. luteus* and *N. castaneus* are synonyms of *N. temminckii*. *N. luteus* is the perfectly adult *N. temminckii*. No difference whatever, except size, can be found on comparing recent specimens and skeletons. Specimens of *N. ornatus*, Blyth, were obtained by Dr. Anderson in the Kakhyen Hills, Yunan.—G.E.D.]

* Swinhoe, l.c., *vide* also Hutton, P. Z. S. 1872, p. 706.

*36. VESPERUGO IMBRICATUS.

Vespertilio imbricatus, Horsfield; "young probably *V. abramus*, Tem., and *V. lobatus*, Gray; probably adult of *V. coromandelianus*, F. Cuv.," Dobson, in P. A. S. B. 1872, p. 156).*

A minute species, about the commonest and most generally diffused of Bats from the base of the Himalaya to Ceylon, as likewise in the Indo-Chinese and Malayan countries, and the South of China. It has also been recorded from Persia.† When disturbed in a room its flight is so exceedingly rapid that it can hardly be followed by the sight.

37. TYLONYCTERIS PACHYPUS.

Vespertilio pachypus, Temk., Monog. Mamm.; *Scotophilus fulvidus*, Blyth, J. A. S. B. vol. xxviii. p. 293; *Vesperus pachypus*, Dobson, P. A. S. B. 1871, p. 212; *Tylonycteris pachypus*, Peters, Monatsb. Akad. Berl. 1872, p. 704.

Tenasserim provinces.

38. KERIVOULA PICTA (J. 53).

Vespertilio pictum, Pallas.

This very beautifully coloured little Bat, as seen alive or quite fresh, occurs in British Burma, as in the adjacent parts of S.E. Asia.

[*39. VESPERTILIO HASSELTII.

Vespertilio hasseltii, Temm. Monog. Mammal. ii. p. 225; *Vesperugo hasseltii*, Wagner, Suppl. Schreb. Säugeth. v. p. 740.

This large-footed bat belonging to the same section of the genus (Subg. *Leuconoë*, Boie) as *Vespertilio capaccini*, Bonap., is readily distinguished from all other allied species by the very small size of the second lower premolar and its position quite internal to the tooth-row. Dr. Peters, who first detected the presence of this small premolar, remarks that the species was long considered as *Vesperugo* on account of the supposed absence of this tooth.§ Tenasserim province, Sumatra and Java.]

40. V. BERDMOREI.

Myotis berdmorei, Blyth, J. A. S. B. xxviii. p. 293.

A small species, akin to the European *V. pipistrellus*, obtained by the late Major Berdmore in the valley of the Sitang. "Of a dark fuscous hue,

* Mr. Swinhoe gives *Vesperugo abramus* (et *akokomuli*), Tem., and *V. imbricatus*, Tem., as distinct, P. Z. S. 1870, p. 618.

† J. A. S. B. xl. p. 461.

‡ P. Z. S. 1872, p. 710.

§ Monatsb. Berl. Akad. 1866.

the fur slightly tipped with earthy-brown on the upper-parts, and much more largely with a paler (almost whitish) brown below; membranes dusky. Length 3¼ in., of which tail 1½ in.; expanse 9¾ in.; fore-arm 1½ in.; ear-conch (posteriorly) ½ in. Three specimens (females).

[This species must ever remain doubtful, for the types referred to above cannot be found in the Indian Museum collection. They were absent from the collection of the Asiatic Society when it was transferred to the Indian Museum, Calcutta.—G.E.D.]

It need hardly be remarked that the foregoing is a meagre list of the *Chiroptera* which may reasonably be expected to inhabit the different provinces of British Burma; but it is a group which for various reasons is neglected by ordinary collectors, and one that to be investigated with tolerable success requires some special attention to be bestowed upon it. Only those zoologists who have made some study of the Bats can have an adequate idea of the multitudinous variety of them, not only as regards specific but very strongly marked divisional forms; and exceedingly little is as yet known of the diversities of habit which must needs accompany so much variation in structure.

Sub-order Carnivora.

Fam. Canidæ.

41. Canis rutilans (J. 137).

Canis rutilans, Müller; *vide* Murie, on "Indian Wild Dogs," P. Z. S. 1872, p. 715 *et seq.* *Tau-khwae* (Mason).

The "Dhole" is generally diffused through the forests, but apparently not common anywhere; it hunts in packs.

A Burmese female in the People's Park, in Madras, "upwards of three years old," is stated by Col. McMaster to answer to Hodgson's description of the *Buánsu* of Nipâl, "except in her height, which cannot be more than seventeen or eighteen inches." In Malacca and Sumatra the race, *C. sumatrensis*, Hardwicke, is smaller and deeper coloured, and the Tenasserim race is probably identical with it, whether or not so with that of India. In the latter there is considerable difference in the appearance of the animal according to season, the winter vesture being longer and paler in colouring, with the brush much more finely developed. This seasonal difference may well have given rise to some of the notions regarding a plurality of species.

*42. C. AUREUS.

Canis aureus, Lin.; *Myae Khwae* (Mason).

The Jackal is not uncommon at Akyab, and it has been shot in the vicinity of Prome, and at Thyetmyo; but in Arakan it has not passed the boundary of the Naf river.

Fam. **Viverridæ.**

Sub-fam. VIVERRINÆ (Civets and Genets).

*43. VIVERRA ZIBETHA (J. 119).

Viverra zibetha, Lin., S.N.T. 65; *Kyoung-myen*, Arakan.

The Grey Civet is a widely diffused species, which, Mr. Swinhoe states, inhabit China from Hongkong to Shanghai, as also the Chusan Archipelago, and the island of Hainan. Dr. Cantor procured it in the Malayan peninsula, Province Wellesley; and it inhabits Arakan, and probably is extensively diffused over the Indo-Chinese countries, as in Lower and Eastern Bengal, and the Tarai at the foot of the Eastern Himalaya.

*44. V. MEGASPILA.

Viverra megaspila, Blyth, J. A. S. B. xxxi. p. 331; *V. zibetha*, apud Waterhouse, Cat. Zool. Soc. Mus. 1838, No. 252; *V. tanggalunga*, apud Cantor, J. A. S. B. xv. p. 197, nec apud Gray. *Khyoung-myen*, Mason.

Large-spotted Civet. Of the same size as *V. zibetha*, with the body-markings large and black, and comparatively few in number, *i.e.* as compared with *V. civettina* of Malabar. I have seen flat skins of this animal from Prome, resembling those which Dr. Cantor procured in Province Wellesley, and one brought from Sumatra by Sir T. S. Raffles, which was formerly in the Museum of the Zoological Society in London. It is nearly allied to *V. civettina* of S. Malabar, but very different from *V. tanggalunga*, Gray, of the Malay countries, which is a much smaller animal, with more cat-like tail, and the spots of which are much smaller and more numerous. In the Philippine Islands it is probable that *V. tanggalunga* should be regarded as an introduced species.

*45. VIVERRICULA MALACCENSIS (J. 121).

Viverra malaccensis, Gmelin, S.N. 92. *Wa-young-kyoung-bank*, Arakan. *Kyoung-ka-do*, Mason.

The Common Viverette. It is abundant in the Indo-Chinese countries, as in India, S. China, and the Malayan peninsula and islands. There is a nearly allied species in Madagascar.

Sub-fam. PARADOXURINÆ (Musangs).

*46. PARADOXURUS GRAYI (J. 124).

Paradoxurus grayi, Bennet, P. Z. S. 1835, p. 118.

Hill Musang. Inhabits the Arakan hills.

*47. P. MUSANGA (J. 123).

Paradoxurus musanga, F. Cuv., Mamm. Lith. ii. t. 55. *Kyoung-woon-bank*, Arakan.

Common Musang. As common as in the neighbouring countries.

48. P. TRIVIRGATUS.

Paradoxurus trivirgatus, Temm. Monagr. ii. t. 63, fig. 1; *Kyoung-na-ga*, Mason.

The three-streaked Musang inhabits Tenasserim provinces, Malayan peninsula, Sumatra, and Java.

*49. P. LEUCOTIS.

Paradoxurus leucotis, Blyth, J. A. S. B. xxvii. p. 274; Horsfield's Catal. Mamm. India House Mus., No. 66. *Na-zwet-phyoo*, Arakan.

The white-eared Musang inhabits Sylhet, Arakan, and Mergui.*

*50. ARCTICTIS BINTURONG (J. 126).

Viverra binturong, Raffles, Trans. Lin. Soc. xiii. p. 253. *Myouk-kya*, or "Monkey-tiger," Arakan.

The Binturong inhabits the Mishmi hills, at the head of the valley of Assam, and occurs southward to the Straits of Singapore, and is also found in the islands of Sumatra and Java. Finlayson procured it in Siam.

Fam. Herpestidæ.

Mungoose.

*51. URVA CANCRIVORA (J. 134).

Urva cancrivora, Hodgson, J. A. S. B. vol. vi. p. 561. *Mwai-ba*, Arakan.

The crab-eating Mungoose is found in Nipâl, the Khásia hills, Arakan, Pegu, N. Tenasserim, Vokien hills near Amoy (Swinhoe). It is the only representative of the Mungoose group in British Burma.

* The species found in the Andaman Islands appears to be identical with *P. leucotis*, Blyth. It was, however, described as a new form by the late Lieut.-Col. Tytler, and named after himself as *P. tytleri* (J. A. S. B. 1864).

Fam. Felidæ.

Cats.

52. Felis tigris (J. 104).

Felis tigris, Lin.; *Tigris regulis*, Gray, P. Z. S. 1867, p. 263. *Kya*, Arakan.

The Tiger. Common in the forests.

53. F. pardus (J. 105).

Felis pardus, Lin.; *Leopardus pardus*, Gray, P. Z. S. 1867, p. 263. *Theet-kya*, Arakan.

The Pard. Also common; and black individuals not rare in the Southern Tenasserim provinces and Malayan peninsula.

*54. F. macrocelis (J. 107).

Felis macrocelis, Temminck; *F. diardi*, F. Cuvier.

The clouded Tiger-cat. A skin has been obtained in the mountains which separate Arakan from Pegu, and the species is probably of general occurrence in the higher mountain forests. Crawfurd noticed a dressed skin of it in the market at Bangkok. As the animal increases in age, its ground-hue becomes more fulvescent, and there is much individual variation in its markings. I have never seen it from the Malayan peninsula, but it inhabits Sumatra and Borneo, as likewise the Eastern Himalayas, and the islands of Formosa and Hainan; doubtless, therefore, the intervening countries generally in suitable localities. Hodgson notes it from Tibet!

55. F. viverrina (J. 108).

Felis viverrina, Bennet, P. Z. S. 1833, p. 68.

The fishing Tiger-cat. Tenasserim provinces, and probably the lowlands generally of British Burma; also Camboja, S. China, Formosa, and all suitable parts of India, with Ceylon. This animal has coarse fur, for a *Felis*, and chiefly inhabits low watery situations, where it preys much on fish.

*56. F. undata (J. 110).

Felis undata, Demarest. *Theet-kyoung*, Arakan.

The Leopard-cat. Generally diffused. Specimens from Arakan and Tenasserim present the ordinary colours of Indian examples, with the body-markings resembling those of *Genetta afra*. Dr. Gray describes *F. tenasserimensis*,* but I cannot perceive that the flat skin upon which this is founded differs from ordinary *F. undata*.

* P. Z. S. 1867, p. 400.

*57. F. CHAUS (J. 115).

Felis chaus, Gildenst. *Khyoung tsek-koon*, Arakan.

The Chaus. The author procured this species in Arakan, and Col. McMaster states that he "shot a very fine one in Burma." Egyptian specimens exhibited in the London Zoological Gardens do not differ in any respect, that I can perceive, from the common Indian species.

Mason refers to a species about the size of a domestic cat, "but its colour and markings are exactly those of a Tiger. These Cats," he adds, "are very abundant in the jungles, and occasionally venture into towns, where they make great havoc among the poultry." I could not well fail to have met with such a species, did it exist, and take leave to doubt that any small species of Cat is coloured and marked exactly like a Tiger. *F. undata* is doubtless intended, at least in part.

Mason also refers to an animal which he denominates the "Fire-cat," or "Fire-tiger," of the Burmans. This is very probably *F. temminckii*, Vigors (*F. moormensis*, Hodgson, and *F. chrysothrix*, Tem. *MS.*), which is found not only in Nipâl and Assam, but in the Malayan peninsula and Sumatra, and therefore may be expected to occur in the intervening territory. It has been lately figured by Dr. Sclater.*

Fam. Mustelidæ.

Sub-fam. LUTRINÆ (Otters).

*58. LUTRA NAIR (J. 100).

Lutra nair, F. Cuv. *Phyau*, Arakan.

Common on both sides of the Bay of Bengal.

*59. AONYX LEPTONYX (J. 102).

Lutra leptonyx, Horsfield, Zool. Res. Java.

Otter with minute claws. "Otters abound in some of the streams. In the upper part of the Tenasserim, a dozen at a time may be occasionally seen on the rocks of the river. The Burmese sometimes domesticate them, when they will follow a man like a dog" (Mason).† As common as the former species.

* P. Z. S. 1867, pl. xxxvi. p. 816.

† No animals are more difficult to determine than the species of Otter, from their general similarity, which may lead to over-hasty identification of them, and the neglect to note specific differences which appear on minute examination. The skulls generally afford good means of discrimination.

Sub-fam. MUSTELINÆ (Martens, Weasels,* and Badgers).

*60. MARTES FLAVIGULA (J. 96).

Mustela flavigula, Boddäert.

Black-capped Marten. Khásia hills and Arakan.

Similar to Himalayan specimens, and differing from the Malayan race, found also in Formosa, by having much longer fur and a wholly black cap, instead of a brown cap with black periphery.

*61. HELICTIS NIPALENSIS (J. 95).

Gulo nipalensis, Hodgson, J. A. S. vol. v. p. 237; *Melogale personata*, Is. Geoffroy. *Kyoung-pyan* (Mason).

The Brock-weasel. Arakan, and common in Pegu.

It is decidedly identical with the species inhabiting Nipâl and Sylhet, if not also with *H. orientalis* (Horsf.) of Java; but distinct from *H. moschata*, Gray, of S. China and Hainan, and *H. subaurantiaca*, Swinhoe, of Formosa. Dr. Gray identifies *Melogale personata*, from the vicinity of Rangoon, with the Chinese *H. moschata*, judging—it may be presumed—from the figure rather than the description in the *Zoologie* of M. Bélanger's *Voyage aux Indes Orientales*.†

*62. ARCTONYX COLLARIS (J. 93).

Arctonyx collaris, F. Cuv., Mamm. Lith. iii. t. 60; *Arctonyx isonyx*, Hodgson. *Khway-too-wet-too*, Arakan; *Khwae-tawet, wet-tawet* (Mason).

Large Burman Sand-badger.‡ Inhabits Assam, Sylhet, and Arakan, and at least as far southward as the country bordering on the Sitang. An Arakan specimen is figured.§

63. A. TAXOIDES.

Arctonyx taxoides, Blyth, J. A. S. B. xxii. p. 591.

The small Burman Sand-badger is much smaller and better clad than the preceding, with the pig-like snout less developed. Both appear to have much the same geographic range.

* The *Mustela nudipes*, F. Cuv., inhabits the mountains of the Malayan peninsula, Sumatra, and Java, and may therefore be looked for on those of the Tenasserim provinces.

† P. Z. S. 1865, p. 153.

‡ [In Jerdon's Mammals of India, the Hindustani Bhalu-soor, *i.e.* Bear-pig, is given as the native name of this animal; but this seems to be an error, for the usual term applied to it is Bâli-soor, which means Sand-pig, which is in consonance with its known habits.—J.A.]

§ J. A. S. B. vol. vii. p. 735, pl.

Nearly allied is the *Mydaus meliceps*, Horsfield, of the higher mountains of the Malayan peninsula, Sumatra, and Java, which is likely also to inhabit those of the Tenasserim provinces. *M. leptorhynchus*,* A. M.-Edwards, is described from N. China.

Fam. Ursidæ.

Bears.

*64. Helarctos malayanus (J. 43).

Ursus malayanus, Raffles, F. Cuv. Mamm. Lithog. iii. t. 58. *Wet-woon*, Arakan.

The Sun Bear. This is the only Bear which inhabits British Burma, where it is diffused from Arakan to Mergui, and thence southward throughout the Malayan peninsula, Sumatra, and Borneo; the Bornean race, *U. eurysplus*, Horsfield,† differing but slightly. How far northward of Arakan its range of distribution may extend, I am unaware; but *Ursus tibetanus*, the common Black Bear of the forest region of the Himalaya, is the only Bear as yet determined from the hill ranges bordering on Assam, and this I believe to be the *U. malayanus* apud Walker;‡ the same animal occurring likewise in S. China, and in the islands of Hainan (?) and Formosa.§ In all probability the *H. malayanus* is generally diffused over the great Indo-Chinese peninsula, where it especially inhabits the precipitous limestone mountains, and is therefore difficult of access, from the tangled vegetation of the places to which it resorts. When brought up tame, it is an animal of gentle disposition, which will follow people about like a dog. I have seen one that suffered itself to be fondled by little children. "On one occasion," writes Mason, while "sleeping in a Karén field that had been recently harvested, I was disturbed all night by a number of them digging up the roots of the sugar-cane that had been left in the field. They will occasionally attack man when alone. On descending the Tenasserim a few years ago on rafts, the foremost raft passed over a rapid, and made short a turn into a little cove below, when a Bear from the shore made a plunge at the raft, and threw the two Karéns on it into the water. At this moment the other boats came in sight, and the Bear retreated. On another occasion I met with a Burman and a Bear that he had just shot, and the Burman assured me that he had shot the Bear in the very act of running upon him. And last year," continues Mason, "a Karén of my acquaintance in Tonghoo was attacked by one, overcome, and left by the Bear for dead.

* Ann. Sci. Nat. ser. v. tom. viii. p. 374, and Ann. M. N. H. (4), t. ii. p. 230.

† Zool. Journ. vol. i. pl. 7.

‡ Calc. Journ. N. H. iii. p. 265. § P. Z. S. 1870, pp. 230, 621.

Though severely bitten, the man recovered." It is probable that such acts are prompted by maternal solicitude. The common Sloth Bear, or *Prochilus labiatus*, of India and Ceylon, is unknown to the eastern side of the Bay of Bengal.

Of the Infra-sub-order PINNIGRADA, or Seals, etc., there is no representative in inter-tropical seas.

Sub-order INSECTIVORA.

Fam. Tupaidæ.

Tupayes.

*65. TUPAIA PEGUANA (J. 88).

Tupaia peguana, Lesson, Bélanger's Voy., Atlas, t. 4; *Cladobates belangeri*, Wagner; *Herpestes* sp., Calc. Journ. N. H. ii. p. 458. *Tswai*, Arakan.

Common throughout British Burma, but hardly separable from *T. ferruginea*, Raffles, of the Malay countries, from which it seems to differ only in wanting the deep ferruginous tinge on the upper-parts, though even this is not quite absent in some specimens. Northward it extends to the Khásias, and even to the lower range of the Sikhim Himalaya.

According to Col. McMaster, "Burmese specimens differ somewhat from those of Arakan, in having the lower parts much darker, and with the pale central line narrower; in the Burmese examples, the whole chin, throat, and breast being buff." He also remarks that "the Burmese Tupaia is a harmless little animal: in the dry season living on trees, and in the Monsoon freely entering our houses, and in impudent familiarity taking the place held in India by the common Palm Squirrel; it is, however, probably from its rat-like head and thievish expression, very unpopular. I cannot," he adds, "endorse Jerdon's statement regarding their 'extraordinary agility,' for they did not to me appear to be nearly so active as Squirrels: at least, I remember one of my terriers on two occasions catching one, a feat which I have never seen any dog do with a Squirrel; cats of course often pounce upon them." Mason remarks that "one that made his home in a mango-tree near my house at Tonghoo made himself nearly as familiar as the cat. Sometimes I had to drive him off the bed, and he was very fond of putting his nose into the tea-cups immediately after breakfast, and acquired quite a taste both for tea and coffee. He lost his life at last, by incontinently walking into a rat-trap."

In the vicinity of Malacca the small *T. javanica*, Horsf.,* is associated

* Zool. Res. in Java.

with *T. ferruginea*, though unnoticed in Dr. Cantor's "Catalogue of the Mammalia of the Malayan Peninsula;" and perhaps the most extraordinary instance in the class of what has been termed "mimicry" occurs in a Squirrel, *Rhinosciurus tupaiades*, Gray, differing little, if at all from *Sciurus laticaudatus*, S. Müller, of Sumatra and Borneo, which inhabits the same district. Not only does this rodent resemble *T. ferruginea* in size and the texture and colouring of its fur, but the muzzle is singularly elongated, and there is even the pale shoulder-streak usual in the genus TUPAIA. As a group of *Insectivora* the Tupayes would seem to "mock" the Squirrels; but the particular species of Squirrel referred to again specially simulates the *Tupaia ferruginea* of the same locality.

Another Malayan species of the order *Insectivora*, the *Gymnura rafflesii*, Vigors and Horsfield (*Viverra gymnura*, Raffles), occurs probably in Mergui, and is doubtfully mentioned as having been received from Arakan,* probably by mistake. This remarkable animal is not unlikely to be the "Opossum" of Colonel Low,† for it is difficult to imagine what other animal could be alluded to by that name.

Fam. Erinaceidæ.

66. HYLOMYS SUILLUS.

H. peguensis, Blyth, J. A. S. B. xxviii. p. 294; Anderson, Trans. Z. S., vol. viii. p. 453.

Procured by Major Berdmore in the valley of the Sitang river. The Bornean specimens which I saw at Leyden appeared, without actual comparison, to be quite identical.

Fam. Soricidæ.

Sub-fam. SORICINÆ (Shrews).

67. PACHYURA INDICA (J. 69).

Sorex indicus, Geoff.; *S. cærulescens*, Shaw; *Pachyura indica*, Anderson, P. Z. S. 1873, p. 231. *Kywet-suk* (Mason).

Indian Musk Shrew. The common pale grey Musk Shrew, vulgarly called the "Musk Rat" in India, occurs in the Tenasserim provinces, where, if I mistake not, it is the prevalent species.

* Calc. Journ. N. H. ii. p. 147.

† J. R. A. S. iii. p. 50, and As. Res. xvii. p. 159.

68. P. MURINA (J. 70).

Sorex murinus, Lin.; *Pachyura murina*, L. Anderson, P. Z. S. 1873, p. 231.

Malayan Musk Shrew. "This," remarks Dr. Jerdon, "is the common large 'Musk Rat' of China, Burma, and the Malayan peninsula, extending into Lower Bengal and Southern India, especially the Malabar coast, where it is said to be the common species, the bite of which is considered venomous by the natives. The musky odour of this Shrew is much less powerful than in *S. cærulescens*." I was never able to obtain a specimen of it in Lower Bengal, and am not wholly satisfied with regard to its alleged range in Burma.

69. P. GRIFFITHII.

Sorex griffithii, Horsfield, Catal.; Tomes, Ann. M. N. H., 2nd ser. vol. xxiv. p. 28; *P. griffithii*, Horsfd., Anderson, P. Z. S. 1873, p. 231.

The large Black Shrew. Inhabits the Khásia hills and those of Arakan; certainly not Afghánistân, as stated by Dr. Horsfield.*

70. P. NUDIPES.

Sorex nudipes, Blyth, J. A. S. B. xxiv. p. 34; *S. perroteti* apud Blyth, *ibid.* xvi. p. 1275. *P. nudipes*, Blyth, Anderson, P. Z. S. 1873, p. 231.

The Bare-footed Shrew. One of the group of minute Shrews, which appears to be of common occurrence in the Tenasserim provinces.

71. CROCIDURA FULIGINOSA.

Sorex fuliginosus, Blyth, J. A. S. B. vol. xxiv. p. 362; *Crocidura fuliginosa*, Anderson, P. Z. S. 1873, p. 231.

The Dusky Shrew. Procured by Major Berdmore in the Tenasserim Provinces.

Sub-fam. TALPINÆ (Moles).

72. TALPA LEUCURA.

Talpa leucura, Blyth, J. A. S. B. vol. xix. p. 215, and figure of skull.

The Sylhet Mole. Obtained by Major Berdmore in the valley of the Sitang.

* The late Mr. S. Griffith collected both in the Khásia hills and in Afghánistân, and his specimens from those two very distinct localities became intermixed and confounded. Hence several Khásia species of mammalia, birds, and reptiles have been erroneously stated by Messrs. Horsfield and Moore to inhabit Afghánistân. *Vide* Ibis, 1872, p. 89.

Order CETACEA.

Fam. Delphinidæ.

Dolphins and Porpoises.

73. Orcella fluminalis.

Orcella fluminalis, Anderson, P. Z. S. 1870, pp. 220, 544; 1871, pl. 43, fig. 2. *La-boing* (Mason).

The Irawádi Dolphin, inhabiting the deep channels of the river from 300 to 600 miles from the sea. Colour uniform dirty white.

Fam. Balænopteridæ.

Rorquals.

74. Balænoptera indica (J. 147).

Balænoptera indica, Blyth, J. A. S. B. vol. xxviii. p. 488.

Indian Rorqual. A specimen eighty-four feet in length was cast upon Juggoo or Amherst Islet, South of Ramri, and East of Cheduba, on the Arakan coast, in 1851: another was stranded on the Chittagong coast in 1842, said to have been ninety feet long and forty-two feet in circumference.* Whale Bay, in the Mergui archipelago, was so named by Captain R. Lloyd, "from the circumstance of its being resorted to by numerous Whales,"† it being the only part of the coast where he had seen them.

Order PROBOSCIDEA.

Fam. Elephantidæ.

75. Elephas indicus (J. 211).

Elephas indicus, Linn.; *Hsen*, Mason; *Chang*, Siamese.

The Asiatic Elephant. The Elephant of Sumatra, and also that of Ceylon is considered by Professor H. Schlegel to be a peculiar species, *E. sumatranus*, Schlegel; but the late Dr. Falconer did not admit of the alleged distinctions, and a large living male Sumatran Elephant in the Zoological Gardens of Amsterdam, as also a half-grown one in that of Rotterdam, are certainly not to be distinguished by any external character from the ordinary Indian Elephant.

* Noted in J. A. S. B. xxi. p. 414, and xxviii. p. 482.

† *ibid.* vii. p. 1030, and map.

Order RODENTIA.

Fam. Sciuridæ.

Sub-fam. Pteromydinæ (Flying-squirrels).

*76. Pteromys cineraceus.

Pteromys cineraceus, Blyth, J. A. S. B. xxviii. p. 276; *P. petaurista*, var. *cineraceus*, Bl., *ibid.* xvi. p. 864. *Shau-byau*, Arakan.

The Burmese Great Flying-squirrel inhabits Arakan, Pegu, Tenasserim provinces. It is a large species, very like *P. petaurista* of Central and Southern India and also Ceylon, but generally with whitish tail; one Tenasserim specimen, however, is unusually rufous, with the tail coloured uniformly with the upper-parts.

Many specimens of this animal require to be collected and compared together.

*77. Sciuropterus phayrei.

Sciuropterus phayrei, Blyth, J. A. S. B. xxviii. p. 278; *S. sagitta*, apud Blyth, *ibid.* xxiv. p. 187.

Pegu, Tenasserim Provinces, and Cambodja, where it was obtained by Mouhot. It is akin to *S. horsfieldi*, Waterhouse (*S. aurantiacus*, Wagler), of the Malayan peninsula.

*78. S. spadiceus.

Sciuropterus spadiceus, Blyth, J. A. S. B. xvi. p. 867, pl. xxxvi. fig. 1. *Kywat-shoo-byan*, Arakan.

It inhabits Arakan, and is a diminutive species, of the same size as *S. volucella* of North America.

Sub-fam. Sciurinæ (Squirrels).

*79. Sciurus macruroides (J. 151).

Sciurus macruroides, Hodgson. *Leng-thet*, Arakan; *Shen* (generic), Tenasserim, Mason.

The large Black Squirrel. This is the Himalayan *S. bicolor*, auct., with densely clad ear-conch, whereas Malayan specimens referred to the same have an almost nude ear-conch. There is a Tenasserim local race, with broad pale transverse band on the loins, forming a kind of cincture. The true *S. bicolor*, Sparrman, is now identified with the Javanese race, *S. hypoleucus*, Horsfield, which is not larger than the *S. macrourus* com-

mon in Ceylon. Examples from the Arakan mountains do not differ from those of the E. Himalaya and the hills bordering on the Bráhmáputra valley to the southward of it. The races brought together under the name *S. giganteus*, Tem., seem to be almost endless, but each of them is locally true to its particular type of colouring, within a moderate range of variation.

*80. S. FERRUGINEUS.

Sciurus ferrugineus, F. Cuv., Mamm. Lithog.; *S. keraudreni*, Is. Geoffroy, *vide* J. A. S. B. xxiv. p. 474, xxxi. p. 334; *S. siamensis*? Gray.

The Bay Squirrel. Occurs in the hilly regions of Arakan and Pegu.

81. S. CANICEPS.

Sciurus caniceps, Gray, Ann. M. N. H. 1842, p. 212; *S. chrysonotus*, Blyth, J. A. S. B. xvi. p. 873, xxiv. p. 474.

The Golden-backed Squirrel. It inhabits the Tenasserim provinces, but is commoner to the southward; it is certainly not found in Bhotan, or any part of India, as asserted by Dr. Gray.

82. S. ATRODORSALIS.

Sciurus atrodorsalis, Gray, Ann. M. N. H. 1842, p. 213; *vide* J. A. S. B. xxiv. p. 477, xxviii. p. 276; var. *S. hyperythrus*, Blyth, J. A. S. B. xxiv. p. 474, *vide* Beavan in P. Z. S. 1866, p. 428; *S. rufogaster*, Gray, same variety.

The Black-backed Squirrel. It is common in the hills about Maulmein, but is replaced on the opposite side of the Salween by the next species. It certainly does not occur in "India, Benáres," as asserted by Dr. Gray.

*83. S. PHAYREI.

Sciurus phayrei, Blyth, J. A. S. B. xxiv. p. 476, xxviii. p. 275; *S. pygerythrus*, var.? *ibid.* xvii. p. 345.

Phayre's Squirrel. It is common throughout the Province of Martaban, but does not inhabit Malabar, as has been stated.*

84. S. BLANFORDI.

Sciurus phayrei, Blyth, J. A. S. B. xxxi. p. 333.

It has been found in the vicinity of Ava, and the Shán hills, but not in "India," as asserted by Dr. Gray.

* Ann. M. N. H. ser. 3, vol. xx. p. 277.

85. S. PICEUS.

Sciurus piceus, Peters, Proc. Zool. Soc. 1866, p. 429.

Tenasserim.

*86. S. LOKRIAH (J. 153).

Sciurus lokriah, Hodgson, J. A. S. B. 1836, p. 233; *S. subflaviventer*, M'Clelland, *vide* J. A. S. B. xxiv. p. 475.

A mountain race, inhabiting Nipâl, Sikhim, the Khásia hills, and those of Arakan.

*87. S. ASSAMENSIS.

Sciurus assamensis, M'Clelland, *vide* J. A. S. B. xxiv. p. 475; *S. blythii*, Tytler, Ann. M. N. H. 1854, p. 72.

A very abundant race, inhabiting the valley of the Bráhmáputra, with Eastern Bengal, Tippera, Chittagong, and Arakan.

*88. S. PYGERYTHRUS.

Sciurus pygerythrus, Is. Geoff., Zoologie Voy. de Belanger, *vide* J. A. S. B. xxiv. p. 475.

It inhabits Lower Pegu, and is common in the neighbourhood of Rangoon.

89. S. SLADENI.

Sciurus sladeni, Anderson, P. Z. S. 1871, p. 139.

Thizyain, in Upper Burma.

90. S. GORDONI.

Sciurus gordoni, Anderson, P. Z. S. 1871, p. 140.

Bhamo, Upper Burmah.

91. S. QUINQUESTRIATUS.

Sciurus quinquestriatus, Anderson, P. Z. S. 1871, p. 142.

A hill species, common at Ponsee, on the Kakhyen range of hills, east of Bhamo, at an elevation of from 2000 to 3000 feet.

92. S. BERDMOREI.

Sciurus berdmorei, Blyth, J. A. S. B. xviii. p. 603, xxviii. p. 418, xxxi. p. 334; *S. mouhoti*, Gray.

The Ground Squirrel. Tenasserim, Martaban, Mergui, Cambodja.

From what I have observed of this species I doubt if it ever ascends trees, as I never saw it retreat to them, but always to the cover of low herbage. It should, perhaps, more properly range as a species of *Tamias*.

93. S. BARBEI.

Sciurus barbei, Blyth, J. A. S. B. xvi. p. 875, pl. xxxvi. fig. 3, xviii. p. 603.

Tenasserim provinces, commoner to the southward, Siam, Cambodja? Hainan? S. China?

A Malacca specimen in the Leyden Museum is marked *Tamias leucotis*, Tem. It is closely allied to *S. m'clellandii* of the E. Himalaya and also of Formosa, but more brightly coloured, having four pale dorsal stripes about equally vivid, alternating with five black stripes. It is doubtless *S. m'clellandii* of Cambodja,* of Hainan,† and of China and Formosa;‡ but a Formosan specimen in the Leyden Museum represents the Himalayan race, *S. m'clellandii*. Mason remarks of *S. barbei* that it abounds in the provinces of Yé, Tavai, and Mergui.§

Fam. Muridæ.

Rats and Mice.

94. HAPALOMYS LONGICAUDATUS.

Hapalomys longicaudatus, Blyth, J. A. S. B. xxviii. p. 296.

A remarkable murine form, from Schwe Gyen in the valley of the Sitang or neighbouring hills, discovered by Major Berdmore.

95. NESOKIA INDICA (J. 172).

Nesokia indica, Gray; *Mus indicus*, Geoff. Probably *Yae-kwet* of Mason.

It has been obtained at Tonghoo by Mr. W. Theobald.‖ The occurrence of this common Indian field Rat in the open country of upper Pegu, together with a Hare akin to the *Lepus ruficaudatus* of the plains of Northern India, and of sundry birds identical with or akin to Indian species which are unknown in the broad belt of forest which fringes the coast of British Burma, indicates the probability of a closer connexion subsisting between the faunæ of the upper provinces of the two peninsulas than we as yet know of; our acquaintance with the fauna of Western Indo-China being chiefly confined to that of the great maritime belt of forest. The present species is, however, indicated by Mr. Swinhoe from Formosa.

* P. Z. S. 1861, p. 137. † *ibid.* 1870, p. 232. ‡ *ibid.* 1870, p. 634.

§ In addition to all of the above, I have seen an undescribed species of medium size from Tonghoo.

‖ P. A. S. B. 1866, p. 240.

96. MUS BANDICOTA (J. 174).

Mus bandicota, Bechstein. *Myae-kywet* (Mason).

This species I give on the authority of Mason, which I accept the more readily as it is known to occur in Siam and the Malayan peninsula and islands; also in Formosa, where Mr. Swinhoe thinks that it was probably introduced when the Dutch were in possession, A.D. 1630.*

*97. M. DECUMANUS (J. 176).

Mus decumanus, Pallas, Glires, 91.

The common Brown Rat. I observed this pest to be very numerous and troublesome at Akyab, but saw no traces of it at Rangoon or Maulmein, nor further southward; but wherever there is European shipping, it will sooner or later find its way and establish itself permanently.

*98. M. ROBUSTULUS.

Mus robustulus, Blyth, J. A. S. B. xxviii. p. 294; Theobald, P. A. S. B. 1866, p. 240; *M. berdmorei*? Blyth, J. A. S. B. xx. p. 173; *M. rufescens*, Gray, var. ?

Common Rat of Rangoon and Maulmein, also of Mergui. Requires to be critically examined in the fresh state.

Under the heading of "White-bellied Rat," Mason remarks that "the Rats are scarcely second to the Termites for the mischief they perpetrate. They burrow in the gardens and destroy the sweet potatoes; they make their nests in the roofs by day and visit our houses and larders by night. They will eat into teak drawers, boxes, and book-cases, and can go up and down anything but glass. In the province of Tonghoo they sometimes appear in immense numbers before harvest and devour the paddy like locusts. In both 1857 and 1858 the Karens on the mountains west of the city lost all their crops from this pest; and it is said that they are equally destructive occasionally in the eastern districts, but have not appeared for several years. The natives say it is the same Rat as the one that frequents houses."

Again, he remarks that Mr. Cross, when on the Tenasserim river a few months ago (in 1858?), wrote—"The people, in common with all who grow the hill paddy, over an extent of country more than fifty miles square, are suffering a famine of rice. This is occasioned by swarms of Rats, which devoured the paddy, or rather cut down the stalks, just as the ears began to fill. The Rats twice visited some parts of this territory during the season,

* P. Z. S. 1870, p. 635.

so that scarcely a stalk of rice escaped them. I met with two of these animals, swimming the Tenasserim where it is more than a quarter of a mile wide, and succeeded in capturing one. The animal is about five inches from the nose to the end" (base?) "of the tail, of a slim and nimble appearance, the belly white, and the rest a mouse colour. During the rains, when the river is much wider and more rapid, these Rats crossed in columns, as the people say, so abundantly that a boat, in passing through, caught bushels of them. They only make their appearance at long intervals, like the locusts of other places. It is said to be from twenty to thirty years since they visited the country before, to any great extent."

99. M. CAUDATIOR (J. 183).

Mus caudatior, Hodgson, Horsf. Cat. Mamm. India House Mus., p. 144; var. *M. cinnamomeus*, Blyth, J. A. S. B. xxviii. p. 294.

Lower Pegu and Martaban.

It differs only from the Nipâlese animal of Mr. Hodgson by having the upper-parts entirely of a bright cinnamon colour.

*100. M. CONCOLOR.

Mus concolor, Blyth, J. A. S. B. xxviii. p. 295, the young; *ibid.* M. ——? p. 294, the adult.

Upper and Lower Burma; Malayan peninsula.

It requires to be critically examined in the fresh state.

101. M. PEGUENSIS.

Mus peguensis, Blyth, J. A. S. B. xxviii. p. 295.

Schwe Gyen, valley of the Sitang river.

A particularly well-distinguished species, of which there is an unmistakeable specimen marked from the Philippines in the Derby Museum of Liverpool. Mason suspects this to be the field Mouse of the Karen districts.

102. M. NITIDULUS.

Mus nitidulus, Blyth, J. A. S. B. xxviii. p. 294.

Valley of the Sitang. Mason notices a "very familiar little Mouse in the houses at Tounghoo," which he never saw in the Tenasserim provinces; and he inclines to refer it to the present species.

103. M. BEAVANI.

Mus beavani, Peters, P. Z. S. 1866, p. 559.

Valley of the Salween.

104. M. BADIUS.

Mus badius, Blyth, J. A. S. B. xxviii. p. 295.

Valley of the Sitang.

It is allied to *M. oleraceus* of India, the type of Dr. Gray's genus *Vandeleuria*.

Other species of Rat and Mouse doubtless remain to be discovered, and it is desirable that they should be minutely described when fresh. Of the former, a very likely species to occur is the *M. andamanensis*, Blyth,* a subspinous Rat which proves to be the *M. setifer* apud Cantor,† but not *M. setifer* of Horsfield, which is identical with *M. bandicota*. Three well-distinguished species of Mice from the Khásia hills are described as *M. cuniculariis*, *M. erythrotis*, and *M. gliroides*, Blyth.‡ According to Mason, "there is a Water Rat throughout the country which burrows in the banks of streams, and takes to the water when pursued."

105. RHIZOMYS SUMATRENSIS.

Mus sumatrensis, Raffles; *R. cinereus*, M'Clelland, Calc. Journ. N. H. ii. p. 456, and pl. xiv. not good; *Spalax javanus* et *Nyctocleptes dekan*, Temminck. *Pwai*, Tenasserim, Mason.

Tenasserim provinces; Malayan peninsula and islands. Arakan? §

*106. R. CASTANEUS.

Rhizomys castaneus, Blyth, J. A. S. B. xii. p. 1007, xxxvi. p. 198; *M. badius* apud Blyth.

Arakan, Pegu.

Barely separable from *M. badius* (J. 201), from which it seems to differ only in its much brighter colouring.

107. R. PRUINOSUS.

Rhizomys pruinosus, Blyth, J. A. S. B. xx. p. 509.

Originally described from the Khásias, and obtained by Dr. Anderson in the vicinity of Bhamo. ‖

108. R. MINOR (J. 201).

Rhizomys minor, Gray, Ann. M. N. H. x. p. 226; Horsfield's Catal. No. 228.

Allied to the two preceding species, but of a dusky brown colour, with white muzzle and around the eye, and pale naked feet. I obtained a living

* J. A. S. B. xxix. p. 103. † *ibid.* xv. p. 254. ‡ *ibid.* xxiv. p. 721.
§ Calc. Journ. N. H. ii. p. 297. ‖ Journ. of Exped. p. 256.

specimen of this animal when in Upper Martaban, but the skin of it got spoiled; and I at once recognized the same species in two drawings of it as obtained in Siam by Capt. Finlayson. It has likewise been obtained at Yanangeen, on the Irawadi. It is even included, together with *R. sinensis*, Gray, in Mr. H. Walker's "Catalogue of the Mammalia of Assam" (*ibid.* iii. p. 267); but both species are there in need of verification. Mason remarks that "this animal, which burrows under old bamboo roots, resembles," to some extent, "a Marmot more than a Rat, yet it has much of the Rat in its habits. I one night caught a specimen gnawing a coco-nut, while camping out in the jungles." According to Mason the Byhais call the Bamboo Rat *Khai*, and they say that there is the Bamboo Khai, the Reed Khai, the Maranta Khai, and the *Wie*, a very small species of the same tribe." In *R. sumatrensis* the fur is thin and bristly. The other three here given are smaller animals, with shorter tail and the fur soft and dense.

Fam. Hystricidæ.

Porcupines.

*109. Hystrix bengalensis? (J. 205).

Hystrix bengalensis, Blyth; *H. malabarica*, Sclater, P. Z. S. 1865, p. 353, pl. xvi. *Phyoo*, Tenasserim (Mason).

The Porcupine of Arakan appears to be the same as that of Assam and of Eastern and Lower Bengal, the skull of which is not tumid, as in *H. leucura*, Sykes. Moreover, I cannot perceive (to judge from the stuffed specimen in the British Museum), that the adult *H. malabarica*, Day, differs from it in any respect. I have only seen small Arakan specimens, however, and will not be too confident that I am right in referring them to the present species.

110. H. longicauda? (J. 206).

Hystrix longicauda, Marsden; *Acantheon javanicum*, F. Cuv., Mém. Mus. ix. t. 1, fig. 3, 4.

I also give this Malayan species with hesitation, though I believe it to be that which inhabits the Tenasserim provinces.

There is also *H. alopæus*, Hodgson,* from Nipâl, which seems to be one and the same with *H. grotei*, Gray,† from Malacca, remarkable for having but one black ring on its white quills. The skins of Porcupines when dried, and afterwards relaxed and set up in museums, are usually in wretched

* J. A. S. B. 1847, p. 772, t. 32.

† [P. Z. S. 1866, p. 306, pl. xxxi. This species is referred by Mr. Sclater to *H. longicauda*, Marsden, P. Z. S. 1871, p. 234.—Ed.]

condition, and when of young or half-grown specimens only, some of the supposed species of them (if they really be species) are difficult of discrimination. These animals require to be compared together when alive, adult, and in good condition, in order to be properly understood.

111. ATHERURA FASCICULATA.

Hystrix fasciculata, Shaw; Buffon, Supp. tom. vii. p. 303, t. 77.

This animal inhabits the Tippera hills, Siam, and the Malayan peninsula, and therefore probably the Indo-Chinese countries generally.

A living Malayan example in the London Zoological Gardens could not be distinguished from its African companions referred to *A. africana*, Gray; but an example from Assam is much paler in colour and more freckled, as was one which I possessed from Tippera. This northern race is well figured in Hardwicke's "Illustrations of Indian Zoology," copied from one of Buchanan Hamilton's drawings.

Fam. Leporidæ.

Hares.

112. LEPUS PEGUENSIS.

Lepus peguensis, Blyth, Journ. As. Soc. B. xxiv. p. 471. *Yung* (Mason).

Inhabits the open country within or beyond the range of forests. Crawfurd long ago remarked that "the Hare is unknown in Pegu, but that it makes its appearance in the hills before the disemboguement of the Irawádi."

Order UNGULATA.

Fam. Suidæ.

113. SUS CRISTATUS (J. 215).

Sus cristatus, Wagner, Münch. gel. Anzeig. ix. p. 535, 1839; *S. indicus*, Gray. *Tau-wet* (Mason).

A boar which I examined at Akyab was of the ordinary Bengal race; but the Tenasserim wild boars are considerably smaller, the skulls of adults being one-fifth less in linear dimensions, though otherwise similar. One such was given to me in Calcutta as that of a tusked sow, and I afterwards found that the Tenasserim boar-skulls differed in no respect. The race requires to be critically examined. Mason remarks that the Tenasserim wild Hogs are of "a small blackish species, exceedingly numerous," and that they are very destructive to the Karen paddy-fields. According to Colonel McMaster, although some heads of Tenasserim wild boars, which I showed

him in Calcutta, "were certainly smaller than those of India," the animals which he had seen in Upper Pegu appeared to him to be about the same size as those which he had seen in former hunting days in India. That Pigs are inimical to snakes is well known; but Mason mentions that he has seen the head of a Python "that was killed by a drove of hogs, whose whole length measured eighteen feet." Whether wild or tame does not matter, but that author repeatedly uses the word "drove" in connexion with wild animals, even rats. It is a remarkable fact (if quite trustworthy) that a number of Hogs should thus combine to destroy a large Python.

Fam. **Tragulidæ.**

Chevrotains.

114. TRAGULUS KANCHIL.

Moschus kanchil, Raffles. *Yung** (Mason).

This small Chevrotain, or "Mouse-Deer," with a medial black stripe on the chest, is common in the southern Tenasserim provinces, and extends throughout the Malayan peninsula, Sumatra, and Borneo; but in Java it appears to be replaced by the equally diminutive *T. javanicus* (*T. pelandoc*, Blyth).† In Cambodja and Cochin-China there is a race which chiefly differs from *T. kanchil* in wanting the medial dark stripe on the chest (*T. affinis*, Gray);‡ and the island of Hainan, it is remarked by Mr. Swinhoe, "produces a Mouse Deer, which I have made out to be *Tragulus meminna*.§ The latter can hardly be, for that species (*Meminna indica*) is elsewhere unknown eastward of the Bay of Bengal. There is, again, a Chevrotain much larger than the *T. kanchil*, which seems to be generally diffused over the Malay countries, the *T. napu*, F. Cuvier, which is not unlikely to occur in South Tenasserim; and what are probably local races of *T. napu* have been described as *T. stanleyanus* and *T. fuscatus*, the pyrrhous *T. stanleyanus* having been erroneously supposed to inhabit Ceylon. *Meminna indica* is the only species of Chevrotain that inhabits Ceylon and the Indian peninsula; and throughout the Malay countries there are the larger *T. napu* and its subordinate races, and—except in Java—the smaller *T. kanchil* (to which *T. affinis* should perhaps be subordinated), with *T. javanicus* in Java only. The *T. kanchil* is the only one, so far as hitherto ascertained, that ranges northward into British Burma, and in the Malayan peninsula it is much more abundant than the *T. napu*.

* The same name which he assigns to *Lepus peguensis*.

† J. A. S. B. xxvii. p. 277.

‡ P. Z. S. 1861, p. 138. § *ibid.* 1870, p. 644.

Fam. Cervidæ.

Deer.

*115. Rusa aristotelis (J. 220).

Cervus aristotelis, Cuv. *Schap.*

Common and generally diffused through the great forests. The Sâmur Deer of Burma appeared to me to be rather small, and I have never seen a fine pair of horns of this species from the countries eastward of the Bay of Bengal.

*116. Hyelaphus porcinus (J. 222).

Cervus porcinus, Zimm.

The *Drai*, or Hog Deer, is very abundant. Mason observes, however, that this species seems to be confined to the plains. "It abounds," he states, "north and east of Maulmein, and on the large islands south of Tâvai; but it is not found north of the station, nor eastward among the hills, nor in the valley of the Tenasserim, but is found again on the plains of the Sitang." Some individuals (especially does) are more or less distinctly "menilled" or spotted when in their summer coat, which has given rise to reports of the Indian Spotted Deer (*Axis maculatus*) having been observed in Burma. The so-called Hog Deer of Malabar is the *Meminna indica*; but, whether or not introduced (as is most probable), the true Hog-Deer inhabits a part of the west and south-west of Ceylon. The Indian Spotted Deer has been introduced into Province Wellesley and has there multiplied, as noticed by Cantor; and according to Raffles also in Sumatra, and there by native agency.

*117. Panolia eldi.

Cervus eldi, Guthrie, Calc. Journ. N. H. ii. p. 415; horns figured, *ibid.* i. pl. xii, ii. pl. xii; *C.* (*Rusa*) *frontalis*, M'Clelland, *ibid.* iii. p. 401, pl. xiii, xiv; *C. lyratus*, Schinz; *C. dimorphe*, Hodgson; *Panolia acuticornis*, Gray. *T'hámine* of Burmese, *Sungrai* of Manipur.

It inhabits Pegu, and thence northward to the valley of Manipur, and southward to Mergui and the adjacent northern part of the Malayan peninsula. In Cambodja and the island of Hainan it is replaced by a nearly allied race, *P. smithii*,* subsequently *C. platyceros* of Dr. Gray;† and interposed between the two races of *Panolia* there would appear to occur the fine

* *Cervus smithii*, Gray, P. Z. S. 1837, p. 45.

† *vide* P. Z. S. 1867, p. 841, figs. 22 and 23.

Rucervus schomburgki, Blyth, which is a Siamese representative of the Indian *R. duvaucelli*, and doubtless similar in its habits. For illustrations of the horns of all four species, *vide* Proc. Zool. Soc. 1867, p. 835, figs. 1–23. The earliest figure of the horns of *P. eldi* is given, with a portrait of its discoverer, Lieut. Eld, in the Bengal Sporting Magazine.*

This remarkable Deer is a highly gregarious species, resorting to openings in the forest, like the Indian Bárá-sing'ha, *Rucervus duvaucelli*.†

*118. Cervulus aureus (J. 223).

Styloceras aureus, H. Smith, G.A.K. iv. 148, t. v. 805.

Gee, or Barking Deer.

The diminutive Deer of this form, commonly known as Muntjacs, are generally distributed over the hill forests of north-east Asia and its islands; but examination of a series of skulls from different localities in the Museum of the London Royal College of Surgeons inclines me to think that the various species of them have not been satisfactorily made out. That of Java, *C. vaginalis*, Boddaërt, is one of the most distinct, and has considerably larger horns than any of the others; again, the small *C. reevesii*, Ogilby, of China is well distinguished; and Dr. Gray characterizes one from Cambodja as *C. cambojensis*,‡ which he has since identified with *Rucervus schomburgki*! The Burmese species differs in no respect that I am aware of from the ordinary Indian one, and again from that inhabiting the Malayan peninsula; but the Sumatran would appear to be somewhat different. It is the most numerous and universally diffused of all the Deer of Burma. More extensive materials for comparison of the different races than are at present available are needed for a final determination of the species of Muntjac Deer.§

Fam. Capridæ.

Goats, Sheep, and Antelopes in part.

*119. Capricornis sumatrensis.

Antilope sumatrensis, Shaw; Marsden; *Hist. Sumatra, Atlas*, pl. xiv; F. Cuvier, Mamm. Lithog.; *A. interscapularis*, Lichtenstein; *C. rubida*, Blyth; *C. swinhoei*, Gray, P. Z. S. 1862, p. 263, pl. xxxv; skull with horns from Arakan, figured Calc. Journ. N. H. i. pl. xii. *Tan-kseik*, Mason.

* l.c. vol. xiv. 1839, p. 346.

† *vide* Lieut. Eld, *loc. cit.*, and especially Lieut. Beavan, in J. A. S. B. xxxvi. p. 175 *et seq.*, and P. Z. S. 1867, p. 759.

‡ P. Z. S. 1861, p. 138.

§ [Sir V. Brooke has since arranged the known species, P. Z. S. 1874, p. 33.—Ed.]

This species appears to be distributed from Arakan through Pegu to the extremity of the Malayan peninsula, and to occur in Siam and Formosa, and also in Sumatra.

This species varies much in colour, from red to black, and the black sometimes with a white nape, or the hairs of the nape may be white at the base only. Two flat skins from Arakan are of a pale red-brown colour; with black dorsal list, and quite resemble the figure of one from Formosa, which is styled *C. swinhoei*. The late Lieut. Beavan, again, described a female shot on "the grass and bamboo-covered sides of Zwagaben" mountain, near Maulmein, as being of a mingled black and ferruginous colour,* and he mentions that the animal had been seen at Thayet Myo in Pegu. Mason also states that it is common on the mountains of Tonghoo, and Cantor obtained it from those of the Malayan peninsula. The "wild goat" mentioned by Crawfurd, as stated by the Siamese "to be found in some of the mountains of their country, and to be shot for their horns, which are prized by the Chinese for certain alleged restorative properties," can hardly be any other. On comparison of skulls from Sumatra, Arakan, and Mergui, I could detect no distinguishing character, and they differ little from those of *C. bubalina* of the forest region of the Himalaya, except in being considerably smaller. The genus is a very peculiar one, by no means so nearly related to the Goats and Gorals as is generally supposed, but examples of it should be studied in captivity before it can be thoroughly understood, and the skeleton of this form is a desideratum in European collections.

Fam. Bovidæ.

The Bovine family.

*120. Bos GAURUS (J. 238).

Bos gaurus, C. H. Smith. Fine skull figured in J. A. S. B. vi. p. 224; another *ibid.* x. 470. *Pyoung.*

The Gaur, or "Bison" of Indian sportsmen, is diffused in all suitable localities throughout British Burma, and its range extends southward to the straits of Singapore, but not to any of the islands. Nowhere does this grand species attain a finer development than in Burma, and the horns are mostly short and thick, and very massive, as compared with those of Indian Gaurs, though the distinction is not constant on either side of the Bay of Bengal. In the Malayan peninsula, where it is known as the *Salandang*, this animal would appear to be becoming extremely rare, at least to the southward; and

* P. Z. S. 1866, p. 4.

we need information respecting its distribution in other parts of Indo-China. I have seen a characteristic skull from Johore, and once possessed a living calf, which was sent, together with a Malayan Tapir, from Singapore.

121. B. FRONTALIS.

Bos frontalis, Lambert, Lin. Trans. vii. p. 57, pl. 4; *B. gavæus*, Colebrooke; P. Z. S. 1866, pl. 1, young bull; Hodgson, J. A. S. B. x. p. 470, skull, fig. 1.

The Gayal or *Mit'hun*.

In the domestic state only, the range of this fine species extends southward to the hills bordering on the Koladyne river, which flows into Akyab harbour from the north. In the hilly parts of Tippera and Chittagong it exists in the wild state. In the fully mature bull the horns are longer and the dewlap is considerably more developed than is represented in the figure cited.

*122. B. SONDAICUS.

Bos sondaicus, S. Müller; *B. bentinger*, Temminck. *Tsoing* of Burmese.

The Banting inhabits Pegu, the Tenasserim provinces and Malayan peninsula, Sumatra, Borneo, and Java; being domesticated in the island of Báli.

The hybrid with the Javan humped cow constitutes the *B. leucoprymnus* of Quoy and Gaymard, as the hybrid Gayal constitutes the *P. sylhetanus* of F. Cuvier. The Banting has bred in the Zoological Garden of Amsterdam, where I have seen bull, cow, and calf in fine condition. The bull, more especially, has an indication of a hump, which, however, must be specially looked for to be noticed; and he has a broad and massive neck like the Gaur, but no raised spinal ridge, nor has either of these species a deep dewlap like the Gayal. The cow is much slighter in build, with small horns that incline backwards; and she retains her bright chestnut colour permanently, while the bulls become black as they attain maturity, excepting always the white "stockings," and also the white patch on each buttock, which is characteristic of the species. In the old bull the cuticle between the bases of the horns becomes enormously thickened, corneous and rugged, and this begins to show before the coat has commenced to change colour, as may be seen in a stuffed specimen in the British Museum, which is that of an animal procured in Pegu by the author of this paper, and which lived for some time in the London Zoological Gardens. How far to the eastward the range of this animal extends in the Indo-Chinese countries, remains to be ascertained; but I have reason to believe that two other species of *Bos* there remain to be described, one of which is domesticated in Siam and the other in Cochin China.

123. Bubalus arni (J. 239).

Bos arni, Shaw.

The Indian Buffalo exists wild, whether or not indigenously so, and everywhere in the domestic state; and, as the calves obtain their full supply of milk, the tame Buffaloes in Burma assume their full development, and are not stunted in their growth, as in most parts of India. The Rev. F. Mason remarks that "there are great numbers of wild Buffaloes in the jungles of the South, which are supposed by the natives to be indigenous; but they are more probably of the domestic race that have run wild, like the wild Horses of America." The Indian Buffalo now abounds in a state of wildness in the north of Australia, where they have spread from Port Essington, and there are many in the delta of the Nile, where also they must needs have descended from domestic stock.

From Crawfurd's description of the animal it would seem that *Bos sondaicus* is domesticated in Siam. He, however, styles it *B. taurus*? "The *Bos taurus*," he remarks, "is found wild in the Siamese forests, and exists very generally in the domestic state, particularly in the northern provinces. Those we saw about the capital were short limbed, compactly made, and frequently without horns. They were generally of a red or a dark-brown colour, and never of the white or grey, so prevalent amongst the cattle of Hindustan. They also want the hump over the shoulders, which characterizes the latter. They are used only in agricultural labour, for their milk is too trifling in quantity to be useful, and the slaughter of them, publicly at least, is forbidden even to strangers. When, during our stay, we wanted beef for our table, our servants were obliged to go three or four miles out of town, and to slaughter the animals at night. The wild cattle, for the protection of religion does not extend to them, are shot by professed huntsmen on account of their hides, horns, bones, and flesh, which last, after being converted into jerk beef, forms an article of commerce to China."*

Fam. Tapiridæ.

Tapirs.

124. Tapirus malayanus.

Tapirus malayanus, Raffles, F. Cuvier, Mamm. Lithog. i. p. 87. *Tu-ra-shu*, Mason.

The Malayan Tapir inhabits the Tenasserim provinces as high as the 15th deg. north lat.; also Lower Siam, the Malayan peninsula, Sumatra, and Borneo; if not likewise the southern provinces of China, where the species is not likely to be a different one. "Though seen so rarely,"

* Embassy to Siam and Cochin China, ii. p. 192.

remarks Mason, "the Tapir is by no means uncommon in the interior of Tavoy and Mergui provinces; I have frequently come upon its recent foot-marks, but it avoids the inhabited parts of the country. It has never been heard of north of the valley of the Tavoy river."

Fam. Rhinoceratidæ.

Rhinoceroses.

125. Rhinoceros sondaicus (J. 213).

Rhinoceros sondaicus, Cuvier; Horsfield, Zool. Res. in Java; S. Müller, Verhand. t. 33; *R. nasalis*, *R. stenorhynchus*, et *R. floweri*, Gray, apud Busk, P. Z. S. 1869, p. 416. *Khyen-hseu*, Mason.

The Lesser One-horned Rhinoceros. So far as I have been able to satisfy myself, this is the only single-horned Rhinoceros of the Indo-Chinese and Malayan countries, its range of distribution extending northward to the Gáro hills, where it co-exists with the large *R. indicus*, and to eastern and Lower Bengal. It would appear to be the only Rhinoceros that inhabits the Sundarbáns, occurring within a few miles of Calcutta; and yet I know of but one instance of its having been brought to Europe alive,* and then it was not recognized as differing from *R. indicus*, which latter is not uncommonly brought down the Bráhmáputra from Assam, and sent to Europe from Calcutta. There is reason, also, to believe that *R. sondaicus* is the species which was formerly hunted by the Moghul Emperor Báber on the banks of the Indus. Southward it inhabits the Malayan peninsula, Sumatra, Java, and Borneo (?*vide* Busk, *loc. cit.*). It is about a third smaller than *R. indicus*, from which it is readily distinguished by having the tubercles of the hide uniformly of the same small size, and also by having a fold or plait of the skin crossing the nape, in addition to that behind the shoulder-blades. In *R. indicus* the corresponding fold does not thus meet its opposite, but curves backward to join—or nearly so in some individuals—the one posterior to the shoulders. A fine living male, before referred to, was exhibited for some years about Great Britain, and was finally deposited in the Liverpool Zoological Gardens, where it died, and its preserved skeleton is now in the anatomical museum of Guy's Hospital, Southwark. Two passable figures of it from life are given in the "Naturalists' Library," where it is mistaken for the huge *R. indicus*.

* [Since Mr. Blyth wrote this paper, another example of this species is now alive in the Zoological Society's Garden.—J.A.]

Rhinoceros sondaicus is found at all elevations, as remarked of it by Dr. Horsfield, in Java; and from the mountains of Palouk, thirty miles north of Mergui, a writer quoted by the Rev. F. Mason observes—"We were on the summit of the highest range of mountains in the provinces. The tall timber trees at the first ascent were dwindled into a thick growth of stunted bushes, unmixed with a single shrub. The path, which was narrow and steep, had reached a level spot, that had been in the rains the wallowing place of a rhinoceros; for it has the habit of wallowing in the mire no less than the hog and the buffalo." The Sumatra Rhinoceros was also tracked by General Fytche to an altitude of about 4000 feet, when he obtained a close view of the animal with two finely developed horns.* Crawfurd was assured at Bangkok that a thousand Rhinoceros horns were thence annually exported to China.

According to Helfer, the *R. indicus*, in addition to *R. sondaicus*, inhabits the northern portion of the Tenasserim provinces; and Mason asserts that a single-horned Rhinoceros from the Arakan jungles was purchased by the London Zoological Society, and lived for many years in the Regent's Park, the species in that case being unquestionably *R. indicus*. Again, according to a writer in the Oriental Sporting Magazine,† both species of one-horned Rhinoceros occur in Burma, and he cites, as his authority for the statement, a writer in the first series of the same periodical (vol. ii. p. 35), mentioning that his said authority appears to be "a thorough sportsman and no mean naturalist." I nevertheless hesitate, upon present evidence, to admit the Great Indian Rhinoceros into the list of Burmese animals.

126. Ceratorhinus crossii?

Rhinoceros crossii, Gray, P. Z. S. 1854, p. 250, with figure of anterior horn, 32 in. in length over the curvature, and 17 in. in span from base to tip; *R. lasiotis*, Sclater.

Ear-fringed Rhinoceros. In the Rhinoceroses of this type the hide is comparatively thin, and is not tessellated or tuberculated, nor does it form a "coat of mail," as in the preceding; but there is one great groove (rather than fold or plait) behind the shoulder-blades, and a less conspicuous crease on the flank, which does not extend upwards to cross the loins, as represented in F. Cuvier's figure; and there are also slight folds on the neck and at base of the limbs; the skin being moreover hairy throughout. There is also a second horn placed at some distance behind the nasal one.

Until recently, the existence of more than one species was unsuspected. In 1868, a young female was captured in the province of Chittagong, and on

* J. A. S. B. xxxi. p. 157. † July, 1832, p. 301.

its arrival in the London Zoological Gardens, early in 1872, was believed to represent the *Rhinoceros sumatrensis* of Bell and Raffles; but soon afterwards another two-horned Rhinoceros was received at the same establishment from Malacca, obviously of a different species, which proved to be the veritable *R. sumatrensis*. Since its arrival, it has now (1873) considerably increased in size, and it probably is not yet quite full grown. As compared with *C. sumatrensis*, it is a considerably larger animal, with much smoother skin, of a pale clay-colour, covered with longer and less bristly hair, the latter of a light brown colour, as seen in the mass. The ears are placed much further apart at the base, and are not lined with hair as in the other, but are conspicuously fringed with long hair; and the tail is much shorter and largely tufted at the end. The horns are worn away, but if the species be truly assigned to *C. crossii*, the anterior would grow very long and curve to a remarkable extent backwards, while the posterior horn would probably be short. A second specimen of an anterior horn, almost as fine as the one first described, has recently turned up among the stores of the British Museum; and I found a smaller anterior horn of *R. crossii* in the Museum of the London Royal College of Surgeons, confirmatory of its peculiar shape. In this group the horns are remarkably slender except at the base, and of much more compact texture than in other Rhinoceros horns. I have reason to believe that this is the two-horned species which inhabits the Arakan hills, those of northern Burma, and which extends rarely into Assam; and I think it highly probable that the skull figured in Journ. As. Soc. B. xxxi. p. 156, pl. iii. f. 1, represents that of *C. crossii* (seu *R. lasiotis*), in which case the range of the species would extend into the Tenasserim provinces. A detailed notice of the individual sent to London has been given by Dr. Anderson.*

127. C. SUMATRENSIS.

Rhinoceros sumatrensis, Bell, Phil. Tr. 1793, p. 3, pl. 2, 3, 4; *R. javanus*, F. Cuv. Mamm. Lithog., very young; *C. blythii*, Gray, Ann. M. N. H. (4), vol. xi. p. 360. *Kyen-shan*, Mason.

The Sumatran Rhinoceros is much smaller than the preceding species, with a harsh and rugose skin, which is black, and clad with bristly black hairs; the ears less widely separated at base, and filled internally with black hairs; the muzzle anterior to the nasal horn much broader; and the tail conspicuously longer, tapering, and not tufted at the end. Horns attaining considerable length, and curving but slightly backwards, as represented in Journ. As. Soc. B. xxxi. p. 156, pl. iv. f. 1.

* P. Z. S. 1873, p. 129.

This is the ordinary two-horned Rhinoceros of the Tenasserim provinces, extending into Siam, and southward throughout the Malayan peninsula and Sumatra; but in Borneo there would appear to be a still smaller species, which is referred to the same by Professor H. Schlegel. How far northward its range extends has not been ascertained, but I suspect that it does not occur in Arakan. A Rhinoceros of some kind inhabits the province of Quang-si, in China, in lat. 15 deg. N., as noticed by Du Halde. In general, this is an exceedingly shy and timid animal, but it has been known to attack the night-fires of travellers, as happened once to Professor Oldham. In this case the animal was shot, and its skull is now in the Museum of Trinity College, Dublin, where I have verified it as appertaining to the present species. For remarks on this and the preceding species, *vide* Ann. M. N. H. (4), vol. x. (1872), p. 399. Lieutenant Newbold noticed the existence of the "Badok, or Sumatran Rhinoceros" in the Malayan peninsula in 1838.*

Order SYRENIA.

Fam. Halicoridæ.

128. Halicore dugong (240).

Trichechus dugong, Erxleben, F. Cuvier, Mamm. Lithog. ii. 120; Zool. Arıstolabe, Atlas, t. 27.

The Malayan Dugong. Mason records that the existence of this animal in the Mergui archipelago was brought to his notice by the late Rev. S. Benjamin in 1853. It is occasionally obtained by the Andaman Islanders. Finlayson strangely asserts that in this animal "a single spiraculum opens near the top of the head."

Fam. Manidæ.

Pangolins.

*129. Pangolinus leucurus.

Manis lucurus, Blyth, J. A. S. B. xi. p. 454; xvi. p. 1274. *Theu-khwæ-ghyat*, Mason.

Burmese Pangolin. Ranges from Arakan to Mergui, and is probably the species "closely allied to *javanicus*" observed by Dr. Anderson near Bhamo. From Malacca I have only seen the *P. javanicus*, Desmarest, and it is probable that *P. auritus*, Hodgson, 1836 (*Manis dalmanni*, Sundevall, 1842, *M. multiscutata*, Gray, 1843), occurs to the northward. From Cambodja Dr. Gray gives *P. pentadactyla* (*Pangolinus typus*).

* Madras Journ. Lit. Sc. vii. p. 70.

Province SAUROPSIDA.

Class AVES.

Sub-class CARINATÆ.

Order *PREHENSORES.*

Fam. Psittacidæ.

Parrots.

1. PALÆORNIS ALEXANDRI (J. 147).

P. eupatrius, L., adopted by Dr. Finsch, *Die Papageien*, tom. ii. p. 11. *Kyai-phoung-ka.*

A mountain species in British Burma, chiefly or wholly confined to the

* It is probable that more species of PALÆORNIS remain to be discovered in the Indo-Chinese peninsula. Some of them are very local, as P. COLUMBOIDES (J. 150), which is confined to the mountains of S. India, as P. CALTHROPÆ is to those of Ceylon. P. ERYTHROGENYS, nobis (*P. nicobaricus*, Gould, *B. As.* pt. ix. pl. 13), is known only from the Andaman and Nicobar Islands. P. CANICEPS, nobis (Gould, *B. As.* pt. ix. pl. 12), was founded on a mutilated specimen obtained alive from a Nicobar savage, and a black-billed (and probably, therefore, female) example of it was subsequently procured by the late Dr. Cantor in Province Wellesley. These were the only specimens known, when Herr v. Pelzeln obtained it in the Car Nicobar, and quite recently I saw three in a collection, which also contained two of P. ERYTHROGENYS, but whence obtained could not be learned, and there were no species peculiar to the Andaman or Nicobar Islands together with them, though several common to the Tenasserim provinces and Malayan peninsula. The fine P. DERBIANUS (*P. Z. S.* 1850, pl. 25; Gould, *B. As.* pt. x. pl. 9) is only known from a single specimen, the habitat of which could not be ascertained; and P. BARBATUS, Gm. (Souancé *Rev. Zool.* 1856, p. 209; *P. luciani*, Verreaux, *P. erythrogenys*, Fraser, *P. Z. S.* 1850, pl. 26; Gould, *B. As.* pt. ix. pl. 11), is yet another species of which the habitat has only recently been ascertained, viz. Western China (Sze-chuen), though three or four specimens of it were preserved in different museums. All of these birds, excepting the first-mentioned two (from S. India and Ceylon), are nearly akin to P. VIBRISCA, though well distinguished in every instance; and the last three of them are not unlikely to prove indigenous to different parts of the Indo-Chinese countries. P. LONGICAUDATUS (Gould, *B. As.* pt. x. pl. 10, 11); *P. malaccensis* (Gmelin, nec Latham); *P. erythrogenys* (Lesson, and of which

loftier elevations. Mason remarks that he never observed it in the provinces of Tavoy and Mergui. Schomburgk, however, notes it from Siam.*

[*Palæornis eupatrius*, Lin., is the correct title. *Psittacus alexandri*, Lin., belongs to the Javan parrakeet.]

2. *P. TORQUATUS (J. 148).

Kyai-gyot.

Resorts to open country as elsewhere, and is therefore chiefly met with in the interior, beyond the maritime belt of forest. Dr. Cantor procured it so far southward as in Province Wellesley.

[Thayet Myo (*Wardlaw Ramsay*).]

3. *P. SCHISTICEPS (J. 150).

P. schisticeps, Hodgs.; Gould, *B. As.* pt. x. pl. 8.

Mountains of Arakan.

[Tonghoo hills (*W. R.*). The Tonghoo bird belongs to the race named *P. finschii*, Hume (Str. Feath. ii. p. 509).]

4. *P. CYANOCEPHALUS (J. 149, *partim*).

P. cyanocephalus, Lin.; Edwards, pl. 233. *Kyai-ta-ma.*

Exceedingly common in the forests of British Burma, where it takes

P. affinis, Gould, and *P. viridimystax*, nobis, are the young), belongs to the southern half of the Malayan peninsula, with the islands of Sumatra and Borneo, and LORICULUS GALGULUS has exactly the same range of distribution; the latter being replaced in Java by L. PUSILLUS, G. R. Gray; which is closely akin to L. VERNALIS of India and Burma, it being, however, well distinguished, which is more than can be averred of P. VIBRISCA as inhabiting the same island.

[The Andaman race of *P. erythrogenys* (*P. affinis*, Tytler, *P. tytleri*, Hume) slightly differs. *P. derbyanus* is not generally admitted to be distinct from *P. melanorhynchus*, Wagler. It is not certain whether the title *Psittacus barbatus*, Gm., should not be expunged. It was given to Latham's *bearded parrakeet* (Syn. i. p. 238, no. 38), described from a specimen, origin unknown, in the Hunterian Museum. Examples of the species, *P. luciani*, are so rare, that a comparison with Latham's description is difficult to make. Eventually examples exhibiting the phase of plumage described by Latham may be met with; in the mean time it seems best to follow Dr. Finsch and adapt Verreaux's title.]

* The Indo-Chinese bird should now be compared with the Andaman race, as described by Mr. V. Ball (*J. A. S. B.* xli. pt. ii. p. 278).

[I have compared a large series of Burmese and Andaman individuals, and find that the latter differ by having the bills considerably larger.]

the place of P. ROSA (Boddaërt) of India generally and Ceylon. In Nipâl both species occur, but the present one only (if I mistake not) in Lower Bengal, and its range extends eastward to the south of China. There are various distinctions, one of which is that in P. ROSA the wings are blue on the inner side, while in P. CYANOCEPHALUS they are green within. P. ROSA is also a much more finely coloured bird than the other, and has a conspicuously longer tail.

[Rangoon, Karen hills, Tonghoo (*W. R.*). Linnæus's title of *Psittacus cyanocephalus*, founded on Brisson's *Psittaca cyanocephala* (Orn. iv. p. 359, no. 70, pl. xix. f. 2, "East Indies"), applies to this race. While *Psittacus purpureus*, P. L. S. Müller (Suppl. p. 74, no. 6, *d.*), founded on the *Perruche à tête rouge de Gingi* (Daubent. Pl. Enl. 264), *Psittaca gingiana erythrocephala*, Briss. (*t.c.* p. 346, no. 65, pl. 29, f. 2, "royaume de Gingi"), as shown by the late Mr. Cassin, ten years ago (P. Ac. N. Sc. Philadelphia, 1864, p. 239), must take precedence of Gmelin's title of *Psittacus erythrocephalus* (S. N. i. p. 325, No. 74 ex Briss.). Mr. G. R. Gray (H. List, ii. No. 8054), who followed Cassin, adopted P. L. S. Müller's title, and retained it, rather vaguely, for the species inhabiting "India and Ceylon," while restricting Gmelin's title of *bengalensis* to the Nipalese form. Curiously enough, Mr. Gray wrongly associated P. L. S. Müller's title of *purpureus* with Daubenton's plate, No. 888, on which Boddaert founded his title of *Psittacus rosa* (Table, p. 53). There does not appear to be conclusive proof of both species occurring in Nipal, but *conf.* Jerdon, in Ibis (1872, p. 6, No. 149). The title of *Psittacus rosa*, Boddaert, strictly pertains to the Bengal form.]

5. *P. VIBRISCA (J. 152).

Psittacus ponticerianus, Gmelin; *P. alexandri* (L.), apud Finsch, *Die Papageien*, tom. ii. p. 59; *P. modestus*, Fraser, the young.

An exceedingly common species in the forests of British Burma, and Mason remarks of it (in particular) that "immense flocks of Parrakeets may be seen simultaneously descending on the rice-fields, where persons have to be in constant attendance to drive them away during the season of harvest;" while of P. TORQUATUS he notices that it is "often seen in the rice-fields, but in smaller companies, which have not the habit of simultaneous descent." Westward, the present species is common in the Terai region of the E. Himalaya, but its range does not extend further into India, whence its synonym of *ponticerianus* is a misnomer. Great numbers of the very young are brought every season to Calcutta from Chittagong, and it is remarkable

that from the earliest age the males only have the upper mandible coral-red. In a presumed female which I possessed in captivity, the upper mandible changed from black to coral-red when the bird was about eighteen months old; and I have seen numerous specimens which had been killed when the change was in progress. I have also shot red-billed and black-billed specimens out of the same flock, and therefore cannot admit the *P. nigrirostris*, Hodgson, as a distinct species, differing only in the colour of the upper mandible. Moreover, the same sexual diversity in the colouring of the bill, whether permanently or otherwise, occurs in several kindred species. Rarely, the lower mandible is also red in Burmese specimens, almost constantly so in Javanese examples; but I have been unable to detect the slightest difference of plumage on comparison of skins from Nipâl, Arakan, and Java.

[Rangoon, Tonghoo (*W. R.*). Assuming that the rose-breasted parrakeets of the Indian Continent and Burma belong to one species, and those of Java and Borneo to another, it is not difficult to allot to the first their correct title. Mr. G. R. Gray (*t.c.* No. 8066), following Cassin (*l.c.*), adopted for the Indian species exclusively P. L. S. Müller's title of *Psittacus fasciatus*, bestowed by him (*t.c.* p. 74, no. 6, f.) on Daubenton's plate (*op. cit.* no. 517), and which subsequently served as the subject of *Psittacus vibrissa*, Boddaert, not *vibrisca* (*t.c.* p. 30), and of *Psittacus pondicerianus*, Gm. (*t.c.* p. 325, No. 73). This plate, as has been shown by Dr. Finsch, was taken from the Javan species, and therefore the titles cited fall before that of *Psittacus alexandri*, Lin. Wagler (Monog. p. 511) first bestowed a title, that of *Palæornis melanorhynchus*, on the Continental species, and by this it must be called.]

6. P. MELANORHYNCHUS.

P. melanorhynchus, Wagler, nec Sykes; Ibis, 1873, p. 79; *P. nigrirostris*, Hodgson, *partim*, vide *Calc. Journ. N. H.* vii. p. 560.*

A most closely allied species to the last, from the Tenasserim provinces, if not also the base of the Eastern Himalaya. As seen alive, together with examples of the preceding, the difference is more conspicuous from its purely white irides, whereas the other has dark irides. The cap has a slight tinge of verditer, but no trace of ruddy colouring, and the red of the breast is continued past the black moustachial streak and the ear-coverts,

* It is worthy of notice that Mason designates the bird, not distinguishing the two races, as the "black-billed Parrakeet."

so as to form a half-collar bordering the sides of the cap; it also does not descend so far on the abdominal region, a larger portion of which is green than in the other. These differences are conspicuous in the living birds when seen together. All hitherto examined have the bill black, but in the male it is probable that the upper mandible is coral-red. A living specimen in the London Zoological Gardens is alleged to be from Kashmir, which is certainly a mistake. There are skins in the British Museum which are positively from the Tenasserim provinces.

[The facts here stated are quite new. I am not aware that they have ever been previously published. Dr. Jerdon certainly was unacquainted with them. Further investigation is most desirable; more especially as Mr. Blyth is completely at issue on many points with what has been averred by Mr. Hume. My own experience does not accord with Mr. Blyth's opinion.]

7. PSITTINUS MALACCENSIS.

Psittacus malaccensis, Latham, nec Gmelin; *P. incertus*, Shaw; Swainson's *Ill. Orn.* pl. 154.

This common Malayan species occurs in Mergui province. It is essentially a short-tailed *Palæornis*, but with affinity to *Tanygnathus*.

[Blyth's generic title *Psittinus* is absorbed by Dr. Finsch in Kuhl's *Psittacula*. Latham's specific title *malaccensis* is also by the same author superseded, on the ground of its conveying an erroneous idea of the geographical range, and Shaw's title *incertus* is adapted. A better or more acceptable reason is that Gmelin and Latham named two distinct species of Asiatic parrots by the title of *malaccensis*.]

8. *LORICULUS VERNALIS (J. 153).

Kyai-tha-da.

Generally diffused in the forests.

[Tonghoo (*W. R.*).]

Order RAPTORES.

Fam. Falconidæ.

9. FALCO PEREGRINATOR (J. 9).

Falco peregrinator, Sundev.; Gould, B. As. pt. iii. pl. 2; *F. communis*, var. (?) Raffles, *ex* Sumatra.

It is asserted by Mason that I showed him a skin of this Falcon received

from Burma, though I have no recollection of the circumstance. It is, however, a most likely species to occur there, as is also *F. peregrinus*, in suitable localities, where ducks resort plentifully. *F. peregrinator* would appear to be chiefly a Malayan species, and the specimen of it originally obtained by Sundevall was obtained on board ship, in lat 6°, between Ceylon and Sumatra, about seventy miles from the Nicobar Islands.

[Major Lloyd has sent me an undoubted example of this Falcon, shot near Tonghoo.]

[10. F. PEREGRINUS (J. 8).

Prome (*Oates*).]

11. HYPOTRIORCHIS SEVERUS (J. 14).

Tenasserim. Inhabits from the S. E. Himalaya to Java and the Philippines, but has not hitherto been met with in the plains of India. Mr. Holdsworth notes it from Ceylon.

*12. TINNUNCULUS ALAUDARIUS (J. 17).

Gyo-theing.

Common. *T. saturatus*, nobis,* from the Tenasserim provinces, is perhaps a distinct race, remarkable for the great development of the black markings on its plumage; but it requires further confirmation.

[Tonghoo (*Lloyd*), Karen nee (*W. R.*), Thayet Myo (*Feilden*).

Tinnunculus atratus, Blyth, apud G. R. Gray, H. L. No. 212, *ex* Burma, is a misprint for *T. saturatus*, Blyth.]

[13. ERYTHROPUS VESPERTINUS? (J. 19).

Mr. Hume has thus, with doubt, identified an example sent to him by Captain Feilden from Thayet Myo.]

14. POLIOHIERAX INSIGNIS.

Poliohierax insignis, Walden, P. Z. S. 1871, p. 627; *Lithofalco feildeni*, A. O. Hume, P. A. S. B. 1872, p. 70.

Upper Pegu.

*15. HIERAX EUTOLMUS (J. 20).

Falco cærulescens, apud Stoliczka, J. A. S. B. pt. 2, xxxix. p. 282. *Koung-oo-hnouk.*

Arakan, Pegu, Tenasserim, Siam.

[The title of *Microhierax*, Sharpe, must be employed for this genus.]

* J. A. S. B. xxii. p. 277; Ibis, 1866, p. 238.

16. H. FRINGILLARIUS.

H. fringillarius, Drapiez; *H. malayensis*, Strickland; *Falco cærulescens*, apud Vieillot, Gal. des Ois. t. 18; Pl. Col. 97.

Malayan Peninsula, Sumatra, Java, Borneo. Obtained by Helfer, probably in Mergui province (specimen in Calcutta Museum). In the north of Arakan, *H. melanoleucus*, nobis,* will most probably be found to occur, as it has been obtained in the province of Kachar.

[Meeta Myo (*Davison*).]

*17. BAZA LOPHOTES (J. 58).

Arakan, Tenasserim, Malacca.

18. PERNIS PTILORHYNCHUS (J. 57).

A long-crested specimen received from Mergui, and described as *P. brachypterus*.† Its primaries were not fully grown. Mr. A. O. Hume notes it from Burma and Siam.

[Tonghoo (*W. R.*), Thayet Myo (*F.* and *O.*)]

*19. ELANUS MELANOPTERUS (J. 59).

Arakan, Tenasserim. "Various localities in British Burma" (*A. O. Hume*).

[Thayet Myo (*W. R.*), Arakan (*O.*).]

*20. SPILORNIS CHEELA (J. 39).

Doung-tswoon.

Common in Arakan, if correctly identified, as is most probable. The nearly allied but smaller race, with shorter crest, *S. bacha* (Daudin); *Falco bido*, Horsfield; *Hæmatornis spilogaster*, nobis; *H. elgini*, Tytler, inhabits the Andamans, South India, and Ceylon, as also Malacca and Java; and, according to Messrs. Swinhoe and Gurney, is an intermediate race.

[Tonghoo (*W. R.*); Thayet Myo (*F.*). *S. elgini*, Tytler, is undoubtedly a distinct species. Nor can I agree to unite *S. spilogaster* with *S. bacha*. At Kalee Gunge Dr. Day obtained an adult bird, in the rich brown plumage of true *S. bacha*.]

21. S. RUTHERFORDI.

S. rutherfordi, Swinhoe, Ibis, 1870, p. 85.

Has been procured in the vicinity of Rangoon, in Siam, and Hainan.

[Said by Mr. Hume to have been obtained near Tonghoo. Neighbourhood of Amherst and Ye (*D.*).]

* J. A. S. B. xii. p. 179 bis.

† J. A. S. B. xxi. p. 436.

*22. Circus melanoleucus (J. 53).

Thein-kya.

Arakan, Pegu, Tenasserim.

[Tonghoo (*W. R.*); Thayet Myo, Rangoon (*F.*).]

*23. C. cinereaceus (J. 52).

Pegu, Tenasserim.

*24. C. swainsonii (J. 51).

Arakan, Pegu.

*25. C. æruginosus (J. 54).

Arakan, Tenasserim.

[Tonghoo, Rangoon (*W. R.*).]

26. Poliornis teesa (J. 48).

Common in Province Amherst.

[Tonghoo (*W. R.*); Thayet Myo (*O.*). Hodgson's generic title, *Butastur*, takes precedence over *Poliornis*, Kaup.]

27. P. indicus.

Falco indicus, Gmelin; *F. javanicus*, Latham; *Buteo poliogenys*, Temminck, *Fauna Japonica*, pl. vii. B., where printed *pyrrhogenys*; *B. pygmæus*, nobis, J. A. S. B. xiv. p. 117; *Astur barbatus*, Eyton.

According to Mr. A. O. Hume, this species "has now occurred on several occasions in Southern Burma." The specimen described as *Buteo pygmæus* was obtained by Helfer. One procured by Mr. Swinhoe in Formosa had a crested occiput.*

28. P. liventer.

P. liventer, Temminck, p.c. 438.

An example from Tonghoo, identified by Viscount Walden;† Siam (*Gurney*).

[Tonghoo (*W. R.*); Thayet Myo (*O.*). To Major Lloyd belongs the credit of having first discovered that this species was an inhabitant of Burma, where, judging by the number of examples sent to me, it appears very common.]

* Ibis, 1864, p. 429.

† Tr. Z. S. viii. p. 37 (1871).

*29. Accipiter virgatus (J. 25).

Arakan, Tenasserim. Common.

[Thayet Myo (*F.*). Captain Feilden was good enough to send me the example here noted, and which I provisionally identify with *A. virgatus*. In Mr. Sharpe's opinion it may belong to the race named *A. stevensoni* by Mr. Gurney. The latter gentleman, however, as will be seen below, identified, although with doubt, this Thayet Myo example as belonging to "*A. rhodogaster*, nearly adult." Above, the plumage is dark cyanous. The breast is dove-coloured, without a trace of rufous. The abdomen pure white, with dove-coloured bands. The ventral region and under tail-coverts pure white; also the throat, with the exception of a mesial line of ash-coloured feathers. Tarsus, 2; wing, 6·25; tail, 5·50.]

30. Teraspizias rhodogastra.

Nisus rhodogaster, Schlegel; Tr. Z. S. vol. viii. pt. ii. p. 33, pl. 11.

Mr. Gurney thus identifies a specimen sent to Lord Walden from Thayet Myo.

[This refers to the example above mentioned. It is, however, highly improbable that a species peculiar to Celebes should occur in Burma.]

*31. Micrastur badius (J. 23).

Thinkyet-oma.

Arakan, Siam, Hainan. Common. *M. soloënsis*, Horsfield, should be looked for, as it was obtained in the Car Nicobar by Herr v. Pelzeln.* *Nisus minutus*, Lesson, is identified with it by Dr. Pucheran,† being founded on a specimen alleged to have been received from the Coromandel coast. Prof. Schlegel notes it from Java, Celebes, the Philippines, and China.

[Tonghoo, Karen hills, at 4000 feet of elevation (*W. R.*); Pahchaun, Pabyouk, Pahpoon (*D.*). The Burman race of this species has been separated by Mr. Hume, under the title of *Micronisus poliopsis*, Str. Feath. ii. p. 325.]

*32. Lophospizias trivirgata (J. 22).

Arakan, Tenasserim.

[Eastern slopes of the Pegu hills (*O.*); pine forest north of Kollidoo (*D.*). Hodgson's title of *indicus* is adopted by some authors for the somewhat larger Nipalese race of this Sumatran species.]

* *Reise "Novara," Aves*, 1850, p. 12.

† Rev. Zool. 1850, p. 210.

*33. Spizaëtus limnaëtus (J. 34).

Arakan, Tennasserim, Malacca, Sumatra.

[Tonghoo (*W. R.*); Thayet Myo (*O.*).]

34. S. alboniger.

S. alboniger, nobis, J. A. S. B., xiv. p. 173; Gould, B. As. pt. xv. f. 1.

Mergui, Malacca, Borneo.

*35. Aquila bifasciata (J. 27).

Won-lo.

Specimen received from Arakan, in the phase of plumage figured as *A. bifasciata* by Hardwicke and Gray.*

*36. A. nævia? (J. 28).

A. orientalis, Cab., Gurney, Ibis, 1872, p. 329.

Arakan.

*37. A. fusca (J. 30).

A. fusca; *vide* Mr. A. Anderson, P. Z. S. 1872, pp. 69, 622; *Morphnus hastatus*, Lesson.

Arakan.

[The author of the title, *A. fusca*, is not written in the MS.]

38. Hieraëtus pennatus (J. 31).

Moulmein.

I have seen a Spanish specimen with rudimentary occipital crest, as usual in Indian examples.

[Thayet Myo (*F.*).]

39. Neopus malayensis (J. 32.)

Tenasserim provinces.†

*40. Pandion haliaëtus (J. 40).

Won-let.

Arakan, Tenasserim. Common.

*41. Polioaëtus icthyaëtus (J. 41).

Common.

[Tonghoo (*W. R.*); Pabyouk (*D.*).]

* *Vide* Mr. W. E. Brook, P. Z. S. 1872, p. 502, and Mr. A. Anderson, *ibid.* p. 620; also Dresser, *ibid.* 1872, p. 863; and H. Gurney, Ibis, 1873, p. 99.

† P. Z. S. 1868, pl. 34.

42. P. HUMILIS.

Falco humilis, S. Muller; *Icthyaëtus nanus*, nobis.

Burma, *fide* Viscount Walden. Mr. W. E. Brooks identifies *Haliaëtus plumbeus*, Hodgson,* with this species.

*43. BLAGRUS LEUCOGASTER (J. 43).

A common maritime species which preys chiefly on sea-snakes.

*44. HALIASTUR INDUS (J. 55).

Common, extending southward to Malacca.

[Tonghoo (*W. R.*); Thayet Myo (*O.*).]

*45. MILVUS GOVINDA (J. 56).

Tswon-boke.

Common in the cold season. At Bangkok it is as abundant as in Calcutta. Cantor procured it at Pinang.

[46. M. AFFINIS.

M. affinis, Gould, P. Z. S. 1837, p. 140.

Thayet Myo examples, obtained by Mr. Oates and Captain Feilden, are thus identified by Mr. Hume.]

[47. BUTEO PLUMIPES (J. 47).

A Buzzard obtained by Captain Feilden at Thayet Myo is identified by Mr. Hume as *B. japonicus*, Schlegel.]

Fam. **Vulturidæ.**

Vultures.

48. VULTUR CALVUS (J. 2).

Vultur calvus, Scopoli; Gould, B. As. pt. xi. pl. 1.

Not a common species.

49. GYPS INDICUS (J. 4).

Vultur indicus, Scopoli; Gray and Mitchell, Gen. Birds, pl. 3, immature plumage.

Arakan, Siam. Vultures assigned to this species are mentioned to have been obtained on Zwagaben mountain by Lieut. Beavan.† I have seen two specimens of *G. indicus* in a Malacca collection. No doubt a Vulture of any kind is there rare, or it would not have been deemed worthy of preservation.

* J. A. S. B., xli. pt. i. p. 73.

† P. Z. S. 1866, p. 3.

According to Sir T. Stamford Raffles, "Vultures are rare on the west coast of Sumatra, but are occasionally seen on the Malay peninsula, and at Pinang."* Mr. E. W. H. Holdsworth notices that the *Vulturidæ* are absent from Ceylon;† and Mr. Wallace asserts the same of the entire Malayan archipelago.‡

[Upper Pegu (*O.*).]

50. G. BENGALENSIS (J. 5).

Leu-ta.

"Often seen in great numbers, even in the suburbs of large towns" (*Mason*). I noticed a few about Akyab only. Cantor procured it in Province Wellesley.§ It abounds as much in Siam as in Bengal.

[Thayet Myo (*Hume*); Pabyouk (*D.*).]

Fam. Strigidæ.

Owls.

51. HUHUA NIPALENSIS (J. 71).

Specimen in nestling garb, obtained by Colonel Tickell upon Moulè-it mountain, and described by him as *Ptiloskelos amherstii.*‖ This species has been confounded with the Malayan *H. orientalis* (Horsfield), which is a much smaller kind, and otherwise differs considerably. The young of both are in the British Museum, which enables me to confirm the present identification.

[Tonghoo (*W. R.*).]

*52. ASCALAPHIA BENGALENSIS (J. 69).

Arakan.

*53. A. COROMANDA (J. 70).

Arakan.

54. SCOPS LETTIA (J. 75).

Arakan, Tenasserim. Identical with Himalayan specimens.

[Rangoon, Karen hills (*W. R.*); Thayet Myo (*F.*). The Rangoon and Karen examples are not separable from Malaccan individuals. But they are distinct from true *S. lempiji*, Horsf., which is from Java.]

* Tr. L. S. xiii. p. 277.
† P. Z. S. 1872, p. 406.
‡ Ibis, 1868, p. 2.
§ P. Z. S. 1854, p. 258.
‖ J. A. S. B. vol. xxviii. p. 448.

*55. S. BAKKAMUNA (J. 74).

S. pennata et *S. sunia*, Hodgson; Gould, B. As. pt. xxii. pl. 3.

Arakan. *Otus mantis*, S. Müller, which is *S. rufescens*, Horsfield, is dubiously stated by Mr. A. O. Hume to have been found in Burma.

[Thayet Myo (*F.* fide *Hume*).]

*56. KETUPA CEYLONENSIS (J. 72).

Tee-dok.

Arakan. The common Indian species, an example of which was obtained by Canon Tristram in the valley of the Jordan. Its range extends eastward to China.

[Tonghoo (*W. R.*); common from Thayet Myo to Tonghoo (*O.*); Amherst (*D.*).]

57. K. JAVANENSIS.

K. javanensis, Lesson; *Strix ketupa*, Horsfield; *Strix ceylonensis*, apud Temminck, P. C. 74.

One received from Ramri Island, Arakan; also Siam. Common in the Malayan peninsula and archipelago.

[Amherst (*D.*).]

*58. ÆGOLIUS BRACHYOTUS (J. 68).

Brachyotus accipitrinus (Gm.), Ibis, 1872, p. 328.

Arakan.

[*Asio accipititrinus* (Pallas) is the correct denomination of this Owl. Those authors who may desire to generically separate it from the long-eared Owl, will have to adopt the generic title of *Brachyotus*, Gould, and not that of *Ægolius*, K. and B., previously employed by Kaup as the generic title of *S. tengmalmi*.]

*59. ATHENE WHITELEYI (?).

Athene whiteleyi (?), Blyth, Ibis, 1867, p. 313; *A. cuculoides* (?).

Arakan, Tenasserim. Common.

A. castanoptera, Horsfield, a Javanese species, is mentioned by Helfer; and an example of the Indian *A. radiata* was obtained by Dr. Cantor from Keddah.*

[Rangoon, Tonghoo, Yey-tho (*W. R.*); Thayet Myo (*O.*). The numerous individuals collected by Major Lloyd and Lieutenant W. Ramsay all belong to true *A. cuculoides*.]

* P. Z. S. 1854, p. 262.

[60. A. PULCHRA.

A. pulchra, Hume, Str. Feath. 1873, p. 469.

Thayet Myo (*W. R.*).]

61. GLAUCIDIUM BRODIEI (J. 80).

Noctua brodiei, Burton; Gould, B. As. pt. xxii. pl. 4.

Obtained by Colonel Tickell upon Moulè-it mountain.

[Meeta Myo, Kyouknyat (*D.*).]

*62. NINOX SCUTULATUS (J. 81).

Khen-bok.

Arakan, Tenasserim, Malacca. Common.

"Very abundant at Tavai; and though I never heard it at Moulmein, its familiar voice saluted me on the first night of my arrival at Tounghoo" (*Mason*).

[Karen hills (*L.*); Tonghoo (*W. R.*); Thayet Myo (*O.*); Pahpoon, Kyouknyat, Amherst (*D.*). Until comparison has been made with Sumatran examples, it will be best to retain the title of the Ceylon species, *N. hirsutus*, for the Burman *Ninox*.]

63. SYRNIUM SELOPUTO.

Strix seloputo, Horsfield; *Strix pagodarum*, Tem., P. C. 220; *S. sinensis*, vera. ? Latham, not of Hardwicke and Gray.

Mergui, Siam, Nicobar Islands. In Assam, according to Mr. A. O. Hume, this species apparently replaces the *S. occellatum* of India, and it is "constantly found in Burma."

[Thayet Myo (*F.*). Identical with Malaccan examples. *S. sinensis*, Lath., founded on Sonnerat's *Hibou de la Chine* (Voy. Indes, ii. p. 185), can hardly refer to this owl.]

64. S. INDRANI (J. 63).

This should be the Burmese race, as it occurs at Malacca, as well as in South India and Ceylon; but Mr. A. Hume has a Burmese specimen, and suspects that "if the Nipâl and Nilgiri birds be distinct, the Burmese, Kumaon, Simla, and Kotegurh birds are intermediate between these two."*

65. PHODILUS BADIUS (J. 62).

Strix badia, Horsfield; Gould, B. As. pt. xxii. pl. 6.

Arakan, Tenasserim, Siam, Malay countries.

[Tonghoo, Karen hills (*W. R.*). Identical with Malaccan and Bornean examples.]

* "Scrap-book," Part I. *Raptores*, No. 2, p. 351.

*66. Strix javanica (J. 60).

Strix javanica, Gm.; Gould, B. As. pt. xxiv. pl. 1; *S. indica*, Blyth, Ibis, 1866, p. 250; nec *S. javanica*, apud Horsfield, as figured by Gray and Mitchell, Gen. Birds, pl. 15.

Common and generally diffused.

[Thayet Myo (*F.*). This is true *S. javanica*, Gm., founded on F. von Wurmb's *Nachteule von Java* (Magazin f. d. Neueste, iv. pt. 2, p. 10, no. 4, 1786). No Latin title was given by this author.]

67. S. candida (J. 61).

S. candida, Tickell; Gould, B. As. pt. xxiv. pl. 2.

Tonghoo. Occurs also in Central and Southern India, China, the Philippine Islands, and Australia.

[Tonghoo (*L.*).]

Order INSESSORES.

Sub-order Picariæ.

Tribe HALYCONES.

Fam. **Bucerotidæ.**

Hornbills.

*68. Dichoceros bicornis (J. 140).

Young-yen, Arakan (*Phayre*). *Oukchingee* (Big-Hornbill), and sometimes *Yonia* (*Beavan*).

This fine Hornbill seems to be generally diffused through the forests, and is by no means rare, nor particularly shy. Southward its range extends to Malacca and Sumatra.*

[Mong (*W. R.*); common on the western slopes of the Pegu hills (*O.*); Pahpoon, and 30 miles north of Ye (*D.*). Mr. Hume (Str. Feath. ii. p. 470) treats the Malaccan race as distinct. The characters which differentiate the Indian from the Malayan forms have yet to be recorded.]

*69. Hydrocissa albirostris (J. 142).

Ouk-Khyen.

The commonest species of Hornbill throughout British Burma.

[Tonghoo, Karen hills (*W. R.*).]

* *Buceros cavatus* and *B. bicornis* are given as distinct species by Mr. W. H. Blanford, Ibis, 1870, p. 466. It can only be by a mistake of some kind.

70. Anorrhinus tickelli.

Buceros tickelli, nobis, J. A. S. B. xxiv. pp. 266, 285; xxviii. p. 412; Ibis, 1864, pl. iii.

Mountains of Amherst Province, up to 4000 feet of elevation. A kindred species from the Nagas was referred to *A. galeritus* by Major Godwin-Austen,* and is named *A. austeni* by Dr. Jerdon;† but it proves to be no other than the Malayan *Craniorrhinus corrugatus* (Tem. P. C. 520), the head being now in the possession of Lord Walden. *A. galeritus* is also a Malayan species.

*71. Aceros plicatus (?).

Buceros plicatus (?), Latham; *B. ruficollis*, nobis, J. A. S. B. xii. p. 176.

Chittagong, Kachar, Arakan, Tenasserim provinces, Malayan peninsula, Sumatra, Java (?). Javanese specimens appear to me to be somewhat different. In Tenasserim, remarks Mr. Barbe, both this species and the next are very common, associating in flocks of a dozen or twenty birds, but the two species do not mingle in the same flock.

[Dr. Day obtained this species in Assam.]

72. A. subruficollis.

A. subruficollis, nobis, J. A. S. B. xii. p. 177.

Tenasserim provinces, Malayan peninsula. This species is very closely akin to the Papuan *A. ruficollis* (verus), the females being undistinguishable.

[Tonghoo (*W. R.*).]

73. A. nipalensis (J. 146).

Munipur, Kachar, Tenasserim mountains.‡

Fam. **Upupidæ.**

Hoopoes.

74. Upupa longirostris.

Upupa longirostris, Jerdon, B. of Ind. i. p. 393. *Toung pee-tsok.*

Tenasserim, Siam, Hainan.

This is hardly to be considered more than a deeply-coloured race of *U. epops*, and I have an impression that Arakan specimens are pale, like those of Lower Bengal and also of Europe.§

[Tonghoo, Thayet Myo (*W. R.*).]

* J. A. S. B. xxxix. p. 96. † Ibis, 1872, p. 6.

‡ For notice of the Hornbills of British Burma, *vide* Tickell, Ibis, 1864, p. 173 *et seq.*

§ *Cf.* Stoliczka, J. A. S. B. xli. pt. 2, p. 235; Sharpe and Dresser, Hist. of Birds of Europe, pt. vii.; Murie, Ibis, 1873, pp. 181 *et seq.*

Fam. **Alcedinidæ.**

Kingfishers.

75. CARCINEUTES PULCHELLUS.

Carcineutes pulchellus (Horsf.), Sharpe, *Mon. Alc.* pl. 96.

The range of this Malayan species extends to Mergui.

[Karen hills (*W. R.*); Amherst (*D.*). The examples from the Karen hills are absolutely identical with those Malaccan individuals which possess a rufous collar. This collar is strongly marked in these Karen specimens. But in many Malaccan specimens it is wanting. When in this common phase of plumage, they become the *C. amabilis*, Hume (Str. Feath. i. p. 474), founded on Upper Pegu examples obtained by Mr. Oates.]

*76. PELARGOPSIS BURMANNICA.

Pelargopsis burmannica, Sharpe, *Mon. Alc.* pl. 35. *Peing-nyen* (generic).

Arakan (?), Tenasserim provinces, Siam, Andaman Islands.

One of several geographical races which are barely separable.

[Yey-tho, Karen nee (*W. R.*); Thayet Myo (*O.*).]

*77. P. AMAUROPTERA (J. 128).

P. amauroptera (Pearson), Sharpe, *Mon. Alc.* pl. 30.

This species is seldom seen far inland, though in India it occurs in the *Tarai* at the foot of the Eastern Himalaya; being chiefly seen about estuaries where the water is brackish. It probably is nowhere more abundant than along the Tenasserim coast.

[Yey-tho (*W. R.*).]

*78. HALCYON PILEATA (J. 130).

Halcyon pileata (Bodd.), Sharpe, *Mon. Alc.* pl. 62.

Common.

[Palow (*O.*); Karope, Tavoy, Moulmein (*D.*).]

*79. H. COROMANDA (J. 131).

H. coromanda (Lath.), Sharpe, *Mon. Alc.* pl. 57.

Common, chiefly about estuaries.

[Meeta Myo, Amherst, Tavoy (*D.*).]

*80. H. SMYRNENSIS (J. 129).

H. smyrnensis (Linn.), Sharpe, *Mon. Alc.* pl. 59.

The most common species of its genus, as generally throughout Southern Asia.

[Rangoon, Tonghoo (*W. R.*).]

*81. Sauropatis chloris (J. 132).

Halcyon chloris (Bodd.), Sharpe, *Mon. Alc.* pl. 87.

Common along the sea-coasts.

[Amherst, Henza Basin (*D.*).]

*82. Ceyx tridactyla (J. 133).

Ceyx tridactyla (Pall.), Sharpe, *Mon. Alc.* pl. 40. *Deing-nyeen.*

Arakan, Tenasserim, Malacca.

[Eastern Pegu hills (*O.*); between Tavoy and Meeta Myo, Karope, Ye (*D.*).]

*83. Alcedo bengalensis (J. 134).

Alcedo bengalensis, Gm., Sharpe, *Mon. Alc.* pl. 2.

Common.

[Rangoon, Tonghoo, Karen nee (*W. R.*); Thayet Myo (*F.*).]

*84. A. asiatica.

A. asiatica, Swainson; *A. meningting*, Horsfield; Sharpe, *Mon. Alc.* pl. 5.

Tenasserim provinces. It is remarked by Mr. W. T. Blanford, that *Pelargopsis burmannica*, *Halcyon smyrnensis*, and *Alcedo bengalensis*, are apparently replaced in the Irawádi delta, where the water is salt, by *P. amauroptera*, *H. pileata*, and *A. asiatica*. According to Helfer, *Alcedo beryllina*, Vieillot (*biru*, Horsfield), is also an inhabitant of the Tenasserim provinces, but I have never seen it even from the Malayan peninsula. The present, however, is one of the species which Helfer did procure.

[This is probably *A. beavani*, Walden, for Mr. Hume remarks that Amherst and Ye examples are identical with individuals from various parts of India and from the Andamans. *A. meningting*, Horsf., the senior title of *A. asiatica*, is a perfectly distinct species.]

*85. Ceryle rudis (J. 136).

Ceryle rudis (Linn.), Sharpe, *Mon. Alc.* pl. 19.

Arakan, Tenasserim, Siam, Malacca, South China.

[Tonghoo (*W. R.*); Thayet Myo (*O.*).]

[86. C. guttata (J. 137).

C. guttata (Vig.), Sharpe, Mon. Alc. pl. 18.

Kollidoo, Pachaun (*D.*).]

Fam. **Coraciadæ.**

Rollers.

*87. Coracias affinis (J. 124).

Coracias affinis, McClell., Gray and Mitchell, Gen. Birds, pl. 211, not good. *Hgnet-kha.*

Generally diffused, and always typically coloured; whereas specimens from Tippera, Sylhet, Assam, and Lower Bengal are mostly crossed more or less with *C. indica*, showing every gradation from one to the other. Gould's figure assigned to *C. affinis* in his "Birds of Asia"* represents a hybrid of the kind; and *C. indica* also interbreeds with *C. garrula* in localities where those two races meet. Eastward, the present species extends at least to Siam.

[Rangoon, Tonghoo, Thayet Myo (*W. R.*).]

*88. Eurystomus orientalis (J. 126).

Arakan, Tenasserim, Malacca.

Fam. **Meropidæ.**

Bee-eaters.

*89. Merops philippinus (J. 118).

Merops philippinus, Linn.; Gould, B. As. pt. vii. pl. 2.

Arakan, Tenasserim, Siam, Malacca, Sumatra, Java, Philippines, South China. The Philippine race does not, as has been asserted, differ in any respect.

[Tonghoo (*W. R.*); Thayet Myo (*O.*).]

*90. M. erythrocephalus (J. 119).

M. erythrocephalus, Gm.; Gould, B. As. pt. viii. pl. 13.

Arakan, Tenasserim, Siam, Malacca. The Javanese *M. quinticolor*, Vieillot, is distinguished by having no rufous above the black pectoral band.†

[Rangoon, Karen nee (*W. R.*); Thayet Myo (*F.*). The Malaccan habitat is doubtful. For reasons already stated (Ibis, 1873, p. 301), Gmelin's title, taken from Brisson, cannot be adopted. If, however, the title of *quinticolor*, Vieillot, is to be used for the Javan race, the continental form must take the name of *M. leschenaulti*, Vieill. In either view the necessity of coining the new title of *M. swinhoei*, Hume, does not seem apparent.]

* Part xxi. pl. 2.

† P. Z. S. 1871, p. 348.

*91. M. VIRIDIS (J. 117).

M. viridis, var. *ferrugeiceps*, Hodgson.

Arakan, Tenasserim provinces, Siam. *M. sumatranus*, Raffles, occurs in Siam, and should be looked for in the Southern Tenasserim provinces.

[Rangoon, Tonghoo hills, Karen hills (*W. R.*).]

*92. NYCTIORNIS ATHERTONII (J. 122).

Nyctiornis athertonii (J. & S.), Gould, B. As. pt. ii. pl. 2.

Tenasserim provinces.

[Tonghoo, Karen hills (*W. R.*).]

93. N. AMICTA.

Merops amictus, Temminck, P.C. 310; Swainson's Zool. Ill., 2nd series, pl. 56; Gould, B. As. pt. ii. pl. 3; *N. malaccensis*, Cabanis.

Procured by Helfer, probably in Mergui province.

[Near Zadee (*D.*). *N. malaccensis*, Cab., was described from the young bird.]

Tribe COCCYGES.

Fam. Capitonidæ.

Barbets.

*94. MEGALÆMA MARSHALLORUM (J. 191).

Megalæma marshallorum, Swinhoe; Marshall's *Mon. Cap.* pl. 16. *Pko-goung.*

Arakan.

[Karen hills (*W. R.*). Mr. Hume has identified examples obtained by Mr. Davison at Kollidoo and Kyouknyat as belonging to *M. virens* (Bodd.), and not to the Himalayan bird.]

*95. M. HODGSONI (J. 192).

M. hodgsoni, Bp.; *M. lineata*, Marshall's *Mon. Cap.* pl. 36, 37.

Khásias, Arakan, Pegu, Tenasserim, Siam, Malacca (?), Java.

[Rangoon, Tonghoo, Yey-tho (*W. R.*); Thayet Myo (*O.*). Vieillot's title of *lineata* cannot be applied.]

*96. M. ASIATICA (J. 195).

M. asiatica (Lath.); Marshall, *Mon. Cap.* pl. 29. *Kok-kha-loung.*

Arakan, where not common.

[Tonghoo (*W. R.*); Pahpoon, Kollidoo (*D.*).]

97. M. FRANKLINII (J. 196).

M. franklinii (nobis); Marshall, *Mon. Cap.* pl. 24.

Khásias, Tenasserim mountains.

According to Col. Tickell, this species "swarms from 3000 to 5000 feet elevation, not higher, nor lower, and from the first level it suddenly supplants *M. lineata* (*M. hodgsoni*?), the *Pokoung* of the Burmese."

[98. M. RAMSAYI.

M. ramsayi, Walden, Ann. N. H. (4), 15, p. 400, June, 1875.

Karen nee (*W. R.*).]

*99. M. CYANOTIS.

M. cyanotis (nobis); Marshall, *Mon. Cap.* pl. 33, fig. 3.

Khásias, Tippera, Kachar, Arakan, Tenasserim provinces.

[Karen Hills (*W. R.*).]

[100. M. MYSTACOPHANUS.

M. mystacophanus (Tem.), Marshall, *Mon. Cap.* pl. 19.

Om-ben-gwen (*D.*).]

[101. M. INCOGNITA.

M. incognita, Hume, Str. Feath. ii. p. 442.

Karope, Ye (*D.*).]

*102. M. HÆMACEPHALA (J. 197).

X. hæmacephala (L. S. Müller); Marshall, *Mon. Cap.* pl. 42.

Arakan, Tenasserim, Siam, Penang, Malacca, Philippines.

[Rangoon, Tonghoo, Karen nee (*W. R.*); Thayet Myo (*O.*).]

Fam. Picidæ.

Woodpeckers. *Theet-touk* (generic).

*103. HEMICERCUS CANENTE (J. 165).

Picus canente, Lesson, Cent. Zool. t. 73.

Arakan, Pegu, Tenasserim. This only differs from the South Indian *H. cordatus* in being constantly larger.

[Karen hills, from 500 to 4000 feet (*W. R.*). Two males are sent by Mr. Ramsay. One has the head uniform deep black; the other with a few buff markings on the feathers of the forehead and crown.]

*104. Alophonerpes gutturalis (J. 168).

Picus pulverulentus, Temminck, P.C. 389; *Picus gutturalis*, Valenciennes.

Arakan, Shan hills, Tenasserim, Malacca, Java. The largest of Asiatic Woodpeckers.

[Arakan and Pegu hills (*O.*); Tonghoo (*L.*). Examples from Cochinchina in no way differ. According to Sundevall (Consp. Av. Picinarum, p. 10, no. 23), Temminck's title has priority, and he quotes the year 1825 as the date of publication. But there must be some mistake, for Sundevall refers to the 65th Livraison of the Recueil, whereas *P. pulverulentus* was described and figured in the 66th. Anyhow, Crotch (Ibis, 1868, p. 500) gives 1826 as the year in which both these Livraisons were published. Elsewhere (Ibis, 1871, p. 164, note) reasons are stated why, while the exact date of Valenciennes' title remains undetermined, preference should be given to the one bestowed by Temminck.]

105. Thriponax crawfurdii.

Picus crawfurdii, J. E. Gray, Griffith's English edition of Cuvier's "Animal Kingdom," Birds, vol. ii. p. 513, pl. 1; *Hemilophus feddeni*, Blyth, J. A. S. B. xxxii. p. 75; *T. jerdoni*, Cabanis, Mus. Heine. ii. p. 105.

Upper Pegu.

[Thayet Myo, Tonghoo (*W. R.*); Pahpoon, Kyouknyat (*D.*).]

106. T. javensis.

P. javensis, Horsfield; *Picus leucogaster*, Reinwardt, Tem. P. C. 501.

Mergui, Malacca, Sumatra, Java, Borneo, Philippines.

*107. Chrysocolaptes guttacristatus (J. 166 *partim*).

Picus guttacristatus, Tickell ♀; *Indopicus delesserti*, Malherbe, *Mon. Picidæ*, pl. 64; Ibis, 1866, p. 355; 1872, p. 8.

Arakan, Tenasserim, Siam, Malacca.

[Yey-tho, Tonghoo (*W. R.*); Thayet Myo (*F.*); Arakan hills (*O.*). Tickell's title has priority over Malherbe's and Hodgson's titles.]

*108. Tiga javanensis (J. 184).

Picus javanensis, Ljungh; *vide* Lord Walden in Ibis, 1871, p. 170; *Picus tiga*, Horsfield; *Tiga intermedia*, Blyth.

Arakan, Tenasserim, Siam, Java. Common. A smaller race (*T. rufa*, apud Stoliczka) occurring in the Malayan peninsula and Sumatra.*

[Yey-tho, Rangoon, Tonghoo, Karen nee (*W. R.*); Thayet Myo (*O.*). Malaccan and Javan examples are smaller, otherwise identical.]

* *Vide* Stoliczka, in J. A. S. B. xxxix. p. 289.

109. GECINUS STRIOLATUS (J. 171).

Pegu, delta of the Irawádi (*Blanford*).

[Tonghoo (*L.*). The Ceylon and Malabar form of this species is considerably smaller than the Sub-Himalayan and Burman. A Ceylon example has the uropygium deep golden orange.]

*110. G. VIRIDANUS.

G. viridanus, nobis, J. A. S. B. xii. p. 1000.

Arakan, Tenasserim, Pegú, Siam. Barely separable from *G. dimidiatus* of Sumatra and Java, but considered so by Lord Walden.*

[Tonghoo (*W. R.*). If considered identical with the Javan bird, this Woodpecker must take the title of *vittatus*, Vieillot.]

*111. G. OCCIPITALIS (J. 172).

Arakan, Tenasserim.

[Yey-tho, Tonghoo (*W. R.*); Thayet Myo (*O.*).]

[112. GECINUS ERYTHROPYGIUS.

Gecinus erythropygius, D. G. Elliot, N. Archiv. 1865, p. 76, pl. iii.; *G. erythropygius*, Wardlaw Ramsay, P. Z. S. April 21, 1874, p. 212, pl. xxxv. (*motu proprio*); *G. nigrigenis*, Hume, P. A. S. B. May, 1874, p. 106.

Foot of Karen hills, also at 600 feet, Tonghoo (*W. R.*); hills north of Pahpoon (*D.*).]

*113. CHRYSOPHLEGMA FLAVINUCHA (J. 173).

Chrysophlegma flavinucha (Gould); B. As. pt. i. pl. 5.

Arakan, Tonghoo.

[Yey-tho, Karen hills, Tonghoo (*W. R.*); Thayet Myo (*O.*); neighbourhood of Pahpoon (*D.*).]

*114. C. CHLOROLOPHUS (J. 174).

Khásias, Arakan, Tenasserim provinces.

[Tonghoo, Karen nee hills, at 3000 feet elevation (*W. R.*); Thayet Myo (*O.*).]

115. C. MENTALIS.

Picus mentalis, Temminck, P.C. 384.

Mergui, Malayan peninsula, Sumatra.

* Proc. Zool. Soc. 1866, p. 539.

116. C. PUNICEUS.

Picus puniceus, Horsfield, Tem. P.C. 423.

Mergui, Malayan peninsula, Sumatra, Java.

[117. VENILIA PYRRHOTIS (J. 176).

Tonghoo hills (*W. R.*); Pahpoon (*D.*).]

*118. GECINULUS VIRIDIS.

Gecinulus viridis, Bl., J. A. S. B. xxxi. p. 341.

Upper Pegu.

[Tonghoo hills, at 2500 feet (*W. R.*); Pahpoon, Kyouknyat, Pahchaun, Ye, Meeta Myo (*D.*).]

*119. MICROPTERNUS PHAIOCEPS (J. 178).

Arakan, Tenasserim.

[Rangoon, Tonghoo (*W. R.*); Thayet Myo (*O.*). Malherbe's title of *rufinotus* must be adopted.]

*120. M. BURMANNICUS.

M. burmannicus, A. Hume, P. A. S. B. 1872, p. 71.

Thayet-myo.

[This is nothing but *M. rufinotus*, and has no claim to rank as a distinct species. Mr. Blyth had no opportunity of examining Thayet Myo examples.]

*121. MEIGLYPTES JUGULARIS.

Meiglyptes jugularis, nobis, J. A. S. B. xiv. p. 195.

Arakan, Tenasserim, Siam.

[Arakan and Pegu hills (*O.*). Included by Sundevall (*t. c.* p. 93, no. 4) among his *species dubiæ*, yet an undoubtedly distinct form.]

*122. M. TRISTIS.

M. tristis, Horsfield; Tem. P.C. 197, fig. 1.

Mergui, Pinang, Malacca, Sumatra, Java.

*123. DENDROTYPES MACEI (J. 157).

Arakan, Tenasserim, Malacca.

[Karen hills, at 3000 feet, Karen nee, at 4000 feet elevation (*W. R.*).]

*124. D. ATRATUS.

Picus atratus, nobis, J. A. S. B. xviii. p. 803, xxviii. p. 412.

Tenasserim mountains.

[Karen hills, at 3000 and 4000 feet. Iris, in male, dark brown; bill

horny, mandible whitish; legs, greenish plumbeous (*W. R.*); pine forests north of Pahpoon (*D.*). An old male exhibits a carmine tinge on some of the pectoral feathers.]

125. D. ANALIS.

Picus analis, Horsfield; *Picus pectoralis*, nobis, J. A. S. B. xv. p. 15.

Tonghoo, where the occurrence of this Javanese species is remarkable.

[Tonghoo (*L.*); Karen nee (*W. R.*); Thayet Myo (*F.*). Identical with Javan examples.]

126. LIOPIPO MAHRATTENSIS (J. 160).

Picus blanfordi, nobis, J. A. S. B. xxxii. p. 75.

Tonghoo. As compared with specimens from Central India, those from Pegu have more of white on the plumage, but Viscount Walden informs me that in this respect they resemble others from Ceylon.

[Thayet Myo (*F.*); Tonghoo (*W. R.*).]

*127. YUNGIPICUS CANICAPILLUS.

Picus canicapillus, nobis, J. A. S. B. xiv. p. 197.

Khásias, Arakan, Tenasserim provinces. Common.

[Tonghoo, Karen nee at 4000 feet (*W. R.*); Thayet Myo (*F.*).]

128. VIVIA INNOMINATA (J. 186).

Picumnus innominatus (Burton); Gould, B. As. pt. xxii. pl. 13.

Tenasserim mountains.

[Karen hills at 2000 feet (*W. R.*).]

*129. SASIA OCHRACEA (J. 187).

Sasia ochracea, Hodgson; Gould, B. As. pt. xxii. pl. 14.

Arakan, Tenasserim.

[Tonghoo hills (*W. R.*).]

[130. S. ABNORMIS.

Picumnus abnormis, Tem., P.C. 371, fig. 3.

Stated by Mr. Hume (Str. Feath. ii. p. 472) to have been obtained by Mr. Davison near Ye.]

*131. IYNX TORQUILLA (J. 188).

Arakan.

[Karen nee (*W. R.*); Thayet Myo (*O.*).]

Fam. Cuculidæ.

Cuckoos.

132. Hierococcyx sparverioides (J. 207).

Arakan, Malacca.

[Rangoon, Yey-tho, Karen nee at 4000 feet (*W. R.*); Pahpoon (*D.*).]

133. H. varius (J. 205).

This species can hardly but occur, as also *H. nisicolor* (J. 206); but in the Malay countries they would seem to be replaced by *H. hyperythrus*, Gould,† of which *Cuculus fugax*, Horsfield, is the young bird. *H. varius* is common in the Dacca district of Eastern Bengal, and Jerdon gives it from "Burma and Malacca," but I do not remember to have seen a specimen from the eastern side of the Bay of Bengal.

134. Cuculus micropterus (J. 203) and C. affinis (J. 204).

These differ only in size, and have the same note *bhokatáko*, which I often heard in the vicinity of Moulmein during the rainy season, but did not obtain a specimen. Both races occur in Java, and *C. affinis* occurs both in Nipál and the Malayan peninsula. Of necessity both of them must inhabit the Indo-Chinese countries. I have never seen a specimen of intermediate dimensions.

[Mr. Hume (Str. Feath. iii. p. 79) makes the important statement that the above numbers of Jerdon belong respectively to the male and female. If this be so, a hitherto much disputed question is satisfactorily settled.]

135. C. canorus (J. 199).

A specimen of this bird, in the plumage of immaturity, was shot in my presence, in the garden of the Commissioner, at Moulmein. Mr. Wallace obtained it in Timor.

[Karen nee at 3500 feet (*W. R.*); Prome (*Raikes*).]

136. C. striatus (J. 200).

C. striatus, Drapiez; Ibis, 1866, p. 359; 1872, p. 12.

The range of this Cuckoo extends from the Himálaya to China and

* Mr. Hume gives *H. strenuus*, Gould, from Thayet Myo. P. A. S. B. 1872, p. 71. [The Thayet Myo example of the supposed Philippine *H. strenuus*, here alluded to, was nothing but *H. sparverioides*.]

† B. As. pt. viii. pl. 15.

N. Australia. I have seen two Tenasserim examples of it. *C. poliocephalus* can also hardly but occur, as examples from Java differ in no respect from others obtained in the Himálayas, Nilgiris, and mountains of Ceylon.

137. C. SONNERATII (J. 202).

Tenasserim provinces, Malayan peninsula and islands. As an Indian bird, I have only seen it from Malabar and Ceylon.*

[Thayet Myo (*W. R.*).]

*138. CACOMANTIS PASSERINUS (J. 209).

Cuculus passerinus, Vahl; *Polyphasia rufiventris*, Jerdon, Ibis, 1872, p. 15.

Arakan, Tenasserim, Siam, Hainan, Pinang. Replaced by a smaller race (*C. threnodes*) at Malacca.

[Thayet Myo, Yey-tho, Tonghoo, Karen nee (*W. R.*). *C. passerinus* is distinct from *C. rufiventris*, the correct title of the species Mr. Blyth refers to. While there is no record of *C. passerinus* ever having been found in Burma, *C. rufiventris* is there very common.]

*139. SURNICULUS LUGUBRIS (J. 210).

Arakan, Tenasserim, Siam, Pinang, Java.

[Tonghoo hills, Yey-tho, Karen nee (*W. R.*). Javan, continental, and Ceylon birds are identical.]

*140. CHRYSOCOCCYX MACULATUS (J. 211).

Cuculus malayanus, Raffles, apud Gray and Mitchell, Gen. Birds, pl. 117.

Arakan, Tenasserim. Mr. Gould distinguishes a smaller race (*C. schomburgki*) from Siam.†

[Tonghoo (*L.*).]

141. C. XANTHORHYNCHUS.

C. xanthorhynchus, Horsfield, Zool. Res. in Java, pl. —.

Procured by Helfer, probably in Mergui province, being the supposed new species of *Chalcites* noticed by Jameson (J. A. S. B. viii. p. 243). Malacca, Sumatra, Java, Philippines.

* According to Lord Walden, the species "*Penthoceryx pravatus* (Horsfield), which inhabits Malacca, Sumatra, Java, and Borneo, is considerably smaller than *P. sonneratii* (Latham) of India and Ceylon." Ibis, 1872, p. 367. *Vide* admeasurements, *loc. cit.*

† P. Z. S. 1864, p. 73.

142. EUDYNAMIS CHINENSIS.

Eudynamis chinensis and *E. malayana*, Cab. Mus. Hein, iv. p. 52; Walden, Ibis, 1870, p. 339.

Nipâl, Tenasserim, Siam.

[Thayet Myo, Rangoon, Tonghoo (*W. R.*). *E. malayana* is the correct title. Malaccan individuals are identical.]

*143. COCCYSTES COROMANDUS (J. 213).

Cuculus coromandus (Linn.); Gould, B. As. pt. vi. pl. 3.

Arakan, Tenasserim, Siam, Malay countries generally.

[Thayet Myo, Rangoon (*W. R.*).]

144. C. JACOBINUS (J. 212).

This common African and Indian species abounds in Upper Pegu; but I have seen it from no other locality eastward of the Bay of Bengal.

[Thayet Myo (*W. R.*).]

145. PHOENICOPHAËS ERYTHROGNATHUS.

Phoenicophaës erythrognathus, Hartlaub, Verz. Brem. Samml. p. 95.

Tenasserim provinces, Malayan peninsula, Sumatra, Borneo.

146. ZANCLOSTOMUS JAVANICUS.

Phænicophaus javanicus, Horsfield, Zool. Res. in Java, pl. —.

Tenasserim provinces, Malayan peninsula, Sumatra, Java.

147. Z. DIARDI.

Melias diardi, Lesson, Traite, p. 132.

Mergui, Pinang, Malacca, Sumatra.

*148. Z. TRISTIS (J. 215).

Arakan, Tenasserim, Siam, Cambodja, Hainan, Pinang, Malacca. A very common species.

[Rangoon, Tonghoo, Tonghoo hills, Karen nee (*W. R.*); Thayet Myo (*O.*).]

*149. CENTROPUS RUFIPENNIS (J. 217).

Generally diffused.

[Thayet Myo, Karen hills, Tonghoo (*W. R.*). Mr. Hume (Str. Feath. i. p. 454) has separated the race which inhabits the Doon, the neighbourhood of Dacca, and Thayet Myo, under the specific title of *C. intermedius*. These Burman examples bear out Mr. Hume's remarks, and may fairly be considered distinct from the common crow pheasant of Peninsular India.]

[150. C. EURYCERCUS.

C. eurycercus, A. Hay, J. A. S. B. 1845, p. 551.

Introduced by Mr. Hume in his list of birds of the Tenasserim provinces (Str. Feath. ii. p. 473), but without the exact locality being stated. Two distinct species seem to be included by him under the title. The smaller may possibly be *C. rectunguis*.]

*151. C. BENGALENSIS (J. 218).

Also generally diffused.

[Karen nee (*W. R.*).]

[152. RHINORTHA CHLOROPHÆA.

Cuculus chlorophæus, Raffles, Tr. L. S. xiii. p. 288.

Lemyne, Thayet-chaung, near Meeta Myo (*D.*).]

Fam. **Trogonidæ.**

Trogons.

153. HARPACTES HODGSONI (J. 116).

Harpactes hodgsoni; Ibis, 1866, p. 342; Gould, B. As. pt. xvii. pl. 1.

Arakan, Tenasserim.

[Karen nee at 4000 feet (*W. R.*); Thayet Myo (*F.*).]

*154. H. ORESCIUS.

Trogon oreskios, Tem.; Gould, B. As. pt. xvii. pl. 3; *Mon. Trogonidæ*, pl. 34; Beavan, Ibis, 1869, p. 407; P. Z. S. 1866, p. 538.

Arakan, Tenasserim provinces, Siam, Cambodja, Java.

According to Col. Tickell, *Harpactes hodgsoni* is "common on the hills from 3000 feet upwards. Below that it is replaced by *H. orescius*. It flies in small flocks, and is active and vociferous on the wing, solitary and quiet during the heat of the day, sitting in the shade."

[Karen hills (*W. R.*).]

Fam. **Caprimulgidæ.**

Night-jars.

*155. LYNCORNIS CERVINICEPS.

Lyncornis cerviniceps, Gould, *Icones Avium*, pt. ii. pl. 4. *Hgnet hyeen*; *Tween-dweng-nghat*.

Generally diffused over the forest-region of British Burma, from Arakan to Mergui. It has recently been procured at Darjeeling. In Upper Martaban

I remarked that on their first appearance, towards evening, these superb Night-jars would seek their food high in the air, descending gradually within gunshot, and finally sweeping about close to the ground, in considerable numbers, as it became too dark to fire at them.

[Tonghoo (*L.*); Pahpoon (*D.*).]

*156. Caprimulgus indicus (J. 107).

Generally diffused, extending southward to Malacca and Sumatra.

[157. C. jotaka.

C. jotaka, Tem. & Schlegel, Fauna Japonica, *Aves*, p. 37, pl. 12, 13.

Tonghoo (*L.*).]

*158. C. macrourus (J. 110).

Indo-Chinese and Malay countries generally, extending to N. Australia.

[Tonghoo (*W. R.*); Thayet Myo (*F.*). Tonghoo examples very much larger than typical Javan individuals. Wing, 8; tail, 7.]

*159. C. monticolus (J. 114).

Indo-Chinese countries generally, extending eastward to South China.

[Tonghoo (*W. R.*); Amherst, Yeboo, Pahpoon (*D.*).]

[160. C. albinotatus (J. 109).

Tonghoo (*W. R.*).]

*161. C. asiaticus (J. 112).

Arakan, Tenasserim, Siam. One or more species of *Batrachostomus* must needs occur, though as yet overlooked.* According to Mason, the Burmese call Night-jars *myæ-wot* (earth-crouchers), while the Arakan name for them is *Hgnet-byen* (outside-bird).

[Thayet Myo (*W. R.*).]

[162. Batrachostomus hodgsoni (J. 106).

Otothrix hodgsoni, G. R. Gray, P. Z. S. 1859, p. 101, pl. 152.

"Karen nee, at 6000 feet. Iris, marbled buff; bill, light madder; legs, light madder, tinged with violet" (*W. R.*).

A male, in grey mottled plumage, and closely resembling the type.

* Mason, however, gives *Podargus affinis*, Blyth, without mentioning any locality. Probably *Otothrix hodgsoni*, G. R. Gray, if the two really differ.

The other known species of this genus within the Indian region are:—

1. *B. javanensis*, Horsf. = *P. cornutus*, Tem. = *B. stellatus*, Gould. Malacca, Java, Borneo, Sumatra.

2. *B. affinis*, Blyth = *P. parvulus*, Tem. = *B. castaneus*, Hume. Borneo, Malacca, Darjeeling.

3. *B. moniliger*, Layard = *B. punctatus*, Hume. Ceylon, Malabar.

4. *B. stictopterus*, Cab. = *B. stellatus*, Gould, *ap.* Salvadori. Malacca, Borneo. I have some doubts whether this is not a phase of *B. javanensis*. In dimensions the two do not materially differ. The markings are similar, but the colouring is dark rufous brown, and not chestnut. I have never met with examples of this species, if it be one, or of *B. javanensis* in grey speckled plumage. But grey examples of *B. affinis* and *B. moniliger* are as common as rufous individuals.

5. *B. auritus*, Gould. Malacca. In rufous-brown, or in grey plumage, very common; but I have never met with it in chestnut plumage.]

Tribe CYPSELI.

Fam. **Cypselidæ.**

Swifts.

*163. ACANTHYLIS GIGANTEA (J. 96).

Cypselus giganteus, Hasselt; P.C. 364.

Arakan, Tenasserim, Andamans, Pinang, Nilgiris, Ceylon.

[Tonghoo (*L.*). *Chætura indica*, Hume, is synonymous.]

164. CYPSELUS PACIFICUS.

Hirundo pacifica, Latham; *C. vittatus*, Jardine and Selby, *Ill. Orn.* 2nd series, pl. 39; *C. australis*, Gould.

Upper Assam, Kachar, Tenasserim provinces, Pinang, China, Australia.

[Thayet Myo (*O.*).]

*165. C. PALMARUM (J. 102).

Pyan-hlwa, Mason.

The common Indian Palm Swift abounds in the Indo-Chinese countries, where also (though not hitherto detected within the limits of British Burma) must needs also occur the allied *C. infumatus*, Sclater (*C. tinus*, Swinhoe; *C. tectorum*, Jerdon),* which inhabits the Nága and Garo hills, was obtained

* Ibis, 1871, pl. x.; Gould, B. As. pt. xxiv. pl. 15.

by Mr. Swinhoe in Hainan, and was originally described by Mr. Sclater from Borneo. It is somewhat remarkable that *C. subfurcatus*, nobis,* has not hitherto been observed in the Indo-Chinese countries, though a resident species at Pinang. The allied western species (*C. affinis*), so common in India, is, however included by Mason.

[The title, *C. batassiensis*, J. E. Gray (Cuv. An. King. (Griffith), *Aves*, ii. p. 60, 1829), founded on Latham's *Balassian Swift* (Gen. Hist. vii. p. 329), takes precedence over *C. palmarum*, J. E. Gray (Hardw. Ill. Ind. Zoo. i. pl. 35, fig. 1, 1832).]

[166. C. INFUMATUS.

C. infumatus, Sclater, P. Z. S. 1865, p. 602.

Tonghoo (*W. R.*); very common in Upper Pegu (*O.*); common in Tenasserim (*Hume*).]

167. COLLOCALIA FUCIPHAGA (J. 103).

Hirundo fuciphaga, Thunberg; Wallace, P. Z. S. 1863, p. 384; Ibis, 1863, p. 323; 1866, p. 341; *C. linchi*, apud Ball, J. A. S. B. xli. pt. 2, p. 376.

Arakan, Tenasserim, Andamans.

"The Swiftlets which build the edible nests," remarks Mason, "are so numerous in the limestone caves on the islets and islands of the Tavai coast, that the Government revenue from the birds'-nest farm in 1847 was nearly eleven thousand rupees; but in 1849 it was more than four thousand rupees less. At Mergui they are not so numerous."

[As has been elsewhere shown (Ibis, 1874, p. 132), this Swift must take the title of *francica*, Gm. Mr. Wallace was the first author who published the opinion that examples from India, Ceylon, Bourbon, Mauritius, the whole of the Malay islands, the Louisiade Archipelago, New Caledonia, Tahiti, and the Marianne islands, do not specifically differ. That naturalist not considering the variations in size and slight variations in colouration which are to be found occurring sufficient to justify specific separation. Examples (*C. spodiopygia*) from Ovalau and Mango island (Fiji) can hardly be separated.]

168. C. LINCHI.

C. linchi, Horsfield; Wallace, P. Z. S.; *Voy.* "*Novara*," 1863, p. 384, Vögel, t. ii. f. 2.

Mergui Archipelago, Nicobars, Java, etc.

[This is the true *Hirundo fuciphaga*, Thunb.]

* J. A. S. B. xviii. p. 807.

*169. MACROPTERYX CORONATUS (J. 104).

Hirundo coronata, Tickell; Gould, B. As. pt. xi. pl. 2.

Pegu, Siam. Replaced by *M. klecho* in the Malayan peninsula.

[Thayet Myo, Tonghoo, Karen nee, at 1700 feet (*W. R.*); Ngabeemah, pine forests north of Kollidoo, Henza Basin* (*D.*).]

Suborder PASSERES.

Fam. Corvidæ.

Crows, Jays, etc.

*170. CORVUS VAILLANTII (J. 660).

Corvus vaillantii, Lesson.

Arakan, Tenasserim, Malacca. Generally diffused in pairs throughout the forests.*

[Pegu (*O.*).]

*171. C. SPLENDENS (J. 663).

Kyie-gan.

At Akyab this Crow abounds, and also (as I was informed by Mr. W. T. Blanford) at Mandell, high up the Irawádi. At Khyouk Phoo, a party of seven individuals made their appearance on the 7th December, 1856, which subsequently stocked the neighbourhood; but to what extent the race may have spread at the present time I am unaware. Elsewhere in Arakan this Crow has still no representative; but across the mountains which divide that province from Pegu, again at Rangoon, Moulmein, Tavoy, and as far South as Mergui, as also in Siam, it is replaced by a wholly black race, quite similar in form and habit, but having a much shriller voice (a sort of *shrieking* caw), if possible still more inharmonious than that of the other. There is just a very faint tinge of ash-colour on the nape and breast, where the common Indian Crow is cinereous; but this must be specially looked for to be remarked. Though abundant about Mergui station, I have not seen it from any locality further south; and I have been assured that it does not occur at Pinang, Malacca, or Singapore. This melanoid race of *C. splendens* is erroneously referred to *C. culminatus* (i.e. *C. vaillantii*) by Mason, as it also

* For variation of size in this species, *cf.* W. T. Blanford, J. A. S. B. li. pt. 2, p. 68.

is by the late Sir R. H. Schomburgk.* Sir A. Phayre, referring to it as the common Crow of the branches of the Irawádi, states that "away from the river, on the hills, there is a Crow of the same size, but not with the same tinge on the neck, being of an uniform black throughout."† As regards the Indian bird, an unknown donor has favoured me with two skins differing remarkably in size, but in no other respect. Length of closed wing 11 in. in the larger specimen, 10 in. in the smaller; of middle tail-feathers, respectively, 6½ in. and 5½ in; tarsus 1¾ in. and 1½ in. Some Ceylon specimens now (1872) living in the London Zoological Gardens are decidedly smaller, and rather darker coloured than Bengal or Akyab specimens; and I have seen other specimens from Ceylon, which again were darker coloured and approximately melanous ‡

[Rangoon, Tonghoo (*W. R.*). The melanoid variety referred to has recently been separated and named *C. insolens*, Hume (Str. Feath. ii. p. 480). The late Mr. G. R. Gray (H. List, ii. p. 14) restricted Vieillot's title of *splendens* (erroneously referring it to Temminck) to a supposed Javan and Sumatran species of *Corvus*, and adopted Hodgson's title of *impudicus* for the Indian. The type of *Le Choucas gris du Bengale*, *C. splendens*, Vieillot (N. D. viii. p. 441, 1817), came from the Indian continent, and no representative race even of that species is known as existing in either Java or Sumatra, Temminck's statement notwithstanding. *C. impudicus*, Hodgson, must continue, as hitherto, a synonym of *C. splendens*, Vieillot. Another curious variety of this Crow occurs in Tonghoo. Two examples of it are of an isabelline cream colour; the urapygium and abdomen being dark brown. I do not, however, propose to name it as belonging to a distinct species.]

Magpie Group.

172. Pica media.

Pica media, Blyth, J. A. S. B. xiii. p. 393; *P. sericea*, Gould; *P. caudata*, apud J. Anderson, Exped., p. 259.

Bhamŏ, China, Hainan, and Formosa.

* Ibis, 1864, p. 252.

† J. A. S. B. xxii. p. 76, xxiv. p. 479.

‡ Some time ago I received a packet containing two skins of *C. splendens*, coloured as in India. Wing, respectively 11 in. and 9½ in.; tail, 6½ and 5½ in.; beak to forehead 2 in. and 1¾ in. The latter are probably the admeasurements of the Ceylon race.

*173. DENDROCITTA RUFA (J. 674).

Common throughout the Irawádi valley, in Pegu (*Blanford*); also in the vicinity of Moulmein.

[Rangoon, Tonghoo, Yey-tho (*W. R.*); Thayet Myo (*F.*); Tenasserim provinces (*D.*).]

*174. D. HIMALAYENSIS (J. 676).

D. himalayensis, nobis, Ibis, 1865, p. 45.

Mountains of Arakan, and probably those of the Indo-Chinese countries generally.

[Tonghoo hills, Karen nee (*W. R.*); north of Pahpoon (*D.*).]

*175. CRYPSIRHINA VARIANS.

Corvus varians, Latham; Lev. *Ois d'Afr.* pl. 56; *Phrenotrix temia*, Horsfield, Zool. Res. in Java, pl. —.

Prome, Bassein, common in the neighbourhood of Moulmein, Lower Siam, Java. I have never seen this species from the Malayan peninsula, though it is cited from Malacca by Herr v. Pelzeln, which I strongly suspect to be a mistake.

[Rangoon, Tonghoo, Yey-tho (*W. R.*); Tenasserim provinces (*D.*). The Malaccan habitat is certainly erroneous. This is another peculiar Javan species, which re-appears north of Province Wellesley. It has long since been compared and specifically identified with Javan individuals.]

*176. C. CUCULLATA.

C. cucullata, Jerdon, Ibis, 1862, p. 20; Gould, B. As. pt. xv. pl. 3.

Thayet Myo, and the dry country above the British frontier. Not seen in Lower Pegu (*Blanford*).

[Thayet Myo (*W. R.*).]

[177. TEMNURUS LEUCOPTERUS.

Glaucopis leucopterus, Tem. P. C. 265.

Meeta Myo (*D.*).]

*178. UROCISSA MAGNIROSTRIS.

Psilorhinus magnirostris, nobis; Gould, B. As. pt. xiii. pl. 3.

Mountains of Arakan, Tenasserim, Siam.

[Tonghoo, Karen nee (*W. R.*).]

*179. Cissa sinensis (J. 673).

Coracias chinensis, Bodd.; Gould, B. As. pt. ix. pl. 8.

Arakan, Tenasserim provinces, China (?).

[Tonghoo, Karen hills (*W. R.*); Thayet Myo (*O.*).]

[180. Garrulus leucotis.

G. leucotis, Hume, P. A. S. B. 1874, p. 106.

Tonghoo, Karen nee; very generally distributed both in the hills and in the plains of the Tonghoo province (*W. R.*).]

Fam. **Sturnidæ.**

Starling family.

Subfam. Eulabetinæ (True Mainas).

*181. Eulabes intermedia (J. 693).

Gracula intermedia, A. Hay; cf. Stoliczka, J. A. S. B. xxxix. pt. 2, p. 327.

Arakan, Tenasserim provinces, Siam. The common "Hill Maina" of Northern India; that of the Andaman and Nicobar Islands now considered to be different.

[Rangoon, Tonghoo (*W. R.*). Perfectly distinct from *E. javanensis*.]

182. Ampeliceps coronatus.

Ampeliceps coronatus, nobis, J. A. S. B. xi. p. 194, xv. p. 32; Gray and Mitchell, Gen. Birds, pl. 81.

Tonghoo, Yé, Mergui, Cochin China.

[Tonghoo (*L.*); South of Moulmein (*D.*).]

Subfam. Sturninæ (Starlings, etc.).

*183. Acridotheres tristis (J. 684).

Za-yet-mouk.

Arakan, Pegu, Tenasserim.

[Rangoon (*W. R.*); Thayet Myo (*O.*).]

*184. A. ginginianus (J. 685).

Tenasserim provinces. Though common in Upper India, as remarked by Jerdon, "it certainly does not occur in Southern India, notwithstanding its specific name, taken from Gingi, south of Madras."

*185. A. FUSCUS (J. 686 *partim**).

Arakan, Tenasserim, Pinang, Malacca, Hainan.

[Rangoon, Tonghoo (*W. R.*).]

[186. A. SIAMENSIS.

A. siamensis, Swinhoe, P. Z. S. 1863, p. 303.

"Karen nee, at 3000 feet. Iris, pale chocolate; bill, orange-yellow; legs, dusky yellow" (*W. R.*).]

*187. STURNOPASTOR CONTRA (J. 683).

Sturnopastor contra, var. *superciliaris*, nobis, J. A. S. B. xxxii. p. 77.

Khásias, Thayet Myo, Tavoy, Siam.

About Tavoy it is particularly abundant, and, as Mason remarks, "is often seen perched on the back of the Buffalo, gathering insects."

[Tonghoo (*W. R.*).]

188. S. NIGRICOLLIS.

Gracula nigricollis, Paykull, Act. Holm. xxviii. pl. 9; *Pastor temporalis*, Tem.

Bhamo, Lower Siam, South China.

189. STURNIA BURMANNICA.

Sturnia burmannica, Jerdon, Ibis, 1862, p. 21; *Pastor peguanus*, Lesson, (?) the young (?).

Thayet Myo and Ava; more common above the British frontier than below it (*Blanford*).

[Tonghoo, Karen nee, Thayet Myo (*W. R.*). A sordid tawney-white albino variety of this species is among the Thayet Myo examples.]

*190. S. PAGODARUM (J. 687).

Arakan.

*191. S. MALABARICA (J. 688).

Arakan, Pegu, Tenasserim.

[This species does not appear to inhabit Upper Pegu, being replaced by the following.]

* The true *A. mahrattensis* (Sykes), of South India, has been received at the London Zoological Gardens. It has the bill wholly yellow, white irides; a less developed frontal crest, and more of white tipping the middle tail-feathers. *A. leucocephalus*, a very distinct species, from Cochin China, is described in the Ibis, 1870, p. 185. Another allied species from Siam is distinguished by Mr. Swinhoe as *A. siamensis* (P. Z. S. 1863, p. 303).

192. S. NEMORICOLA.

S. nemoricola, Jerdon, Ibis, 1862, p. 22.

Thayet Myo.

[Rangoon, Tonghoo (*W. R.*). *T. leucopterus*, Hume (Str. Feath. ii. p. 480, note) appears to be synonymous.]

193. S. SINENSIS.

Oriolus sinensis, Gmelin; Pl. Enl. 617; *Pastor elegans*, Lesson, Bélanger, Voyage, pl. 6.

Pegu (*Lesson*); China.

[That this species winters in Pegu is suggested by Mr. Swinhoe (P.Z.S. 1871, p. 384), but the fact has yet to be established.]

194. CALORNIS DAURICA.

Turdus dauricus et *Gracula sturnina*, Gmelin; *Pastor malayensis*, Eyton; Pl. Enl. 627, fig. 2.

Mergui, Malacca, Dauria.

[This bird can hardly be placed in the genus *Calornis*. It is more nearly allied to the members of *Sturnia*. Its oldest specific title is *sturnina*, Pallas. It is difficult to decide what species is meant to be depicted in Pl. Enl. 627, fig. 2.]

195. C. AFFINIS.

C. affinis, A. Hay, J. A. S. B. xv. pp. 36, 369.

Tippera, Arakan, Nicobar Islands.

196. C. CHALYBEA.

Turdus chalybeus et *T. strigatus*, Horsfield; *T. insidiator*, Raffles, Tem. P.C. 199. figs. 1, 2.

Mergui, Malacca, Sumatra, Java.

[If the Mergui *Calornis* belongs to the Malaccan and Sumatran species, it must take the title of *insidiator*, Raffles, until it has been shown that the Javan *Calornis* belongs to the same species.]

[197. SARAGLOSSA SPILOPTERA (J. 691).

Karen hills at 2000 feet, Tonghoo (*W. R.*).]

Fam. **Ploceidæ.**

Weaver-Birds.

198. PLOCEUS JAVANENSIS.

Loxia javanensis, Lesson, Traité, p. 446.

Pegu, Siam, Java, Lombok. Observed by myself in Rangoon station.

[Rangoon, Tonghoo (*W. R.*); Thayet Myo (*O.*).]

*199. P. PHILIPPINUS (J. 694).

P. baya, nobis; *cf.* W. T. Blanford, J. A. S. B. xli. pt. 2, p. 167. *Tsa-ghaung-kwet*.

Arakan, Lower Pegu, Malacca, Sumatra, not Philippines. Attaches its pensile nests to the projecting thatch of dwelling-houses in Rangoon, as duly noticed by Jerdon.

[Rangoon, Tonghoo (*W. R.*); Thayet Myo (*O.*).]

*200. P. MANYAR (J. 695).

Arakan, Thayet Myo, Siam, Java.

201. P. BENGALENSIS (J. 696).

Thayet Myo, Ava.

Fam. **Astrildidæ**.

Waxbills, Amadavats, etc.

202. PADDA ORYZIVORA.

Loxia oryzivora, Lin.; Edwards, pl. 41.

The well-known "Java Sparrow" of British dealers in birds, which is extensively diffused over the Malay countries, was procured in Mergui province by Major Berdmore. Mr. Swinhoe notices it from Amoy, Hong-kong, and Shanghai; but in the vicinity of those emporia it has probably escaped from captivity in the first instance, as it likewise has in that of Madras, in Madagascar, Zanzibar island, the Seychelles, St. Helena, Celebes, and the Philippines.

*203. MUNIA RUBRINIGRA (J. 698).

Arakan, Pegu, Tenasserim, South-west China. Common. Bornean specimens are similar to Indian and Burmese, having the black of the abdominal region and lower tail-coverts well developed; but this black is much reduced in quantity, and sometimes nearly obsolete, in examples from Malacca and Sumatra. In the race inhabiting Celebes (*M. brunneiceps*, Walden), the black beneath is well developed, while that on the head and neck is much embrowned. The race with white underparts, having the black abdominal patch and lower tail-coverts (Edwards, pl. 355), has never been observed eastward of the Bay of Bengal, but occurs rarely in Lower Bengal, and prevalently (if not wholly) in South India and Ceylon. *M. formosana*, Swinhoe,* is yet another of these very slightly differing races, for which names are barely admissible.

[Tonghoo (*W. R.*).]

* Ibis, 1865, p. 356.

*204. M. punctularia (J. 699).

Arakan, Pegu, Tenasserim, Siam. The true Indian race, as distinguished from the kindred *M. nisoria* (Tem.), which inhabits the Malayan peninsula, and has ash-coloured upper tail-coverts.

[Rangoon, Tonghoo (*W. R.*). The Burman spotted *Munia*, as represented by Mr. Ramsay's examples, belongs to *M. sub-undulata*, Godwin-Austen (J. A. S. B. xliii. p. 370, May 6, 1874), *M. superstriata*, Hume (Str. Feath. ii. p. 481, note, Oct. 1874), being a synonym.]

*205. M. acuticauda (J. 702).

Arakan, Tenasserim, Siam, Malacca, Sumatra, China, Formosa. This species is the *Fringilla muscardina* of the Leyden Museum, a systematic name which is adopted for it by Mr. Gould.* In Japan it is extensively bred, white, partially white, and of pale colouring.

[Tonghoo hills (*W. R.*); Thayet Myo (*O.*). I cannot find that Mr. Gould employed the title of *muscardina* in any part of the Z. S. Proceedings of 1859.]

*206. M. leuconota (J. 701).

Tau-tsa, "Forest Sparrow."

Arakan. Of general diffusion.

207. Astrilda amandava (J. 704).

Mason includes this species (the common Speckled Waxbill, Amadávat, or *Lál Muniá* of India) without remark; and Sir R. H. Schomburgk notices its occurrence in Siam, as also Mr. Gould (from specimens sent by Schomburgk).† "Many are brought to Bangkok for sale. They frequent the rice-fields and pastures, and go in flocks." I do not remember having seen Burmese specimens; but Jerdon notices that the range of the species extends to Assam and Burma, which Mr. W. T. Blanford assures me is the fact.

Fam. **Fringillidæ.**

True Finches.

Subfam. Passerinæ (Sparrows).

*208. Passer indicus (J. 706).

P. domesticus, var. (?), Ibis, 1867, p. 41. *Ein-tsa* (House Sparrow).

Not uncommon at Akyab, but rare to the southward, in the jungle-clad provinces. Common, together with *P. montanus*, at Thayet Myo. Nubian specimens are undistinguishable.

* P. Z. S. 1859, p. 150. † P. Z. S. 1859, p. 150.

*209. P. MONTANUS (J. 710).

The common house Sparrow everywhere to the eastward of the Bay of Bengal, its range extending southward to the Malay countries, and eastward to China and Japan, Formosa, and the Philippines.

*210. P. ASSIMILIS.

P. assimilis, Walden, An. M. N. H. (4), v. p. 218.

Tonghoo.

*211. P. FLAVEOLUS.

P. flaveolus, nobis, J. A. S. B. xxxi. p. 344. *Passer jugiferus*, Tem., Bonap. Consp. Av. i. p. 508.

Arakan, Upper Pegu; "abundant in the bushes near Thayet Myo; also common further up the Irawádi" (*W. H. Blanford*). Doubtful as an inhabitant of the Philippines, as alleged of *P. jugiferus*, which I identified with the present species in the Royal Museum of Natural History at Leyden. According to Mason, this species "is found throughout the country," but he shows that he did not recognize *P. montanus* to be the common Sparrow of the country!

["Iris, in ♀, brown; bill above, pinkish brown, below somewhat paler; legs brownish. Karen nee" (*W. R.*). One example, a female, has the mandibles crossed as in *Loxia*, the maxilla to the left, the mandible to the right.]

Subfam. FRINGILLINÆ (Typical Finches).

*212. CARPODACUS ERYTHRINUS (J. 738).

Arakan.

[Tonghoo (*W. R.*).]

Subfam. EMBERIZINÆ (Buntings).

*213. EUSPIZA AUREOLA (J. 723).

Arakan, Pegu, Tenasserim, China. Occurs in large flocks in the interior, which migrate northward to breed.

[Tonghoo (*L.*). *Mirafra flavicollis*, McClell., as long since stated by Horsfield and Moore, is the female. *E. flavogularis*, Blyth, is also synonymous. In the H. List, No. 7679, McClelland's title is made to represent a distinct species, and that of Mr. Blyth is treated as a synonym of *M. flavicollis*.]

214. Emberiza rutila.

Emberiza rutila, Pallas; Tem. and Schl., Fauna Japonica, Aves, tab. 56B.

A single specimen procured by Mr. W. H. Blanford, near Bassein. Another since obtained at Sikhim.

[Tonghoo, Karen nee, Tsankoo hills (*W. R.*); neighbourhood of Pahpoon (*D.*).]

[215. E. fucata (J. 719).
Tonghoo, Thayet Myo, in winter (*O.*).]

[216. E. pusilla (J. 720).
Karen nee, at 5500 feet (*W. R.*).]

*217. Melophus melanicterus (J. 724).
Arakan, Pegu, Siam, South China.
[Karen nee (*W. R.*).]

Fam. **Alaudidæ.**

Larks.

*218. Alauda gulgula (J. 767).
Sent from Arakan, where probably not common. It is likely to be so in Upper Burma.

219. Alaudula raytal (J. 762).
"Abundant on the banks of the Irawádi, in Upper Burma, frequenting the sand-dunes, to the colour of which its own plumage closely approximates. During the height of the flood of the Irawádi, I observed it feeding on the roads and plains in the station of Thayet Myo in small parties" (*Jerdon*).

*220. Mirafra assamica (J. 754).
Arakan.

221. M. affinis (J. 755).
Common at Thayet Myo (*W. H. Blanford*).
[*M. microptera*, Hume (Str. Feath. i. p. 483), is synonymous.]

Fam. **Motacillidæ.**

Wagtails and Pipits.

*222. Corydalla richardi (J. 599).
Arakan.
[Tonghoo, Karen nee (*W. R.*); Pahpoon, Tavoy, Moulmein (*D.*).]

*223. C. RUFULA (J. 600).

Arakan, Tenasserim.

[Rangoon, Tonghoo (*W. R.*).]

*224. PIPASTES MACULATUS (J. 596).

Anthus maculatus, Hodgs.; Gould, B. As. pt. xvii. pl. 11; Fauna Japonica, Aves, pl. xxiii.

Arakan, Tenasserim. *Anthus agilis*, Sykes, is true *P. trivialis*.

[Karen nee hills, from 2000 to 5200 feet elevation (*W. R.*). Some eminent ornithologists decline to admit the specific distinction of *A. agilis*, *A. maculatus*, and the common European Tree Pipit. In the H. List, No. 3640, L. S. Müller's title of *plumatus* is adopted for the European bird. But as Linnæus published the twelfth edition of the Systema ten years before L. S. Müller bestowed the title cited, it is more in accordance with accepted practice to prefer the Linnæan title.]

*225. ANTHUS ROSACEUS (J. 605).

Arakan.

[226. A. CERVINUS.

Motacilla cervina, Pallas, Zoogr. Rosso-As. i. p. 511.

Examples obtained by Mr. Davison in Tenasserim are thus identified by Mr. Hume.]

*227. BUDYTES VIRIDIS (J. 593).

Motacilla cinereicapilla, Savi, N. Giorn. d. Lett. p. 190.

Arakan, Tenasserim. Bengal and Egyptian specimens quite similar.

[Rangoon, Tonghoo, Karen nee at 3000 feet elevation (*W. R.*).]

[228. B. CALCARATUS (J. 594).

A single immature example obtained at Pahpoon by Mr. Davison is thus identified by Mr. Hume.]

*229. LIMONIDROMUS INDICUS (J. 595).

Motacilla indica, Gm.; Gould, B. As. pt. xiv. pl. 13.

Arakan, Tenasserim, Malacca, China.

[Thayet Myó (F.).]

*230. MOTACILLA LUZONENSIS (J. 590).

Arakan, Tenasserim.

[Tonghoo (*W. R.*). The black-backed, white-faced species, is referred to under the above title. But strictly Sonnerat described the grey-backed

bird. While Scopoli in his diagnosis, taken from Sonnerat, misquoted the description, and converted the word "grey" into black." The members of this section of the genus which inhabit Luzon have not hitherto been examined, and it therefore remains quite uncertain from what species Sonnerat described. It is not improbable that he did so from an Indian example *M. dukhunensis.*]

[231. M. DUHUNENSIS (J. 591).
Tonghoo, Karen nee (*W. R.*); Pahpoon (*D.*).]

*232. M. BOARULA (J. 592).
Arakan, Tenasserim, Malacca.
[Rangoon (*W. R.*). Whether or not specifically distinct from *M. sulphurea* of Europe, this bird must take the title of *melanope*, Pallas.]

Fam. **Henicuridæ.**

Henicures.

*233. HENICURUS GUTTATUS (J. 584, *partim*).
Enicurus guttatus, Gould, P. Z. S. 1865, p. 664; B. As. pt. xviii. pl. 11.
East Himalaya, Khásias, Arakan.

*234. H. IMMACULATUS (J. 585).
Khásias, Arakan, Tenasserim.
[Thayet Myo (*O.*).]

*235. H. SCHISTACEUS (J. 586).
Arakan, where much less common than the preceding race; Tenasserim, China.
[Karen hills (*W. R.*).]

[236. H. LESCHENAULTI.
Turdus leschenaulti, Vieill. N. D. 20, p. 269.
This Javan and Foochow bird is stated by Mr. Hume to have been obtained in the neighbourhood of Pahpoon and at Meeta Myo. If the identification is correct, an interesting fact. It may perhaps be *H. frontalis.*]

Fam. **Brachyuridæ.**

Pittas.

*237. HYDRORNIS NIPALENSIS (J. 344).
Hydrornis nipalensis, Hodgson; Gould, B. As. pt. i. pl. 2.
Arakan, Tenasserim.

[238. H. OATESI.

H. oatesi, Hume, Str. Feath. i. p. 477.

"Karen nee, from 2500 to 4000 feet. Iris (male not quite mature), brown; bill, pale brown; legs, light fleshy pink. Iris (in adult female), brown; bill, dark vinous brown; legs, light fleshy pink" (*W. R.*).]

*239. BRACHYURUS CYANEUS.

Pitta cyanea, nobis, J. A. S. B. xii. p. 1008, xvi. p. 153; Gray and Mitchell, Gen. Birds, pl. 55; Gould, B. As. pt. i. pl. 2*a*; D. G. Elliot, Mon. Brachyuridæ, pl. xiii. *Myat-gnung.*

Arakan, Martaban; Tenasserim (*Helfer*).

[Karen hills, at 2000 feet. Iris, hair brown; bill, black; legs, fleshy (*W. R.*).]

*240. B. MOLUCCENSIS.

Turdus moluccensis, P. L. S. Müller; Elliot, Ibis, 1870, p. 413; Mon. Brachyuridæ, pl. iv.; *Pitta cyanoptera*, Temminck, P.C. 218.

Arakan, Tenasserim, Siam, Malacca, Sumatra, Java, Borneo, South China (Amoy). One specimen, received from Arakan, has the bill fully as large as in *B. megarhynchus* (Schlegel), from the Isle of Banka.*

[Rangoon (*W. R.*); Thayet Myo (*D.*). There is no evidence in favour of the Javan habitat attributed to this *Pitta* by Temminck. The size of the bill varies considerably.]

[241. B. MEGARHYNCHUS.

Pitta megarhyncha, Schlegel, Vog. Nederl. Ind. *Pitta*, p. 32, no. 8, pl. 4. fig. 2.

A well-marked species, hitherto known as being peculiar to the island of Banka, but stated by Mr. Hume (Str. Feath. ii. p. 475) to occur at Tavoy and Amherst in the months of May, June, and July.]

*242. B. CUCULLATUS (J. 346).

Nipâl, Khâsias, Arakan, Malacca.

[Rangoon (*W. R.*); Thayet Myo (*F.*); Amherst (*D.*). Malaccan individuals are identical with Himalayan and Burman examples.]

Fam. **Turdidæ.**

Thrushes.

Subfam. TURDINÆ.

*243. MYIOPHONUS TEMMINCKII (J. 343).

Khâsias, Arakan, Tenasserim.

[Karen hills (*W. R.*). *M. eugenei*, Hume (Str. Feath, i. p. 475) is synonymous. *M. temminckii* extends to Siam.]

* Ibis, 1870, pl. xii.

[244. Brachypteryx cruralis (J. 338).
Karen nee, 5000 feet (*W. R.*).]

[245. Pnoepyga squamata (J. 329).
Karen nee, at 4000 feet (*W. R.*).]

*246. Petrocossyphus cyaneus (J. 351).

Arakan, Tenasserim. Generally, but not always, with more or less of ferrugineous colouring on the abdominal region, as in specimens from the East Himalaya. "In Burma," remarks Colonel M'Master, "this is the tamest and most confiding bird I have ever seen; it not only frequently enters the verandahs, but the inner rooms of houses, and is almost startling with its noiseless and uncanny familiarity. Whilst at Tonghoo, I had, every season, one or two of them about my house, so fearless, that they might almost have been handled. I saw one, in my verandah at Rangoon, kill and swallow a large scorpion."*

[Karen hills, from 2000 to 4000 feet (*W. R.*).]

247. Monticola saxatilis.

Turdus saxatilis, L.; Pl. Enl. 562.

"Upper Burma, on the banks of the river near Ava."† "Summers on the Pekin mountains" (*Laird*).

*248. Orocoetus cinclorhynchus (J. 353).

Arakan.

*249. Geocichla citrina (J. 355).

Arakan.

[Tonghoo, Karen nee (*W. R.*); Thayet Myo (*O.*); neighbourhood of Ye and Amherst (*D.*).]

*250. Turdus obscurus.

Turdus obscurus, Gmelin; *T. pallens*, Pallas; *T. rufulus*, Drapiez; *T. modestus*, Eyton;‡ Fauna Japonica, Aves, pl. xxvii. *Myai-lu-hgnet.*

Khásias, Arakan, Andamans, Malacca, Java, Borneo, China, and North-East Asia, according to season.

[251. T. pallidus.

T. pallidus, Gm. S. N. i. p. 815.

Karen nee, at 5000 feet in January (*W. R.*). Has also been received by Major Godwin-Austen from N. Cachar.]

* J. A. S. B. xl. pt. 2, p. 211. † *vide* Blanford, Ibis, 1870, p. 466.

‡ Not *T. javanicus*, Horsfield, which is the same as *T. fumidus*, S. Müller.

[252. T. SIBERICUS.

T. sibericus, Pallas, Reise, Russ. Reichs, iii. p. 694, no. 10.

Karen nee, March 1, at 2500 feet. Iris (in female), rich brown; bill, black, slightly yellow at gape; leg, brownish yellow (*W. R.*).]

*253. ZOOTHERA MARGINATA.

Zoothera marginata, nobis, J. A. S. B. xvi. p. 141.*

Khásias, Arakan.

["Karen nee, from 1500 to 3000 feet. Iris (♂, ♀), dark brown; maxilla, dark brown, almost black; basal half of mandible, albescent; legs, brown with a tinge of pink; orbital skin, purplish" (*W. R.*).]

[254. OREOCINCLA MOLLISSIMA (J. 370).

Karen nee, at 5000 feet (*W. R.*).]

[255. O. DAUMA (J. 371).

Thayet Myo (*Hume*).]

Subfam. ——

*256. ANTHOCINCLA PHAYREI.

Anthocincla phayrei, nobis, J. A. S. B. xxxi. p. 343.

One specimen procured in Tonghoo. [Pahpoon (*D.*).]

Subfam. SAXICOLINÆ (Wheatears, Robins, etc.).

*257. CITTOCINCLA MACROURA (J. 476).

Arakan, Tenasserim, Malacca, Sumatra, Java. The Hainan race is smaller, according to Mr. Swinhoe.

[Rangoon, Tonghoo, Karen nee, at 1500 feet (*W. R.*).]

*258. COPSYCHUS SAULARIS (J. 475).

Gracula saularis, Lin.; Gould, B. As. pt. xv. pl. 5. *Tha-beik-lway.*

Arakan, Pegu, Tenasserim, Siam, South China.

[Rangoon, Tonghoo, Karen nee (*W. R.*).]

259. MYIOMELA LEUCURA (J. 477).

Procured by Col. Tickell upon Moulè-it mountain, at an elevation of 5500 feet, being probably the same species as was obtained by Bélanger in Pegu, in which case, the kindred Javanese race (*Brachypteryx albifrons*,

* *Z. monticola*, apud Godwin-Austen, J. A. S. B. xli. pt. ii. p. 142.

Boie)* is figured for it by M. Lesson, by the name *Notodela diana*, in the supposition of its being a more brightly coloured specimen of the same bird; the two species being very nearly allied. *M. leucura* has also been obtained in the Khásias.

[Karen nee (*W. R.*). In his text Lesson also describes the Javan bird, and there is nothing to show that he referred to any other species. The genus *Notodela*, of which *Lanius diana*, Lesson, is the type, must, therefore, merge in *Brachypteryx*.]

*260. Rhyacornis fuliginosa (J. 505).
Arakan, Thayet Myo, China.†

[261. Ruticilla aurorea (J. 500).
Thayet Myo (*F.*).]

*262. Chæmarrhornis leucocephalus (J. 506).
Arakan.

*263. Cyanecula suecica (J. 514).
Arakan.

*264. Calliope camtschatkensis (J. 512).
Arakan.
[Karen nee (*W. R.*); Thayet Myo (*F.*); Pahpoon (*D.*).]

[265. Larvivora cyane.
Motacilla cyane, Pallas, Reise Russ. Reichs, iii. p. 697, no. 18.
Pahpoon (*D.*).]

266. Brachypteryx ——— (?).
From Zwagaben mountain, described by Lieut. Beavan.‡

267. Oreicola jerdoni (J. 487).
Rhodophila melanoleuca, Jerd.; Gould, B. As. pt. xviii. pl. 11.
"Obtained only once, in long elephant-grass, in the northern portion of the Bassein district" (*W. H. Blanford*).

*268. Pratincola ferrea (J. 486).
Arakan, Pegu, Tenasserim, South China.
[Tonghoo, Tonghoo hills, Karen nee, at elevations of from 2500 to 4000 feet (*W. R.*).]

* Bonap. Consp. Av. i. p. 257.
† *R. aurorea* has been received both from the Khâsias and the Malayan peninsula.
‡ Ibis, 1870, p. 321.

*269. P. CAPRATA (J. 481).

Lay-khya.

Arakan, Tenasserim, Java, Celebes, Lombock, Floris, Philippines, Timor.

[Tonghoo, Yey-tho, Karen nee, at 3500 feet (*W. R.*); Thayet Myo (*O.*).]

*270. P. INDICA (J. 483).

P. indica, nobis; Gould, B. As. pt. xv. pl. 12.

Arakan, Pegu, Tenasserim.

[Rangoon, Tonghoo (*W. R.*). It has been shown most conclusively by Mr. Dresser (B. Eur. Dec. 1873) that the Asiatic Stonechat cannot be specifically separated from the European. Mr. Blyth's title must therefore give way to that of *P. rubicola* (Lin.).]

271. P. LEUCURA (J. 484).

P. leucura, nobis; Gould, B. As. pt. xviii. pl. 12.

"Banks of the Irawádi, near Thayet Myo, and throughout Upper Burma. Common, and a constant resident" (*W. H. Blanford*).*

[Tonghoo (*L.*).]

Fam. **Muscicapidæ.**

Chat-flycatchers.†

272. NILTAVA GRANDIS (J. 316).

Chaïtaris grandis, nobis; Gould, B. As. pt. ii. pl. 4.

Tenasserim mountains.

*273. N. SUNDARA (J. 314).

N. sundara, Hodgson; Gould, B. As. pt. ii. pl. 5.

Mountains of Arakan and Tenasserim.

[Karen nee, at 4000 feet (*W. R.*).]

[274. N. MACGRIGORIÆ (315).

Phœnicura macgrigoriæ, Burton; Gould, B. As. pt. ii. pl. 6; *Niltava vivida*, Hume, Str. Feath. ii. p. 475.

[Karen nee, at 3000 feet (*W. R.*); three days south of Pahchaun (*D.*).

* Query *Saxicola hemprichii* (?), Ehrenberg, Symb. Phys., fol. *aa*. [The characters which distinguish *P. leucura* from *P. hemprichii* will be found stated by Mr. Dresser, B. Eur., *sub P. rubicola*.]

† These Chat-flycatchers, with mottled nestling plumage, intergrade much with the preceding subfamily.

Karen examples identical with Himalayan, etc. The Tenasserim bird has been separated under the title cited, from being "altogether brighter than the Himalayan species." No other character (?) is mentioned.]

*275. CYORNIS RUBECULOIDES (J. 304).

Arakan, Pegu, Tenasserim provinces.

[Rangoon, Tonghoo hills, Karen nee, from 600 to 2000 feet (*W. R.*). Many of my Burman examples, and also some from Ceylon, have the dark blue of the throat divided by the rufous colouring of the breast running up almost to the chin. Examples obtained in the neighbourhood of Pahpoon and Ye are identified by Mr. Hume as belonging to *Cyornis elegans* (Tem.); an identification, judging by his remarks (Str. Feath. iii. p. 104, *sub C. rubeculoides*), which requires confirmation. *Cf.* Walden, Ibis, 1872, p. 373.]

[276. C. TICKELLI (J. 305, 306).

C. tickelli, Blyth, J. A. S. B. 1842, p. 491.

Karen nee (*W. R.*).]

*277. SIPHIA STROPHIATA (J. 319).

Arakan, Tenasserim.

[278. S. ERYTHACA (J. 322).

S. erythaca, Blyth & Jerdon, P. Z. S. 1861, p. 201.

Karen hills, at 4000 feet (*W. R.*); pine forests north of Pahpoon (*D.*).]

*279. ANTHIPES MONILIGER (J. 317).

Arakan, Tenasserim.

[Karen nee, at 5000 feet (*W. R.*).]

*280. ERYTHROSTERNA MACULATA (J. 326).

Arakan, Tenasserim, Java.

[Karen nee, at from 3000 to 5000 feet (*W. R.*).]

*281. E. LEUCURA (J. 323).

Arakan, Pegu, Tenasserim, Hainan. Very common about Akyab in the cold season; obtained also at Bassein.

[Rangoon, Karen hills (*W. R.*).]

282. E. ACORNAUS? (J. 325).

Zwagaben.*

[Karen nee, at 2500 feet (*W. R.*). *E. sordida*, Godwin-Austen, is the female of some species of *Xanthopygia*, perhaps of *X. narcissina*, but from which the type slightly differs.]

* Beavan, Ibis, 1870, p. 320.

*283. Eumyias melanops (J. 301).
Arakan, Tenasserim.
[Karen nee, at from 700 to 5000 feet; frequents rocky hills (*W. R.*).]

*284. Butalis latirostris (J. 297).
Arakan, Malacca, Sumatra, China.
[Tonghoo (*W. R.*); Pabyouk and Meeta Myo (*D.*).]

*285. B. sibiricus (J. 296).
Muscicapa sibirica, Gmelin; *cf.* W. E. Brooks, J. A. S. B. xli. pt. 2, p. 75.
Arakan.
[Tonghoo hills, Karen hills at 700 feet, in December, a young bird (*W. R.*).]

286. B. ferrugineus (J. 299).
Thayet Myo, Hainan, South China.

Fam. **Sylviidæ.**

Warblers.

*287. Arundinax aëdon (J. 518).
Arakan, Tenasserim, China.
[Tonghoo (*W. R.*).]

*288. Acrocephalus brunnescens (J. 515).
Arakan.
[Hemprich & Ehrenberg's specific title, *stentorea*, has precedence.]

*289. A. dumetorum (J. 516).
Arakan.

[290. A. bistrigiceps.
A. bistrigiceps, Swinh., Ibis, 1860 (January 1st), p. 51. *Salicaria maackii*, Schrenck, Amur Lande, i. pt. ii. p. 370, pl. 12, fig. 4–6 (June, 1860).
Tavoy (*D.*).]

[291. Neornis flavolivacea (J. 552).
A specimen obtained by Mr. Oates in Upper Pegu is doubtfully thus identified by Mr. Hume (Str. Feath. iii. p. 139).]

[292. N. ASSIMILIS.

Horornis assimilis, Hodgs. Cat. B. of Nipaul, Brit. Mus. 2nd ed. p. 143; Blyth, Ibis, 1867, pp. 21, 22; Godwin-Austen, J. A. S. B. 1874, p. 167.

Karen nee (*W. R.*). In all respects identical with Shillong, Naga hills, Assam, and Darjeeling examples, excepting that the entire under-surface is more decidedly tinged with pale sordid yellow. *N. assimilis* can be readily distinguished from *N. flavolivacea*, by its shorter wing and tail, weaker and much shorter bill, and by having the under shoulder-coverts pure sulphur-yellow.]

*293. PHYLLOPNEUSTE FUSCATUS (J. 555).

Horornis fulviventris, Hodgson, P. Z. S. 1845, p. 31.

Arakan, China.

[Yattoun (*O.*); Ye-boo, Pahpoon (*D.*).]

*294. P. BRUNNEUS.

P. brunneus, Blyth, J. A. S. B. xiv. p. 591; *P. maackii*, Schrenck; *cf.* Ibis, 1871, p. 109.

Arakan.

*295. P. MAGNIROSTRIS (J. 556).

P. borealis, Blasius, Naumania, 1858, p. 313; Ibis, 1871, p. 110.

Arakan, China.

[Mr. Hume (Str. Feath. ii. p. 478) includes *P. borealis* as a Tenasserim species, but omits *P. magnirostris*.]

*296. P. VIRIDANUS (J. 560).

P. schwartzi, Radde, Reisen, ii. p. 260, pl. ix. f. 1, a, b, c.

Arakan.

[Neighbourhood of Pahpoon (*D.*).]

[297. P. LUGUBRIS (J. 558).

Pahpoon (*D.*).]

[298. P. BROOKSI.

Phylloscopus brooksi, Hume, Str. Feath. ii. p. 505.

Pahpoon (*D.*).]

299. REGULOIDES TROCHILOIDES (J. 564).

Amherst.

[Karen hills, from 3000 to 4000 feet (*W. R.*); Tonghoo (L.); neighbourhood of Pahpoon (*D.*).]

*300. R. SUPERCILIOSUS (J. 565).

Arakan, Tenasserim.

[Tonghoo, Karen hills, from 700 to 2500 feet (*W. R.*).]

*301. R. PROREGULUS (J. 566).

Arakan.

[Pine forests north of Pahpoon (*D.*).]

302. R. VIRIDIPENNIS (J. 567).

Originally described from the Tenasserim hills, and since obtained plentifully at Darjeeling.

[Karen hills, from 2000 to 4000 feet (*W. R.*).]

[303. R. EROCHROA (J. 568).

Karen nee, Karen nee hills at 3000 feet (*W. R.*).]

*304. ABRORNIS XANTHOSCHISTUS (J. 572).

Arakan.

305. A. SUPERCILIARIS (J. 574).

A. superciliaris, Tickell, J. A. S. B. xxviii. p. 414.

Originally described from the Tenasserim hills, and since found to be common at Darjeeling.

[Tonghoo hills, Karen nee (*W. R.*).]

[306. A. CHRYSEA, n.s.

Above bright oil-green, two broad dark stripes springing from the forehead, passing over the head and descending down the sides of the neck, where they are almost black. A central single stripe thus formed on the head, yellowish-green. A broad stripe, springing near the nostril and passing over the eye, and thus bounding the dark stripe, bright yellow. Ear-coverts mingled black and green. Cheeks, chin, throat, thigh-coverts, under tail-coverts, shoulder-edge, under shoulder-coverts, and axillaries, bright canary-yellow. Breast paler yellow, shading to pale silky grey on the abdominal region and flanks. Quills light brown, edged externally with bright greenish yellow. Major wing-coverts tipped and edged with yellow. Rectrices like the quills, all but the middle pair being edged on their interior margins with very pale yellow. Maxilla brown; mandible pale straw-colour. Wing, 2; tail, 2·75; tarsus, 0·56; bill from forehead, 0·50. Karen hills, ♀ (*W. R.*).

I am not sure whether this is not *Reguloides fulviventer*, Godwin-Austen, a species founded on a carbolized example, in which the green and yellow may have become changed to grey, or altogether discharged.]

*307. CULICIPETA BURKII (J. 569).

Arakan.

[The generic title, *Cryptolopha*, Swainson, is synonymous and has precedence. The Arakan form may possibly belong to the following species.]

308. C. TEPHROCEPHALUS.

C. tephrocephalus, J. Anderson, P. Z. S. 1871, p. 213.

Bhămo.

["Iris, brown; bill, above brown, below yellowish; legs, pale greenish brown, Karen hills, at 3500 feet" (*W. R.*); neighbourhood of Pahpoon (*D.*). Dimensions of the bill in the specimen from the Karen hills equal to those of Darjeeling examples of *C. burkii*.]

Fam. Garrulacidæ.

Babblers.

*309. GARRULAX LEUCOLOPHUS (J. 407).

Khásias, Arakan.

*310. G. BELANGERI.

G. belangeri, Lesson, Bélanger's Voyage, Atlas, t. 4.

Tenasserim provinces.

The Himalayan *G. leucolophus*, the range of which extends to Arakan, the Tenasserim *G. belangeri*, the *G. diardi*, Lesson, = *G. leucogaster*, Walden, of Siam and Cochin-China, and the *G. bicolor*, Lesson, of Sumatra, are mutually representative races or conspecies, but which do not appear to grade into one another. Each in its own range abounds, and from its noisiness is the most prominently conspicuous bird in the forest.

[Tonghoo (*W. R.*); Thayet Myo (*F.*).]

311. G. STREPITANS.

G. strepitans, Tickell, J. A. S. B. xxiv. p. 269.

Tenasserim mountains, where common from 3000 to 5000 feet elevation (*Tickell*).

312. G. CHINENSIS.

Lanius chinensis, Scopoli, Del. Fl. Faun. Insubr. ii. p. 85; *Corvus auritus*, Daudin.

Tenassèrim provinces, also South China. Obtained by myself in Upper Martaban, where observed associating with *G. belangeri*.

[Tonghoo. Iris (♂), lake colour; bill, black; legs, dusky brown (*W. R.*).]

313. G. PECTORALIS (J. 412).

Arakan. As remarked by Dr. Jerdon, "Specimens from the Himalayas have usually the ear-coverts silver-grey, whilst those from Arakan have them black and grey in every gradation." In some the pectoral band is wanting.

[Thayet Myo, Karen nee (*W. R.*).]

*314. G. MONILIGER (J. 413).

Arakan, Tenasserim. Very similar to the last, and therefore liable to be confounded with it; but it is smaller and conspicuously less robust.

[Rangoon, Thayet Myo, Yey-tho, Karen hills (*W. R.*).]

*315. G. ALBIGULARIS (J. 411).

Tavoy, Siam (*Gould*).

*316. TROCHALOPTERON MELANOSTIGMA.

Trochalopteron melanostigma, nobis, J. A. S. B. xxiv. p. 268.

Tenasserim mountains, where obtained by Colonel Tickell, "up to the vast wall-like crags of Moulè-it, 7500 feet."

[Karen nee. Iris (♂), deep chocolate; bill, black; legs, pale brown (*W. R.*).]

[317. ACTINURA RAMSAYI.

Actinura ramsayi, Walden, Ann. M. N. H. (4), 15, p. 402 (June 1st, 1875).

Karen nee, at 3500 feet. Iris (♂ ♀), light hair brown; bill, horny brown; legs, slaty brown (*W. R.*).]

*318. SIBIA MELANOLEUCA.

Sibia melanoleuca, nobis, J. A. S. B. xxviii. pp. 413, 451.

Moulè-it mountain, where obtained by Colonel Tickell. "Evidently exceedingly rare, or confined to elevated peaks. A pair only seen, of which the male was secured. Lively and restless, with a prattling whistle like that of *S. capistrata*." It is a conspecies with *S. capistrata* of the Himalaya, and *S. gracilis** of the Khásias.

[319. S. PICAOIDES (J. 430).

Karen nee, at 5000 feet (*W. R.*).]

* J. A. S. B. xx. p. 521; xxvii. p. 422.

*320. Gampsorhynchus rufulus (J. 384).

Arakan, Tenasserim.

[The Tenasserim race has been separated by Mr. Hume under the title of *G. torquatus* (P. A. S. B. 1874, p. 107).]

321. Pterythrius erythropterus (J. 609).

Lanius erythropterus, Vigors; Gould, B. As. pt. viii. pl. 8.

Bhămo.*

322. P. æralatus.

P. æralatus, Tickell, J. A. S. B. xxiv. p. 267.

Tenasserim mountains, at 3500 to 4500 feet elevation.

[Karen nee hills, from 4000 to 5000 feet. Iris (♀), deep lavender; bill, above black, below lavender; legs, dull white; claws, dark brown (*W. R.*).]

*323. Allotrius melanotis (J. 611).

Pteruthius melanotis, Hodgson; Gould, B. As. pt. viii. pl. 11.

Tonghoo.

Fam. Liotrichidæ.

[324. Cutia nipalensis (J. 612).

Karen nee, at 6000 feet (*W. R.*).

Sundeval (M. N. Av. Disp. Tentamen, p. 41) rejects the generic title *Cutia*, and adopts Hodgson's substituted title of *Heterornis*.]

[325. Lioptila annectans (J. 613).

Karen nee (*W. R.*).

The ferruginous colouring of the lower back, rump, and upper tail-coverts, in the example from Karen nee, is much darker than is observable in a numerous series from Darjeeling, Assam, and the Munipur hills.]

*326. Liothrix lutea (J. 614).

Sylvia lutea, Scopoli; Gould, B. As. pt. iii. pl. 17.

Khásias, Arakan, South-west China.

*327. L. argentauris (J. 615).

Mesia argentauris, Hodgson; Gould, B. As. pt. xiv. pl. 10.

Khásias, Tenasserim mountains.

[Tonghoo hills, Karen nee hills, from 1500 to 4000 feet (*W. R.*).]

* *vide* J. Anderson, Exped. p. 259.

[328. L. STRIGULA (J. 616).
Tonghoo hills (*W. R.*).]

329. SIVA CYANOUROPTERA (J. 617).
S. cyanouroptera, Hodgson; Gould, B. As. pt. xiv. pl. 12.
Khásias, Tenasserim mountains.
[Karen nee (*W. R.*).]

[330. MINLA CASTANEICEPS (J. 619).
Karen nee, at 5200 feet (*W. R.*).]

331. STAPHIDEA STRIATA (J. 625).
Is this identical with *I. castaneiceps*, Moore, from the Khásias, and with *S. torqueola*, Swinhoe,* from China? Obtained by Col. Tickell on Moulè-it mountain at an elevation of 3000 feet.
[Distinct from *S. torqueola*, but doubtfully so from *S. castaneiceps*.]

*332. YUHINA GULARIS (J. 626).
Arakan.

[333. PROPARUS DUBIUS.
P. dubius, Hume, P. A. S. B. 1874, p. 107.
Discovered by Mr. Davison in pine forests north of Pahpoon. *Query* = *Minla rufogularis*, Mandelli?]

Fam. ——— (?) †

*334. HERPORNIS XANTHOLEUCA (J. 630).
Khásias, Arakan, Tenasserim, Malacca. A very closely allied race from Hainan and Formosa is named *H. tyrannula*, by Mr. Swinhoe.‡
[Common in the Pegu hills (*O.*).]

Fam. **Zosteropidæ.**

*335. ZOSTEROPS PALPEBROSUS (J. 631).
Sylvia palpebrosa, Tem.; P. Z. S. 1872, pl. xx. fig. 1.
Arakan, Tenasserim, Nicobar Islands.
[Karen hills (*W. R.*).]

* Gould, B. As. pt. xxiii. pl. 14.
† [Title omitted in MS.]
‡ Ibis, 1870, p. 347, pl. 10.

336. Z. SIAMENSIS.

Z. siamensis, nobis, Ibis, 1867, p. 34.

Tenasserim mountains.

[Rangoon (*W. R.*).]

[337. *Z. austeni*, n.s.

Karen nee, at 2500 feet (*W. R.*).]

Above, dark uniform oil-green; underneath, light yellowish-green; almost pure yellow on chin, throat, and under tail-coverts. A shade of black below the eye. Quills dark brown, edged externally with the colour of the dorsal plumage. Shoulder-edge bright yellow. Axillaries and under shoulder-coverts white tinged with yellow. Rectrices hair-brown, narrowly edged externally with green. Wing, 2·6; tail, 1·50; tarsus, 0·50; bill, from forehead, 0·55.]

Fam. ——— (?).*

*338. MUSCITREA CINEREA.

Muscitrea cinerea, nobis; J. A. S. B. xvi. p. 122.

Arakan. A remarkable form, of which the affinities are not obvious. The only specimen became destroyed by insects.

[The type was obtained in the island of Ramree.]

Fam. **Paridæ.**

Titmice.

*339. MELANOCHLORA FLAVICRISTATA (J. 650).

Parus flavocristatus, Lafr.; Gould, B. As. pt. xx. pl. 15.

Arakan, Tenasserim mountains, Malacca, Sumatra. "One obtained at Kyodan, Salween river" (*Beavan*).

[Karen nee (*W. R.*). The specific title, *sultanea*, Hodgs., has precedence.]

[340. PARUS COMMIXTUS.

P. commixtus, Swinhoe, Ibis, 1868, p. 63.

Karen nee, at 3000 feet. Iris, hair brown; bill, black; legs, plumbeous (*W. R.*); pine forests north of Pahpoon (*D.*). Barely separable from Japanese examples of *P. minor*.]

* [Title omitted in MS.]

[341. P. NIPALENSIS (J. 645).

P. nipalensis, Hodgson, Ind. Rev. ii. p. 31 (1838).

Thayet Myo (*F.*). The Indian species is now admitted to be distinct from the Javan, *P. cinereus*, and the title of *P. cæsius*, Tickell, has been adopted for it by Mr. Swinhoe. Where or when Tickell published this title I have failed in discovering, yet Jerdon certainly employs it as a synonym (*l. c.*).]

*342. MACHLOLOPHUS SUBVIRIDIS.

Parus subviridis, Tickell, J. A. S. B. xxiv. p. 267; xxviii. p. 413.

Tenasserim mountains, at 3500 feet elevation.

[This must still continue a doubtful species. It was founded on a single example, shot at an elevation of 3500 feet in the Tenasserim hills by Col. Tickell. A second individual (much injured) from Tenasserim was identified with it by Mr. Blyth (*l. c.*) four years later. Both appear to have been examples of *M. spilonotus* in immature plumage.]

[343. M. SPILONOTUS (J. 649).

Karen nee, at 3500 feet (*W. R.*).]

[344. ÆGITHALISCUS ERYTHROCEPHALUS (J. 634).

Parus erythrocephalus, Vigors, P. Z. S. 1831, p. 23.

Karen nee, 3000 feet (*W. R.*).]

Fam. Sittidæ.

Nuthatches.

345. SITTA NEGLECTA.

Sitta neglecta, Walden, Ann. M. N. H. (4), v. p. 218.

Tonghoo.

[Tonghoo, Yey-tho, Karen nee (*W. R.*).]

*346. DENDROPHILA FRONTALIS (J. 253).

Arakan, Tenasserim, Malay countries.

[Tonghoo, Karen nee, Tsanko hills (*W. R.*). Identical with examples from Ceylon, India, Java, and Borneo.]

[347. CERTHIA DISCOLOR (J. 245).

Karen nee, 5000 to 6000 feet (*W. R.*).]

Fam. **Timeliidæ.**

*348. POMATORHINUS HYPOLEUCUS.

Pomatorhinus hypoleucus, nobis, J. A. S. B. xiii. p. 319; xiv. p. 559; xxiv. p. 273; *P. albicollis*, Horsf., Gray and Mitchell, Gen. Birds, pl. 57.

Nipâl, Khásias, Arakan, Tenasserim.

[349. P. OCHRACEICEPS.

P. ochraceiceps, Walden, Ann. M. N. H. (4), 12, p. 487.

Tonghoo, Karen nee hills, at 2500 feet. Iris (♂), pale straw-yellow; bill, coral-red, with a marked tinge of orange; legs, greenish (*W. R.*).]

*350. P. SCHISTICEPS (J. 402).

Khásias, Tippera, Arakan.

[Upper Pegu (*O.*).]

*351. P. LEUCOGASTER (J. 403).

Khásias, Arakan, Tenasserim. This and the preceding species resemble each other in colouring; but *P. schisticeps* is altogether larger, and has proportionally longer and coarser bill and feet, with very much longer and straighter claws.

["Karen nee, at 3000 feet. Iris (♂) straw-yellow; bill, orange-yellow, black at nostrils; legs, slaty (*W. R.*).]

*352. P. PHAYREI.

P. phayrei, nobis, J. A. S. B. xvi. 452.

Sikhim, Tavoy, Khásias, Arakan.

*353. P. ALBIGULARIS.

P. albigularis, nobis, J. A. S. B. xxiv. p. 274.

This species and *P. hypoleucus* were procured by Colonel Tickell upon Moulè-it mountain, at from 5000 to 6000 feet elevation. According to Mason, it is very common in the province of Tavoy.

[354. P. MARIÆ.

P. mariæ, Walden, Ann. M. N. H. (4), 15, p. 403 (June 1st, 1875).

Tonghoo hills (*W. R.*).]

[355. P. ERYTHROGENYS (J. 405).

Pine forests north of Pahpoon (*D.*).]

*356. TIMELIA JERDONI (J. 396).

Timalia erdoni, Walden, Ann. M. N. H. (4), x. p. 61; *T. bengalensis*, Godwin Austen.

"Upper Burma, where much more abundant than in Bengal, and less shy, affecting hedge-rows and villages, instead of the unfrequented grass jungles and thickets, in which alone it is seen in Bengal" (*Jerdon*).

Mr. W. T. Blanford informs me that he has Burmese specimens of intermediate size to *T. jerdoni* and *T. pileata*, Horsfield, rendering the propriety of their separation doubtful.

[Rangoon, Tonghoo (*W. R.*); Pahpoon, Yeboo (*D.*). The continental form must take the title of *T. bengalensis*, Godwin Austen (J. A. S. B. 1872, p. 143), which has priority over mine. As the specific validity of the species in no way depends on its dimensions, the information quoted has no bearing on the point. And this remark equally applies to Mr. Hume's observations (Str. Feath. iii. p. 118). The large series, from various parts, I have had opportunities of comparing with the Javan species, fully support Dr. Jerdon's, Major Godwin Austen's, and my own conclusions.]

*357. MIXORNIS RUBICAPILLA (J. 395).

Motacilla rubicapilla, Tickell; Ibis, 1872, p. 376.

Arakan, Tenasserim.

[Karen nee (*W. R.*); both sides of the Pegu hills (*O.*).]

*358. PELLORNEUM RUFICEPS (J. 399).

Arakan, Tenasserim.

359. P. TICKELLI.

P. tickelli, nobis, J. A. S. B. xxviii. p. 414; *P. subochraceum*, Swinhoe, Ann. M. N. H. (4), 7, p. 257.

Tenasserim mountains.

[Rangoon, Tonghoo, Thayet Myo, Karen hills (*W. R.*).]

360. P. MINOR.

P. minor, A. O. Hume, Str. Feath. ii. p. 298.

Thayet-myo.

[A synonym of *P. tickelli*.]

361. TURDINUS CRISPIFRONS.

Turdinus crispifrons, nobis, J. A. S. B. xxiv. p. 269.

Tenasserim mountains.

* Generically identical with *Cacopitta*, Bonap. (1850).

362. T. GUTTATUS.

T. guttatus, Tickell, J. A. S. B. xxviii. pp. 414, 450.

Tenasserim mountains.

363. T. BREVICAUDATUS.

T. brevicaudatus, nobis, J. A. S. B. xxiv. p. 272; Gould, B. As. pt. xxiv. pl. 9; *T. striatus*, Walden.

Khásias, Tenasserim mountains. These three species were discovered by Col. Tickell.

[364. DRYMOCATAPHUS FULVUS.

Drymocataphus fulvus, Walden, Ann. M. N. H. (4), 15, p. 401 (June 1st, 1875).

Karen nee, at 2500 feet (*W. R.*).]

365. TRICHOSTOMA ABBOTTI (J. 387).

Arakan (Ramri), Moulmein. This bird is barely separable from the (so-termed) *Brachypteryx sepiaria*, Horsfield, which is *Myiothera grisea* of the Leyden Museum, and *Malacopteron olivaceum*, Strickland. Its range extends to Eastern Bengal, and to the Nipâlese tarai.

[Rangoon, Tonghoo, foot of Karen hills (*W. R.*). Identical with examples from the Garo hills, from hills near Mymensing, from Dunapur, and from Dunsiri valley.]

[366. T. MINOR.

T. minor, Hume, Str. Feath. ii. p. 535.

Lemyne, Meeta Myo, Ye (*D.*). Judging by the description, a species of doubtful validity. But, if distinct from the Indian species, probably true *T. abbotti*.]

[367. T. RUBIGINOSA.

T. rubiginosa, Walden, Ann. M. N. H. (4), 15, p. 402 (June 1st, 1875).

Karen nee (*W. R.*).]

*368. ALCIPPE NIPALENSIS (J. 388).

A. phayrei, nobis, J. A. S. B. xiv. p. 601, wanting the dark sincipital stripes, is probably the young.

Arakan, Tenasserim. "Common, but local, in hilly jungles up to 4000 feet" (*Tickell*).

[369. A. MAGNIROSTRIS, n.s.

Karen nee hills, at 3000 feet (*W. R.*).

All the individuals obtained in the locality named differ from Darjeeling,

Garo hills, and Naga hills examples, by wanting the grey-coloured cheeks and ear-coverts of *A. nipalensis*, and by having the tail brown and not rufous. All the dimensions are greater. Wing, 2·75; tail, 3; tarsus, 0·87.]

*370. STRACHYRHIS NIGRICEPS (J. 391).

Arakan, Tenasserim mountains. "In hilly forests, 3000 feet" (*Tickell*). *Timalia larvata*, S. Müller,* from Sumatra, is nearly akin and should be compared with it.

[Pegu hills (*O.*).]

[371. S. RUFICEPS (393).

Karen nee (*W. R.*); neighbourhood of Pahpoon (*D.*).

A single Karen nee example, in very indifferent order, appears to belong to this species.]

[372. S. RUFIFRONS.

S. rufifrons, Hume, Str. Feath. i. p. 479.

Pegu hills (*O.*).]

*373. S. CHRYSEA (J. 394).

S. præcognitus, Swinhoe.

Arakan, South China.

[*S. chrysea* is also stated by Dr. Jerdon to occur in Arakan, and in Mr. Blyth's manuscript the number of that species in Jerdon's Birds of India (394) is added to the title. But it is evident that *S. precognita*, Swinhoe, cannot be a synonym, for it is the name of a species nearly allied to, although distinct from, *S. ruficeps*. This last species was probably omitted by Mr. Blyth through accident, while to it he doubtlessly intended to add *S. precognita*, Swinhoe, as a synonym, and not to *S. chrysea*.]

[374. S. ASSIMILIS, n.s.

Above cinereous olive-green. Feathers of the head yellow, with brown central streaks. Cheek and ear-coverts, pale brown tinged with yellow. Entire under surface, dilute yellow. Quills, brown edged externally with pale yellow. Rectrices, cinereous brown tinged with olive-green. Wing, 1·92; bill, from forehead, 0·56; tail, 1·92; tarsus, 0·58.

"Karen nee (♂, ♀) at 2800 feet of elevation. Iris (♂), lake; bill, lavender, pink at base of mandible; legs, brownish yellow; feet, greenish. Iris (♀), brown; bill, dark plumbeous, pinkish at base of mandible; legs, light greenish-brown" (*W. R.*).]

* Bonap. Consp. Av. i. p. 217.

*375. Pyctorhis sinensis (J. 385).

"Very common in Upper Burma" (*Jerdon*). I noticed it abounding in the vicinity of Akyab.

[Karen nee (*W. R.*); Thayet Myo (*O.*).]

376. P. altirostris.

Chrysomma altirostre, Jerdon, Ibis, 1862, p. 22.

Common at Thayet Myo.

[This species has not been recognized since Dr. Jerdon described it thirteen years since. By some it is regarded as nothing but *P. sinensis*, a species thoroughly well known to Dr. Jerdon. But, moreover, he mentions (*l. c.*) that "it will probably be considered worthy of separation as a subgenus," and that it "makes an approach to the *Paradoxornis* group." In conversation Dr. Jerdon has asserted that it was a "good species."]

*377. Paradoxornis ruficeps (J. 375).

Paradoxornis ruficeps, nobis; Gray and Mitchell, Gen. Birds, pl. 94, fig. 1; Gould, B. As. pt. vi. pl. 12.

Received from Arakan, and the only species as yet received from any part of British Burma, though others may be expected to inhabit the same localities.*

[Karen nee, at 2500 feet (*W. R.*).]

[378. P. gularis (J. 374).

P. gularis, Horsf.; Gray and Mitchell, Genera of Birds, ii. pl. 94, fig. 2.

Karen nee, at 5600 feet (*W. R.*).]

Fam. **Megaluridæ.**

*379. Crateropus gularis.

Chatarhea gularis, nobis, J. A. S. B. xxiv. p. 478.

"The familiar garden-babbler of Thayet Myo, and still more abundant and familiar higher up the Irawádi, as Mr. W. J. Blanford informs me" (*Jerdon*).

[Thayet Myo (*W. R.*).]

* *Suthora brunnea*, J. Anderson, P. Z. S. 1871, p. 211. Momien, Yunan. 4500 feet.

380. C. EARLEI (J. 439).

"Not rare at Thayet Myo, but confined entirely to the long grass and reeds on the islands and *churrs* of the Irawádi" (*Jerdon*).

*381. C. CAUDATUS (J. 438).

Arakan, Thayet Myo. As this and the two preceding species are absolutely congeneric with sundry African species of undoubted *Crateropus*,* I can only refer them to that genus. It is remarkable that the true *Malacocerci*, so characteristic of India and Ceylon, have no typical representative in the countries eastward of the Bay of Bengal.

*382. MEGALURUS PALUSTRIS (J. 440).

The range of this species extends from India, Assam, and Burma to Java and the Philippines. I do not remember to have seen it, however, in collections from the Malayan peninsula.

*383. DRYMOECA LONGICAUDATA (J. 544).

Arakan.

[384. DRYMOECA BLANFORDI, n.s.

Above brown (darkest on the head), with an olive-green tinge, which is in some very distinct on the rump. A dull, broad, albescent stripe springing from the base of the bill, and extending back over and beyond the eye. Ear-coverts mingled albescent and pale brown. Cheeks, wing lining, and all the lower surface of body yellowish white, faintly rufescent on flanks and thigh-coverts. Quills, brown externally, narrowly edged with olive-green. In some with an indistinct rufous shade. Rectrices, pale brown above; albescent underneath. All but middle pair with a bold subterminal brown transverse isolated mark. Middle pair with a faint indication of a dark terminal spot. (♂) Wing, 2; tail, 2·50; tarsus, 0·82; bill, from forehead, 0·58.

"Iris (♀), dark buff; maxilla, horny brown, mandible, pale; eyelids, yellowish brown; legs, dull white. Iris (♂), yellowish brown; bill, fleshy brown; eyelids, yellowish brown; Tonghoo" (*W. R.*).]

*385. PRINIA FLAVIVENTRIS (J. 532).

Arakan, Tenasserim, Malacca.

[Rangoon (*W. R.*). The type of Delessert's species came from Bhootan. Assam (Tezpur) examples obtained by Major Godwin Austen agree with

* *Cf.* Ibis, 1867, p. 6.

Delessert's diagnosis, the ear-coverts and the lores being grey; the superciliary region being dark coloured like the head. Sylhet individuals do not differ, but specimens from the Munipur hills, while otherwise undistinguishable, possess pure white lores continued into a bold pure white supercilium. Out of a large series obtained by Lieutenant W. Ramsay at Rangoon, one only has the lores and superciliary ridges pure white. All the other specimens being like the Assam and Sylhet birds. In my series of the Javan representative form, *P. familiaris*, one example only has white lores and supercilium. The presence of a white supercilium does not appear to indicate the sex, for all the Munipur birds whose sex had been determined are marked ♂, while the single Rangoon example with a white supercilium is noted a ♀, and the others, some ♂ and some ♀.]

*386. P. RUFESCENS.

P. rufescens, nobis, J. A. S. B. xvi. p. 456; *P. beavani*, Walden.

Arakan, Pegu.

[*P. beavani* is a distinct species. *P. rufescens* is a very rufous form of *P. gracilis*.]

[387. P. GRACILIS (J. 536).

Rangoon (*W. R.*); Pegu (*O.*); Kollidoo (*D.*).]

[388. P. HODGSONI (J. 538).

Rangoon, Karen nee (*W. R.*); Thayet Myo (*O.*).]

[389. P. BEAVANI.

P. beavani, Walden, P. Z. S. 1866, p. 651.

Yey-tho, Karen hills, at 2000 feet (*W. R.*); Thayet Myo (*O.*); Tenasserim (*D.*).]

*390. CISTICOLA SCHÆNICOLA (J. 539).

Arakan, Pegu, Hainan, South China, Formosa.

[391. HORETTES PALLIDIPES.

Phylloscopus pallidipes, Blanford, J. A. S. B. 1872, p. 162, pl. vii.

Pahpoon (*D.*).]

[392. H. SERICEA, n.s.

Above uniform, rather dark, brown washed with an olive tint, having in some lights a ruddy tone. Under-surface of body and wing-lining silky white, the flanks, thigh-coverts, and under tail-coverts sullied with pale

brown. Cheeks and ear-coverts mixed pale brown and white. Space before the eye and superciliary ridges, sordid white. Quills and rectrices brown, edged with the colour of the upper plumage. Wing, 2; tail, 1·75; tarsus, 0·68; bill, from forehead, 0·60.

"Iris (♀), dull brown; bill, yellow; legs, fleshy white. Karen hills" (*W. R.*).]

[393. SUYA CRINIGERA (J. 547).

Thayet Myo (*O.*).]

[394. S. ERYTHROPLEURA, n.s.

Male, above rufous brown, the base of the feathers being ash. On the lower back and upper tail-coverts the rufous hue predominates. Space before the eye, dark brown. A white line, springing from near the nostril, passes back over and behind the eye. Ear-coverts, cheeks, chin, throat, breast, abdomen, and wing-lining, creamy white, strongly suffused with rufo-fulvous. Flanks, thigh-coverts, and under tail-coverts bright ferruginous. Quills, brown edged with ferruginous. Rectrices like the back.

(♂) Wing, 1·87; tail, 4·87; tarsus, 0·88; bill, from forehead, 0·65. Tonghoo (*W. R.*).]

*395. ORTHOTOMUS LONGICAUDA (J. 530).

Of general occurrence, extending eastward to South China and Formosa, and southward to Singapore.

[Tonghoo, Karen nee (*W. R.*); Thayet Myo (*O.*); Tenasserim (*D.*). The Ceylon and Indian Tailor-bird must stand *O. sutorius* (G. R. Forster), Zool. Ind. p. 17 (1781), even if it be considered identical with the South China species, *Muscicapa longicauda*, Gm.= *O. phyllorrhaphæus*, Swinh., which it appears to be.]

*396. O. EDELA.

O. edela, Tem., P.C. 599, fig. 2.

Tavoy, Siam (*Gould*). According to Mason, "Tailor-birds are very common at Tavoy, though rare at Moulmein." He is not likely to have discriminated the particular species.

[I am not certain which species is intended by Mr. Blyth. The authority of Mr. Gould is quoted for the occurrence of this Javan race of the common Indian Tailor-bird at Tavoy and in Siam. The Javanese *O. edela* and the Indian *O. sutorius* are barely separable, the Javan being chiefly distinguished by having the lores and superciliary stripe pale ferruginous, and not greyish-

white. All the Burman examples, and those from Siam, I have been able to examine, belong to *O. sutorius*. Formerly Mr. Blyth mistook the more recently described *O. flavi-viridis*, Moore, for *O. edela*, and Moore's species does occur in Burma.]

[397. O. FLAVI-VIRIDIS.

O. flavi-viridis, Moore, P. Z. S. 1854, p.

Rangoon (*W. R.*).

The description of *O. nitidus*, Hume, agrees well with this species, before the grey throat and black breast-feathers have been assumed. Mr. Hume's specimens were obtained at Pahpoon, Kyouknyat, and Thayetchaun.]

[398. O. CORONATUS (J. 531).

Tsan koo hills, at 3000 feet (*W. R.*).]

[399. LOCUSTELLA LANCEOLATA.

Sylvia lanceolata, Tem., Man. d'Orn. iv. p. 614; *Locustella subsignata*, Hume; *cf.* Dresser, B. Eur. parts 35 and 36.

Yeboo (*D.*).]

Fam. **Laniidæ**.

Shrikes.

*400. LANIUS TEPHRONOTUS (J. 258).

Arakan.

[Kyouknyat (*D.*).]

*401. L. NIGRICEPS (J. 259).

L. nigriceps, Frankl.; Gray and Mitchell, Gen. Birds, pl. 71.

Arakan, Siam.

[Tonghoo (*W. R.*); neighbourhood of Pahpoon (*D.*).]

402. L. CRISTATUS (J. 261).

Arakan.

[Rangoon, Karen nee (*W. R.*); Thayet Myo (*O.*); Tenasserim (*D.*).]

* *vide* Lord Walden, "On the Rufous-tailed Shrikes," Ibis, 1867, p. 212. Mason includes *L. tigrinus*, Drapiez, but I know not on what authority.

403. L. COLLURIOIDES.

L. collurioides, Lesson, Voyage Bélanger, p. 250; *L. hypoleucus*, nobis, J. A. S. B. xvii. p. 249.

Pegu, Martaban, Tenasserim provinces, Siam. "Thayet Myo and Ava in cold season only" (*W. T. Blanford*).

[Rangoon, Tonghoo, Thayet Myo, Karen nee (*W. R.*).]

*404. TEPHRODORNIS PELVICA (J. 263).

Arakan, Tenasserim, Hainan.

[Karen hills (*W. R.*); Thayet Myo (*O.*).]

*405. T. PONTICERIANA (J. 265).

Pegu.

[Tonghoo (*W. R.*); Thayet Myo (*O.*).]

*406. HYLOTERPE PHILOMELA (J. 266).

Arakan, Pinang, Java, Borneo, Andaman Islands.

[Must stand *Hyloterpe grisola* (Blyth). *Hylocharis occipitalis*, Hume, Str. Feath. ii. p. 202, is synonymous.]

407. HEMIPUS OBSCURUS.

Muscicapa obscura, Horsfield; *M. hirundinacea*, Reinwardt.

Mergui.*

[408. H. PICATUS (J. 267).

Muscicapa picata, Sykes, P. Z. S. 1832, p. 85.

Tonghoo, Karen nee, at 1500 feet, Tsan koo hills (*W. R.*); Thayet Myo (*O.*); Pahpoon (*D.*). All the examples sent to me by both Major Lloyd and Lieutenant Wardlaw Ramsay, from the Tonghoo province, belong to the South Indian and Ceylon species. But Mr. Blyth seems to be correct in his opinion that the Assam bird, *M. capitalis*, is a distinct species. All the examples of the male I have seen from Darjeeling, Assam, and the Naga hills, have the back brown, and the head alone black (*cf.* Blyth, Ibis, 1866, p. 368; Jerdon, *op. cit.* 1872, p. 116; and compare Hume, Str. Feath. 1873, p. 435; 1875, p. 93). Young males in both species wear the female dress. The young *H. picatus* in transition plumage, before assuming the full black dorsal garb, shows brown on the back. *H. capitalis*, ♂, when adult, retains the brown colouring on the back]

* Mason also gives *M. picatus*, meaning doubtless *M. capitalis* (cf. Ibis, 1866, p. 368).

Fam. **Graucalidæ.**

*409. Graucalus macei (J. 270).

Arakan, Tenasserim.

[Rangoon, Tonghoo hills, Karen nee from 2500 feet to 4000 feet (*W. R.*); Thayet Myo (*F.*).]

*410. Volvocivora avensis.

Volvocivora avensis, nobis, Catal. p. 327; *C. melanoptera*, nobis, J. A. S. B. xv. p. 307.

Common in Arakan.

[Rangoon, Tonghoo, Thayet Myo, Karen nee (*W. R.*); Pabyouk, near Amherst (*D.*).]

*411. V. sykesi (J. 268).

Upper Pegu.

[412. V. melanoschistus (J. 269).

V. melaschistos, Hodgson, Ind. Rev. i. p. 328 (1836).

Examples obtained at Pahpoon, Pabyouk, Ye-boo, and Ye, by Mr. Davison, are thus identified, with doubt, by Mr. Hume (Str. Feath. ii. p. 474).]

*413. Pericrocotus speciosus (J. 271).

Turdus speciosus, Lath.; Gould, B. As. pt. ix.; *P. rutilus*, Gould; *P. fraterculus*, Swinhoe; *P. andamanensis*, Tytler. *Hgnet-men-tha* ♂, *hgnet-men-thamie* ♀ ("Prince and Princess Bird," Mason).

Arakan, Tenasserim, Andaman Islands, Khásias, Siam; and Hainan (*Swinhoe*). Mr. V. Ball remarks of this species that "the amount of red on the central tail-feathers varies much in specimens from various parts of India and Burma." Four out of five males from the Andamans have the central tail-feathers wholly black. The specimens in Lord Walden's collection from India have black middle tail-feathers, while in those from Burma the outer web is red. Others sent by Mr. Swinhoe as *P. fraterculus* do not appear to be separable.

[Tonghoo, Karen nee (*W. R.*); Thayet Myo (*O.*). Out of a numerous series from Tonghoo and its vicinity only one male has the middle pair of rectrices completely black; while in all the females, without exception, they are entirely black. Some Assam examples have the middle pair black.]

*414. P. brevirostris (J. 273).

Phœnicornis brevirostris, Vigors; Gould's Century, pl. 8.

Arakan.

[Karen nee, at 3000 feet (*W. R.*); pine forests north of Pahpoon (*D.*).]

*415. P. ROSEUS (J. 275).

Muscicapa rosea, Vieillot; Gould, B. As. pt. ix. pl. —

Arakan.

[Tonghoo (*W. R.*); Pahpoon (*D.*).]

*416. P. PEREGRINUS (J. 276).

Parus peregrinus, Linn.; Gould, B. As. pt. ix. pl. —

Arakan, Tenasserim. Common; some of the males very brightly coloured, and appearing to grade into *P. flagrans*, Boiè, of the Malayan peninsula, Sumatra, and Borneo. Mr. V. Ball remarks that "Andaman specimens correspond to the darker-plumaged variety of this bird from Madras and Ceylon, from one of which Gould's figure is taken."

[Tonghoo (*L.*); Karen nee (*W. R.*); Thayet Myo (*F.*).] *P. flagrans*, Boiè, in no way resembles *P. peregrinus*, otherwise than by its small dimensions. It is a diminutive form of *P. ardens*, Boiè, which, in its turn, is a small form of *P. speciosus*. The female of *P. flagrans* is yellow and grey, as in the other two species. *P. peregrinus* is a distinct type, and has no known representative in any part of the Malayan sub-region.]

*417. P. ALBIFRONS.

P. albifrons, Jerdon, Ibis, 1863, p. 20.

Thayet-myo. An interesting "double" of the Indian *P. erythropygius*.

[Tonghoo (*L.*); Thayet Myo (*O.*).]

Fam. Pipridæ.

Manakins.

*418. CALYPTOMENA VIRIDIS.

Calyptomena viridis, Raffles; Horsfield, Zool. Res. in Java, pl.; Stoliczka, J. A. S. B. xxxix. pt. 2, p. 284.

Tenasserim mountains.*

"These birds resort to dense thickets when alarmed, but will sally out to feed on fruits (wild figs), and they mingle with Barbets and other birds while so doing. The note is low and sweet—a low whistle. Like the *Eurylaimi*, they are tame and stupid" (*Tickell*). Helfer also procured this species in the Tenasserim provinces.

* *vide* J. A. S. B. xiii. p. 243; Tickell, *op. cit.* xxiv. p. 279.

Fam. **Eurylæmidæ.**

Broadbills.

*419. Serilophus rubropygius (J. 139).

Raya rubropygia, Hodgs.; Gould, B. As. pt. v. pl. —

Arakan, Khásias, S. E. Himalaya.

*420. S. lunatus.

S. lunatus, Gould; B. As. pt. v. pl. —

Tenasserim provinces. "These birds are much better flyers than the *Eurylaimi*. I found them once in a flock, like Titmice, but very high up" (*Tickell*). Dr. Helfer states, in his MS. notes quoted by Mr. F. Moore, "that he observed this bird in societies of thirty or forty, upon the loftiest trees in the forests in the Tenasserim provinces; and that they are so very fearless that the whole flock can be shot down one after the other." He only observed them on one occasion.

["Iris, iridescent green and brown; bill, turquoise blue, paler towards the tip; region of nostrils, gape, and under surface of basal half of mandible, orange; legs, orange-green; claws, bluish-white" (*W. R.*). Karen hills, 30 miles north of Tonghoo (*L.*); Karen nee, at 3000 and 4000 feet (*W. R.*); Pahpoon, Amherst, Om-ben-gwen (*D.*).]

421. Corydon sumatranus.

Coracias sumatranus, Raffles; Gould, B. As. pt. v. pl. —

Tenasserim provinces, Malacca, Sumatra, Borneo. "A singular and rare bird; crepuscular (very likely diurnal as well), and so stupid and tame as to allow itself to be pelted without moving" (*Tickell*).

[Karen hills (*W. R.*).]

*422. Eurylæmus javanicus.

Eurylæmus javanicus, Horsf.; Gould, B. As. pt. v. pl. —

Tenasserim provinces, Malayan peninsula, Sumatra, Java, Borneo. "Not common, at least it is not often seen, being very quiet and secluded, though excessively tame, and not crepuscular like *Corydon*" (*Tickell*).

[Tonghoo hills (*L.*).]

423. E. ochromelas.

E. ochromalus, Raffles; Gould, B. As. pt. v. pl. —

Tenasserim provinces, Malayan peninsula, Sumatra, Borneo.

424. CYMBORHYNCHUS MACRORHYNCHUS.

Todus macrorhynchus, Gm.; Gould, B. As. pt. v. pl. —

Bassein, Tenasserim provinces, Siam, Malayan peninsula, Sumatra, Borneo.

[Count Salvadori has recently (Atti R. Ac. Sc. Torino, ix. p. 421) restricted Latham's Great-billed Tody to Sumatra and Borneo, also to Java, but with a doubt, and has separated the Malayan Broadbill under a new title, *C. malaccensis* (*t. c.* p. 425). True *C. macrorhynchus*, according to the Count, has a black and unspotted tail; whereas the Malayan bird, on the three outer pairs of rectrices, has, towards the apex, and on the inner webs, a white oblique spot. In the Malaccan bird this is so, and Sumatran examples will more probably be found to agree with the Malaccan rather than with the Bornean. But to which race Latham's type, contained in the Leverian Museum, belonged, Count Salvadori does not make quite clear. Latham's type, however, is, as the Count mentions, and as Herr von Pelzeln has told us (Ibis, 1874, p. 19), extant in the Vienna Museum. We may therefore assume that the Count, with his accustomed accuracy, has satisfied himself on the point.]

*425. C. AFFINIS.

C. affinis, nobis, J. A. S. B. xv. p. 312; Gould, B. As. pt. 5, pl. —

Arakan (Ramri), Tavoy (*Gould*), Siam, and Cambodja (*G. R. Gray*).

*426. PSARISOMUS DALHOUSIÆ (J. 138).

Eurylaimus dalhousiæ, Jameson; Gould, B. As. pt. v, pl. —

Arakan, Tenasserim, Sumatra. "On the table-land of Cherra Punji," remarks Mr. Frith, "flocks of this bird often ascend, while, as they fly about from garden to garden, the native boys hunt them by intercepting and turning their flight away from the gardens, when they are soon fatigued and easily caught with the hand" (J. A. S. B. 1855, p. 279, note).

[Karen hills, at 3000 feet (*W. R.*). I can find no record of a comparison having been made between this species and Sumatran *E. psittacinus*, S. Müll.]

Fam. **Hirundinidæ.**

Swallows.

*427. HIRUNDO RUSTICA (J. 82).

Mostly of the smaller eastern race (*H. gutturalis*, Scopoli), but I think not exclusively so. Arakan, Tenasserim.

[Tonghoo (*W. R.*); Thayet Myo (*O.*).]

[428. H. TYTLERI.

H. tytleri, Jerdon, B. Ind. iii. p. 870.

Thayet Myo (*O.*); Tavoy (*D.*).]

[429. H. HORREORUM.

H. horreorum, Barton, Fragm. N. H. 1799, p. 17.

Tonghoo (*W. R.*). Undistinguishable from Californian examples.]

[430. H. FILIFERA (J. 84).

Pahpoon (*D.*).]

*431. CECROPIS ERYTHROPYGIA (J. 85, *partim*).

Hirundo erythropygia, Sykes; Gould, B. As. pt. xx. pl. 10; Ibis, 1866, p. 337.

Common in parts of the jungles, at least during the northern winter.

[432. C. STRIOLATA.

Hirundo striolata, Tem., Faun. Japonica, p. 33.

Karen nee, at 2600 feet, in March; Karen hills, at 3000 feet, in January (*W. R.*). Identical with Flores, Formosan, and Chinese examples. Quite distinct from *C. erythropygia*, which is barely separable from *C. rufula*.]

433. CHELIDON URBICA (J. 92).

Col. Tickell writes: "There are great numbers here" (at Moulmein) "in the season; and I have also seen large flocks of them in India, but they appear from time to time, not constantly, as does *H. rustica*."*

*434. COTYLE SINENSIS (J. 89).

Common along the rivers, where it holds the place of *C. riparia* in Europe.

[Tonghoo (*W. R.*); Pahpoon (*D.*). *C. obscurior*, Hume, Str. Feath. iii. p. 43, is founded on a single indifferent specimen of a species of *Cotyle* obtained at Thayet Myo by Mr. Oates.]

Fam. **Artamidæ**.

Clusterers.

*435. ARTAMUS FUSCUS (J. 287).

Arakan, Tenasserim, Siam, Hainan. In the Andamans and Nicobars, *A. leucorhynchus* (Lin.) replaces it.

[Tonghoo, Thayet Myo, Karen hills (*W. R.*).]

* J. A. S. B. xxiv. p. 809.

Fam. **Dicruridæ.**

Drongos.

*436. Chibia hottentota (J. 286).

Arakan.

[Tonghoo, Karen hills (*W. R.*); Pahpoon, Moulmein (*D.*).]

*437. Bhringa remifer (J. 283).

Arakan, Tenasserim.

[Tonghoo, Karen hills (*W. R.*); Thayet Myo (*O.*). The Burman examples, as well as Indian, are not separable from the Javan.]

*438. Chaptia ænea (J. 282).

Arakan, Tenasserim.

[Tonghoo, Karen hills, Karen nee (*W. R.*); Thayet Myo (*O.*). *C. malayensis*, A. Hay, is identical with the Sumatran *Edolius picinus*, S. Müller, Bp. Consp. i. p. 352, the type of which I have compared at Leyden.]

*439. Dissemurus paradiseus (J. 284, *partim*).

Arakan, Tenasserim. I provisionally bring together the various races of *Bhimráj* (as they are designated in Bengal), because it appears to me that their differentiation is not yet sufficiently understood; but specimens from different localities differ much in size and in the development of the frontal crest. In some the latter is rudimentary, if it exist at all; while in others it attains a length of 2½ in.,* the frontal plumes flowing over and beyond the occiput. The ordinary length in Burmese specimens is about 1½ in. In one specimen in the Calcutta Museum, which is believed to have been procured by Helfer, the frontal crest is rudimentary, whilst the racket tail-feathers attain very unusual length, the unwebbed portion of them being much more spirated than I have seen in any other. Again, there is one race, found especially in Tippera, with the frontal crest 2½ in. long, and the closed wing 6¾ in. But, with the exception perhaps of this Tippera bird, there would seem to be all possible gradations in different localities, especially as regards the development of the frontal crest. The longest crested (or Tippera form) is styled *Chibia malabaroides* by Mr. Hodgson,† and the *Edolius grandis*, Gould,‡ is described to have the crest 1½ in. in length. *E. paradiseus* (*Cu-*

* *vide* figure in J. A. S. B. xv. p. 295.

† India Review, 1837, p. 325; *syn. Lanius malabaricus*, as figured by Latham and Shaw, not as described by Latham from Sonnerat's figure.

‡ P. Z. S. 1836, p. 3.

culus paradiseus, L.) is based on Brisson's *Cuculus cristatus siamensis*, founded on a drawing by Poivre of a Siamese specimen, and should therefore denote the ordinary Tenasserim bird, which is identical with the *Bhimráj* of the Calcutta bird-dealers. As observed in captivity, this species has astonishing powers of mimicry.* I had one which imitated the fine song of the Shâma (*Cittocincla macroura*) to perfection; also the crowing of cocks, and every other sound produced by domestic poultry, the cawing of crows, the notes of various other wild birds, the bleating of calves, the cry of a dog being whipped, mewing of cats, etc.; but I do not remember to have heard one sing in the wild state. Mason, however, mentions its loud, flute-like notes, and remarks of one that used to come at sunset every evening, and perch on a bough near his dwelling in Dong-yan; "there it would sit and pour forth an incessant strain of melody for half an hour at a time." As seen alive, it presents a very different appearance from the stuffed specimens exhibited in museums, the hackled feathers of the neck showing to advantage. When tamed it is very fearless and familiar, and may be suffered to have its liberty in country places. It preys with avidity on small birds and other animals. But with all its extraordinary faculty of imitating sounds, the *Bhimráj* never attempts to articulate human speech, in which some examples of the hill maina (*Eulabes*) succeed so admirably.

[Thayet Myo, Karen nee, Tonghoo, Rangoon (*W. R.*). These examples agree with the Siam bird. An individual from Tonghoo, obtained by Major Lloyd, has the outer pair of rectrices feathered along the whole length of the inner side of the shaft. This is found occasionally to occur in individuals of many species of *Dissemurus*. *E. intermedius*, Lesson, is founded on some species, with the outer pair of rectrices fully webbed. Malabar individuals sometimes exhibit the same peculiarity. In *D. megarhynchus* it is normal. On the other hand, *D. lophorhinus* sometimes has the inner web wanting, except at the extremity of the outer rectrices.]

*440. Buchanga atra (J. 278).

Muscicapa atra, Hermann, if distinct from *B. macrocerca* of Java; Ibis, 1872, p. 119.

Arakan.

[Tonghoo, Karen nee, Rangoon (*W. R.*). *Muscicapa atra* is Hermann's title for the South Indian bird, which is invariably smaller than that of Northern and Eastern India. *D. macrocercus*, Vieillot=*E. longus*, Tem., pertains to the Javan bird alone; a distinct form. Some Burman examples

* *cf.* Ibis, 1860, p. 99.

possess, while others want, the white rictal spot, an unstable character among the continental races, but never found, so far as at present recorded, in true *B. macrocerca*, nor in *B. cathæca*. Adult Tonghoo birds agree best in the relative proportions of the rectrices with *B. cathæca*.]

441. B. INTERMEDIA.

D. intermedius, nobis, J. A. S. B. xv. p. 298; xxxix. pt. 2, p. 322; Viscount Walden in P. Z. S. 1866, p. 545.

Arakan hills, near Bassein (*W. T. Blanford*), South Tenasserim, Pinang, Malacca (*Stoliczka*).

[Tonghoo, Karen nee, Karen hills (*W. R.*); Moulmein (*Beavan*). Lieut. W. Ramsay has sent from the localities cited a very numerous series of a species of *Buchanga*, which provisionally, until I have been able to examine typical Penang examples, are here referred to *B. intermedia* (Blyth). They vary but slightly in their dimensions when full grown. Wing, 5·25; outer pair of rectrices, 6·12; middle pair, 4·25. Nor is there much if any variation in their colouring when in perfect plumage. Lores, jet black; under surface, pure uniform bluish-ash, with little or no gloss; above, glossy bluish-ash, somewhat darker than below, and paler on the rump; rectrices, ashy-blue. They are almost identical in colouration with Javan *B. leucophæa*, that bird however being smaller, and having a less forked tail. Wing of *B. leucophæa*, 5; outer pair of rectrices, 5·38; middle pair, 4. Among a large number of Javan birds I can find no variation of colouration when in perfect plumage. *B. mouhoti*, Walden, is not separable from this Burman form.]

[442. B. PYRRHOPS.

Dicrurus pyrrhops, Hodgs., Gray's Zool. Misc. p. 84, no. 553.

Rangoon, (*W. R.*).

The Rangoon examples sent by Lieutenant W. Ramsay are all referable to *B. pyrrhops*. They are identical with individuals from Deyra Doon, Nipaul, and Dacca. In colouration they do not differ from *B. intermedia*, but their dimensions are considerably larger. Wing, 5·75; outer pair of rectrices, 6·50; middle pair, 4·50. In perfect plumage they do not vary among one another. Nor can either they or *B. intermedia* be confounded with fully-plumaged examples of *B. longicaudata*, either from Malabar, Ceylon, Simla, Mussoorie, Nipaul, Darjeeling, and Asalu. The ashy Drongos have no representative in Southern India or in Ceylon. While *B. longicaudata* has no representative in Java, so far as is yet recorded, nor have I ever seen a Malaccan or Burman example of it. Along the lower ranges of the

Himalaya it certainly occurs, and there meets *B. pyrrhops*. In immature plumage *B. longicaudata* might, by a superficial observer, be mistaken for *B. pyrrhops*. But in adult full dress it is as distinct as it is from *B. atra*, with which, however, it was also for long confounded. By some *B. leucophæa*, *B. intermedia*, and *B. pyrrhops* might be considered as constituting one species, but no author who had studied the subject would unite them with *B. longicaudata*. The *D. cineraceus*, Horsf., *apud* Blyth (J. A. S. B. 1846, p. 299), and there described by Mr. Blyth from a Malaccan specimen presented by me to the Calcutta Museum, was an example of *B. leucogenys*, in the young plumage before the pure white cheeks are developed, and in which phase of plumage it may be easily mistaken for *B. leucophæa*. It ranges from Malacca through Siam, Camboja, and China, to Japan. It is not unlikely that it, as well as *B. longicaudata*, may be found to occur in Tenasserim. Mr. Blanford gives the last (Ibis, 1870, p. 468) from the Bassein district.]

443. Dicrurus annectens (J. 279).
Nipâl, Tenasserim, Malacca.
[Rangoon (*W. R.*). *D. affinis*, Blyth, is synonymous.]

Fam. Tchitreadæ.

Flycatchers.

*444. Tchitrea affinis (J. 289).
Arakan, Tenasserim, Malacca.
[Thayet Myo (*W. R.*). The oldest and correct generic title is *Muscipeta*, Cuvier. Count Salvadori (Uccelli, Borneo, p. 137) adopts *Terpsiphone*, Glogger, a more recent title for an undefined genus.]

[445. T. paradisi (J. 288).
Mr. Hume thus identifies, but with doubt (Str. Feath. iii. p. 474), a single example of an "immature female" obtained at Lemyne by Mr. Davison.]

[446. Philentoma velatum.
Drymophila velata, Tem. P. C. 334.
Om-ben-gwen (*D.*).]

*447. Hypothymys azurea (J. 290).
Arakan, Tenasserim, Malay countries, Philippines. Common.
[Thayet Myo (*O.*).]

*448. MYIALESTES CINEREICAPILLA (J. 295).

Arakan, Tenasserim, Malacca.

[Tsan koo hills, Karen nee, 3500 feet (*W. R.*). The title of this genus must stand *Culicicapa*, Swinh., it having precedence over *Empidothera*, Sundev.]

*449. LEUCOCERCA ALBIFRONTATA (J. 292).

Tonghoo.

[Thayet Myo (*O.*). Lesson's specific title, *aureola* (Tr. p. 390), was published during the same year as that of Franklin. Until we have means of determining the month, or day of the month of the year 1831, on which the Traité was published, it will be most convenient to retain the title by which the species is best known. Franklin published his title on the 9th of August.]

[450. L. ALBICOLLIS (J. 291).

Platyrhynchus albicollis, Vieillot, N. Dict. 27, p. 13 (1818).

Karen nee hills, at 4000 feet (*W. R.*); Pahpoon (*D.*); Thayet Myo (*O.*).]

451. L. JAVANICA.

Muscicapa javanica, Sparrman, Mus. Carls. pl. 75.

Mergui, Siam. The common species of the Malay countries.

[452. CHELIDORNYX HYPOXANTHA (J. 294).

Rhipidura hypoxantha, Blyth, J. A. S. B. xviii. pp. 930, 935.

Tonghoo hills (*W. R.*).]

Fam. **Brachypodiidæ.**

Bulbuls.

*453. HYPSIPETES PSAROIDES (J. 444).

Arakan, Fokien province, China (*Swinhoe*).

454. H. CONCOLOR.

H. concolor, nobis, J. A. S. B. xviii. p. 816, probably *H. yunanensis*, J. Anderson, P. Z. S. 1871, p. 213.

Tenasserim mountains (Bhamŏ district?). This and the preceding, a Himalayan race (found also on the Khásias), the darker-coloured *H. ganeesa* of South India, the still darker *H. nigerrimus*, Gould, of Formosa, and the black *H. perniger*, Swinhoe, of Hainan, are geographical representatives of

each other, or conspecies, and it is remarkable that Ceylon examples are not so dark coloured as are those from the mainland of South India, nor so grey as are Himalayan specimens. In *Turdus melaleucus*, J. E. Gray (*H. niveiceps*, Swinhoe), of China, however, we have the same type, with the coral-red bill, but the black cap replaced by pure white; a remarkable variation, which is repeated among the black-headed and white-headed cinnamon-coloured munia grosbeaks.

[Tonghoo, Karen hills, at 1500 feet. Iris, hair-brown; bill and legs, lake-red (*W. R.*). *H. yunanensis*, Anderson, is synonymous. The white-capped Chinese species must stand *H. leucocephalus* (Gm.), founded on Sonnerat's *Merle Dominiquain de la Chine*, Voy. Indes, ii. p. 191.]

*455. H. MACCLELLANDI (J. 447).

H. holti, Swinhoe, Ibis, 1861, p. 266.

Arakan, South China.

456. H. TICKELLI.

H. tickelli, nobis, J. A. S. B. xxiv. p. 275.

Tenasserim provinces.

[Karen nee hills, 2500, 4000 feet. Iris, red-brown; bill, brown; legs, fleshy brown (*W. R.*). Under-surface of body plumage hardly distinguishable from the same in *H. malaccensis*.]

*457. IOLE VIRIDESCENS.

Iole viridescens, nobis, Ibis, 1867, p. 7; *I. virescens*, nobis, J. A. S. B. xiv. 573.

Arakan, Khásias, Tippera, Tenasserim (where obtained by Helfer).

[Tonghoo (*L.*); Yey-tho, Tsan koo hills (*W. R.*).]

*458. HEMIXUS FLAVALA (J. 448).

Pycnonotus flavala (Hodgs.), Gray and Mitchell, Gen. Birds, pl. 59.

Khásias, Arakan, Tenasserim. A representative species, *H. castaneinotus*, Swinhoe, inhabits Hainan.

[*H. hildebrandi*, Hume, Str. Feath. ii. p. 508.

Karen hills, at 2000 feet. Iris (?), lake-brown; bill, black; legs, light brown (*W. R.*); forests north of Pahpoon (*D.*). A representative form, with the head and crest dark brown, not grey. Probably the species determined by Mr. Blyth as *H. flavala*.]

459. TRACHYCOMUS OCHROCEPHALUS.

Turdus ochrocephalus, Gm.; *Tricophorus crispiceps*, nobis, J. A. S. B. xi. p. 204.

Mergui. Common at Malacca, Sumatra, Java, Borneo.

*460. Criniger flaveolus (J. 451).

Arakan, Tenasserim.

[*C. griseiceps*, Hume, Str. Feath. i. p. 478.

Tonghoo hills, Karen nee (*W. R.*); Upper Pegu (*O.*); north of Pahpoon (*D.*). Differs slightly from true *C. flaveolus* by having the feathers washed with a cinereous tinge, but does not appear to have been discriminated by Mr. Blyth.]

461. C. ochraceus.

C. ochraceus, Moore, Cat. E. I. C. Mus. i. p. 252.

Tenasserim (obtained by Helfer).

[This is a small form of *T. gutturalis*, S. Müller.]

[462. Alcurus striatus (J. 449).

Trichophorus striatus, Blyth, J. A. S. B. 1842, p. 184.

Tonghoo hills, at 5000 feet (*W. R.*).]

*463. Ixus finlaysoni.

Pycnonotus finlaysoni, Strickland, Ann. M. N. H. 1846, p. 411.

Arakan, Tenasserim provinces, Siam. "This," remarks Mason, "is a very common bird in Moulmein, and in the dry season its musical, though little varied notes, are often heard. It is rarely seen at Tavai."

[Tonghoo hills, Karen hills (*W. R.*).]

[464. I. annectens.

I. annectens, Walden, Ann. M. N. H. (4), 15, p. 401.

Rangoon (*W. R.*).]

465. I. blanfordi.

Pycnonotus blanfordi, Jerdon, Ibis, 1862, p. 20; *Pycnonotus familiaris*, nobis, J. A. S. B. xxxi. 343.

Very abundant at Thayet Myo.

[Tonghoo (*W. R.*).]

*466. I. flavescens.

Pycnonotus flavescens, nobis, J. A. S. B. xiv. 563; *P. luteolus*, from Siam *apud* Horsf. and Moore, Cat. E. I. C. Mus. 1, p. 243 (?).*

Khásias, Arakan.

[Tonghoo hills, Karen nee, at from 2500 to 4000 feet. Iris, light brown; bill and legs, black (*W. R.*); north of Pahpoon (*D.*).]

* Gould gives *P. goiavier* (*Muscicapa goiavier*, Scopoli) from Siam (P. Z. S. 1859, p. 151). The true *I. goiavier*, however, is peculiar to the Philippines, and the species intended by Mr. Gould must stand as *I. analis*.

467. Otocompsa monticola.

Ixos monticolus, M'Clelland, P. Z. S. 1839, p. 160; Ibis, 1867, p. 440.

Khásias, Tenasserim provinces. Probably *O. jocosa*, var. *sinensis*, J. Anderson, from Bhamo. Barely separable from *O. jocosa* of Bengal and Northern India, which again only differs from *O. fuscicaudata*, Gould, of South India, by having white spots on its rectrices. Another instance of different local races or conspecies. Mason remarks that this is one of the most common birds in the neighbourhood of Tavoy.

[Rangoon, Tonghoo, Karen nee, Karen hills (*W. R.*). The Bengal bird must take the specific title of *emeria*, Lin., even if the Chinese race, *Lanius jocosus*, Lin., is identical with it, as stated by Mr. Swinhoe, and who is doubtless correct. Linnæus described the Bengal Bulbul twice over in the 12th edition of the Systema, once under the genus *Lanius*, and again under *Muscicapa*, but both times with the same specific title, *emeria*.]

*468. Pycnonotus hæmorrhous (J. 462).

Turdus cafer, Gm., founded on *Merle huppé du Cap de bonne espérance*, P. E. 563, fig. 1.

Specimens from Arakan and South India appear to me to be undistinguishable, although the larger and much blacker *P. pygæus* takes its place in Lower Bengal.

[Thayet Myo, Tonghoo, Rangoon (*W. R.*). Rangoon examples more properly fall under the race named *pygæus* by Hodgson. This appropriate title, which had been adopted by Jerdon, Blyth, and other accurate authors, was changed, through misprint or other error, in the Hand-List, No. 3957, to the inappropriate title of *pygmæus*. *H. pusillus*, Blyth, founded on the South Indian bird, is a synonym of true *P. hæmorrhous*.]

469. P. nigripileus.

P. nigropileus, nobis, J. A. S. B. xvi. p. 472.

Tenasserim provinces. Common. Another representative race of the preceding, which again only differs from *P. crocorrhous*, Strickland, of Java, in having the lower tail-coverts crimson.*

[Tonghoo, Karen hills (*W. R.*); Moulmein, Amherst (*D.*).]

* *P. xanthorrhous*, J. Anderson (P. A. S. B. 1869, p. 265; *P. andersoni*, Swinhoe), is a species described from Yunan and from the Ichang gorge of the Upper Yang-tsze.

[470. P. ATRICAPILLUS.

Muscicapa atricapilla, Vieill. N. Dict. 21, p. 489 (1818); A. Hay, M. J. L. Sc. xiii. p. 160; Ibis, 1866, p. 318.

Hæmatornis chrysorrhoides, Lafr., Rev. Zool. 1845, p. 367.

Karen nee, from 1000 to 2000 feet (*W. R.*); Pahpoon, Meeta Myo hills, Tavoy (*D.*).]

*471. RUBIGULA FLAVIVENTRIS (J. 456).

Arakan, Tenasserim, Siam. Common.

[Rangoon, Tonghoo, Karen nee (*W. R.*).]

*472. BRACHYPODIUS MELANOCEPHALUS.

Lanius melanocephalus, Gm.; *Turdus atriceps*, Tem., P.C. 147. *Bok-wa.*

Tippera, Arakan, Tenasserim provinces, Malacca, Sumatra. Dr. Stoliczka remarks that he has seen this species "darting after insects almost like a Flycatcher."

[Karen nee (*W. R.*).]

[473. B. CINEREIVENTRIS.

B. cinereiventris, Blyth, J. A. S. B. 1845, p. 576.

Tonghoo (*W. R.*). I have great doubts whether this is a species distinct from *B. melanocephalus*. It seems to be rather a variety, the yellow of the nape and under surface being changed to grey. A Malaccan example in my collection is in a stage of transition from yellow to grey. Where not grey, these examples do not differ from *B. melanocephalus*. Mr. Blyth describes (*l. c.*) "the tail-feathers as being less deeply tipped with yellow," etc., but the rectrices in these two examples are identical with those of Malaccan and Burman specimens of *B. melanocephalus*. In Sumatran *Ixus chalcocephalus* all the yellow plumage of *B. melanocephalus* is changed to grey, the black and metallic parts only remaining the same in the two forms. Whether it be considered as a distinct species or not, *B. cinereiventris* is an interesting example of an "incipient" species.]

Subfam. PHYLLORNITHINÆ (Hurriahs).

474. PHYLLORNIS JAVENSIS.

Meliphaga javensis, Horsfield; *Chloropsis sonnerattii*, Jard. and Selby, Ill. Orn. pl. 100; Gould, B. As. pt. xiii. pl. 6.

This Malayan species was obtained on Moulè-it mountain by Col. Tickell.*

[Ye (*D.*).]

* J. A. S. B. xxiv. p. 277.

*475. P. HODGSONI (J. 465).

P. hodgsoni, Gould, B. As. pt. xiii. pl. 8. *Hgnet-seing* (generic).

Arakan; also obtained by Mr. W. T. Blanford seventy miles above Ava.*

[Rangoon, Tonghoo, Yey-tho, Thayet Myo, Karen nee (*W. R.*). The continental species seems to have been separated from the Sumatran, on insufficient evidence. The Malaccan form is considerably smaller.]

*476. P. CHLOROCEPHALUS.

P. chlorocephalus, Walden, Ann. M. N. H. (4), 1871, vol. vii. 241; *Turdus cochinchinensis*, Gm. (?).

Arakan, Tenasserim; has been obtained also on the Garo hills.

[Tonghoo, Karen nee, at 1600 feet (*W. R.*).]

*477. P. HARDWICKII (J. 466).

Chloropsis hardwickii, Jard. and Selby; Gould, B. As. pt. xiii. pl. 7.

Arakan, Tenasserim mountains. *P. lazulina*, Swinhoe, of Hainan, is barely separable.

[Tonghoo hills, Karen hills, from 3500 to 4000 feet (*W. R.*). *P. lazulina* has the shoulder patch coloured like the moustache, and the crown cinereous green.]

*478. IORA LAFRESNAYII.

Iora lafresnayii, Hartlaub, Rev. Zool. 1844, p. 401; Mag. de Zool. 1845, t. 60; Stoliczka, J. A. S. B. xxxix. pt. ii. p. 309; ♀ *I. innotata*, nobis, J. A. S. B. xvi. p. 472.

Arakan, Malacca. Apparently of rare occurrence.

[*Phœnicomanes iora*, Sharpe, P. Z. S. 1874, p. 427, pl. 54, is synonymous. As long since pointed out (Ibis, 1866, p. 317), if *Sylvia leucoptera*, Vieill., is a species of *Iora*, and there can be but little doubt that it is, Vieillot's generic title of *Ægithina* must supersede Horsfield's.]

*479. I. TYPHIA (J. 468).

I. typhia, Ibis, 1867, p. 10.

Indo-Chinese countries generally, Malayan peninsula, Sumatra, Java, and Borneo. Throughout this range of distribution it never shows the black upper parts of *I. zeylonica*, but there co-exists with it in the Malay countries, the *I. scapularis*, Horsfield, the male of which is *I. viridissima*, Temminck.

[Rangoon, Tonghoo, Karen nee (*W. R.*). Javan *I. scapularis*, ♀, is certainly not separable from *I. typhia*, ♀; the bill however is shorter. *I.*

* J. A. S. B. xxxii. p. 79.

viridissima is not the male of *I. scapularis*. *I. viridis*, Bp., may be the male of *I. scapularis*, but then it is difficult to separate *I. viridis* from *I. typhia*. *I. viridis*, described from Bornean examples, occurs also at Malacca, and is the species referred to above as the *I. typhia* of those countries. It is certainly of a much deeper yellow underneath than *I. typhia* of India and Burma, having the chin, cheeks, throat, breast, and under tail-coverts intense golden, much deeper than in *I. zeylonica* in full plumage, and it is but little less brilliant in the female. The bill, too, is somewhat stouter than in *I. typhia*, and much more so than in Javan *I. scapularis*, a character also relied on by Bonaparte. As it is possible that *I. typhia* does sometimes assume this rich golden colour, although in the many individuals I have examined I have never met with one, *I. viridis* had better, for the present, remain a synonym of *I. typhia*. Of the males, one Tonghoo example (April 19) has the interscapulary region black. Another (April 15) has the entire head and nape black. A Rangoon individual (June 6) has the occiput and nape black, forehead mixed black and green, some interscapulars turning to black, or reverting to green. All the rest (a large series) green above. A Karen nee male, in otherwise typical plumage, has the middle pair of rectrices broadly tipped (quarter of an inch) with green, remainder very narrowly tipped with green, outer pair fringed on inner and outer margins, and tipped with the same colour. This example has the chin, cheeks, throat, and breast very deep yellow, but not golden, as in *I. viridis*. The mutations, both in colouring and markings, which exhibit themselves in all the members of this genus, have been too little studied and are too little known to entitle any one at present to pronounce dogmatically on the subject. The problem is a much deeper one than whether *I. zeylonica* and *I. typhia* are to stand in our lists as titles representing one species or two distinct species. The admitted fact that the occurrence of birds in the *I. zeylonica* garb are exceptional in Burma and the rule in Ceylon and peninsular India, whereas breeding males are rarely (as yet recorded) found in Ceylon and peninsular India in *I. typhia* plumage, is one that cannot be disposed of or accounted for by a mere dogmatic assertion that all belong to one species. *Cf.* Captain Cock (Hume, Nests and Eggs, p. 297).]

Subfam. IRENINÆ (Irenas).

*480. IRENA PUELLA (J. 469).

Coracias puella, Lath.; nec *Muscicapa cyanea*, Begbie, v. *Irena malayensis*, Moore; *cf.* Viscount Walden, Ann. M. N. H. (4), v. p. 417; J. A. S. B. xxviii. p. 274.

Arakan, Tenasserim.

[Tonghoo, Karen hills (*W. R.*); Thayet Myo (*O.*). The *Irena* of the

Karen hills very closely resembles the Malabar bird; the colour of the males is however perhaps a shade lighter, approaching more nearly to *I. cyanea*.]

Fam. **Oriolidæ.**

Orioles.

*481. PSAROPHOLUS TRAILLII (J. 474).

Pastor traillii, Vigors; Gould, B. As. pt. xxiii. pl. 5.

Arakan, Tenasserim. A mountain species, inhabiting the more elevated forests. In Hainan and Formosa it is represented by *P. ardens*, Swinhoe, as in Java by *O. sanguinolentus*, Tem.

[Tonghoo, Karen hills, Karen nee (*W. R.*). Swainson's generic title, *Analcipus*, has precedence. The oldest title for the Javan species is *cruentus*, Wagler.]

*482. ORIOLUS MELANOCEPHALUS (J. 472).

Loriot de la Chine, P.E. 79.

Arakan, Tenasserim provinces, Malayan peninsula.

[Tonghoo, Yey-tho, Thayet Myo, Karen nee (*W. R.*).]

*483. O. INDICUS (J. 471).

O. indicus, Jerdon, Ill. Orn. pl. 15.

Arakan, Tenasserim, China, Java. The *Couliavan* of Buffon, P. E. 570, upon which is founded *O. chinensis*, L., does not represent this species, but *O. acrorhynchus*, Vigors, which appears to be peculiar to the Philippines.

[Rangoon (*W. R.*). The Rangoon individuals, all in perfect plumage, cannot be separated from China examples. They must therefore take the title of *O. chinensis*. The title of *O. hippocrepis*, Wagler, cannot be used for any species of *Oriole*, as it was applied to Indian, China, Cochinchina, Javan, and Sumatran examples generally, and, moreover, included the Philippine *O. acrorhynchus*. D'Aubenton's plate, above alluded to (P. E. 570), the subject of which may have been described by Montbeillard, not Buffon (Hist. Nat. Ois. iii. p. 262), certainly agrees best with *O. acrorhynchus*, Vigors. But Linnæus founded no title on it. Montbeillard identified, by reference, his *Coulavan* with Brisson's *O. cochinsinensis*, described from individuals obtained in Cochinchina by Poivre, and brought by him to Reaumur. On Brisson's species *O. chinensis*, Lin., was founded, but the description in the "Ornithologia" applies better to the Chinese bird than to the Philippine.]

*484. O. TENUIROSTRIS.

O. tenuirostris, nobis, J. A. S. B. xv. 48.

Arakan, Pegu, Martaban. Apparently not common, and distinguished from the preceding species by having a much more slender bill.

[Tonghoo (*L.*); Thayet Myo, Karen nee (*W. R.*); Kollidoo (*D.*).]

Fam. **Nectarinidæ.**

Sunbirds.

*485. ARACHNOTHERA MAGNA (J. 223).

Arakan, Tenasserim.

*486. A. AURATA.

A. aurata, nobis, J. A. S. B. xxviii. p. 416.

Tonghoo.

[Karen hills, at 2500 feet (*W. R.*). Jerdon (B. Ind. i. p. 361) refers to an *Arachnothera phayrei*, Blyth, from Pegu. I cannot find that Blyth ever published any such title. Jerdon states that *A. phayrei* is very close to *A. magna*. *A. aurata* is noted in my private memoranda (written some years ago) on Jerdon's work, as being intended: a correction almost certainly entered, as in many other instances, after personal reference to Blyth or Jerdon, although the circumstance has escaped my memory. There is a *Nectarinia phayrei*, Blyth, a title Jerdon may have had in his mind. As Blyth does not include *A. phayrei* in this list, it is most probable that he never published such a title, and that it occurs (*l. c.*) through a slip of the pen.]

*487. A. PUSILLA (J. 224).

Tippera, Arakan, Tenasserim, Pinang, Malacca, Sumatra.

[Tonghoo (*W. R.*). This species must take the specific title of *longirostra*, Lath., Ind. Orn. i. p. 299. One Tonghoo example, shot in April, has the orange pectoral tufts fully developed; while in another (♂), obtained on the 20th of that month, they are absent. Javan individuals can hardly be separated.]

[488. A. MODESTA.

Anthreptes modesta, Eyton, P. Z. S. 1839, p. 105.

Meeta Myo (*D.*). Thus identified by Mr. Hume.]

*489. ARACHNECHTHRA ASIATICA (J. 234).

Certhia asiatica, Latham; Ibis, 1870, p. 20; *A. intermedia* (?), A. O. Hume, Ibis, 1870, p. 436, from Tippera.

Arakan, "Thayet Myo, Yenan-khyoung" (*Blanford*). *A. intermedia* is described to have the bill of intermediate length to those of *A. asiatica* and *A. lotenia*; but neither Mr. W. T. Blanford nor myself distinguished the more eastern form from that common in North India.

[Tonghoo, Thayet Myo, Karen nee (*W. R.*); general, north of Ye (*D.*). *A. intermedia* cannot claim specific rank.]

*490. A. FLAMMAXILLARIS.

Nectariniâ flammaxillaris, nobis; Ibis, 1870, p. 24.

Arakan, Tenasserim, Pinang, Siam, South China (?).

[Rangoon, Yey-tho (*W. R.*).]

*491. ÆTHOPYGA MILES (J. 225).

Cinnyris miles, Hodgs.; Ibis, 1870, p. 32.

Viscount Walden remarks that Moulmein and Tippera specimens in his collection are smaller than those from the Deyra Doon and from Nipâl. "From Tippera, wing 2·12, tail 2·72, bill ·57; from the Deyra Doon, wing 2·18, tail 3·18, bill 6. The Moulmein specimen is still smaller."

[Tonghoo (*L.*). Some five years ago I pointed out (*l. c.*) that Moulmein and Tippera specimens differed from Deyra Doon and Nipaul individuals, but I refrained from separating the former specifically until the variations that *Æ. miles* undergoes had been investigated. While identifying the Tenasserim race (south of Moulmein) with *N. lathami*, Jard., Mr. Hume (Str. Feath. ii. p. 473, note) has bestowed on it the specific title of *cara*. The Tenasserim and Tonghoo race does slightly differ from true *Æ. miles*, but it certainly is not *Æ. lathami*, which is described as having a blue front and upper tail-coverts, and black interior maxillary stripes. There can be little doubt that *N. lathami* is=*Æ. eupogon*.]

*492. Æ. GOULDIÆ (J. 227).

Cinnyris gouldiæ, Vigors; Ibis, 1870, p. 35.

Mountains of Arakan, where probably also occur *Æ. nipalensis*, *Æ. saturata*, and *Æ. ignicauda*, all of which inhabit the Khásias.

[493. Æ. DEBRII.

Nectarinia debryii, G. Verr., R. M. Zool. 1867, pl. 15; Walden, Ibis, 1870, p. 35.

Karen nee, at 4000 feet. Iris (♂), bill, and legs, brown (*W. R.*). A

representative form of *Æ. gouldiæ*, from which it only differs by having the breast vermilion.]

[494. Æ. SANGUINIPECTUS.

Æ. sanguinipectus, Walden, Ann. M. N. H. (4), 15, p. 400 (1st June, 1875).

Karen nee hills, at from 2500 to 3000 feet (*W. R.*).]

*495. NECTAROPHILA HASSELTI.

Nectarinia hasseltii, Tem.; *Certhia brasiliana*, Gm.; Ibis, 1870, p. 41.

Tippera, Arakan, Tenasserim, Pinang, Malacca, Sumatra, Borneo.

*496. ANTHOTHREPTUS MALACCENSIS.

Certhia malaccensis, Scopoli; Ibis, 1870, p. 47.

Arakan, Tenasserim, Siam, Cambodia, Malacca, Sumatra, Java, Borneo, Celebes, and Sula Islands, but "does not reach the Moluccas" (*Wallace*).

*497. CHALCOPARIA PHÆNICOTIS.

Nectarinia phœnicotis, Tem.; *Certhia singalensis*, Gmelin; Ibis, 1870, p. 48.

Tippera, Arakan, Tenasserim, Siam, Malacca, Sumatra, Java, Borneo.

[Rangoon, Tonghoo (*W. R.*).]

*498. DICÆUM CRUENTATUM (J. 236).

Certhia cruentata, Lin.; Gould, B. As. part vi. pl. —

Arakan, Tenasserim, Pinang, Malacca, Sumatra, Borneo. Very abundant in the vicinity of Mergui station.

[Rangoon, Yey-tho, Tonghoo (*W. R.*); Thayet Myo (*F.*). The race which inhabits Sarawak has been specifically separated by Count Salvadori under the title of *D. nigri-mentum* (Ucc. Borneo, p. 165). Malaccan individuals appear also to differ, although but slightly, from Burman, Bengal, and Assam examples.]

*499. D. TRIGONOSTIGMA.

Certhia trigonostigma, Scopoli; *C. cantillans*, Latham (*cf.* Stoliczka, J. A. S. B. xxxix. pt. 2, p. 303).

Arakan, Tenasserim, Malacca, Sumatra, Borneo.

[Karen hills, at 3000 feet (*W. R.*).]

*500. D. CHRYSORRHÆUM (J. 237).

Khásias, Arakan, Tenasserim, Malacca.

[Tonghoo. Iris (♂, ♀), brown; bill, black; legs, dark slate-colour (*W. R.*).]

*501. D. ERYTHRORHYNCHA (J. 238).

Certhia erythrorhyncha, Latham, Ind. Orn. i. p. 299; *Nectarinia minima*, Tickell.

Latham's title was founded on the drawing of a young specimen, with the colour of the bill exaggerated. A still smaller species from Hainan has been described as *D. minullum*, Swinhoe, Ibis, 1870, p. 240.

Arakan, Tenasserim. Exceedingly abundant in the jungles near Moulmein, and coming within reach of the hand if the spectator remains motionless.

[There is nothing in Latham's text to indicate that he described from a drawing.]

[502. D. VIRESCENS.

D. virescens, Hume, Str. Feath. ii. p. 198.

Pahpoon and neighbourhood (*D.*).]

[503. D. OLIVACEUM.

D. olivaceum, Walden, Ann. M. N. H. (4), 15, p. 401 (June 1st, 1875).

Tonghoo hills, Karen hills (*W. R.*).]

[504. MYZANTHE IGNIPECTUS (J. 241).

Karen nee, at 4000 feet (*W. R.*).]

Order GEMITORES.

Pigeons.

Fam. Treronidæ.

Hurrials.

*505. TORIA NIPALENSIS (J. 771).

Not uncommon in Arakan; occurs also in the Malayan peninsula, and in Sumatra.

[Pegu hills (*O.*); Tenasserim (*D.*). The generic title, *Toria*, must give way to *Treron*. The species seems to be identical with *T. nasica*; if so, its range extends to Borneo.]

*506. CROCOPUS VIRIDIFRONS.

Treron viridifrons, nobis, J. A. S. B. xiv. p. 849; Bonap., Icon. des Pigeons, pl. 9.

Pegu, Tenasserim provinces, Siam. This race is barely separable from *C. phœnicopterus*, but its colours are always purer and more strongly contrasted. Mr. W. T. Blanford, however, gives *C. phœnicopterus* from Ava, in addition to *C. viridifrons* from Bassein and Thayet Myo.*

[Tonghoo (*W. R.*).]

* Ibis, 1870, p. 469.

*507. Osmotreron phayrei (J. 776).

Common in Arakan and Pegu, rare in Lower Bengal. In colour it quite resembles *Toria nipalensis*, but the bill is very differently shaped.

[Tonghoo (*W. R.*); Tenasserim (*D.*).]

*508. O. bicincta (J. 774).

Arakan, Pegu, Tenasserim provinces, Siam, Malacca (*fide* Walden) and India generally. A slightly different race inhabits Hainan (*O. domvillei*, Swinhoe).* From Siam Mr. Gould notes the allied *T. viridis* (Scopoli)= *vernans*, Lin., in addition to *O. bicincta*. *O. viridis* is a common Malayan species, which is likely to occur in South Tenasserim.

[Tonghoo (*W. R.*). The common Malayan species alluded to is *Columba vernans*, Lin. Mr. Hume notes it from Tenasserim (Str. Feath. i. p. 461, and iii. p. 162), but does not include it in his list of Tenasserim birds (*op. cit.* ii. p. 481.]

[509. Sphenocercus sphenurus (J. 778).

[Tonghoo hills (*W. R.*); hills north of Pahpoon (*D.*).]

[510. S. apicaudus (J. 779).

Tonghoo hills (*W. R.*); hills north of Pahpoon (*D.*).]

Fam. Columbidæ.

Pigeons and Doves.

Subfam. Carpophaginæ (Fruit Pigeons).

*511. Carpophaga insignis (J. 781).

Mountains of Arakan.†

In the Leyden Museum I remarked that *C. insignis* (Hodgson) appeared to be the same as *C. badia* (Raffles), the former being rather brighter in colouring; while *C. lacernulata* (Tem.), of Sumatra and Java, is rather smaller with a distinct grey cap.

[*C. lacernulata* is, as yet, only with certainty recorded as an habitant of Java.]

*512. C. ænea (J. 780).

Bung-madie.

Generally diffused over British Burma, and identical with the species as found in Central India and in the Andaman Islands; while the correspond-

* Ibis, 1870, p. 534. † *cf.* J. A. S. B. xxviii. p. 416.

ing bird of the Nicobars (*C. insularis*, nobis*) is constantly distinguishable. *C. rosacea* (Tem.), from Timor, etc., differs very slightly. In Southern India and Ceylon the race is smaller, but otherwise similar (*C. pusilla*, nobis†). Of this small race I observed four specimens from Travancore and Ceylon in the Museum at Leyden.

[Tonghoo (*L.*).]

513. C. BICOLOR.

Columba bicolor, Scopoli; Sonnerat, Voy. t. 103; *C. alba*, Gmelin; *C. littoralis*, Tem.

Mergui archipelago, Nicobar Islands, Malayan peninsula.

Subfam. COLUMBINÆ (Pigeons).

514. ALSOCOMUS PUNICEUS (J. 782).

Arakan, Tenasserim, not uncommon on Ramri Island; Central India, Ceylon. It is nearly allied to *Columba ianthina*;‡ and an unnamed species of the *Palumbus* or Cushat group from Siam (*Xiengmai*) would seem to be indicated by the late Sir R. H. Schomburgk.§

[Tonghoo (*W. R.*). The examples constituting the large series obtained at Tonghoo by Lieutenant W. Ramsay in no way differ from Maunbhoom and Upper Assam individuals.]

*515. COLUMBA LIVIA (J. 788).

Columba livia, var. *intermedia*, Strickland; *C. turricola*, Bonap.

Common, as throughout India, and only differing from the wild European *livia* in having no white above the tail. It everywhere grades into the domestic Pigeon.

*516. TURTUR TRANQUEBARICUS (J. 797).

Turtur tranquebaricus, Hermann, Obs. Zool. p. 200. *Gyo* (generic).

Arakan.

[Karen nee (*W. R.*). The Karen nee examples belong to true *T. humilis* of the Philippines, and not to *T. tranquebaricus*.]

*517. T. TIGRINUS.

Columba tigrina, Tem.; Knip, Pig. pl. 43.

Indo-Chinese and Malayan countries. This can hardly be considered as

* J. A. S. B. xv. p. 371.

† *op. cit.* xviii. p. 816.

‡ Fauna Japonica, Aves, t. lx. c.

§ Ibis, 1864, p. 250.

being other than a race of *T. suratensis*, of India with Ceylon, but, except where the two come in contact, the difference would seem to be maintained.

[Yey-tho, Thayet Myo (*W. R.*). Mr. Hume, Str. Feath. iii. p. 164) speaks of "typical *tigrina* from Sumatra." As the species, *T. tigrinus*, was not described from a Sumatran individual, it is difficult to gather what is meant by the expression "typical."]

*518. T. MEENA (J. 793).

Gyo-peing-tu-ma.

Arakan, Tenasserim. A specimen of *T. cambaiensis* flew on board a steamer when in sight of land on the voyage from Moulmein to Rangoon.*

[Tonghoo, Karen nee, at 4000 feet (*W. R.*):]

[519. T. RISORIUS (J. 796).

Thayet Myo (*F.*). Professor Schlegel (Mus. P.-Bas, *Columbæ*, p. 123) adopts the title of *T. douraca*, Hodgs., for this Indian dove, and restricts the Linnæan title to the domestic bird of Europe (*t. c.* p. 125). But all the authors Linnæus quotes described the bird from India. It is the *Turtur indicus* of Aldrovandi, and Linnæus says "*habitat in India.*"]

520. MACROPYGIA RUFICEPS.

Columba ruficeps, Tem.; P.C. 561.

Mergui, Province Wellesley, Java. A finer species akin to this inhabits the Andaman and Nicobar Islands, *M. rufipennis*, nobis;† and the *M. tusalia* is likely to occur on the higher mountains of Arakan, if not further south; it is not rare on the Khásias, and a smaller race of the same is described from Hainan.‡

[This Javan species may occur as stated, but the following appears to be the commoner form.]

[521. M. ASSIMILIS.

M. assimilis, Hume, Str. Feath. ii. p. 441.

Karen hills, at 3000 feet. Iris (♀), grey; bill and legs, vinous brown (*W. R.*); Kollidoo (*D.*).]

[522. M. TUSALIA (J. 791).

Karen nee (*W. R.*); Kollidoo (*D.*).]

* Beavan, Ibis, 1869, p. 406. † J. A. S. B. xv. p. 371.

‡ Ibis, 1870, p. 355.

*523. Chalcophaps indicus (J. 798).

India, Indo-China, and Malay countries, Andaman Islands; but the Nicobar race* is a little peculiar, and corresponds with *C. mariæ*, Bonap.

[Rangoon, Tonghoo, foot of Karen hills (*W. R.*); Tenasserim (*D.*). Recent investigations do not confirm the opinion that the Nicobar race of this species differs.]

Subfam. Calœninæ (Hackled Ground-Pigeons).

524. Calœnas nicobaricus.

Columba nicobarica, Lin.; Edwards, pl. 339; Pl. Enl. 491.

This remarkable bird is common in the Mergui archipelago, and I have received the young from the Cocos Islets, north of the Andamans. It seems to be only able to maintain itself in islands where there are no small carnivorous mammalia; and I doubt, therefore, the statement that it is "common on the Tenasserim coast."†

Order GALLINACEÆ.

Poultry-Birds.

Fam. Pavonidæ.

Pheasants, etc.

Subfam. Pavoninæ (Peafowl).

*525. Pavo muticus.

Pavo muticus, L. *Oo-doung*. Elliot, Mon. Phas. pt. ii. pl. 11.

Chittagong, Arakan, Tenasserim, Siam. Invariably of darker and less vivid colouring than the species as it occurs in Java, but not otherwise differing. In the provinces of Sylhet and Assam the Indian species, *P. cristatus*, replaces it.‡

It is doubtful, at present, whether this species really inhabits the Malayan peninsula or Sumatra; but Crawfurd distinctly asserts that it inhabits "the tropical countries lying between India and China,—of the Malayan peninsula, and the islands of Sumatra and Java."§ On the other hand, Wallace remarks that "it is a singular fact in geographical distribution that the Peacock should not be found in Sumatra or Borneo, while the superb

* J. A. S. B. xv. p. 371.

† Calc. J. N. H. i. p. 605.

‡ Calc. J. N. H. ii. p. 144.

§ Tr. Ethn. Soc. *n.s.* vol. ii. p. 451.

Argus, fire-backed, and ocellated Pheasants of those islands are equally unknown in Java."* Raffles must mean this species when he states that "the common Peacock is a native of the Malayan peninsula and of Java, and is also known to Sumatra." He gives the Malayan name as *M'ree* or *Marak*, but in Sumatra he may only have seen tame Peafowl, imported from Java. The late Dr. Cantor had specimens in his collection from Pinang and Province Wellesley, but whether procured there in the wild state I am unaware; it may be remarked, however, that the same collection contained specimens of *Gallus varius*, which is understood to be quite peculiar to Java.

[The occurrence of this species in Burma offers a notable instance of the fact that Javan forms, unknown in the Malay peninsula south of Pinang, and in Sumatra and Borneo, reappear in Burma.]

Subfam. ARGUSANINÆ.

526. ARGUSANUS GIGANTEUS.

Phasianus argus, L.; Elliot, Mon. Phas. pt. iii. pl. 2.

Mergui, Malayan peninsula, Sumatra.

*527. POLYPLECTRON CHINQUIS.

Polyplectron chinquis, Temminck; *Pavo tibetanus*, L.; Gould, B. As. pt. xxiii. fig. 1; Elliot, Mon. Phas. pt. ii. pl. 8. *Doung-Kula*, *Monuwur*, and *Day-o-da-huk*.

Sylhet, Assam, Tenasserim provinces; South-West China (*Swinhoe*).

[The oldest name for this species is *P. thibetanus*, but as it involves a geographical error, Temminck's title is adopted by most authors.]

Subfam. PHASIANINÆ (Pheasants).

528. GALLUS FERRUGINEUS (J. 812).

Tetrao ferrugineus, Gm.; Elliot, Mon. Phas. pt. ii. pl. 9.

The wild common Fowl. Abundant in the forests, and the domestic poultry of the Karéns is commonly recruited from the wild race, which is not the case in those parts of northern and central India where the wild and tame inhabit the same forest districts. The cheek-lappet of the cock is pure white and contrasting in the Indian race, and red in the Indo-Chinese race. The tarsi are always slate-coloured in the wild bird, but tend to become yellow in the domestic before any other change is perceptible.

[Tonghoo (*W. R.*); Tenasserim (*D.*).]

* Malay Archipelago, i. p. 169.

*529. NYCTHEMERUS LINEATUS.

Phasianus lineatus, Latham; *P. reynaudii*, Lesson; *P. fasciatus*, M'Clelland; Elliot, Mon. Phas. pt. iii. pl. 7. *Yeet.*

Pegu, Martaban, Tenasserim. Common down to the sea-level or nearly so. In Arakan the race is hybrid (*Lophophorus cuvieri*),* and presents every gradation from *N. lineatus* to *G. horsfieldi*† of Tippera and Sylhet.‡

[Karen hills (*W. R.*). Wagler's generic title *Gennæus* has precedence.]

530. N. ANDERSONI.

Euplocamus andersoni, Elliot, P. Z. S. 1871, p. 137; Mon. Phas. pt. v. pl. 11.

This fine species, intermediate to *N. lineatus* and the well-known Silver Pheasant, *N. argentatus*, Swainson,§ was discovered by Dr. J. Anderson in Yunan.

Another beautiful species, *Diardigallus prælatus*, Bonap.,‖ inhabits the Shán States, and is now bred in European *vivaria*. According to M. Germain, this bird is common through the forest region of French Cochin-China.

In the Yunan mountains the superb Lady Amherst Pheasant¶ was obtained by Dr. J. Anderson.

[The oldest published title with a description for *D. prælatus*, is *craufurdii*, J. E. Gray (Cuv. R. An. (Griffith), *Aves*, iii. p. 27). Mr. Craufurd brought the type (♀) from Ava, but we have no evidence that the species is indigenous to Burma, and it is therefore not here included.]

531. EUPLOCOMUS IGNITUS.

Phasianus ignitus, Latham; *E. vieillotti*, Gray; Gould, B. As. pt. ii. pl. 8; Elliot, Mon. Phas. pt. ii. pl. 10.

This large Malayan Pheasant is common along the valley of the great Tenasserim river. Kachar.

Subfam. PERDICINÆ (Partridges).

*532. FRANCOLINUS PHAYREI.

Francolinus phayrei, nobis, J. A. S. B. xii. p. 1011; xxiv. p. 480.

Common in Pegu, and a young example is contained in the British Museum from Cochin-China. Very similar to *F. sinensis* (*Tetrao chinensis*,

* Tem., P.C. v. pl. 1.

† Elliot, Mon. Phas. pt. iv. pl. 4.

‡ *vide* J. A. S. B. xviii. p. 817.

§ Elliot, Mon. Phas. pt. i. pl. 6.

‖ *Phasianus craufurdii* (?), Gray, ♀; Gould, B. As. pt. xi. pl. 4; Elliot, Mon. Phas. pt. i. pl. 12.

¶ *Thaumalea amherstiæ*, Gould, B. As. pt. xviii. pl. 7; Elliot, Mon. Phas. pt. ii. pl. 10.

Osbeck, *T. perlatus*, Gmelin), but less robust, having the bill and feet more slender. In Hainan the species is described as identical with that of South China. Sir. R. H. Schomburgk's *F. pictus* from Siam is doubtless the present species.

[Thayet Myo, Karen nee (*W. R.*). The slight differences between the Burman and Chinese races of this Francolin, relied on by Mr. Blyth, seem hardly sufficient to constitute a separate species. A comparison made between numerous examples from Burma and China disinclines me to concur in Mr. Blyth's opinion.]

533. ARBORICOLA RUFIGULARIS (J. 825).

This species of Peura Partridge, which inhabits the South-East Himalaya, at a lower altitude than *A. torqueola*, was obtained by Colonel Tickell in the mountainous interior of the Tenasserim provinces, at elevations of from 3000 to 5000 feet.

*534. A. INTERMEDIA.

A. intermedia, nobis, J. A. S. B. xxiv. p. 277.

I failed to discriminate these two races, until I had received numerous living examples of *A. atrigularis* from Sylhet, when I remarked the difference of *A. intermedia*, which I have reason to suspect was received from Arakan. There is a specimen of the latter in the British Museum, habitat unknown. (Since the above was written, Mr. W. T. Blanford has obtained *A. intermedia* from Arakan.)

535. A. BRUNNEIPECTUS.

A. brunneipectus, Tickell, J. A. S. B. xxiv. p. 276.

Tenasserim mountains, from 3000 to 5000 feet (*Tickell*).

[Tonghoo and Karen hills (*W. R.*).]

536. A. CHLOROPUS.

A. chloropus, Tickell, J. A. S. B. xxviii. pp. 415, 453.

"Tolerably numerous; but as far as my observations go, is entirely confined to the forests on the banks of the Zummee river. Unlike its known congeners, it avoids mountains, and inhabits low though not humid jungles, where the ground merely undulates or rises into hillocks. Early in the morning these birds come out on the pathway, scratching about in the elephants' dung, and turning over the dead leaves for insects. They do not appear to have any crow or call, though during the pairing season this may not be the case" (*Tickell*). This species is nearly allied to *A. charltoni*

(Eyton), *A. pyrrhogaster* (Reichenbach) of Province Wellesley, but is sufficiently distinguished.

[Eastern slopes of the Pegu hills (*O.*).]

537. Caloperdix ocellata.

Tetrao ocellatus, Raffles, Tr. L. S. xiii. p. 322; *Perdix oculea*, Tem.; Hardw. Ill. Zool. i. pl. 58.

Obtained by Major Berdmore in Mergui province. *Hab.* also Province Wellesley and Sumatra.

[Temminck's specific title has precedence.]

538. Bambusicola fytchei.

Bambusicola fytchei, J. Anderson, P. Z. S. 1871, p. 214, pl. xi.

Was obtained on the hill-sides of Ponsee, at an elevation of 3000 feet.

539. Rollulus cristatus.

Columba cristata, Gmelin; *Perdix coronata*, Latham.

Valley of the Tenasserim river, Siam, Malayan peninsula, Sumatra, and Borneo. "More common about Malacca than in the Wellesley Province and in Tenasserim" (*Stoliczka*).

[Must stand as *Rollulus roulroul.*]

*540. Coturnix communis (J. 829).

Arakan, Martaban.

[Karen nee (*W. R.*).]

541. C. coromandelicus (J. 830).

Common in Upper Burma.

542. Excalfactoria chinensis (J. 831).

Tetrao chinensis, Lin.; Gould, B. As. pt. x. pl. 12.

Arakan, Tenasserim, Malayan peninsula and islands.

Fam. **Turnicidæ.**

Hemipodes.

543. Turnix blanfordi.

Turnix blanfordi, nobis, J. A. S. B. xxxii. p. 80; *Hemipodius maculosus*, Tem. (?); *Turnix maculatus*, Vieillot, Gal. des Oiseaux, t. 217.

Arakan, Pegu.*

[Tonghoo, Karen nee (*W. R.*); Kollidoo (*D.*). Not to be separated from Shanghai and Chefoo examples.]

* *vide* Swinhoe, in P. Z. S. 1871, p. 402.

544. T. PLUMBIPES (J. 833).

T. plumbipes, Hodgson, Beng. Sport. Mag. 1837, p. 345.

Tenasserim specimens are quite similar to those from Nipâl.

[Thayet Myo, Karen nee, Tonghoo (*W. R.*). Not separable from Malaccan examples; but differing somewhat from Javan *T. pugnax*.]

Order GRALLATORES.

Waders.

N.B.—Bustards are foreign to the Indo-Chinese countries, but a straggler of the Likh Florikim (*Sypheotides aurita*) is recorded to have been shot at Sandoway, Arakan (Bengal Sport. Mag. 1835, p. 151).

Tribe LIMICOLÆ (Plovers and Snipes).

Fam. **Charadriadæ.**

Plovers.

*545. AESACUS RECURVIROSTRIS (J. 858).

Common along the banks of rivers.

[Kyasoo creek (*W. R.*).]

546. OEDICNEMUS CREPITANS (J. 859).

Yenan-khyoung (*W. H. Blanford*).

547. CHÆTUSIA CINEREA (J. 854).

Bassein, China and Japan.*

[Tonghoo (*W. R.*); Ye (*D.*). As Professor Schlegel (*l. c.*) gives Mr. Blyth's title precedence, it may be accepted for the present. Further investigation may, however, show that Temminck and Schlegel's title was published at an earlier date. The Report in which Mr. Blyth first described *C. cinerea* was for March, 1842, but was only actually published with the Proceedings of the A. S. B. for June, 1842.]

*548. SARCOGRAMMA ATRINUCHALIS.

Sarcogramma atronuchalis, nobis, J. A. S. B. xxxi. p. 345, note.

Common from Arakan to Malacca. It has much more black on the nape than the Indian race, margined with white below, more or less developed.

[Yey-tho, Thayet Myo, Tonghoo, Karen nee (*W. R.*).]

* H. Schlegel, Mus. des Pays-Bas, *Cursores*, p. 69.

549. Sarciophorus bilobus (J. 856).

Thayet-Myo.

[Boddaert's specific title, *malabaricus*, has priority, as a glance at Pl. Enl. 880 will show.]

*550. Hoplopterus ventralis (J. 857).

Common along the banks of rivers. Mr. Swinhoe met with it in Hainan [Tonghoo, Karen nee (*W. R.*).]

*551. Squatarola helvetica (J. 844).

Arakan.

[Tonghoo (*W. R.*).]

*552. Charadrius fulvus (J. 845).

Common in the cold season.

[Thayet Myo, Tonghoo (*W. R.*).]

553. Ægialites placida.

Ægialites placidus, G. R. Gray, Cat. Hodgs. Coll. 2nd ed. p. 70, 1863; *A. hartingi*, Swinhoe; *Eudromias tenuirostris*, A. O. Hume, probably *Charadrius longipes*, apud David, N. Arch. de Mus. 1867, p. 38.

A specimen of this bird was believed by Dr. Jerdon to have been procured by him in Burma, but he was not sure whether he obtained it on the coast or inland.

*554. Æ. mongolica (J. 847).

Common in the cold season.

*555. Æ. dubia (J. 849).

Charadrius dubius, Scopoli, Del. Fl. Faun. Insubr. ii. p. 92.

Smaller than the European *Æ. curonicus*, but otherwise similar, and of common occurrence.*

[*Æ. philippensis*, apud Jerd., No. 849, and which is the number in Mr. Blyth's MS., is=*C. curonicus*, Gm. But perhaps the species actually intended by Mr. Blyth is *Æ. minuta* (Pallas), apud Jerdon, No. 850, and of which Lieutenant W. Ramsay obtained specimens at Tonghoo. The title *C. philippensis*, Lath., was founded on the same plate as that of *C. dubius*, Scopoli. Until the species which inhabits the island of Luzon has been studied, the correct titles for the two species cannot be determined. The synonymy is very simple, but the correct application of the various titles cannot be made until the Philippine type has been compared.]

* For notice of *Æ. philippensis*, commonly referred to the same, *vide* Ibis for 1867, p. 164.

[556. Æ. CURONICUS (J. 849).
Rangoon (*W. R.*).]

*557. Æ. ALEXANDRINUS (J. 848).
C. alexandrinus, Lin.
Arakan.
[Tonghoo (*W. R.*).]

Fam. Hæmatopodidæ.

*558. STREPSILAS INTERPRES (J. 860).
Arakan.

559. HÆMATOPUS OSTRALEGUS (J. 862).
Arakan; China and Japan (*H. Schlegel*).

Fam. Glareolidæ.

Pratincoles.

*560. GLAREOLA ORIENTALIS (J. 842).
Arakan, Pegu.
[Tonghoo (*W. R.*).]

*561. G. LACTEA (J. 843).
Arakan, Pegu, Tenasserim. Dr. Jerdon found this species breeding at Thayet Myo, with the young just flown in May.
[Tonghoo (*W. R.*).]

Fam. Recurvirostridæ.

*562. HIMANTOPUS AUTUMNALIS (J. 898).
Arakan. *H. leucocephalus** will doubtless be met with.†
The Stilt-plovers of the Old World have bright rose-coloured legs, and ruby-red irides; while those of America (*H. nigricollis*) have very much paler pinkish legs and dark irides; diversities which are not seen in the dry skins.
[Karen hills (*W. R.*).]

* Gould, Birds of Australia, vol. vi. pl. 24.
† *cf.* Ibis, 1865, p. 35, 1867, p. 169; J. A. S. B. xli. pt. 2, p. 253.

Fam. **Scolopacidæ.**

Snipes, etc.

*563. Totanus glottis (J. 894).
Arakan.
[Upper Pegu (*O.*).]

*564. T. stagnatilis (J. 895).
Arakan, Tenasserim.
[Upper Pegu (*O.*).]

*565. T. calidris (J. 897).
Arakan.
[Karen nee (*W. R.*).]

*566. Actitis glareola (J. 891).
Arakan.
[Tonghoo, Karen nee (*W. R.*).]

*567. A. ochropus (J. 892).
Arakan.
[Upper Pegu (*O.*).]

*568. A. hypoleucus (J. 893).
Arakan, Tenasserim.
[Tonghoo (*W. R.*).]

*569. Xenus cinereus (J. 876).
Arakan, Tenasserim.*

*570. Limosa ægocephala (J. 875).
Arakan.

*571. Numenius lineatus (J. 877).

Numenius lineatus, Cuvier, R. An. 2nd ed. i. p. 521; Lesson, Tr. d'Orn. p. 565; *N. major*, Fauna Japonica, Aves, pl. 66.

Arakan.
[Kyasoo creek (*W. R.*). Mr. Blyth has always maintained that the Indian differed from the European Curlew.]

*572. N. phæopus (J. 878).
Arakan, Tenasserim, Andamans, and Nicobars.
[Thayet Myo (*F.*).]

* *cf.* Ibis, 1873, p. 68.

*573. TRINGA SUBARQUATA (J. 882).
Arakan, Tenasserim.

*574. T. PLATYRHYNCHA (J. 886).
T. platyrhyncha, Tem.; Gray and Mitchell, Gen. Birds, pl. 157, fig. 2.
Arakan.

*575. T. SALINA (J. 884).
T. salina, Pallas; *T. damacensis*, Horsfield; *T. subminuta*, Middendorff.
Arakan, Tenasserim.

[Rangoon, Tonghoo (*W. R.*). While *T. damacensis*, Horsf., remains unidentified, it will be best to adopt Middendorff's title of *subminuta* for this species. Mr. Swinhoe identifies *T. salina*, Pallas, with *T. albescens*, Tem., a species which has a red neck and throat in spring. For it, *T. ruficollis* is the oldest title.]

*576. T. TEMMINCKII (J. 885).
Arakan.
[Tonghoo (*W. R.*).]

577. EURYNORHYNCHUS PYGMÆUS (J. 887).
E. pygmæa (Lin.), Gray and Mitchell, Gen. Birds, pl. 157, fig. 1; Gould, B. As. pt. xxi. pl. 13; Ibis, 1869, pl. xii.
Estuaries of rivers, on extensive mud-banks left by the tide.

*578. PHILOMACHUS PUGNAX (J. 880).
Arakan.
[Moerhing's generic title cannot be used, and as Leach gave no generic characters, and was not substituting a title, *Pavoncella* must fall, and *Machetes*, Cuv., be adopted.]

579. GALLINAGO SCOLOPACINA (J. 871).
Common in Upper Burma.
[Tonghoo (*W. R.*); Pabyouk (*D.*).]

*580. G. STENURA (J. 870).
The most common snipe of the Indo-Chinese and Malayan countries.
[*Scolopax stenura*, Kuhl, MS.; *S. sthenura*, Bp., An. St. Nat. 1829; *S. horsfieldii*, J. E. Gray, Zool. Misc. 1831, p. 2. Mr. G. R. Gray (H. L. No. 10344) most unaccountably gives Dr. Gray's title the precedence.]

[581. G. GALLINULA (J. 872).
Upper Pegu (*O.*).]

[582. SCOLOPAX RUSTICOLA (J. 867).
An example of this Woodcock was shot at Moulmein by Colonel D. Brown a few years since (*fide* Hume, Str. Feath. ii. p. 482).]

*583. RHYNCHEA BENGALENSIS (J. 873).
Arakan, Tenasserim.
[Rangoon, Yey-tho (*W. R.*).]

Fam. **Parridæ.**

Jacanas.

*584. METOPIDIUS INDICUS (J. 900).
Arakan, Tenasserim.
[Tonghoo (*W. R.*).]

*585. HYDROPHASIANUS SINENSIS (J. 901).
Arakan, Tenasserim.
[Tonghoo (*W. R.*). Must stand *M. chirurgus* (Scop.), unless on comparison the Philippine bird be found to differ.]

Fam. **Gruidæ.**

Cranes.

586. GRUS ANTIGONE (J. 863).
Kyo-gya.
Arakan and Pegu. Very numerous in the interior in large flocks. According to Lieut. Beavan, it breeds in Burma.* Cantor procured it in Province Wellesley, and it is common in Siam.

587. G. LONGIROSTRIS (J. 865).
G. longirostris, Tem., Fauna Japonica, Aves, pl. lxxii.; *G. cinerea*, of Indian authors; *cf.* Ibis, 1873, p. 81.
Included by Mason, and was observed by Mr. Swinhoe in Hainan.

* P. Z. S. 1867, p. 762.

Fam. **Ibididæ.**

Ibises.

*588. Falcinellus igneus (J. 943).
Arakan.

*589. Geronticus papillosus (J. 942).
Arakan.

*590. Ibis melanocephalus (J. 941).
Kula-gowk.
Arakan, Tenasserim, Siam.

Fam. **Ciconiidæ.**

Storks.

*591. Tantalus leucocephalus (J. 938).
Arakan, Tenasserim. Common.
[Tonghoo (*W. R. in epist.*).]

*592. Anastomus oscitans (J. 940).
Kha-ru-tsoke.
Arakan.

*593. Xenorhynchus australis (J. 917).
Arakan, Tenasserim.
[The Asiatic Jabiru, even if it be identical with the Australian, must take the title of *asiatica*, Lath.]

*594. Ciconia episcopus (J. 920).
Ciconia microscelis, Gray and Mitchell, Gen. Birds, pl. 151. *Khyee-kheng-tswop.*
Arakan, Tenasserim, Malayan countries.
[Upper Pegu (*O.*).]

595. C. alba (J. 919).
Included by Mason.

596. Leptoptilus argala (J. 915).
Arakan, Tenasserim. Breeds on trees on the limestone mountains.
[Tonghoo (*W. R. in epist.*). Although long ago shown by Professor Schlegel (Mus. P.-Bas, *Ardeæ*) that, under the title of *Ardea dubia*, Gmelin

had confounded three distinct species, namely the two Indian and the African, Mr. G. R. Gray (H. L. No. 10195) adopted Gmelin's title for the larger Adjutant of India. It is even doubtful whether Latham's title of *argala* may in strictness be employed. If it be rejected, an unexceptionable title, Professor Alfred Newton suggests, is available in *A. gigantea*, R. Forster (1795, Faun. Ind. p. 11), and the adoption of which would avoid the necessity of using Temminck's most objectionable title of *marabu*.]

*597. L. JAVANICA (J. 916).

Dung-tsat and *Nghet-gyee*.

Arakan, Tenasserim, Hainan.

Fam. Ardeidæ.

Herons.

*598. ARDEA SUMATRANA (J. 922).

Ardea sumatrana, Raffles; Gould, B. Austr. vol. vi. pl. 54.

Arakan, Tenasserim, Malacca, Sumatra, and Australia.

*599. A. CINEREA (J. 923).

Generally diffused.

*600. A. PURPUREA (J. 924).

Khyung byaing.

Generally diffused.

*601. HERODIAS ALBA (J. 925).

Arakan.

[*Cf.* Swinhoe, P. Z. S. 1871, p. 412, *E. modesta*.]

*602. H. INTERMEDIA (J. 926).

Ardea intermedia, Wagler; Fauna Japonica, Aves, pl. 69; Gould, B. Austr. vol. vi. pl. 57.

Frequents open places about the town of Rangoon. Obtained at Bhamŏ.

*603. H. GARZETTA (J. 927).

Common in the interior.

604. H. EULOPHOTES.

H. eulophotes, Swinhoe, Ibis, 1860, p. 44; Gould, B. Austr. vol. vi. pl. —.

Obtained by Major Berdmore at Mergui.

605. H. CONCOLOR.

Demiegretta concolor, nobis, J. A. S. B. xv. p. 372.

Arakan (Ramri), Andaman and Nicobar Islands.*

*606. BUPHUS COROMANDUS (J. 929).

Arakan.

*607. ARDEOLA GRAYI (J. 930).

Arakan.

[Karen nee (*W. R.*).]

[608. A. PRASINOSCELES.

A. prasinosceles, Swinhoe, Ibis, 1860, p. 64.

Examples obtained by Mr. Davison at Tavoy and Ye-boo, are thus identified by Mr. Hume (Str. Feath, ii. p. 483).]

*609. BUTORIDES JAVANICUS (J. 931).

Common.

[Tonghoo, Rangoon (*W. R.*).]

*610. ARDETTA FLAVICOLLIS (J. 932).

Common.

[Tonghoo, Rangoon (*W. R.*).]

*611. A. CINNAMOMEA (J. 933).

Common.

[Rangoon, Tónghoo (*W. R.*).]

*612. A. SINENSIS (J. 934).

Common.

[Tonghoo (*W. R.*).]

*613. GORSACHIUS MELANOLOPHUS.

Ardea melanolopha, Raffles, Tr. L. S. xiii. p. 326.

Specimen obtained in Ramri by Major J. R. Abbott.

* *Ardea jugularis*, Forster, is given by Herr v. Pelzeln from the Nicobars, in addition to *A. concolor*.

[The specific title of *sacra*, Gm., supersedes that of *concolor*, Blyth (*cf.* Walden, Ibis, 1873, p. 318). *A. jugularis*, Forster, is synonymous.]

*614. Nycticorax griseus (J. 937).
Arakan, Bhamŏ.
[Rangoon (*W. R.*).]

Fam. **Rallidæ.**

Rails, Coots, etc.

*615. Porphyrio poliocephalus (J. 902).
Arakan, Tenasserim. *P. smaragdinotis* is given from Siam.*
[Tonghoo (*W. R.*). Latham's description agrees well with the common Indian purple Coot. He says nothing about a brown back, and that the whole head, neck, and lower parts are unicolorous pale lavender-blue, as stated by Mr. Hume (Str. Feath. iii. p. 185). Latham describes the bird as having the back purple; the head and neck, blue-grey, growing to azure towards the chin; breast and belly verditer green (Suppl. ii. p. 375).]

*616. Gallicrex cristatus (J. 904).
Arakan, Tenasserim.
[Upper Pegu (*O.*). Must stand *G. cinereus* (Gm.).]

*617. Porzana phœnicura (J. 907).
Rallus phœnicurus, Forster; Gould, B. As. pt. xxiv. pl. 12.
Arakan, Tenasserim, Siam. Common.
[Tonghoo (*W. R.*).]

*618. P. maruetta (J. 909).
Arakan.

*619. P. pygmæa (J. 910).
Common.

*620. P. fusca (J. 911).
Common.

*621. Hypotænidia striata (J. 913).
Common.
[Rangoon (*W. R.*).]

* Ibis, 1864, p. 246, note.
[*P. smaragdinus*, Tem. P. C. 421 = *P. indicus*, Horsf., and not the African *P. smaragnotus*, Tem. = *Gallinula madagascariensis*, Lath., is the species alluded to.]

[622. Rallina ceylonica (J. 912).
Thayet Myo (*O.*).]

[623. R. fasciata.
Rallus fasciatus, Raffles, Tr. L. S. xiii. p. 328.
Amherst (*D.*).]

*624. Rallus indicus (J. 914).
R. japonicus, Schlegel.
Arakan.

*625. Gallinula chloropus (J. 905).
Arakan.
[Upper Pegu (*O.*).]

*626. Fulica atra (J. 903).
Arakan.

*627. Podica personata.
Podica personata, G. R. Gray, P. Z. S. 1848, 90, *Aves*, pl. 4; Gen. Birds, pl. 173.
Cachar, Tenasserim provinces, Malacca.

"These very rare birds in Tenasserim," remarks Col. Tickell, "are met with in shady deep narrow streams in forests, whether in the tideway or remotely inland. They swim rapidly, but seldom dive; and although eminently aquatic in conformation, resort, strange to say, for safety to land. Scrambling up the steep banks when shot at, and running with unexpected rapidity into dense thickets, its flight is like that of the Coot, or Water-hen, squattering along the surface of the water." *

Fam. **Laridæ.**

Gulls.

628. Larus ichthyaëtus (J. 979).
Ramri.

*629. Xema brunneicephala (J. 980).
Chroicocephalus tibetanus, Gould. Mason also includes *X. ridibunda*.
Arakan.

* Tickell, J. A. S. B. xxviii. p. 455.

630. Lestris pomatorhinus.

An example in mature plumage procured by Colonel Tickell near Moulmein.*

Fam. **Sternidæ.**

Terns.

*631. Gelochelidon anglica (J. 983).

Arakan.

*632. Hydrochelidon indica (J. 984).

Arakan, Tenasserim.

633. Thalasseus cristatus (J. 989).

Sterna bergii, Licht.; *S. velox*, Ruppell.

Tenasserim coast.

634. Th. medius (J. 990).

Sterna media, Horsfield; *S. affinis*, Ruppell; *S. bengalensis*, Lesson; *S. torresii*, Gould.

Arakan, Tenasserim.

*635. Seena aurantia (J. 985).

A common river Tern.

[Tonghoo, Sittang river (*W. R.*).]

*636. Sterna melanogastra (J. 987).

Sterna melanogastra, Tem.; Gould, B. As. pt. x. pl. 16.

A common river Tern.

Of maritime Terns which must needs occur on the coast may be mentioned *Onychoprion melanauchen* (Tem.), P.C. 427, which breeds plentifully in the Nicobars; *O. panaya*, *Anous stolidus*, and *A. tenuirostris*.†

On the coast must also necessarily occur *Phaëton æthereus*, *Sula fiber*, and probably *Fregata*.

[Tonghoo (*W. R.*). Horsfield's title, *javanica*, has priority.]

[637. S. minuta (J. 988).

Tonghoo (*W. R.*).]

[638. S. ——?

Irrawady river (*W. R.*). I have not as yet been able to identify this species.]

* J. A. S. B. xxviii. p. 416. † *cf.* Ibis, 1867, p. 178.

639. RHYNCHOPS ALBICOLLIS (J. 995).

Not rare. Frequently seen on the Tavoy river, according to Mason.

[Tonghoo (*W. R.*).]

Order NATATORES.

Tribe TOTIPALMATÆ.

Fam. Pelecanidæ.

Pelicans.

640. PELECANUS JAVANICUS.

Common.

[Jerdon's number is left blank in MS.]

*641 P. PHILIPPINENSIS.

P. philippinensis, Gm.; Ann. M. N. H. xiv. p. 122; J. A. S. B. xviii. p. 821.

Common.

[Jerdon's number is left blank in MS.]

Fam. Graculidæ.

Cormorants.

642. GRACULUS CARBO (J. 1005).

Obtained by Colonel Briggs at Tavoy,* and common in Upper Burma.

Finlayson probably means this Cormorant when he mentions having procured "a fine species of black Pelican" in the Gulf of Siam.

[Tonghoo (*W. R.*).]

643. G. FUSCICOLLIS (J. 1006).

Phalacrocorax sulcirostris, Brandt.

Bhamo, Mouloung lake (*J. Anderson*).

644. G. PYGMÆUS (J. 1007).

Ten-gyie.

Common.

[Tonghoo, Sittang river (*W. R.*).]

* P. Z. S. 1859, p. 150.

Fam. Plotidæ.

Darters.

*645. Plotus melanogaster (J. 1008).

Ten-gyie.

Arakan, Tenasserim. Enormous flocks near Mengoon (*J. Anderson*). The alleged Australian species (*P. novæhollandiæ*, Gould) differs in no respect.

[Tonghoo (*W. R.*).]

Tribe LAMELLIROSTRES.

Fam. Anatidæ.

*646. Sarcidiornis melanonotus (J. 950).

Tau-won-bai.

Common.

[Tonghoo (*W. R.*).]

*647. Dendrocygna arcuata (J. 952).

Common. *D. major* is also included by Mason.

[Tonghoo (*W. R.*).]

*648. Casarca rutila (J. 954).

Arakan, Bhamo.

649. C. leucoptera (J. 955).

Inhabits the valleys of the great rivers, from the Megna at least to the Tenasserim. The *Anas scutulata*, S. Müller, seems to be a domesticated, if not hybrid, variety of this species, and the examples of it in the British and Leyden Museums have much intermixture of white in the plumage.

*650. Nettopus coromandelianus (J. 951).

Karagat.

Common.

[Tonghoo (*W. R.*).]

*651. Anas pœcilorhyncha (J. 959).

Arakan, Bhamo, Tenasserim.

*652. A. caryophyllacea (J. 960).

A. caryophyllacea, Latham; Gray and Mitchell, Gen. Birds, pl. 168.

Arakan, Bhamo.

*653. A. STREPERA (J. 961).
Arakan.

*654. A. ACUTA (J. 962).
Arakan.

*655. A. CIRCIA (J. 965).
Arakan, Tenasserim. Has been known to breed near Moulmein.
[Tonghoo (*W. R.*).]

*656. A. CRECCA (J. 964).
Arakan, common at Bhamo, Hainan.

*657. A. PENELOPE (J. 963).
Arakan, Hainan.*

*658. FULIGULA NYROCA (J. 969).
Arakan.

659. BRANTA RUFINA (J. 967).
Bhamo.
[If employed, *Branta* should be written *Brenthus*. But as the type of Scopoli's genus (Ann. I. Hist. Nat. p. 67) is *A. bernicla*, Lin., *A. rufina* cannot well be included under it.]

Tribe —— (?)

Fam. **Podicipidæ.**

Grebes.

*660. PODICEPS PHILIPPENSIS (J. 975).
Arakan.
[Tonghoo (*W. R.*).]

* *A. punctata* (*Anas punctata*, Cuv., Gould, B. Austr. vii. pl. 11; *Querquerdula andamanensis* ? Tytler) inhabits the Andaman Islands (Ball, J. A. S. B. xli. pt. ii. p. 290).
[Not *A. punctata*, Cuv., but *M. gibberifrons*, S. Müller = *M. albogularis*, Hume.]

[From the total number of birds known to inhabit Burma, 660, as noted in the foregoing list, four must be deducted. Namely:

1. *Palæornis melanorhynchus*, apud Blyth.
2. *Teraspizias rhodogastra.*
3. *Micropternus burmannicus=M. rufinotus.*
4. *Pellorneum minor=P. tickelli.*

The next seven species may have been confounded with species also enumerated:

5. *Caprimulgus indicus* with *C. jotaka.*
6. *Cypselus batassiensis* with *C. infumatus.*
7. *Sturnia malabarica* with *S. nemoricola.*
8. *Brachyurus megarhynchus* with *B. moluccensis.*
9. *Cryptolopha burkii* with *C. tephrocephalus.*
10. *Orthotomus edela* with *O. flavi-viridis.*
11. *Macropygia ruficeps* with *M. assimilis.*

And the total may have to be still further reduced by three more species, namely:

12. *Sturnia sinensis*, its occurrence not resting on good evidence.
13. *Machlolophus subviridis*, apparently *M. spilonotus*, juv.
14. *Brachypodius cinereiventris*, perhaps a variety only of *B. melanocephalus.*

The following four species, not separately enumerated, may have to be added:

1. *Megalæma virens*, in addition to *M. marshallorum.*
2. *Hemixus hildebrandi*, in addition to *H. flavala.*
3. *Criniger griseiceps*, in addition to *C. flaveolus.*
4. *Osmotreron vernans.*

Further investigations will doubtless make known a great many more forms belonging to either Himalayan or Malayan genera.]—Walden.