

XII NOTES ON THE NEUROPTERA IN THE COLLECTION OF THE INDIAN MUSEUM

By JAMES G. NEEDHAM.

The observations of the following pages are based on the study of a large series of miscellaneous Neuroptera belonging to the Indian Museum, sent to me by the Superintendent, Dr. Annandale, for study. With these were sent a considerable number of specimens from the collection of the Imperial Entomologist, Mr. Maxwell-Lefroy. Together, these specimens illustrate the greater part of the described Neuropterous fauna of the Indian empire. The entire known fauna in the Mantispidæ was represented: the smallest proportion of it was present in the Odonata.¹ This latter group has been collected a little more systematically perhaps than any other, but the specimens reside mainly in the collections of the European specialists who have described them, or in the British Museum.

Of the true Neuroptera (Neuroptera *s. str.*) most of the Indian forms have been described by three British naturalists: by Francis Walker, in the *Catalogue of Neuropterous Insects of the British Museum*, and in vol. v of the *Transactions of the Entomological Society of London*; by J. O. Westwood in his *Cabinet of Oriental Entomology*; and by Robert McLachlan in various scattered papers. Nearly all of Westwood's species are in the collection, including his *Ascalaphus obscurus*, a species long considered lost.

The Perlidæ of the collection are mostly new to science, which is not surprising, since but one species was known from the whole of India. The Odonata, Ephemeridæ, and Myrmeleonidæ of the collection are mostly well known, and in the Hemerobiidæ, Chrysopidæ, Ascalaphidæ, and Perlidæ occur the most interesting new forms and all the new genera.

In the collection were a few Termites which, for want of any knowledge of the group, I was compelled to return unnamed. And likewise, not knowing the Trichoptera, with Dr. Annandale's consent, I turned them over to Dr. C. Betten for study, and his report on them follows further on (p. 231). I have to express my gratitude to Dr. Annandale for his patience in waiting through the

¹ By far the greater part of the collection of the Indian Museum was named some years ago by the late Baron de Sélys Longchamps, and therefore was not sent to Prof. Needham.—*N. Annandale*.

delays of sickness and change of location for the return of the specimens, and for this report upon them.

PERLIDÆ.

This is the most neglected of all the neuropteroid groups of the Indian fauna. Hitherto, apparently, there has been but one species of stone-fly described from the whole of India, and that one very imperfectly. It is the *Perla duvaucelii* of Pictet, known hitherto from a single specimen in the Museum of Paris. It is represented in the present collection by two male specimens, and with it are six other undescribed species. One of these is represented by a mere fragment: the other five are described herewith. Three are referred to *Perla* (s. lat.), one each to *Neoperla* and *Leuctra*, and one represents a new and very interesting genus with hairy eyes and greatly reduced labial palpi.

Perla benigna, sp. nov.

One male. Sikkim, E. Himalayas (Reg. No. $\frac{8994}{7}$).

Length 12 mm., with setæ 5 mm. or more additional, the tips perhaps broken. Expanse of wings 30 mm.

A brownish species with conspicuous yellow costal border to the fore wings. Head wider than the prothorax, and closely inserted into its flaring front end. Prothorax wider anteriorly, with rather straight fore border and sharp angles: hind angles more or less obtuse. Head blackish above, with an open W-mark directed backwards between the antennæ, the middle point of the W resting on the middle ocellus. Tubercles of the vertex yellow. Antennæ brown, the sides of the basal segment darker.

Prothoracic disc minutely pubescent, scarcely rugulose, fuscous in colour with a yellowish median line that is dilated anteriorly and runs out narrowly along the front border. Meso- and meta-thorax brown above and below and paler across the ends and along the sides. Abdomen yellowish, the three apical segments slightly darker. Legs yellow at the base, including two-thirds of the femora; beyond this brown. Setæ fuscous, concolourous, with dense pubescence and numerous stouter hairs; 15 segments present, measuring 5 mm., wings (pl. xix, fig. 1) brown, with a yellow costal band that is delimited behind by the main stem of the radial vein, except towards the base where it is a little wider; the veins in the yellow band are very indistinct. The venation is shown in plate xix, fig. 1.

The ninth segment of the abdomen (pl. xix, fig. 3) of the male is narrow upon the dorsal side and very wide below. On the mid-dorsal line (pl. xix, fig. 2) it is produced backward in a thin, flat, bifid triangular process. On the ventral side it is prolonged greatly, and upturned to enclose the tip of the abdomen. The upturned end is squarely truncated and margined with a rim-like

carina, beneath which is a conspicuous round callosity or tubercle, directed posteriorly. On the sloping sides of the apical margin of the ninth segment is another low carina which is decurrent at its junction with the posterior rim just described. The tenth segment is narrow and is mostly included. A pair of hooks arise from the inner side of the setæ, curving dorsally and then forward, with their tips opposed to the bifid dorsal process of the ninth segment (pl. xix, figs. 2, 3 and 4).

This is the largest species in the collection, and it is doubtless in life a rather handsome insect. It combines characters of the American genus *Acroneuria* with those of *Perla*, and will doubtless eventually be removed to a new genus.

Perla ione, sp. nov.

Eight males and five females. Kulu, W. Himalayas (Reg. Nos. $\frac{5838}{5}$, $\frac{5938}{1}$, $\frac{5831}{8}$, $\frac{5830}{8}$), also one of more recent collection by Dr. Annandale from Kurseong, probably of the same species, although the sides of the prothorax appear to be more convergent behind and the spot on the top of the head is more extensive. A specimen labelled Kurseong, E. Himalayas (Reg. No. $\frac{1556}{14}$), also appears to be the same.

An obscure brownish species, with scanty and indistinct markings. Length of male 11 to 15 mm., antennæ 8 mm. and setæ 5 to 6 mm. additional, and expanse of wings 33—35 mm. Length of female 15 mm. and expanse of wings 43—45 mm.

Head yellowish, with a diffuse fuscous spot between the ocelli (in the unnumbered specimen mentioned above, overspreading the ocelli in an obscure quadrate path). Antennæ fuscous. Body nearly uniform brownish. Legs yellowish brown, somewhat darker on the knees and tarsi. Wings subhyaline, with veins obscurely fuscous. Setæ yellowish.

The ninth abdominal segment is extended beneath posteriorly in a long scoop-shaped prolongation, which covers only the lower third of the end of the abdomen. Externally it is regularly convex and smooth without callosity, but with a more or less thickened rim across the upturned margin. The tenth segment is included below, but exposed and bifid above, divided into two high prominences, that are at first erect and then suddenly bent forward, ending in obtuse points, parallel and closely approximated (pl. xix, fig. 5). The eighth ventral abdominal segment in the female is prolonged posteriorly on the ventral side in an obtusely triangular flap nearly as wide as the abdomen.

This is the most abundantly represented species in the collection, and it is a typical *Perla*.

The eggs of this species as they appear when removed from the ovary are roundish oval with a revolute strongly chitinated collar at the micropylar end: the margins of the collar are lobed and fimbriate (pl. xix, figs. 6 and 7). The surface of the shell is pitted all over with little round shallow depressions.

Perla cymbele, sp. nov.

A single female specimen from Pharping, Nepal, altitude *circa* 5,000 feet (*R. Hodgart*, October 1907).

Very similar to the preceding species ; a little smaller. Length 12 mm. Expanse of wings 32 mm.

Brown. Head pale brownish, with a broad diffuse transverse band of darker brown between the eyes and covering the ocelli. Ocelli equidistant from each other and from the eyes, the anterior ocellus one-half smaller than the others. The elevated antero-lateral margins of the frons have a blackish tinge.

The prothorax is wider than the head. Its fore border is straight or slightly bisinuate, the anterior angles are slightly acute, the sides are slightly convex and convergent posteriorly to the slightly obtuse hind angles. There is a fine black transverse carina on the disc closely paralleling the front margin, joined in the rear by a similar mid-dorsal narrow black line. On the sides of the disc are some low obscure rugosities. The meso- and metathorax and the basal segments of the abdomen are yellowish brown. Legs yellowish brown, slightly darker on the tarsi. Wings smoky hyaline. Antennæ and setæ broken.

The posterior ventral prolongation of the eighth abdominal segment is slightly narrower than in *P. ione*, and distinctly bifid at the tip. It is thin and transparent, and not easy to see in dried specimens.

The eggs of this species are very different from those of *P. ione*, being elongate oval, or slightly narrowed to the micropylar end. They are deeply pitted all over the opposite end. The chitinated rim about the micropyle is low and smooth, and not revolute.

Neoperla indica, sp. nov.

Three males and five females. Kulu, W Himalayas (Reg Nos. $\frac{6925}{1}$, $\frac{6930}{1}$, $\frac{6936}{1}$). A yellowish species near *Perla luteola*, Burm., and *Neoperla pilosella*, Klp., from Java. Length of male about 7 mm., expanse of wings 21 mm. Length of female about 10 mm., expanse 28 mm.

Colour brownish yellow, darker above on the head and prothorax, paler beneath and on all the appendages. Antennæ long, somewhat paler towards the base, and clothed throughout with close pubescence, as are the long yellow palpi. Head without distinguishable colour pattern, with a diffuse darker area on the disc and darker pigmentation around eyes and ocelli. Each of the two ocelli is separated from the other by about its own diameter.

Prothorax straight margined in front, slightly narrowed on the convex sides posteriorly in the male, but not perceptibly narrowed in the female, its disc sub-rugulose, and with a fine brown mid-dorsal line, and a similar line on each lateral margin. Legs yellow: only the claws brownish. Wings (pl. xx, fig. 1) yellowish, veins darker. Setæ and abdomen yellow, the former clothed with short pubescence.

The seventh abdominal segment of the male bears a mid-dorsal backwardly directed conical prominence with roughened tip, and the eighth segment bears a somewhat similar process that is, however, ante-apical, thin and flat and squarely truncated on the tip (pl. xx, fig. 2). The ninth segment is moderately produced on the lower side and upturned so as to cover a little of the apex of the abdomen, and bears on its dorsal side a pair of roughened prominences, between which rest the tips of the longer prominences of the divided tenth segment. These latter are long-conic, directed forwards and convergent at tips.

The eighth segment of the female is apparently scarcely produced posteriorly on the ventral side, but straight margined, the thin edge of the sternite that covers the openings of the oviducts being very difficult to see.

Perla duvauceli, Pictet.

Hist. Nat. Névr., Perlides, pp. 258-9, pl. xxvii, figs. 1-2, 1841

Two males in the collection of the Museum from Kulu (Reg. Nos. ~~5846-47~~⁵⁸⁴⁶⁻⁴⁷). These specimens were pinned, and old, and badly shrivelled, but when boiled in KHO the essential characters became readily apparent. Both agree in size with Pictet's brief description, and one of them showed enough of colour pattern for comparison.

Length about 11 mm., with antennæ 5 mm. and setæ 3 mm. additional. Expanse of wings 25 mm. There are two minute ocelli wide apart upon the disc of the head: the antennæ and setæ are yellow, and pubescent, with hairs of the same tawny colour. The prothorax is narrower than the head, and is transversely oval in form, with all the angles rounded off, the hind angles a little more broadly rounded. The wings are yellowish, with weak venation, especially indistinct along the costal margin (pl. xix, fig. 11).

The ninth abdominal segment of the male (pl. xix, figs. 12-14) is very peculiar. Its posterior prolongation on the ventral side is short, not upturned around the end of the abdomen, and before it on the middle of the segment is a low, broad, hairy elevation bearing a membranous penis at its tip. The tenth segment is annular and exposed, one-third as long as the ninth; from its hind margin on the dorsal side there grows out posteriorly a short stout downwardly directed spine. To this spine are opposed two claw-like upcurved hooks that arise from the inner side of the base of the setæ.

I confess to much pleasure in identifying this species, which has stood for more than half a century as the only representative of this family known from India. It is destined ultimately to bear another generic name.

CRYPTOPERLA, gen. nov.

Eyes hairy; labial palpi greatly reduced; face vertical with high frontal ridge; venation as shown in pl. xix, fig. 15. Otherwise much like *Neoperla*.

Type, the following species:—

Cryptoperla torva, sp. nov.

(Pl. xix, figs. 15—21.)

A single female specimen from Kulu, W Himalayas (Reg. No. $\frac{5848}{5}$).

Length 9 mm., and antennæ 7 mm. additional; setæ wanting.

Colour nearly uniform pale yellowish brown, a little paler beneath and on the setæ and bases of legs. Head very flat above, its disc margined anteriorly by an irregularly semicircular elevated margin, which overhangs the base of the antennæ, and beneath which the face is vertical. Ocelli apparently two but very obscure. Antenna with the obliquely conic second segment set at an angle upon the stout basal segment; there appears considerable irregularity in the slenderer segments immediately following; there are forty or more segments in all. Maxilla with palpus of normal length, but the labium with greatly abbreviated palpi having the terminal segment conically pointed (pl. xix, fig. 21).

The wings are subhyaline, slightly darker on the costal margin, especially in the stigmatic region: the venation is shown in pl. xix, fig. 15.

The eighth segment of the female is remarkably produced on its ventral side in an enormous scoop-shaped concave plate, widely truncated across the end, and covering the entire tip of the abdomen ventrally. Its lateral margins spring from the middle of the sides of segment 9 (pl. xix, fig. 1a).

Leuctra indica, sp. nov.

Three specimens from Upper Assam (Reg. Nos. $\frac{1321}{9}$, $\frac{1351}{9}$, $\frac{1348}{9}$).

Length of body 4 to 5 mm. and antennæ of equal length; expanse of wings of male 11 to 12 mm.

Colour brown, the legs, the under side of the body, the base of the antennæ and the middle of the abdomen, paler. Wings fumose with brown veins. Venation shown in figure 3 of pl. xx. The end segments of the abdomen are of a darker brown. The male appendages are shown in dorsal and lateral views in figures 4 and 5 of plate xx.

ODONATA.

The collection in this order consists almost entirely of well known representatives of the Indian fauna, and a list of it would add little to present knowledge. A single *Gomphidia T-nigrum* in the Lefroy collection is the only Gomphine in the lot. Apart from some of the smaller Agrioninæ, which I may take occasion to report on later, the most interesting specimens of the order were three species collected rather recently by Dr. Annandale. Two of these were from Bhim Tal, Kumaon; a fine pair of *Anotogaster basalis*,

Sél., and several of both sexes of the elegant *Megalestes major*, Sél., both collected on the 22nd of September 1906. The other one of the three is *Bayadera hyalina*, Sélys, represented by both sexes, from Kurseong, E. Himalayas, 5,000 ft.

EPHEMERIDÆ.

The mayflies of the collection were, as is always the case with pinned specimens, in rather dilapidated condition, and not all are determinable. There appear to be about nine species, as follows:—

Palingenia sp.? perhaps *P. robusta*, Etn.—In absence of figures of the male genitalia, I am unable to be sure about the identity of these specimens; all are in bad condition, more or less teneral, and with crumpled wings. The species will be recognized by the male forceps figured herewith (pl. xx, fig. 8), which is different from the forceps of any species that has been figured hitherto. It belongs to the subgenus *Anagenesia*. (The specimens are from Seistan, Persia.—N. A.)

There are three nymphs of some species of *Palingenia* collected by Dr. Annandale at Matiana, Simla hills, and sent to me in alcohol.

Ephemerà sp.—A series of specimens in the Lefroy collection from Pusa, Bengal, that at present I do not feel qualified to name; the forceps limb of the male is shown in pl. xx, fig. 9.

The genus *Epeorus* is represented by a fragment of a female sub-imago without locality label.

Chlæon marginata, Hagen.—This species and the following one, hitherto known only from Ceylon, are represented in the collection by a series of both pinned and alcoholic specimens. The specimens are from Calcutta, and from Rajshahi, E. Bengal, in February and December; from Sylhet in November and December; sub-imagos and cast sub-imaginal skins are included in the alcoholic material from Rajshahi, where the skins "were found on the walls of a room of a house some distance from water."

Chlæon bimaculatum, Etn.—This species was found with the preceding by Dr. Annandale at Rajshahi, E. Bengal. The wings of the male are quite hyaline, and therefore I think it is a female that is meant where male is stated in Eaton's *Monographic Revision of Ephemeridæ*; with that adjustment the agreement of these specimens with those described from Ceylon (p. 182), save for an unnoticed brown spot before the apex of the hind femur, appears to be complete. I figure on pl. xx, fig. 6, the wing of the female, and on pl. xx, fig. 10, the forceps limb of the male.

There are three small nymphs in alcohol which might belong, so far as I can see, to either one of the two preceding species.

Cænis perpusilla, Walk.—Specimens, both pinned and alcoholic from Rajshahi, appear to agree with this insufficiently known species, which was described from Ceylon. It may be

further described from material carefully preserved by Dr. Annandale, as follows:—

Length of male 3.5 mm., with setæ 11 mm. additional.
Length of female about 4 mm., with setæ 3.5 to 4 mm. additional.
Expanse of wings 9 mm.

White, with narrow lines of sooty black across the top of the head between the eyes, and on the sides of the prothorax, and on the humeri of the mesothorax and across the apex of the metathorax, and across the apical dorsal margins of the abdominal segments. The black is a little more pronounced towards the sides of the segments and towards the apex of the abdomen. Mesothorax pale brown above with a narrow paler median line. Wings whitish, with the usual purplish costal band, whose extent is indicated in pl. xx, fig. 7.

The nymphs of two additional species, also collected by Dr. Annandale, at Matiana, Simla district, W. Himalayas (8,000 ft.), are worthy of mention, since they are all that are known of two species representing other genera in India. The first of these is a single grown nymph (length 8 mm.) of a species of *Leptophlebia*, a genus hitherto unreported from India. The coloration is dark olivaceous above and yellowish below (perhaps greenish in life). The setæ are broken off. The side margins of the abdominal segments are narrowly yellow above, and there is a pair of small oblique submedian dots on the dorsum of each segment.

There are also two nymphs, of a species of *Heptagenia* (*s. lat.*), from a small stream at Matiana, which differ from all known nymphs of that genus in the possession of a series of mid-dorsal abdominal hooks or triangular teeth, one terminating the mid-dorsal keel on each segment from the first to the ninth, successively smaller on the eighth and ninth segments. These are pale smooth nymphs, the larger of which measures 12 mm. in length of body. There is a conspicuous black spot on the humeral cross-vein in the nymphal wing which may be carried over in the adult.

PSOCIDÆ.

This family is represented in the collections before me by half a dozen species, three of which are well known, one of which is undeterminable, and the other two of which are new. Unfortunately, while the well-known species are represented by excellent series of specimens, the new ones are not, and are therefore left unnamed.

Psocus taprobenes, Hagen.—The Museum specimens of this handsome species are from Calcutta, Munshibazar (S. Sylhet) and Upper Assam, and those in the Lefroy collection are from Rungpore (Eastern Bengal and Assam), from Dacca, and from Pusa, Bengal.

Ceratipsocus subcostalis, Enderlein, is represented by a single specimen in the Museum collection from Upper Assam.

Myopsocus griseipennis, McL.—About a dozen specimens collected by Dr. Annandale at Bhim Tal, Kumaon (alt. 4,500 ft.), W. Himalayas, in September 1906.

Myopsocus sp. A.—A species very similar to the preceding, with an expanse of wing of 13 mm. and in coloration much less densely marmorate on the wings; stigma yellow, and basal cells of the wing and a space before the cubital vein more or less hyaline. Specimens from Upper Assam.

Ceratipsocus sp. B.—This is a smaller species (expanse of wings 8 mm.) with wings clouded rather than marmorate, and with an equal distribution of the clouds all over them: veins alternately white and black. Specimens from Upper Assam.

Epipsocus sp. (?).—Specimens in the Lefroy collection from Pusa, Bengal.

EMBIIDÆ.

I have spent much time over the three or four species of this family represented in the collection, with not very satisfactory results. I think I have identified *E. saundersi*, Westwood (from Surat, Bombay Presidency, "at light"; Pusa collection), and *E. michaeli*,¹ McLachlan, but what the third species that is represented by a single male specimen from Pamben, Rameswaram Island, Palk Straits, S. India, is, and whether described or not, I am unable to say. It is hard to pick out distinctive characters from bare descriptions. But my figures of the male abdominal appendages on pl. xx, figs. 11—13, will enable anyone who comes after me to be certain as to what species I had before me. The third species, near *E. tartara*, Saussure, but with complete venation, 24-jointed antennæ, and an expanse of 17 mm., is perhaps the same as the large black wingless females in the Lefroy collection.

SIALIDÆ.

Corydalis territans, sp. nov.

One female from Sikkim, E. Himalayas (Reg. No. $\frac{882d}{5}$).

Length of body 40 mm. (probably considerably more in life for the abdomen is shrunken). Expanse of wings 136 mm. Head entirely rufous. Mandibles black. Antennæ broken, only two basal segments present; these are rufous at ends and broadly ringed with jet black between. The elevated rim of the vertex at the inner side of the antennæ is edged with black, as are the three close-set ocelli internally. Disc of the head rugulose, without colour pattern. The lateral margins of the hind angles of the head are thin and flat and minutely serrulate on their flaring border, produced behind into the usual sharp spine, and in this species ending anteriorly in a second thin flat triangular spine or tooth just behind the eye, while the tooth which in other Oriental species of this genus lies nearer the top of the head, is in this species wanting.

¹ Males of this species are often found in Calcutta at night on whitewashed walls illuminated by lamps, both outside and in houses.—*N. A.*

Prothorax slightly longer than wide (length 7 mm., width 6 mm.), red and finely transversely rugulose above, with a long black lateral stripe each side, more or less tending to be broken into three spots. Second and third thoracic segments and abdomen of a sordid reddish fulvous.

Wings fumose, with partly hyaline cells between the brown-bordered costal cross-veins and with two conspicuous hyaline bars across the disc, bordered by areas of darker brown. These hyaline bars cross the area traversed by the radial, median and cubital veins; the proximal bar is at the level of the base of the radial sector and the second at the level of the first fork of the sector. On the proximal side of the first bar three basal cells are more or less hyaline, and on the distal side of the second bar are four small hyaline spots in the next adjacent cells, the two anterior quadrate, the two posterior smaller, linear, the three posterior, in line, and out of line with the first.

Hind wing without hyaline spots, with veins of darker brown all around the wing-margin.

Legs rufous beneath and basally, blackish superiorly and towards the apex. The fore femora are darker than the others.

The three Oriental species now made known in the genus, which was so long supposed to be strictly American, may be separated as follows:—

- a. Two teeth on the lateral margin of the head, and none on the convex surface above the hind angle: head red *territans*, Ndm.
- aa. One tooth on the lateral margin at the hind angle of the head on each side, and one above this on the convex surface. Head bicoloured.
- b. The darkest markings of the fore wings comprised in a wide costal strip *asiatica*, Hardwicke, W. China.
- bb. Darkest markings of the fore wings are upon the cross-veins of the wing disc *orientalis*, McL., Naga Hills, Assam.

There remains also a fourth species, mentioned by McLachlan in the *Transactions of the Entomological Society of London* for 1896, p. 283, but not described, from Assam, which agrees with *asiatica* and *orientalis* in the conformation of the hind angles of the head, and not at all with *territans*. Probably good specimens of this species will yet be found.

Of other Sialidæ, the collection includes four species of *Neuromus* and one of *Chauliodes*:—*Neuromus latratus* from Shillong, Khasi Hills, Assam; *N. infectus*, McL., from Sikkim; *N. decemmaculatus*,

Wlk., from the N. Khasi Hills (*Godwin-Austen*); and *N. maculipennis*, Gray, from the same locality. The *Chauliodes* is *Ch. simplex*, Walker, likewise from the N. Khasi Hills (*Godwin-Austen*).

MANTISPIDÆ.

All the members of this family that have hitherto been reported from India are represented in the Museum collection.

Mantispa nodosa, Westwood.—There is a single broken specimen of this huge species from the Domdami Valley, N. Assam (Reg. No. $\frac{9797}{15}$).

Mantispa rugicollis, Navas.—Of this species, recently described from the Himalayas, there is a single good specimen from Sikkim (Reg. No. $\frac{9798}{15}$). Another wingless fragment, apparently similar, is from Upper Assam (Reg. No. $\frac{1268}{9}$).

Mantispa quadrituberculata, Westwood.—There is a series of this handsome species from Kulu, W. Himalayas (Reg. Nos. $\frac{6921}{1}$, $\frac{6923}{1}$, $\frac{6924}{1}$), and Sibsagar, Assam (*S. E. Peal*).

Mantispa lineolata, Westwood.—From Kulu, W. Himalayas (Reg. Nos. $\frac{6916}{1}$, $\frac{6917}{1}$, $\frac{6919}{1}$).

Mantispa indica, Westwood.—Kangra Valley, W. Himalayas, 4,500 ft., November 1899 (*Dudgeon*); Sikkim; Upper Assam; Calcutta (Reg. No. $\frac{9799}{15}$).

PANORPIDÆ.

Four species representing this family are in the collection before me, two that have long been known, and two that are new to science.

Panorpa furcata, Hardwicke.—Soondrijal, Nepal (*Hodgart*, October, 1907) (Reg. No. $\frac{9795}{15}$), three females. There is also a single pale specimen that shows hardly more of coloration on the wings than the furcate middle band; I think it is a teneral specimen of the same species.

Panorpa appendiculata, Westwood.—This species is represented by four females in the Lefroy collection, from Igatpuri, Bombay.

Panorpa fenestrata, sp. nov.

(Pl. xxi, figs. 13—15.)

Upper Assam (Reg. Nos. $\frac{1273}{9}$, $\frac{1274}{9}$, $\frac{2084}{10}$).

Length of body 15 mm. Antennæ 11 mm. Rostrum 4 mm. Expanse of wings 28 mm.

Colour black, paler beneath and rufescent on the basal segment of the antennæ, on the hind angles of all the thoracic segments and on the sides of the rostrum. The last three abdominal segments of the male, wholly rufous.

Wings bicoloured, the basal half mainly hyaline, with two diffuse basal spots on the fore wings only, and just before the

middle with a broad transverse bar, broadly bifurcated in front, the arms of the fork surrounding a round hyaline spot on the costa. Apical half of the wings brown, inclosing a large transverse oval hyaline spot behind the stigma, and a smaller more proximal spot on the hind margin. The subcostal vein is confluent with the costal far before the stigma, and the upper division of the radial sector is three times forked. The abdominal appendages of the male are as shown in pl. xxi, figs. 13—15.

Panorpha sordida, sp. nov.

(Pl. xxi, figs. 16, 17.)

One male and two females, 64, 65 and 66, Pusa collection, from Khasi Hills, Assam (May). c. 5,000 ft., in wooded spots.

A pale brownish species with smoky hyaline, nearly concolorous wings.

Length, male 11 mm., female 10 mm. Antennæ of female 10 mm. Expanse of wings 22 mm.

Pale fuscous, the second and third thoracic segments fulvous, diffusely phalerate with blackish on all sutures. Base of antennæ tawny yellow. Legs of the same colour, the tips of the femora, tibiæ and tarsi brownish. Terminal segments of the abdomen in the male, fawny.

Wings smoky hyaline with brown veins, unmarked in the male and in one female, in the other female showing two brownish bands; the first a diffuse cross-band just beyond the middle of the wing, bifurcated and obsolescent behind, and an oblique apical spot beyond the stigma extending but little upon the hind margin beyond the apex. The sub-costal vein joins the costa at the level of the stigma, and the anterior division of the radial sector is twice forked. The abdominal appendages of the male are as shown in pl. xxi, figs. 16, 17.

NEMOPTERIDÆ.

Croce filipennis, West.—Specimens from Calcutta and from Katihar, Purneah District (*C. A. Paiva*); and in the Lefroy collection from Surat and Igatpuri, Bombay. [Common in Lower Bengal in March and April.—*N. A.*]

Croce capillaris, Klug.—Bushire, Persian Gulf (*W. D. Cumming*). One specimen.

Halter halterata, Forsk.—A series of specimens from N. Baluchistan (*Dr. Maynard*).

ASCALAPHIDÆ.

In the collections before me are all the Indian genera of this family save only *Ascalaphodes*, and also two new genera, described below. One of these is founded on the long-lost *Ascalaphus obscurus* of Westwood, while the other is represented by a new species.

HOLOPHTHALMI

Idricerus decrepitus, Walk.—Two specimens, Dehra Dun, base of W Himalayas, United Provinces, and the N.-E. Frontier of India (*Godwin-Austen*).

ABRONIUS, gen. nov.

Eyes undivided, body hairy, wings widest just before the middle, the front wings broader than the hind, and with a basal tooth that is penetrated by a branching vein: the area included in the cubital fork is wider than the area that lies in front of the cubital vein. The oblique vein that indicates the base of the hinder branch of the median vein is in the fore wing situated just before the base of the radial sector and just beyond the cubital fork. The

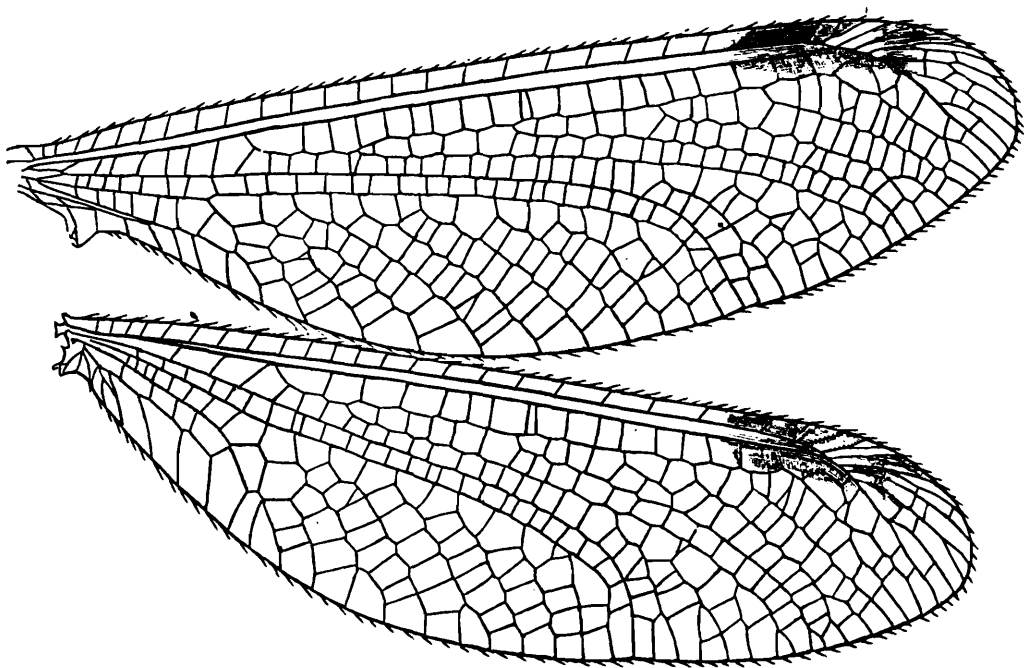


FIG. 1.—Wings of *Abroniuss canescens*, Ndm.

tibial spurs are as long as the three basal segments of the tarsus, the four basal segments are subequal and together hardly as long as the fifth, or as long as the claws.

Type, the following species:—

Abroniuss canescens, sp. nov.

A single incomplete specimen in the Indian Museum collection from Quetta, Baluchistan (*Webb-Ware*) (Reg. No. $\frac{2327}{4}$).

Expanse of wings 54 mm. A pale greyish and tawny species with hoary vestiture. Face yellow, clothed with brown-tipped hairs, and with a tuft of longer whitish hairs arising between the bases of the antennæ. Behind the head several erect fringes of stiff hairs arise in transverse lines from the front of the thorax. Wings

hyaline with brown cross-veins, stigma yellow, diffuse, but conspicuous. Fore and hind wings of nearly equal length, but the hind wing somewhat narrower. In the cubito-anal loop of the fore wings there is but one cross-vein beyond the level of the cubital fork. Legs yellow, with hoary hairs intermixed with slender black spines. Abdomen wanting.

I judge from the description that the (?) *Idricerus albardanus* of McLachlan from Mesopotamia, belongs also to this genus.

SCHIZOPHTHALMI.

Ogcogaster segmentator, West.—Seven specimens, males and females, in the Museum collection from Kulu, W. Himalayas (Reg. Nos. $\frac{6807}{1}$, $\frac{6880}{1}$, $\frac{6881}{1}$, $\frac{6886}{1}$, $\frac{6887}{1}$, $\frac{6889}{1}$, $\frac{6911}{1}$), and one from Mundi, W. Himalayas (Reg. No. $\frac{6635}{2}$).

Ogcogaster tessellatus, West.—One specimen in the Lefroy collection from Rawalpindi, Punjab, and one from Sirsia, Bengal.

Acheron longus, Walk.—A number of specimens, mostly females, from Upper Assam; Sibsagar, Assam (male); Arrakan and Tavoy, Burma. [Also two specimens from Buxa, Bhutan frontier, E. Bengal, determined by de Sélys.—N. A.]

Hybris angulatus, West.—Several specimens (I cannot be quite sure about the females, which are still best determined by association with their males) from Johore, Malay Peninsula (*J. Wood-Mason*); Tavoy, Lower Burma (Reg. No. $\frac{8189}{7}$); Sibsagar, Assam (*S. E. Peal*); and Calcutta.

Hybris javanus, Burm.—Two males, both broken specimens, from Karachi, W. India (*Cumming*).

Glyptobasis dentifer, West.—One male, Dehra Dun, base of W. Himalayas, October 14th (Reg. No. $\frac{8013}{4}$).

Siphlocerus nimius, Walk.—One broken female specimen from Pusa, Bengal (*Lefroy collection*).

Helicomitus sp.?—A number of specimens, all females and therefore undeterminable (with our present knowledge of this genus), from Barsoë, Purneah District, N. Bengal, and from Calcutta, in the Museum collection; and from Pusa and Mohanpore, Bengal, in the Lefroy collection.

STYLONOTUS, gen. nov.

Superior and inferior divisions of the eyes subequal. Club of antennæ short, obconic. Wings narrow, with their front and hind margins parallel for most of their length, fore wings much longer than the hind, meshwork open. Hind angle of the fore wing without tooth or conspicuous angulation, the radial sector five or six times forked, the median vein apparently simple, there being no oblique vein to indicate the base of a posterior branch; stigma conspicuous. The third segment of the abdomen bears a conspicuous dorsal process, longer than the segment.

Type, *S. Ascalaphus obscurus*, West.

Stylonotus obscurus, Westw.

McLachlan refers to this (*Trans. Ent. Soc. London* for 1891, p. 513) as a lost species. It is represented in the collection before me by one male and four female specimens. Evidently Westwood knew only the female, for he could not have missed describing the extraordinary process that arises from the back of the male abdomen. The females agree well with his description, not all of them, however, showing clearly the velvety black lines on sides of the basal abdominal segments; but some of them show these lines finely. The male may be described as follows:—

Length 26 mm. Antennæ 16 mm. Expanse of wings 55 mm. Length of fore wing 23 mm., of hind wing 19 mm. Brownish,

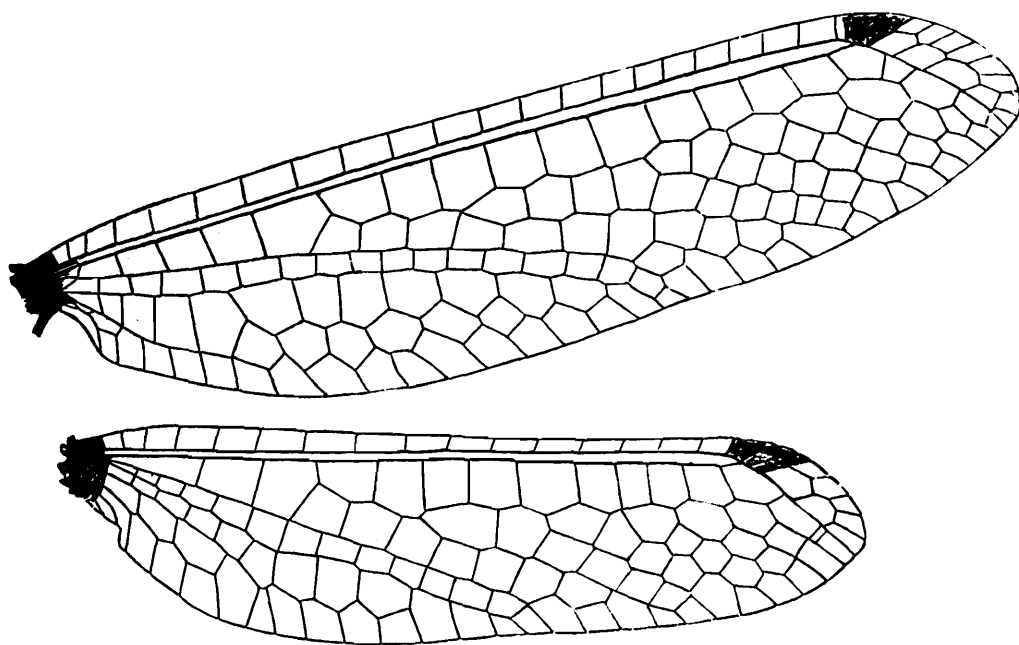


FIG. 2.—Wings of *Stylonotus obscurus*, Westw.

more or less hairy about the face, the sides of the thorax and the base and apex of the abdomen a vertical line of shining yellowish brown on the cheeks next the eyes; vertex tipped with long erect yellowish hairs. Rear of head smooth, shining, black on its lower half, yellow on the upper, with a transverse black line each side traversing the yellow area. Legs yellowish. Wings hyaline with clear reddish-brown veins and a reddish stigma that covers about four cells. Abdomen brown, paler at base, where encircled with long whitish hairs; the third segment bears a long apical stylus twice as long as the segment, clothed beneath its obtuse tip with short dense black pubescence. Terminal abdominal appendages short and concealed by the apical hairs. The single male specimen is from Kulu, W Himalayas (Reg. No. $\frac{0.0.8.8}{1}$). There are two females from the same locality and two from Mundi, Kangra district, W Himalayas (3,200 ft.) (Reg. Nos. $\frac{0.0.8.8}{2}$, $\frac{0.0.8.8}{2}$).

MYRMELEONIDÆ.

The Myrmeleonidæ of the collection sent me are a most showy and interesting lot; among them are represented a considerable proportion of the described regional forms. The list is as follows:—

Stiphroneura inclusa, Walk.—Sikkim, E. Himalayas. One specimen.

[There is also a specimen in the collection from Upper Burma.—*N. A.*]

Stenares improbus, Walk.—Bangalore, S. India (*Cameron*). One specimen.

Palpares tigroides, Walk.—Dalkhola, Purneah District, N. Bengal (*C. A. Paiva*). One specimen.

Palpares contrarius, Walk.—One in the Lefroy collection from Mussoorie, United Provinces, and one in the Museum collection from Khurda, Orissa, 23-iii-84 (*W. C. Taylor*) (Reg. No. $\frac{9+23}{10}$).

Palpares infimus, Fabr.—One specimen in the Lefroy collection from Bulsar, Bombay Presidency.

Palpares pardus, Rbr.—A number of specimens of this handsome and very variable species in the collection of the Museum from Dehra Dun, base of W. Himalayas, October 1900, from Khurda, Orissa (*W. C. Taylor*), and from Bangalore, S. India (*Cameron*) [also from Rampur Haut, Bengal, “common in railway carriages at light,” 10-x-1907 (*Paiva*).—*N. A.*], and in the Lefroy collection from Surat, Bombay, and from Pusa, Bengal.

Palpares sp.?—Perhaps a variety of the preceding, in the Lefroy collection, from Pusa, Bengal.

Periclystus singularis, West.—Two specimens in the Lefroy collection, one from Surat, Bombay, the other from Pusa, Bengal.

Tomatares compositus, Walk.—One fragment in the Museum collection from Cutch, W. India.

Acanthaclisis edax, Walk.—One specimen from Ramnad, Madura district, S. India; Aug., 1905 (*Annandale*) (Reg. No. $\frac{9+23}{14}$).

Acanthaclisis horridus, Walk.—One specimen from Sibsagar, Assam.

Acanthaclisis eustalacta, Gerst.—One specimen from Lucknow, United Provinces (*B. Aitkin*).

Myrmeleon marginicollis, Gerst.—Several specimens from Kulu, W. Himalayas.

Myrmeleon sagax, Walk.—Several specimens from Bhim Tal, Kumaon, W. Himalayas, and Upper Assam. [Also three specimens from Kurseong, E. Himalayas.—*N. A.*]

Myrmeleon punctulatus (?), Rbr.—One specimen from Chatrapur, Ganjam district, Madras.

Formicaleo verendus, Walk.—Several specimens in the Museum collection from Kulu and one from the Kangra Valley, W. Himalayas; one in the Lefroy collection from Mussoorie, United Provinces.

Formicaleo periculosus, Walk.—A number of specimens in the Lefroy collection from Pusa, Bengal.

Macronemurus nefandus, Walk.—Three specimens in the Museum collection; two from Kulu, W Himalayas, and one from Dehra Dun, base of W Himalayas.

Macronemurus infestus, Walk.—One specimen in the Lefroy collection from Surat, Bombay, and one from Pusa, Bengal.

Creagris sedulus, Walk.—One specimen in the Lefroy collection from Mussoorie, United Provinces, and one from Palamow, Bengal, three in the Museum collection from Chatrapur, Ganjam district, Madras, and one from Shahzadpur, Allahabad, United Provinces.

Myrmeleon adversus, Walk.—Two specimens of what I take to be this species are in the Lefroy collection, one from Pusa, Bengal, and one from Bulsar, Bombay Presidency.

Myrmecalurus acerbus, Walk.—A number of specimens in the Museum collection from Bushire, Persian Gulf (*W. D. Cumming*); Baluchistan (*J. Cleghorn*); Seistan, Persia (*Sir A. H. McMahon*), and in the Lefroy collection from Mussoorie, W. Himalayas, United Provinces; Palamow, Bengal; Chevist, Punjab; and Pusa, Bengal.

CHRYSOPIDÆ.

This family is represented in the collections before me by at least a dozen species representing five genera, one of which is a new genus. Apparently but two species, *Chrysopa ignobilis*, Walk., and *Ancylopteryx candidus*, Fabr., stand in our lists to the credit of India. Nevertheless there are numerous described Oriental species in several genera, and some of them are poorly described. Therefore, I have refrained from describing any but the most strongly marked species in the collections sent for study, especially those belonging to the enormous genus *Chrysopa*.

Besides the new genus *Tumeochrysa* described below, the recently described *Eremochrysa* of Banks, hitherto known only from America, is represented in the collection by a single handsome species.

The genera of Chrysopidæ of the Indo-Australian region may be separated as follows:—

- a. Cells in the basal part of the fork of the median vein alike, the third ("third cubital cell") undivided: antennæ excessively long and slender; much longer than the fore wings; the three series of gradate veins of the fore wing not parallel.
- b. The first (innermost) series of gradate veins joins the radial sector anteriorly;

cells of the wing disc broad
and venation open, net-like *Synthochrysa*, gen. nov.
Type *H. stigma*, Girard.

- bb.* The first series of gradate veins parallels the radial sector for much of its length and anteriorly joins the second series; all cells of the wing disc and outer margins are narrowly transversely linear

Apochrysa.

- aa.* Of the cells in the basal part of the main fork of the median vein the third is differentiated, appearing to be transversely or obliquely divided.

- b.* Apparently about equally divided

Nothochrysa.

- bb.* Very unequally and obliquely divided.

- c.* Gradate veins distributed irregularly over the wing disc, not in regular series. Basal segment of the antennæ enormously enlarged

Tumeochrysa.

- cc.* Cross-veins of the fore wing forming two rather regular gradate series.

- d.* Basal part of the costal space narrow, gradually widened towards the middle of the wing.

- e.* With a single gradate series in the hind wing

Eremochrysa.

- ee.* With two gradate series in the hind wing

Chrysopa.

- dd.* Costal space of the fore wing suddenly and greatly dilated *Ancylopteryx.*

Nothochrysa robusta, sp. nov.

A single female specimen (the type) from Sibsagar, Assam (*S. E. Peal*) (Reg. No. $\frac{9822}{15}$), and a single male that I take to belong to the same species, from Darrang, western base of Dafla Hills; also in Assam (*Godwin-Austen*).

Length of female 19 mm. Antennæ 16 mm. additional. Expanse of wings 62 mm.

Colour tawny yellow, including the legs; the top of the thorax and the eyes with coppery reflections. Antennæ brownish, paler

basally. Prothorax wider than long, with the front angles broadly eroded, and the hind angles square, front and hind borders darker in colour and with a sulcate middle brown median groove.

The male is slightly smaller and the prothorax is as long as wide, and on either side of its disc are four oblique brownish dashes arranged in two pairs.

The wings of both male and female are hyaline with veins mostly yellow. The ends of all cross-veins abutting on the radial vein are blackish, this colour more intense apically, where the apex of the radial sector also is black. Gradate cross-veins black, and in the inner series the connecting veins also. There are sixteen cross-veins in the inner gradate series. The wing roots are strongly stained with brown, including also a few stout basal cross-veins.

Nothochrysa lefroyi, sp. nov.

A number of specimens of both sexes represented in both collections. In the Lefroy collection from Pusa, Bengal; Lyallpur, Punjab; and from the Khasi Hills, Assam (3,000—5,000 ft.). The Museum specimens are from Kulu, W Himalayas, and Sibsagar, Assam (S. E. Peal) (Reg. Nos. $\frac{6.3.2.4}{1}$ and $\frac{5.8.7.8}{6}$).

Length of body 11 mm. Antennæ 14 mm. additional. Expanse of wings 38 mm.; fore wing length 18 mm., width 5 mm.; hind wing length 17 mm., width 4.5 mm.

Colour dull fulvous, with phalerate sutural markings of greenish black. Face tawny yellow, with reddish brown lines on the sutures. Antennæ black except at the base where two segments are more or less yellowish. Eyes with coppery and greenish bronze reflections. Prothorax with eroded front angles (as in the preceding species) about as wide as long (a little wider in the female), with a narrow mid-dorsal longitudinal sulcus, dull tawny yellowish in colour, with darker, diffuse triangular spots extending upwards from the sides in some of the (female) specimens. Meso- and meta-thorax tawny yellow, phalerate with greenish black on the sutures. Legs yellowish, hind ones paler. Wings hyaline, veins tawny yellow, no black on cross-veins. Stigma diffuse, rather long. Nine gradate cross-veins in the inner series.

Nothochrysa indigena, sp. nov.

Two specimens from Calcutta in the Museum collection, one labelled "Indian Museum premises (R. Hodgart)."

Length of body 13 mm. Antennæ 15 mm. Expanse of wings 38—42 mm. Fore wing of the type specimen (Reg. No. $\frac{9.5.9.5}{7}$), length 18 mm., width 7 mm.; hind wing, length 17 mm., width 5.5 mm.

A yellowish fulvous species with a black dorsal band covering the second and third segments of the thorax and the fourth, fifth, and sixth segments of the abdomen, and with large and conspicuous brown stigma. Head fulvous, including the antennæ. Eyes with

coppery reflections. Wings hyaline, veins yellow. Wing-roots black, as are two cross-veins in the anal angle. The gradate cross-veins are also blackish, and a few of the cross-veins joining the radial vein and the radial sector are blackish on both their ends. Inner gradate series consists of eight or nine cross-veins.

TUMEOCHRYSA, gen. nov.

Allied to *Anomalochrysa* of the Hawaiian Islands, having the cross-veins of the wing disc scattered, not arranged in regular gradate series. Antennæ about as long as the body, shorter than the wings, in the male at least with huge erect tumid basal segments.

Type *T indica*.

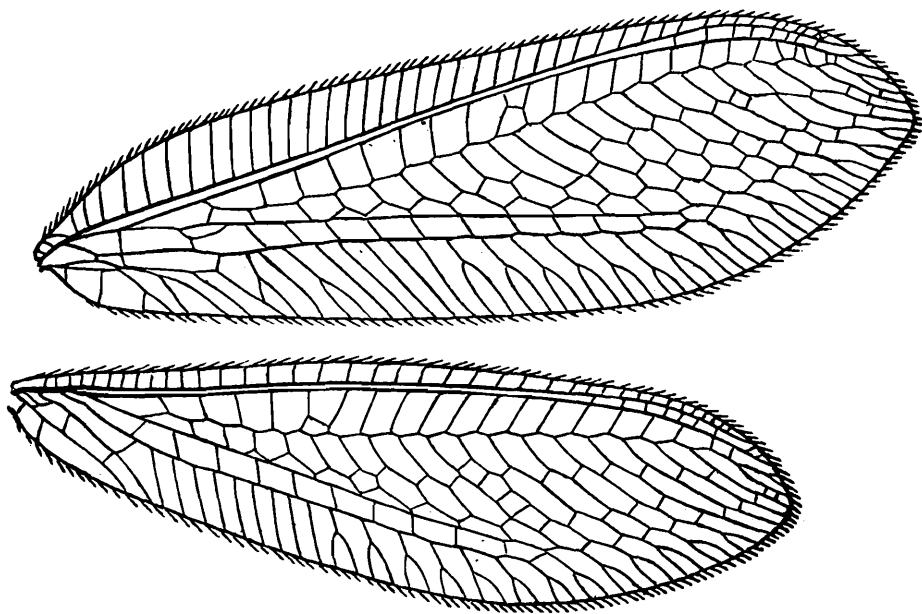


FIG. 3.—Wings of *Tumeochrysa indica*, Ndm.

Tumeochrysa indica, sp. nov.

One male specimen collected by Dr. Annandale at Bhim Tal, Kumaon, W Himalayas (4,500 ft.), 19—22-ix-06 (Reg. No. $\frac{9821}{16}$).

Length 15 mm. Antennæ 15 mm. Expanse of wings 45 mm.

A rather slender and elongate species, yellowish in colour (perhaps greenish in life). Face yellow. Head surmounted by the high, erect, basal antennal segments, which nearly cover its entire width, and which are closely approximated to one another. Each basal segment is yellow, swollen, sub-tuberculate on the postero-internal side, and is as long as the next twelve subequal segments succeeding it, and bears on its outer side a diffuse red line. On the disc of the head there is in the rear a similar transverse red line from eye to eye, extended forward between the basal segments of the antennæ on the median line in a diffuse triangular dilatation.

Thorax yellow beneath, somewhat darker above and tinged with reddish on the principal convex areas. Legs pale yellow, the tips of the tarsi darker. Wings hyaline with yellow veins, otherwise unmarked. Abdomen yellow beneath, somewhat darker above, and clothed with scanty yellowish pubescence. The paired lateral appendages short and scarcely forcipate. There is a median ventral appendage, three times as long as the laterals, jointed at two-thirds its length, and with the tip strongly reflexed at this joint.

Eremochrysa marmorata, sp. nov.

A single specimen from Upper Assam in the Museum collection (Reg. No. $\frac{2086}{106}$), broken and incomplete, but striking and characteristic. I refer it tentatively to *Eremochrysa* of Banks, and with it McLachlan's New Zealand species *Chrysopa opposita*.

Length of body about 10 mm., of antennæ about 12 mm. Expanse of wings 25 mm. The coloration is wholly obscure save in the wings, which are beautifully marked, and are quite sufficient for the recognition of the species. The membrane of the wings is hyaline, and the cross-veins are all tinged with golden brown, strongly on the basal third of both wings, and all about the entire wing margins, weakly and diffusely and confluent over the wing disc. The brown on the base of the radial sector and about the stigma amounts to diffuse spots of distinctly darker colour.

Ancylopteryx tessellatus, sp. nov.

Four specimens in the Museum collection, two from Upper Assam (Reg. Nos. $\frac{1275}{9}$ and $\frac{1278}{9}$) and two from Sibsagar, Assam (S. E. Peal) (Reg. No. $\frac{2823}{183}$).

Length to wing tips 15 mm., expanse of wings 28 mm. Antennæ about as long as the fore wings. Head, including antennæ, and prothorax pale yellow. Prothorax one half longer than wide, legs yellow, the tips of the tarsi somewhat darker. Wings hyaline and veins white. There are pale cloud-like brown spots at the stigma, at the hinder end of the inner gradate series of cross-veins and on the tips of the cubital vein where these reach the hind margin. And there are paler more diaphanous and more confluent clouds on three or four of the cross-veins at the rear of the stigma (at the front of the radial vein), on the base of the radial sector and on the anterior gradates, and in alternate spaces along the hind margin of the fore wing. Hind wing similarly marked, but less distinctly, only the basal spot being at all clear.

Ancylopteryx candidus, Fabr.—One specimen from Upper Assam (Reg. No. $\frac{1316}{9}$).

HEMEROBIIDÆ.

Two indigenous genera, *Hyposmylus* and *Berotha*, and two wide-spread ones, *Hemerobius* and *Drepanopteryx*, are not represented in the collection; the genus *Osmylus* is represented by two of

its five species: *Sisyra* is represented by bred specimens of the new species discovered by Dr. Annandale in the freshwater sponges, *Spongilla carteri* and *S. alba*, and whose habits are briefly described by him in a paper on "Some animals found associated with *Spongilla carteri* in Calcutta" (*Journ. Asiatic Soc. Bengal* (N.S.), 2, pp. 187—196, 1906). And in addition to this new *Sisyra*, there are two new genera of Hemerobiidæ represented.

I think I have identified the *Hemerobius setulosus* of Walker, and it is a *Micromus*.¹ And since McLachlan long ago identified Walker's *Hemerobius setulosus* as a species of *Osmylus*, the typical genus *Hemerobius* appears to be without a representative in India. A second species of *Micromus* is represented by a poor teneral specimen in the Lefroy collection, which agrees in size and number of divisions of radial sector, and number of cross-veins in its gradate series with *M. australis*, Hagen, from Ceylon, and it is probably that species; colour comparison is impossible.

The two species of *Osmylus* in the collection are *O. langi*, McL., from Kulu, W. Himalayas, and Kurseong, E. Himalayas; and *O. tuberculatus*, Walker, from Upper Assam and from the valley of the Tenasserim river, Lower Burma.

The new species and genera are described below.

Sisyra indica, sp. nov.

(Pl. xxi, fig. 1.)

Male and female specimens, bred by Dr. Annandale from larvæ taken on *Spongilla carteri*. Bred 16th March, 1907. [Common in Calcutta.—N. A.]

Length to wing tips 5 mm. Expanse of wings 10 mm. Length of antennæ 3 mm. Colour brown, nearly uniform. Antennæ black. Legs pale. Disc of head and thorax clothed with sparse yellowish hairs. Prothorax wider than long. Abdomen blackish, except the apex which is somewhat paler. Wings (pl. xxi, fig. 1) smoky hyaline, with brown veins. Costal cross-veins very unequally distributed, there being about ten in the basal half and only one in the distal half of the space between the base and the stigma.

The median vein is three times dichotomously forked in the fore wing, but in the hind wing the posterior division of this vein has one forking fewer than the anterior. The ovipositor of the female is straight and stout and blunt at tip, and is about as long as the abdomen is thick. The paired lateral appendages of the abdomen in the male are stout and convex and hairy basally on the outer side, but internally they are suddenly extended in a pair of long slender claw-like processes directed inwards and crossed at their tips, these slender horny processes being longer than the basal part from which they arise.

The cocoon of this species is oval in form and 4 mm. long. It consists of fine spun pure white silk, close woven; the outer

¹ The specimen is from Kulu, W. Himalayas.—N. A.

layer is irregularly woven, with stay threads extending to all the high places in the dried sponge mass, in the hollow of which it nestles.

The larva of this species is 4.5 mm. in length, and 1 mm. in width, and its suctorial setæ are as long as the head and thorax together and somewhat longer than the setaceous antennæ. The setæ on the middle abdominal segments are rather more closely sessile than in the other larvæ of *Sisyra* hitherto described, but otherwise apparently similar. Some of the larvæ sent me by Dr. Annandale were taken by him from osteoles of *Spongilla alba*.

Dr. Annandale has sent me the following notes on the habits and ethology of this species:—

“I am now able to send you larva, pupa and adult of the common sponge *Sisyra* of Calcutta. This species is common in the canals of *Spongilla carteri*, one of our most abundant freshwater sponges in India. I have only found the larvæ between August and March, that is to say in the rains and cold weather, but the sponge as a rule dies in the hot weather. The larvæ vary from green to white in colour, and can usually be discovered clinging to the walls of the oscula and larger canals of the sponge, in which these structures are more patent than they are in most Indian species. The proboscis seems to be inserted into the substance of the cells of the host, and if the sponge is green, the contents of the stomach of the parasite are also green. If the sponge dies, and the water becomes foul, the parasite forsakes it; and I have even found a few individuals among filamentous algæ in the tanks. The mode of progression adopted, when the insect is at large, is either that of crawling slowly on a solid support or that of swimming through the water by means of movements of the abdomen. The thorax is held vertically upright, in the latter case, with the head flexed a little downwards and the abdomen strongly upward; so that the whole animal has the outline of an S when seen from the side. The abdomen is alternately approximated to and removed from the thorax with great rapidity, and these actions bring about a forward movement. I could not observe any regular movements on the part of the jointed gills, but apparently they aid in supporting the insect upright in the water.

“At the beginning of March a great number of specimens of *Spongilla carteri*, being attached to the ends of hanging branches and in similar situations, are left high and dry, as the water evaporates from the tanks. In the circumstances the larvæ, sooner or later, leave the interior of the sponge, in which they sometimes continue to live for some days after it has been left dry, and pupate in hollows on the external surface. A flimsy cocoon of white silk, covered and fixed by a loose web of the same material, is spun, and the imago emerges in about a week. The imago is very sluggish and apparently takes to flight with difficulty.”

ANNANDALIA, gen. nov.

Mandibles strongly dentate. Palpi with the terminal segment lanceolate, attenuate to apex. Antennæ short. Wings short and broad, hairy. Subcosta and radius separate to the wing margin. Costal space wide basally, with a basal recurrent vein. Two subcosto-radial cross-veins, one basal and one near the middle of the wing. One series of gradate veins in the fore wing situate just beyond the middle of the wing, wanting in the hind wing, both wings with a very wide area of dichotomous forks.

Type, the following species :—

Annandalia curta, sp. nov.

(Pl. xxi, figs. 2—4.)

Two specimens from Calcutta, collected by Dr. Annandale on the 3rd August, 1906. [Single individuals of this species are not uncommonly found in Calcutta seated at night round lamps on the whitewashed walls of houses. They are very sluggish. —N. A.]

Length of body 4 mm. Length to wing tips 5 mm. Antennæ 2 mm. Expanse of wings 9 mm. Fore wings, length 4 mm., width 2 mm.; hind wings, length 3 mm., width 1.5 mm. Fore wings oblong, obtusely rounded at both ends, and oblique; hind wings obovate obtuse at outer end. Membrane of wings hyaline, strongly marked with brown in two shades, the colour being laid on in transverse concentric lines around the wing base as a centre. The veins are alternately yellow and brown, the brown occurring where the concentric lines of dark colour cross the veins. There are three darker areas in the fore wing, a blackish one on the base of the wing extending outwards to the base of the radial sector, upon which is a black tri-radiate spot; there is a second dark area, a little paler, laid across the base of the second division of the radial sector, and this is confluent at fore and hind margins of the wing with a third darker area, which encircles the wing apex covering the terminal forks of the veins. The hind wings are largely hyaline, slightly infuscated on the costal area and on area of the marginal forks. The hind wing is almost without cross-veins. The anterior branch of the cubital vein is in the fore wing dichotomously four times forked, and the median vein three times forked.

The general colour of the body is blackish brown. The head is wholly blackish. The antennæ are dull yellowish, darker at both ends. The antennæ consist of about forty remarkably uniform segments, each hardly longer than wide, only the two basal and terminal segments markedly differentiated; the basal one being four times as long as the second segment, and likewise the last segment about twice as long as the others. The labrum is semicircular, and the palpi are black in colour and lance-acuminate in form.

PAROSMYLUS, gen. nov.

Labrum emarginate, mandibles broad and coarsely toothed. Fore coxæ (in the male at least) with a cylindric corneus internal process. Wings broad, moderately hairy, costal area narrow at base, widened beyond, and traversed by numerous partly branched cross-veins; subcosta and radius fused at tip. One basal subcostal cross-vein, the radial sector arising near it.

Gradate cross-veins hardly differentiated, the cross-veins of the disc being numerous and irregular in arrangement. Median and cubital veins each with two long closely parallel branches, suddenly terminating in the peripheral border of marginal forks, the hinder branch of the cubitus with a long dependent series of forks to the hind margin. Tarsal claws serrate basally.

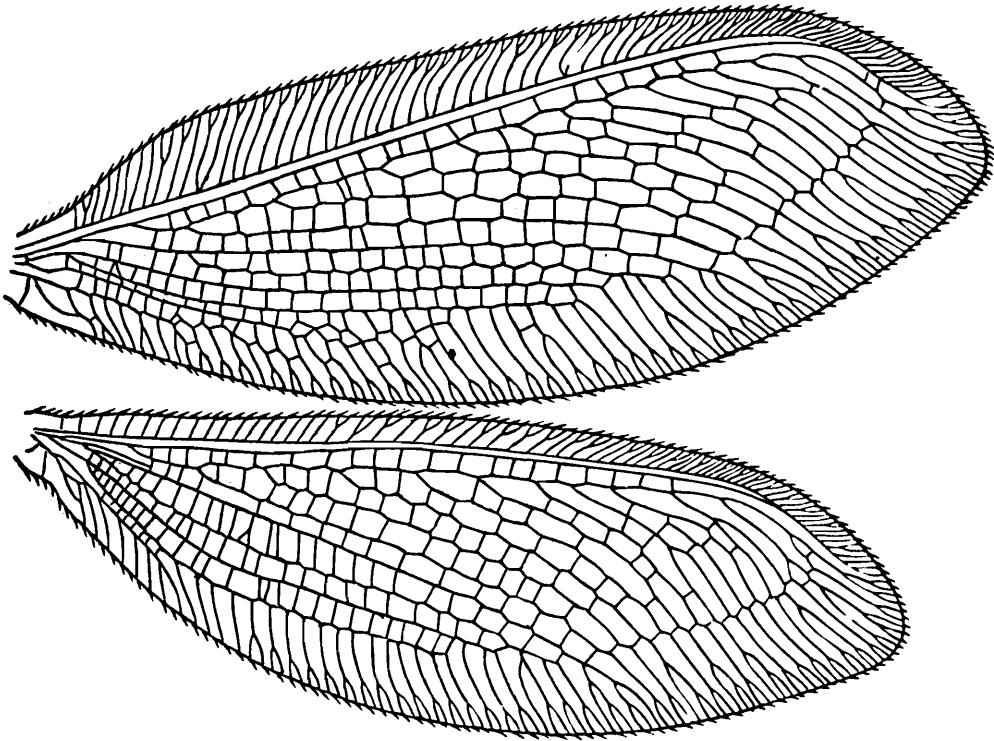


FIG. 4.—Wings of *Parosmylus prominens*, Ndm.

Type, the following species:--

Parosmylus prominens, sp. nov.

(Pl. xxi, figs. 5—10.)

Four specimens, male and female, from Kulu, W. Himalayas, and one from Lahoul (10,400 ft.), W. Himalayas.

Length of body 14 mm. Antennæ 10 mm. Length of fore wing 27 mm., of hind wing 26 mm.; expanse of wing 57 mm.

Colour fuscous, paler beneath and on sutures. Head with a broad convex prominence just behind the three ocelli. Antennæ short, consisting of about 56 segments, with a short stout cylindric basal segment and the third segment about twice as

long as the second or the fourth. Palpi short, their segments of nearly equal length. Legs rather stout and long; fore coxæ with the internal process shown in plate xxi, fig. 5, and all the claws basally serrate (plate xxi, fig. 9).

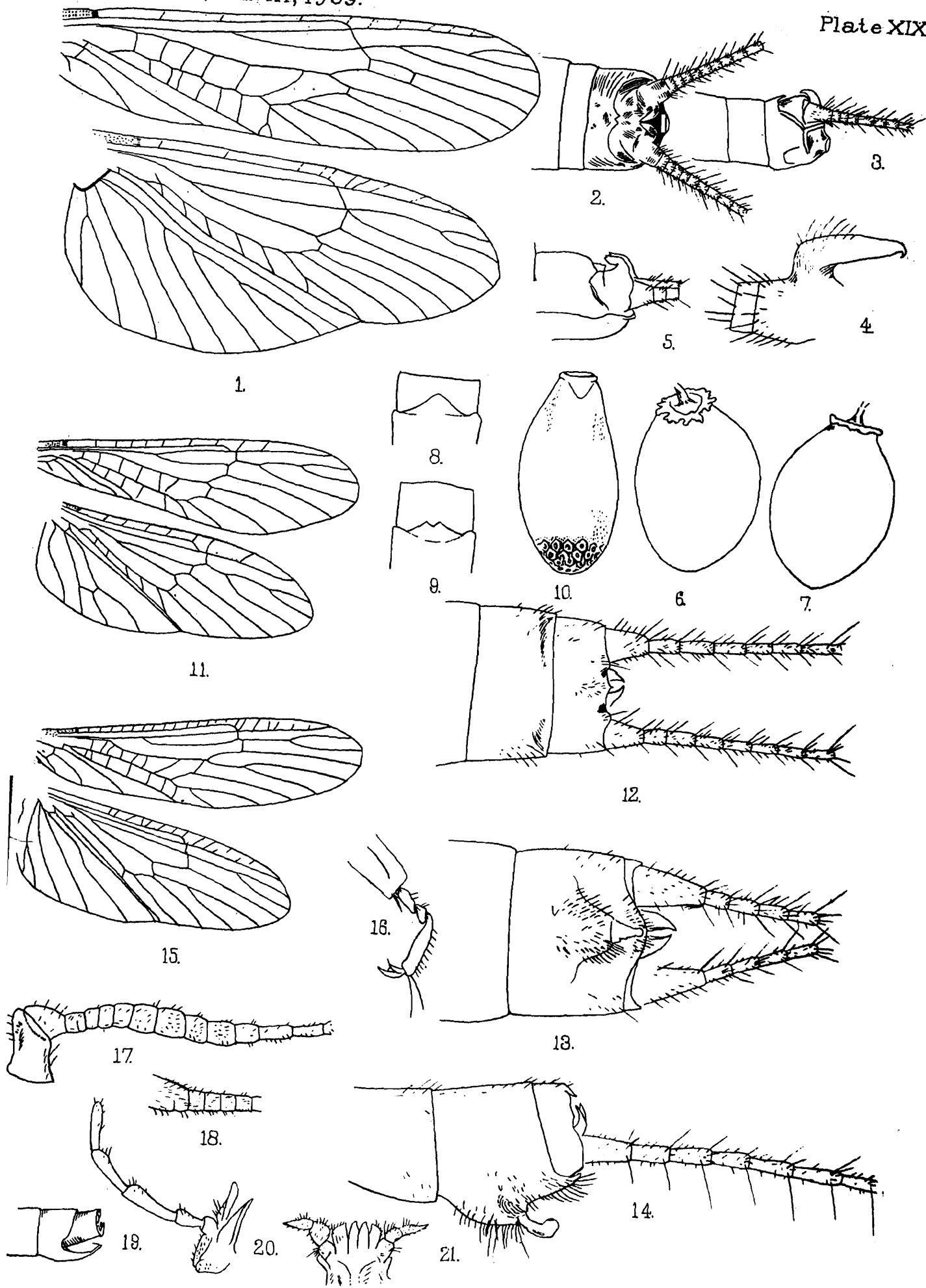
The wings are broad except at base, with membrane smoky hyaline and parti-coloured brownish veins. The wide costal strip is traversed by long close-set cross-veins separating between very narrow cells; and when forked, the forks are short and close to the costa. The cells of the disc are more or less hexagonal or quadrate but towards the region of the terminal forks they become very much elongated. The first forks of the radial sector and of the median vein are at about the same distance outwards from the wing base, and the sector closely parallels the main stem of the radial vein. The colour pattern of the wings is very complex, the dull brown touches being minute. There is a series of alternate lighter and darker brownish touches about the whole wing margin; four or five of these are decurrent from the front margin and traverse the yellowish stigma. There is a series of minute brownish clouds covering the cross-veins between the radius and its sector, there are three larger ones laid across the branches of the cubital vein, and there are numerous faint clouds upon the disc and on the anal angle. There is a round, more or less tuberculoid spot in the middle of the disc, fainter in the hind wing. The hind wing as a whole is paler, the disc being almost hyaline.

The genital apparatus of the male is most curious and puzzling. It is shown in lateral view in plate xxi, fig. 8. What I have been tentatively calling a sperm conveyor depends from the hindmost segment. This is boat-shaped in outline, with a pair of minute palps on the bi-lobed posterior end. It appears to be capable of being swung in and out on a more or less flexible and muscular pedicel, and when swung inwards, its point must be close to the sperm orifice. The abbreviation of the segment before it, and the prolongation of the one before that, are shown in the figure; and behind the ventral prolongation of the apex of the last mentioned segment protrude a pair of lanceolate processes of uncertain function. Observation of living specimens would be most valuable, as an aid to understanding these parts.

There is a fragment of a second species from the valley of the Tenasserim river (Reg. No. $\frac{6009}{4}$) with the male genitalia well preserved. It is obviously different (pl. xxi, figs. 11 and 12).

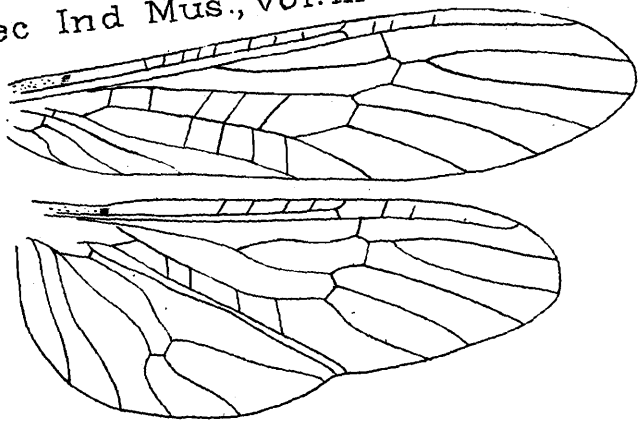
EXPLANATION OF PLATE XIX.

- FIG. 1.—Wings of *Perla benigna*, Ndm.
,, 2.—End of male abdomen of same, dorsal view.
,, 3.—The same in lateral view.
,, 4.—Base of seta and recurved appendage of its base, as viewed from within.
,, 5.—End of male abdomen of *Perla ione*, Ndm., in lateral view.
,, 6, 7.—Outlines of eggs of same.
,, 8.—The ventral aspect of the eighth and ninth segments of the female of the same species.
,, 9.—Like view of the same parts in *Perla cymbele*, Ndm.
,, 10.—The egg of *Perla cymbele*, Ndm.
,, 11.—Wings of *Perla duvaucelii*, Pict., male.
,, 12—14.—Dorsal, ventral and lateral views, respectively, of the tip of the abdomen of the male in the same species.
,, 15.—Wings of *Cryptoperla torva*, Ndm.
,, 16.—Foot of same.
,, 17.—Base of antenna of same.
,, 18.—Base of abdominal seta of same.
,, 19.—Lateral view of the seventh, eighth and ninth abdominal segments of the female of the same species, showing enormous lamina.
,, 20.—Maxilla of the same.
,, 21.—Labium of the same, showing reduced palpi.

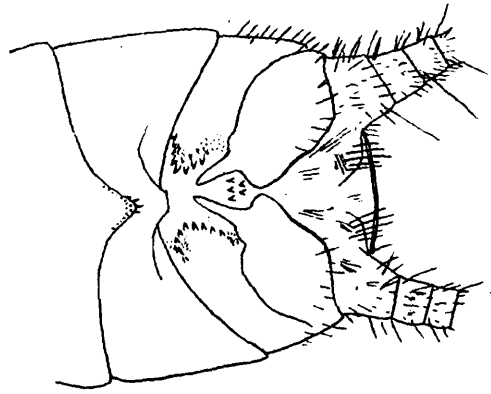


EXPLANATION OF PLATE XX.

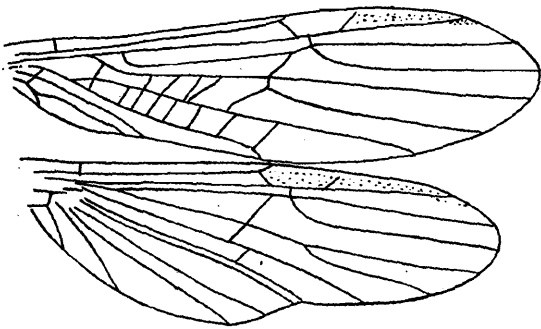
- FIG. 1.—Wings of *Neoperla indica*, Ndm.
,, 2.—Dorsal view of end of male abdomen of same.
,, 3.—Wings of *Leuctra indica*, Ndm.
,, 4, 5.—Dorsal and lateral views, respectively, of the end of the male abdomen of the same.
,, 6.—The wing of *Chlæon bimaculatum*, Etn.
,, 7.—The wing of *Cænis perpusilla*, Walk.
,, 8.—Genital appendages of the male abdomen of *Palingenia* sp. (?).
,, 9.—Forceps limb of the male of *Ephemera* sp. (?).
,, 10.—Forceps limb of *Chlæon bimaculatum*, Etn.
,, 11.—Dorsal view of the tip of the male abdomen of *Embia saundersi*, West.
,, 12.—The same view of like part in *Embia michaeli*, McL.
,, 13.—The same view of like part in *Embia* sp. (?).



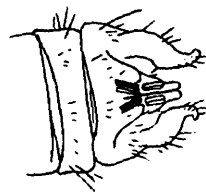
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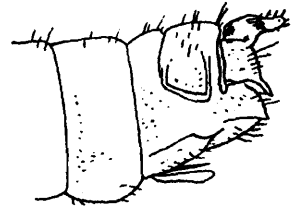
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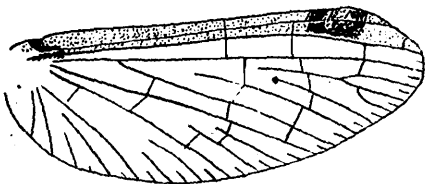
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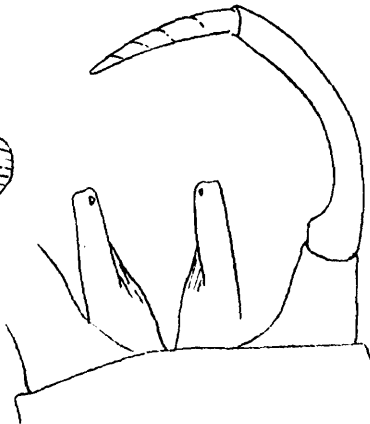
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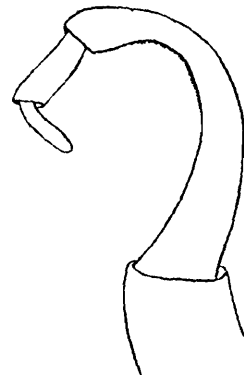
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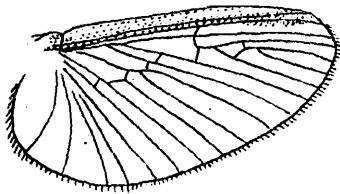
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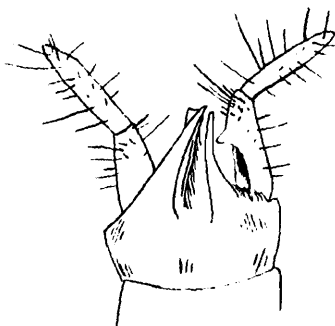
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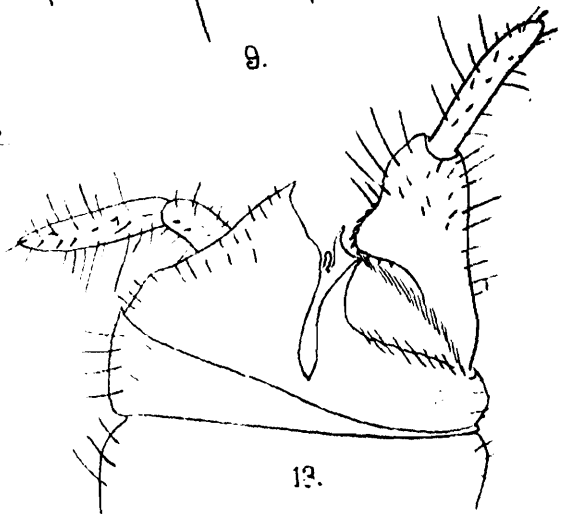
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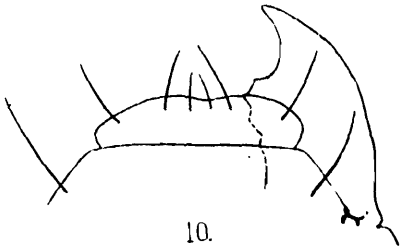
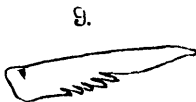
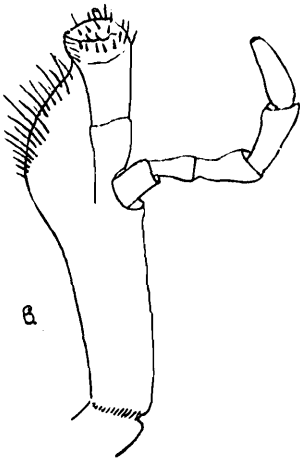
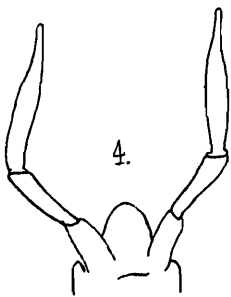
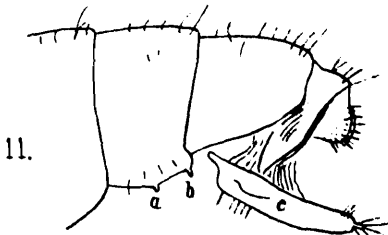
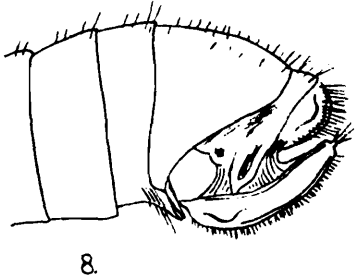
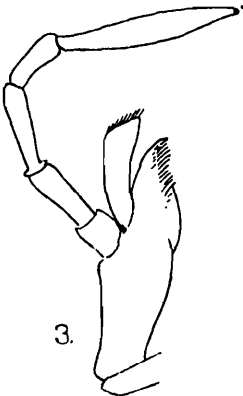
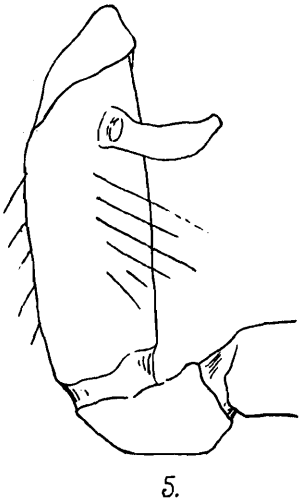
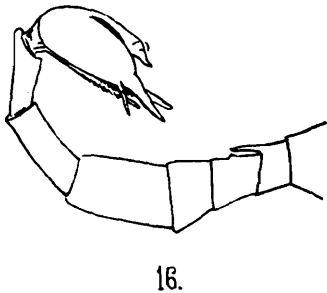
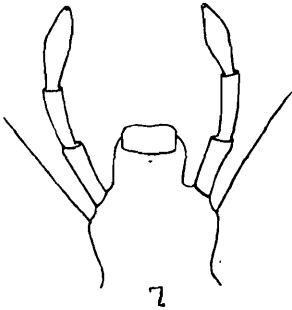
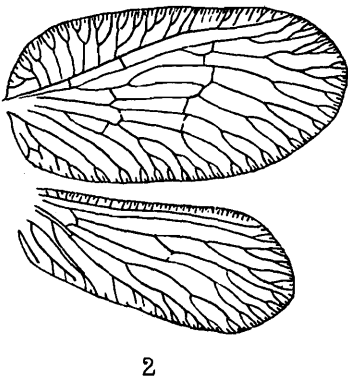
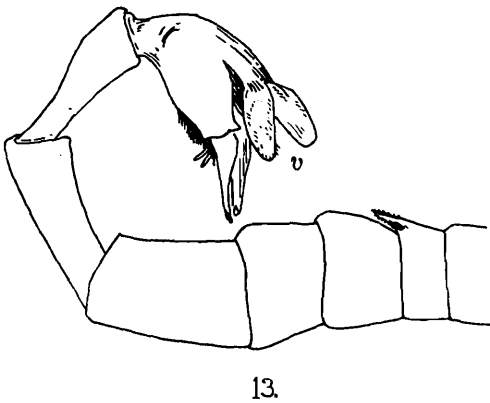
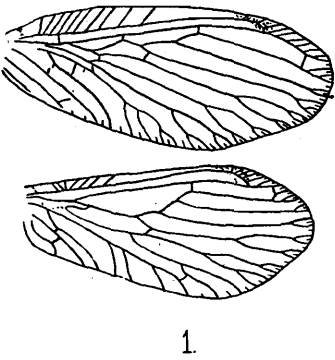
13.



11.

EXPLANATION OF PLATE XXI.

- FIG. 1.—Wings of *Sisyra indica*, Ndm.
,, 2.—Wings of *Annandalia curta*, Ndm.
,, 3.—Maxilla of the same.
,, 4.—Labium of the same.
,, 5.—Base of fore leg of *Parosmylus prominens*, Ndm. (male).
,, 6.—Maxilla of same.
,, 7.—Labium of same.
,, 8.—End of male abdomen, in lateral view.
,, 9.—Tarsal claw of same.
,, 10.—Dorsal view of labium and mandible, *in situ*.
,, 11.—End of male abdomen in *Parosmylus* sp. (?) (undescribed) from the valley of the Tenasserim river: *a*, paired, *b*, median unpaired ventral tubercles; *c*, sperm conveyor (?).
,, 12.—Ventral view of the latter.
,, 13.—Abdomen of the male of *Panorpa fenestrata*, Ndm., in oblique lateral view: *v*, ventral appendages.
,, 14, 15.—Lateral and ventral views of same, respectively.
,, 16.—Abdomen of male of *Panorpa sordida*, Ndm., lateral view.
,, 17.—Ventral appendages of same (the tips injured).



XIII NEW INDIAN LEPTIDÆ AND BOMBYLIDÆ, WITH A NOTE ON COMASTES, OSTEN SACKEN, v. *HETEROSTYLUM*, MACQUART.

By E. BRUNETTI.

Atherix intermedia, mihi, sp. nov.

♂ West Bengal. Long. $8\frac{1}{2}$ mm.

This species closely resembles both *limbata* of Osten Sacken and my recently described *calopa*, and takes an intermediate position between the two.

From *limbata* it is distinguished by an all-black thorax, with a little whitish shimmer on the humeral parts, round the edges of the dorsum and in front of the insertion of the wings; also by an oblique, whitish stripe on the sides of the thorax, which, otherwise, are wholly black, as is also the scutellum. The legs are black; the fore femora (except base and tip), the apical half of the middle femora, the middle tibiæ wholly, and the hind femora are yellow, but the latter bear a broad, deep, black band, occupying about the middle half of their length. The wing has a large, very distinct blackish brown stigma, whilst the cross-band on the wing is much darker. The abdomen is differently coloured, closely resembling that of *calopa*, except that the posterior half of the 4th and 5th segments are occupied by a whitish band, which is invisible from certain points of view. The basal half of the 5th, and the whole of the 6th segment, is black.

From *calopa*, the broad band on the hind femora easily separates it, this character being consistent in the ten specimens examined. The wing marks also distinguish it by the prominent stigma and the much more distinct apical part.

Described from ten ♂♂ in excellent condition taken by Dr. Annandale, 16-iv-09, on Paresnath Hill, West Bengal, at an altitude of 2,000 ft., on rocks at the edge of a small jungle stream, where it was present in large numbers.

N.B.—This is evidently a good species, the ten specimens agreeing exactly in all particulars, whilst the three examples of my *calopa* are also consistent; *limbata* of Osten Sacken, however, according to him, appears to be variable. My present species is best described as possessing the abdomen of *calopa* with the wing of *limbata*, with the addition of an all-black thorax and a large, black stigma.

Atherix labiata, Big.

A ♂ in my collection from Maskeliya, Ceylon, taken in March, agrees well enough with Bigot's description for me to have little doubt of its identity with his species. The pale basal third of the hind femora differentiates this species from all other Oriental ones.

Chrysopilus ornatipennis, mihi, sp. nov.

♀ South India. Long. 4 mm.

Head.—Frons blackish grey, grooved down the centre, one-fourth of width of head, only slightly wider towards vertex; ocelli on subtriangular, concolorous, slightly elevated triangle, black, with a narrow, pale border, and a few microscopic bristles. Antennæ, 1st and 2nd joints livid brown, 3rd with greyish pubescence, bristle very long. Proboscis shining, livid brown at base, bright yellow on narrow part, with two very minute dark brown hairy lamellæ. Back of head yellowish grey above, bluish grey below, with numerous minute black bristles, especially towards the vertex.

Thorax yellowish brown, the dorsum covered with microscopic scales, which, seen from behind, are brilliantly emerald-green on the centre and bright blue towards the sides, the posterior part and over the whole of the scutellum. In addition to the scales the entire surface of the thorax and the scutellum is covered with long curved bristly hairs. Sides of thorax uniformly shining tawny yellow.

Abdomen brownish, becoming yellow on posterior border, covered on entire upper surface rather closely with soft black hairs, which extend round the sides and are very short on the yellow belly; they are rather thicker and longer on the fore corners of the abdomen. The 5th segment is much reduced in size, blackish grey; 6th and 7th stylate, blackish grey with a broad, distinct, pale yellow posterior border, supplemented by a long, thick, cylindrical blackish grey ovipositor.

Legs.—Coxæ and femora bright tawny yellow, tibiæ pale brown, tarsi black; coxæ with some bristly hair on and around them, hind pair with a black streak on apical border; middle and hind tibiæ with two short yellow spines at extreme tip.

Wings pale blackish grey, posterior part nearly clear, light grey or nearly clear in the following places: distal ends of basal cells; middle of anal cell; a rather narrow pale yellowish band from the middle of the fore border (adjacent to the black stigma) to the distal end of the discal cell, thence becoming pale grey; a yellowish grey diffused spot just beyond (and contiguous to) the stigma. All the cells below the 3rd longitudinal vein are pale grey or clear in their centres. The upper branch of the third vein bears a small appendix at the bend, which is rectangular. The inner cross-vein is placed at one-third of the discal cell, and the two forks of the upper branch of the fourth vein spring almost simultaneously from the upper corner of the discal cell. Halteres pale yellow.

Described from a single perfect ♀ from Tenmalai in the Western Ghats (Travancore State, South India), taken by Dr. Annandale, 22-xi-08; now in the Indian Museum.

***Chrysopilus flavopunctatus*, mihi, sp. nov.**

♂ South India. Long. 5 mm.

Head.—Vertex very small, elevated, with the ocelli as in *ornatipennis*. Facets in upper half of eyes rather larger than those in lower half. Frons deep black; face dark grey. Antennæ brown, third joint black, bristle long, microscopically hairy. Proboscis dusky yellowish brown; palpi rather robust, pale brown, hairy.

Thorax.—Dorsum and scutellum dark brown, with microscopic hairs which appear bright green when seen from behind; scutellum with some rather long black hairs. Sides shining dark brown, nearly bare.

Abdomen dark brown, nearly black towards tip, with short blackish hairs; belly concolorous.

Legs dark brown; fore coxæ and fore femora wholly; posterior femora towards the tips pale; knees black; all coxæ with black hairs. Hind tibiæ with two pale yellow spines at tip.

Wings blackish brown; stigma in marginal cell, elongated, deep black, extended to costa on the outer side of a short, bright yellow stripe which intersects it in the middle, this stripe also reaching to the costa.

There is a pale, parti-coloured irregular spot (yellowish and pale grey) at the distal end of the 1st basal cell, and extending below into the 2nd. Posterior border of wing fading into light grey, the veins in this part being narrowly suffused with black. Halteres pale yellow.

Described from a perfect ♂ in the Indian Museum collection, taken by Dr. Annandale at Maddathorai (Travancore State, South India), 18-xi-08.

***Chrysopilus magnipennis*, mihi, sp. nov.**

♀ Ceylon. Long. $4\frac{1}{2}$ mm: long. alar $6\frac{1}{2}$ mm.

Head mainly brownish yellowish grey, a little darker here and there, especially just above the base of the antennæ. Ocellar triangle distinct. Antennæ black, the joints subequal in length, 2nd narrowly white at tip, 3rd with grey hair, style long. Palpi blackish brown, brownish grey dusted. Proboscis blackish brown, with a few hairs. Under side of head with a little black hair.

Thorax.—(Denuded.) Ground colour black, also at sides. Traces of a little grey hair and some golden yellow hairs around base of wings and on scutellum.

Abdomen black, moderately close grey hair, with which are intermixed some golden yellow ones. Belly with grey hair.

Legs wholly yellowish, except coxæ, a very narrow ring at base of femora, and the tarsi tips black.

Wings practically clear; venation as in my *segmentatus*, except that the upper branch of the 2nd longitudinal vein takes towards its tip a slight downward curve, thence curving rather sharply upwards to the costa, and enclosing a well-marked, large, dark brown stigma. Halteres: stem black, club yellowish.

Described from a perfect ♀ (except denudation of thorax and scutellum) in my collection, from Maskeliya, Ceylon, taken in August, and sent me by Mr. E. Green.

N.B.—This species should be near Bezzi's *sauteri*, but differs by the black antennæ; yellow hairs on abdomen; and the very different proportionate lengths of the body and the wings.

***Exoprosopa niveiventris*, mihi, sp. nov.**

♀ West Bengal. Long. 18—20 mm.

Head.—Frons, at widest (level of antennæ), one-third the width of the head, narrowing at vertex to half this width; dark brown, covered with close, light brownish orange scales, which become lighter coloured below the antennæ. The whole frons is also covered with short black hairs; the ocelli are small, black, close together, placed on a small tubercle. Mouth border yellow, proboscis dark brown. Antennæ black, first and second joints thickly beset above and at the sides with strong black bristles; third joint rather long, absolutely bare, with a very distinct style, which itself bears a microscopic but distinct apical joint. From the base of the antennæ obliquely to the edge of the eye, there is on each side of the frons a narrow groove, quite destitute of scales or pubescence. Back of head broad behind the eye, with minute black pubescence, and covered towards the sides with yellowish white, soft scales, which may perhaps extend over nearly all the back of the head in some specimens. A fringe of short, bright orange-yellow hairs encircles the back part of the head, meeting the dense pubescence of the thorax.

Thorax dull black, with some short black hairs towards anterior border, and in front of the scutellum.

The front part of the thorax (not extending to the dorsum proper) is covered densely with narrow, elongated, bright yellow scales, which also extend to the sides of the thorax, and form fan-shaped bunches below each shoulder, and behind each wing. These scales become almost thick pubescence at the sides of the dorsum, being especially thick above each wing. The true dorsum is very sparsely covered with very short yellowish scales, which probably even in perfect specimens never wholly cover the surface. The scales at the sides of the thorax are more yellow than orange. The posterior calli are prominent, ferruginous, covered with irregular small black bristles, with some yellowish white long scaly pubescence on the outer side, and there are four powerful long black spines placed close together and directed horizontally backwards.

Scutellum ferruginous brown, an irregular double row of black spines on posterior margin, and short yellow scales round the

dorsum, which is quite bare in the middle, both of scales and hairs.

Abdomen.—Ground colour black, covered with microscopic black scales. Thick, scaly, whitish pubescence at the sides of the 1st segment. At the base of the 2nd segment (which is the widest) a wide band of scaly yellow-white pubescence; the remaining segments also bear similar bands at their bases, of more whitish scaly pubescence, this being shortest on the 5th segment. On the posterior borders of the 1st, 6th and 7th segments is placed a row of rather strong black bristles, directed backwards. Genital organ distinct, black, encircled towards the posterior part and at the sides by a rather thick fringe of orange hairs; the tip itself more greyish, and bearing two vertical rows (containing seven in each) of rather long, roseate scales, like the teeth of a comb. Belly black, nearly covered, except towards the tip, with close, nearly snow-white, scaly pubescence, the tip with black bristles.

Legs black. Coxæ with yellowish white scales and distinct black bristles. Femora with similar scales and short black hairs, the middle pair with two rows of short, distinct spines on under side; the hind pair with a similar row. Fore tibiæ bare; middle tibiæ beset somewhat irregularly with four rows (one on each side) of conspicuous but moderately short bristles. Hind tibiæ closely beset with dirty white, elongated scales, lying close to the surface, and intermixed with strong, moderately short, black bristles. An irregular circlet of black spines at tip, most of them on the under side. Tarsi minutely but closely pubescent, with a row of minute spines below, being longest on hind pair.

Wings pale grey, costal cell and the basal parts of all the veins ferruginous brown. Costal apparently bare, but viewed microscopically it presents a very closely placed row of minute black spines, which are conspicuous on the extreme base of the costa, where they are larger, and are intermixed with close-lying, dark greyish scales. At the extreme base of the costa is a very powerful, thick, black, curved spine. Tegulæ bright orange, with a fringe of elongated scales, which are black on outer part of the edge and dirty white towards the base. Alula of wing grey, with a fringe on posterior border of grey scales, which continue for a short distance along the posterior margin of the wing. Halteres: stem brownish, club very pale creamy orange.

Described from two ♀♀ in almost perfect condition (dorsum of thorax and scutellum may possibly have been rubbed), in the Indian Museum, taken by Dr. Annandale at the base of Paresnath Hill, West Bengal, 16-iv-09 (1,000 ft.) A conspicuous species, resembling a *Hyperalonia* of my fourth group (*Rec. Ind. Mus.*, ii, 443).

***Exoprosopa* ? *niveiventris* ♂**

? ♂. West Bengal. Long. 16 mm.

Head almost exactly as in *niveiventris*, except that the first joint of the antennæ is pale, and the back part of the head is less

puffed out behind the eyes, where it is covered closely with very small creamy orange scales. Mouth border whitish, bare.

Thorax.—Dorsum dusky olive-brown, with two faint but distinct, narrow, widely separated blackish lines. Anterior part and sides with pubescence as in *niveiventris*, except that it is whitish below the posterior calli. Scutellum as in *niveiventris*.

Abdomen as in *niveiventris*. The genital organ is concealed within the body, but is covered with whitish shimmer and fine black bristles, its tip apparently consisting of a pair of rather complex orange-coloured claspers; the upper side of the tip being covered with thick, black, bristly spines.

Legs.—The under side of the fore femora is pale, and the spines below the hind tarsi less conspicuous.

Wings wholly very pale grey, including costal cell. The veins in the middle at the base of the wing are pale orange, as are also the subcostal, third and fifth longitudinals. Halteres cream colour.

Described from a single example taken by Dr. Annandale in company with *niveiventris* ♀, of which species I conclude the present specimen is the ♂. The frons is barely appreciably narrower, therefore the narrowness of the back of the head above, the difference in shape of the genital organs, and the nearly clear wings are the only points in which it materially differs from the previously described species.

***Exoprosopa collaris*, W**

One from either the Kangra Valley (4,500 ft.) or Sikkim.

***Argyramœba obscurifrons*, mihi, sp. nov.**

♀ Simla district. Long. 7 mm.

Head.—Frons moderately wide at vertex, increasing to double the width at level of antennæ, where it forms one-third the width of the head; grey, with blackish patches; covered rather thickly with black hairs, and with some whitish scales intermixed just above the antennæ. Ocellar triangle distinct, small, with some hairs. Antennæ, first and second joints black, bristly; third grey-dusted, bare, apical style rather short. Under side of head blackish grey, a moderately thick band of bristly hairs across lower part of face. Proboscis withdrawn, apparently dark brown. Back of head dark grey, minutely pubescent, some minute pale scales just behind the eyes, which latter are black.

Thorax.—Dorsum blackish grey, with a rather thick fringe of bristly hair in front, reaching over the shoulders and continued below. Bristly hairs between the shoulders and the roots of the wings. Sides lighter grey, with occasional whitish reflections, nearly bare. Scutellum blackish grey, with soft black hair.

Abdomen black, covered mainly with soft black hairs. A thick bunch of white hair on each shoulder, behind which, on the

posterior border of the 1st segment, near each side, are a few snow-white scales. There is also a row of white scales (more or less interrupted in the middle) to the posterior border of the 2nd segment, and another on the last segment. Belly black, softly pubescent, some whitish hairs in centre, and a longitudinal stripe of short yellowish hairs near the tip.

Legs black, minutely pubescent; femora with a little soft black hair below; posterior tibiæ with short bristles on outer and hinder sides.

Wings very pale grey, with the oblique baso-costal dark brown band occupying nearly half the wing, passing across the middle of the discal cell (where it is somewhat extended) to the hind margin of the wing which it reaches just before the tip of the anal cell. The colour is extended also from the costa to about the middle of the first posterior cell, enclosing a clear spot near the base of the first submarginal cell, and another near the base of the first posterior cell. On the outer cross-vein there is a circular spot, and a trace of a small one on the costa, near the tip of the marginal cell. Halteres yellowish.

Described from a single specimen taken by Dr. Annandale at Phagu (9,000 ft.), Simla district, 14—15-v-09.

Argyramœba limitarsis, mihi, sp. nov.

♀ Western Himalayas. Long. 5 mm.

Head.—Frons one-fourth of head at vertex, widening to one-third at level of antennæ, with rather thick brownish black hair. Ocellar triangle inconspicuous. Face blackish, with hair which from above appears whitish grey. Antennæ, first joint black (remainder absent). Proboscis withdrawn, apparently, with mouth border reddish brown. Back of head only slightly puffed out, blackish grey, with some whitish hairs.

Thorax shining black, with some yellowish white hair, and stiffer bristles towards the posterior corners. Sides of thorax black, with some whitish hair. Scutellum dark cinereous grey, with vestiges of some short yellow hair, and a few pale yellow bristles on posterior margin.

Abdomen blackish grey, with a slight brownish fringe, covered more or less sparsely with short pale yellow hair, most conspicuous on borders of segment. A bunch of whitish hair on each shoulder of the 1st segment. Belly with whitish hair.

Legs.—Coxæ yellowish grey with whitish pubescence. Femora and tibiæ pale yellow, the latter with minute bristles; tarsi blackish towards tips.

Wings nearly clear. A rather bright yellowish brown baso-costal band extends along the costa just beyond the middle, thence extending posteriorly along a line comprising the inner cross-vein, the base of the discal cell, and the outer side of the second basal cell. Below this cell the colour immediately fades away to a pale

grey, which covers the anal and axillary cells. Appendiculation of the upper fork of the second vein short but distinct. Halteres creamy yellow.

Described from a perfect specimen (except the missing antennæ) in the Indian Museum from Hathikund, Garhwal district, base of Western Himalayas, 3-v-09.

N.B.—The species falls in the central one of my groups in this genus.

Argyramœba claripennis, mihi, sp. nov.

♀ Punjab. Long. 7 mm.

Head.—Frons one-fourth width of head at vertex, broadening at level of antennæ to one-third; dark grey, with yellowish hair, which on the face becomes greyish or nearly white. Ocellar triangle inconspicuous. Antennæ black, with the upper sides of the joints greyish; basal joints with rather thick hair; bisection of style obvious, pencil of hairs small. Proboscis dark, withdrawn. Back of head dark grey, with thick yellowish grey hair in the middle.

Thorax.—Dorsum blackish grey, with short yellow hair, of which a bunch of paler colour is placed on each shoulder; a long and a shorter yellow spine in front of each wing, and five or six long yellow bristles towards each posterior corner, also some yellow bristles towards posterior margin of dorsum. Scutellum dark grey, with short yellow hair, and some yellow bristles on posterior margin. Sides of thorax ash-grey, white dusted, with a bunch of greyish white hair below each shoulder, and whitish hairs below this again.

Abdomen blackish, hardly shining, posterior margins of segments with rather wide, light brown bands. Whole dorsal surface apparently covered with short, soft, bright yellow hairs which become longest towards the sides on the posterior margin of the anal segments; where the brown segmental margins are also widened.

Belly blackish grey, with minute elongated whitish scales; belly becomes reddish yellow towards tip. There are two long pendent bristles towards the posterior margin, about the middle of each ventral segment. Genitalia not conspicuous but withdrawn.

Legs uniformly pale yellow except blackish towards the tarsi tips. The coxæ and femora are rather thickly, the tibiæ slightly, covered with minute whitish woolly scales, the tibiæ bearing moderately short black bristles in addition, as do also the hind femora near the tip. There is a row of microscopic bristles on the hinder side of the hind tibiæ.

Wings quite clear; submarginal cell brownish yellow; appendiculation not obvious; upper branch of second vein forming a very distinct downward loop towards its end. Halteres yellow.

Described from a single perfect example in the Indian Museum collection from Lahore, 8-v-08.

***Argyramœba nigrofemorata*, mihi, sp. nov.**

♂ Western Himalayas. Long. 5 mm.

Head.—Frons very narrow, about one-twelfth of the width at vertex, enlarging to nearly one-third at level of antennæ; dark grey in colour, becoming gradually ash-grey on the face below the antennæ. Frons with moderately thick black hair; face with thick soft white hair. Antennæ black, normal, bisection of style distinct, pencil of hairs very short. Proboscis brown. Back of head ash-grey, with minute pubescence and some rather short thick yellowish hair towards lower part.

Thorax.—Dorsum blackish grey with short yellow hairs intermixed with stiff short black bristly hairs; anterior margin with rather long bristly yellow hair; a longer and a shorter yellow spiny bristle in front of each wing base. Sides of thorax light grey, with pale yellowish or whitish hairs. Scutellum concolorous with thoracic dorsum, and with some longer bristles towards posterior margin.

Abdomen subconical, blackish grey, with soft short yellow hairs. Belly mainly yellow with longer yellow hair. Genitalia apparently large and complicated, but withdrawn.

Legs.—Coxæ blackish, with reddish yellow tips and whitish hairs; femora black, with bases and tips reddish yellow, whitish grey scales and a little soft whitish hair below; tibiæ reddish yellow, with small black bristles, and with thicker shorter black bristles on hinder side, all the bristles on the hinder pair being stronger than on the other pairs; tarsi brown, closely pubescent, black towards tips, pulvilli yellow.

Wings quite clear; subcostal cell yellowish brown; appendiculation distinct; upper branch of second vein forming very distinct downward loop towards its end. Halteres rather deep yellow.

Described from a perfect ♂ in the Indian Museum collection taken at Hathikund, Garhwal district, base of Western Himalayas, 3-v-09.

Argyramœba duvaucelii*, Macq.Redescription.*

This species was first described under *Anthrax*, and I retained it in this genus in my recent paper; but a number of specimens recently obtained by the Indian Museum afford me the opportunity of recognising it as a true *Argyramœba*, the pencil of hairs at the tip of the antennal style being conspicuous, whilst the anterior branch of the third longitudinal vein shows a strong tendency to appendiculation, although it is actually appendiculated in one specimen only, in which, moreover, an additional veinlet (in one wing only) produces the particular submarginal cell characteristic of *Hyperalonia*. As this species was very insufficiently described by its author, I venture to append a redescription.

* * * * *

♂ ♀ Long. 8—10 mm.

Head.—Frons at level of antennæ, one-third the width of the head, narrowing at vertex to one-third of this width (♂) or about half this width (♀); blackish grey, with short, soft black hairs. Face with moderately long and thick white hair. Mouth border very narrowly yellow; proboscis dark brown, shining, hairy.

Antennæ black, with a little greyish white shimmer; first two joints with black bristles, third bare, prolonged into the usual style, which is pale at the tip, the pencil of hairs quite distinct. Vertex of head with a distinct but short and deep indentation, which is almost better described as a *hole*, from which a central dark grey hairy protuberance arises, bearing the red ocelli, placed closely together.

Thorax dark cinereous, the dorsum with sparse yellowish short hairs round the edges. Anterior part of thorax with a dense fringe of very narrow long greyish white scales, intermixed behind with long, soft, black hairs, these latter continuing more or less over the whole dorsum, but rather shorter.

Sides of thorax with greyish white long thick scaly pubescence, thickest and most scaly below the humeral region; thinner, shorter and whiter posteriorly. It extends somewhat sparsely above the insertion of the wings. Scutellum blackish cinereous, covered with rather sparse but long soft black hairs and with traces of a little short yellow hair around the whole scutellum. A row of stiff hairs on posterior margin. Several strong black spines below the edge of the dorsum anterior to insertion of wing; the posterior calli also, moderately conspicuous themselves, bear a few stiff long bristles.

Abdomen blackish grey, 2nd segment distinctly but not greatly longer than the five remaining ones. The whole dorsum apparently covered with small yellowish white or quite white scales, which may be thickest at the bases and posterior margins of the segments. The whole surface is also covered lightly with moderately long, soft, black hairs, and there is a bunch of long whitish scaly pubescence at each side of the first segment. This pubescence is continued along the sides of the abdomen. Belly blackish, with short white hairs; longer white pubescence towards the base and the last segment (in the ♂ only), with rather closely placed, somewhat large and elongated snow-white scales, which sometimes spread over the last two, or even three, segments and extend round over the sides.

In the ♀, these white scales below the abdomen are absent, and are replaced by long black hair on the ultimate segment. The genital organs in the ♂ consist of a pair of stout upper claspers (?), the apical half tapering to a blunt point, each with a small lamella at the tip. This large organ is rufous brown, a little blackish above at the base, and with some reddish yellow hairs on the inner sides. Below these large claspers are some further, apparently complex organs which are not easily visible, the whole being protected by a large,

black, curved ventral plate, bearing on its margin reddish hair near the base and black hair posteriorly. In the ♀ the genital organs consist of a rather large subconical process with dense reddish or yellowish hair. In one example this organ is almost wholly withdrawn within the abdomen.

Legs black. Coxæ with rather long silky white hair; femora and tibiæ with small whitish scales, which extend, more sparsely, to the tarsi. All the femora with soft hairs below and some irregular weak bristles. The tibiæ generally with small, apparently irregularly placed spines, the most regular being a row on the outer side of the hind tibiæ. All the legs minutely pubescent.

Wings almost clear, first posterior cell rather widely open; fifth generally narrowly open, but in two specimens closed exactly on the margin; the lower side of the discal cell occasionally with the beginning of a very small appendix. Costal cell and extreme base of wing, brownish yellow; subcostal cell dark brown, very narrow. Fork of the third longitudinal vein sharply angled, and with only a tendency to appendiculation (which actually occurs only in two or three specimens, in two of which, moreover, there is an additional veinlet in one wing only, this veinlet producing the cell usually characteristic of *Hyperalonia*).

A dark brown suffusion, distinct but small, occurs at the base of the second vein, joined to that over the inner cross-vein; suffusions also at the angle of the fork of the third vein; over the outer cross-vein, the colour carried upwards along the inner side of the discal cell; also over the lower extremity of the veinlet, connecting the two branches of the fourth longitudinal.

Costa minutely spinose, with the usual spiny portion at the base. Halteres light brown, tip of club creamy. Tegulæ milk-white, with snow-white hair. Alulæ concolorous with wing, bearing a fringe of minute black hairs.

Described from several of each sex taken at Bhogaon, Purneah district (N. Bengal), 19—26-iii-09, by Mr. Paiva. These were in good condition and quite uniform in the specific characters. The Indian Museum also has a specimen from Sahelwa, Bahraich district (United Provinces, India), 11-iii-09 [Hodgart].

Argyramœba fallax, Meij.

One ♀ from Calcutta, 1-vi-09, presuming my previous identification of the species to be correct.

Argyramœba distigma, W

Several taken by Dr. Annandale, 16-iv-09, at Paresnath (West Bengal) on the edge of a small mountain stream at an elevation of 2,000 feet, and again at an elevation of 4,400 feet. One ♀ from Jalaban, in the plains of the Naini Tal district, 21-v-09.

Anthrax afra, F.

Two from Pipera, Gonda District (United Provinces, India), 9-iii-09, taken by Mr. Hodgart.

Anthrax insulata, Wlk.

Four headless specimens from Kūmdhik, Nepal Terai, 22-iii-09, but undoubtedly this species. Also a ♀ in good condition from Pipera [Hodgart].

Anthrax himalayensis, mihi, sp. nov.

♀ West Himalayas. Long. $6\frac{1}{2}$ —11 mm.

This species very closely resembles *maura*, L., of Europe, and for some time I was doubtful as to its specific distinctness, the first two specimens seen by me coming from Naini Tal, taken in May or June, 1893 (from the Lucknow Museum, now in the Indian Museum collection).

However, on Dr. Annandale capturing five further examples in the Simla district (7,000 to 9,000 ft.), 12—16-v-09, I have no hesitation in considering the form distinct, though allied very closely to *maura*, which must therefore be deleted from the Oriental catalogue.

The difference, though not great, is invariably consistent in the seven specimens before me, compared with four specimens of *maura* from Europe.

1. The abdominal bands of hair are white, not yellow.

2. The basal dark half of the wing bears no narrow pale yellow spaces around the cross-veins of that region as is the case in *maura*; but there is a small oval sub-hyaline spot in the upper corner of the first basal cell, with a narrow transverse streak above it, both these being weak or absent in *maura* (see text-figs. 1 and 2).

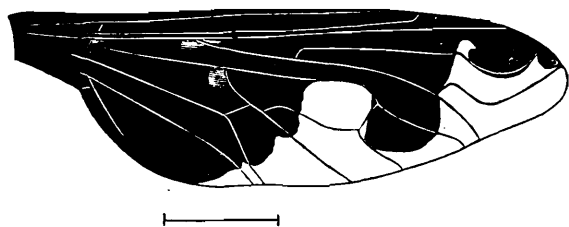


FIG. 1.

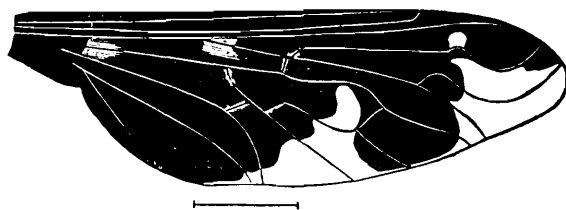


FIG. 2.

FIG. 1.—Wing of *A. himalayensis*.
 „ 2. „ „ „ *maura*.

3. The lobe of the dark part (which in *maura* extends broadly to the posterior margin of the wing) attains only the middle of the second posterior cell, where it is rounded off; and the apical portion of the dark part, near the tip of the wing, more nearly forms a small additional lobe than in *maura*.

4. In *maura* there are generally a few very small pale spots towards the upper and outer part of the dark portion of the wing. These are altogether absent in *himalayensis*, in which the dark colour moreover, is in some specimens quite black, in others dark brown.

N.B.—The remains (a thorax and upper part of each wing) of a large specimen in the Indian Museum (without history) bears a label "*A. bidens* Big., n. sp. Ind." It evidently is a specimen of my new species.

Anthrax aperta, Wlk.

Four examples taken by Dr. Annandale at Simla, 16-v-09, agree very closely with those in the Pusa collection and from Mussoorie previously referred to this species by me.

Taken on *Sedum* and the common marguerite.

Anthrax aureo-hirta, mihi, sp. nov.

♂ Calcutta. Long. 5 mm.

Head.—Frons at vertex one-eighth width of head, widening to barely double this width at the level of the antennæ; black, slightly shining. Ocelli on small raised tubercle.

Face black. Some white dust on each margin of the lower part of frons and of the face, and yellow and black short hair intermixed, above and below the antennæ, which are wholly black, the first two joints bearing some stiff black hairs, the third, soft white microscopic pubescence. Proboscis somewhat large, blackish at base, brownish towards tip, with some hairs.

Eye margins rather deeply cut away at the middle of the side. Back of head considerably puffed out, black, with golden yellow hair at the sides and a fringe of stiff bright yellow hair at the back, and with microscopic black hairs on the remaining portions.

Thorax.—Dorsum black, with short, not thick, bright golden yellow hairs; also a bunch of bristly yellow hair on each side, just behind the shoulder, with some yellow bristles; some yellow hair on anterior margin. A large reclinate yellow spine above each wing base and three or four black bristles on posterior portion of dorsum. Sides of thorax ash-grey, with some patches of whitish hair. Scutellum black, with golden yellow hair, and some black bristles towards posterior margin.

Abdomen moderately shining black, rather closely covered with short, bright golden yellow hair, which forms a large fan-shaped bunch on each side of the 1st segment, where it becomes almost scaly. There are short black hairs intermixed with the yellow towards the sides of the dorsum. Belly with close, soft, bright yellow hair.

Legs.—Coxæ black, with whitish hair; femora and tibiæ yellow, with short black bristles, which are longest on the latter,

and form a circlet at the tibiæ tips; tarsi black, with very short pubescence and bristles.

Wings very pale brown up to just beyond the middle where the colour fades away. Halteres creamy yellow.

Described from a unique specimen in perfect condition in the Indian Museum collection, from Calcutta, taken 1-vi-09.

N.B.—This species does not quite fall naturally into any of my temporary divisions of this genus, as the darkening of the wing does not partake of the usual oblique form; the coloration extending over the whole basal half of the wing.

***Bombylius scintillans*, mihi, sp. nov.**

♂ South India. Long. 5 mm. without proboscis, which measures 3 mm.

Head nearly as broad as thorax, black; eyes barely contiguous, but for about half the distance from the vertex to the antennæ; facets divided horizontally, those of upper half of eye much larger. Vertex distinct, ocelli red. Antennæ and proboscis entirely black, the former with microscopic white hairs on 3rd joint seen under a microscope. Bushy long black hair at the base of the antennæ, on the face and on under side of head. Some *elongated silvery white scales* in a row across the frons just above the antennæ, and more numerous ones in a small patch of them on each side of the face. The *surface* of the face itself is silvery white with a faint bluish shimmer when seen in certain directions. Back of head blackish, covered on upper part with bushy bright yellow hair, and on lower part with long black hair.

Thorax.—Surface deep velvet-black, with some black hairs at the sides and round the bases of the wings. The anterior part of the dorsum with bright yellowish hairs. (The surface is denuded posteriorly, but bears a few white scales with which it may normally be covered, but which may have accidentally come from the abdomen.) Scutellum black.

Abdomen dull shining black, bare of hairs on dorsum; a few at sides and on the wholly black belly. A thick row of *silvery white scales* at the posterior border of each segment, and distributed over the surface; in perfect specimens the dorsum of the whole abdomen is probably covered with them.

Legs black, with minute bristly pubescence on tarsi; middle femora with soft black hairs below; hind femora with several spiny bristles below; posterior tibiæ with numerous bristles.

Wings deep smoky brown, nearly black at base and on basal part of costa; posterior border paler; a blackish spot on upper angle of 2nd basal cell. Halteres black.

Described from a unique ♂ in perfect preservation (except for some denudation of the thorax and abdomen) in the Indian Museum, captured by Dr. Annandale at Kulattupuzha, at the western base of the Western Ghats (Travancore, South India), 19-xi-08.

***Bombylius comastes*, mihi, sp. nov.**

♀ South India. Long. $3\frac{3}{4}$ mm. + proboscis 2 mm.

Head.—Frons as broad as thorax, dark olive-brown, with some long erect black hairs; two large oval raised spots, concolorous just below vertex. Ocelli distinct, small, bright red, situated at extreme vertex, at which is a small bunch of long black hairs. Antennæ black, first joint with rather long black hair, style of third joint minute. Mouth, proboscis and under side of head black. A small cluster of *snow-white scales* on the face at each side of the antennæ, with a larger cluster of longer ones immediately below the smaller cluster, some few isolated small similar scales scattered along the mouth border. One or two small similar scales are placed on each side of the frons, just below the vertex, on the raised spots. Back of head grey, with thick yellowish hair on upper part, and a row of snow-white scales behind the outer orbit of eyes, for a considerable distance.

Thorax.—Ground colour velvet-black; dorsum partly denuded but with some small scales remaining of a brilliant emerald-green hue, while in front of the base of the wings are some small snow-white scales. Anterior part of dorsum with yellowish hair, some yellowish hair on sides and snow-white ragged hair on the lower part of the thorax in front. Black bristly hair appears scattered sparsely over the thorax, with a few bristles near the base of the wings. Scutellum dull black (denuded), with traces of green scales similar to those on the thorax.

Abdomen.—Ground colour dull black; traces of variegated scales, emerald-green, pink and white; some grey hair at sides of 2nd segment, with a few snow-white scales, which latter also appear to occur at the sides of the 4th segment. The sides of the abdomen and the whole of the tip bear long black hairs, as does also the belly.

Legs black, hind femora and posterior tibiæ with short spiny bristles. Some yellowish grey long hair around the coxæ.

Wings clear. Costal cell pale yellowish brown on distal half. Wings at base (including the tegulæ) similarly coloured, up to the base of the basal cells which are absolutely colourless. *The veinlet closing the first posterior cell* is in a direct line with that joining the two branches of the fourth longitudinal, the venation otherwise being that of normal *Bombylius*. Halteres black.

Described from a single ♀ (perfect except for some denudation of the thorax and abdomen) in the Indian Museum collection, taken by Dr. Annandale at Trivandrum (Travancore State, South India), 13-xi-08.

N.B.—In the unusual venation referred to, this species resembles the genus *Comastes*, Os. Sac., but, possessing neither the remarkably long antennal style nor the distinct emargination of the eyes characteristic of that genus, it must remain in *Bombylius*. The broad head, as wide as the thorax, is also characteristic of

Comastes, in opposition to the usually comparatively small and narrow head in typical *Bombylius*.

***Bombylius vicinus*, mihi.**

Two ♀ ♀ from Kumdhik, Nepal Terai, taken in company with *Anthrax insulata*.

***Bombylius propinquus*, mihi, sp. nov.**

I have a ♂, taken at Haragama, Ceylon, in January 1908, which closely resembles *terminalis*, mihi, but, intermixed with the yellowish brown soft hair on the front part of the head, are numerous long black bristly hairs. There is no snow-white pile around the antennæ; the lower part of the head is brownish yellow (not white), and without white hair; the base of the proboscis is yellow, and there is no snow-white pile at the abdomen tip. The wings have a blackish brown baso-costal band, occupying nearly half the surface of the wing; 1st posterior cell closed some distance from the border. The proboscis is 4 mm. long; the whole insect only 5 mm. From my *vicinus* it is also distinguished by the wholly black antennæ. Type in my collection.

***Bombylius wulpïi*, mihi.**

Bigot's description of the ♂ of this species is quite good. It is very unlike the ♀, as it has the last four segments of the abdomen (except the extreme tip) snow-white. I recently received a ♂ and ♀ from Mr. E. Green, taken *in cop.*, at Peradeniya, Ceylon, in April 1909.

***Systæchus socius*, Wlk.**

One ♀ from near Theog, Simla district, 14-v-09 (7,000 ft.), taken by Dr. Annandale, agrees very well with Walker's description.

***Dischistus resplendens*, mihi.**

Four ♀ ♀ taken by Dr. Annandale on a hillside below Theog (Simla district), 14-v-09.

N.B.—The suggestions in my description of this species, as to the normal appearance of it in perfect condition, are fully borne out by the above four perfect examples. Dr. Annandale describes this species as hovering slowly over banks of wild thyme, with its hind legs curved upwards, and as having much the appearance on the wing of a large mosquito, such as *Toxorhynchites*; the proboscis being extended in front of the head adds to the resemblance, while the glittering scales give the insect a splendour comparable to that of *T. immisericors*, Wlk., which in life is one of the most gorgeous of Indian Diptera.

Usia sedophila, mihi, sp. nov.

♂ ♀ Simla. Long. $2\frac{3}{4}$ — $3\frac{1}{2}$ mm.

♂ *Head*.—Vertex prominent, black, shining; a few erect long hairs. Ocelli distinct, whitish. Eyes black, bare, contiguous for more than half the distance from vertex to antennæ; facets in front and above distinctly larger than those behind and below, but no distinct dividing line. Antennæ black, bare, except for an occasional hair; first two joints short, third somewhat flattened, but thick and slightly curved, elongate, and with a peculiar notch towards the tip on upper side in which is a single hair.

Proboscis about twice the length of the head, black, cylindrical, stiff, straight, bent upwards at tip, bare, except for a few minute hairs at tip. Face dark greyish, with some stiff black hairs on each cheek, and a long, elevated, shining black callus between the median line and the eye margins. Back of head black, not produced behind margins of eyes, with long sparse black hairs, continued on under side of head.

Thorax dull black, velvety on dorsum, some black and pale hairs towards the sides, and three whitish grey elongate spots on anterior border, of which the middle one is often absent, and the outer ones are occasionally indistinct or absent also. Lower part of thorax more or less dark grey. Scutellum black, with some erect light tawny hairs.

Abdomen dull black, conical, 1st segment narrow, wholly black, the remaining six broader, but of diminishing length and breadth to the tip, and with a rather bright yellow narrow posterior border to each segment.

Dorsum comparatively bare, but the sides of the abdomen with pale yellow hairs. Genitalia small, inconspicuous, conical, blackish. Belly blackish, posterior margins of segments whitish grey.

Legs uniformly black, very shortly pubescent; femora with a little soft hair; hind tibiæ with short bristles.

Wings nearly clear; subcostal cell pale yellow, venation normal. Halteres dark brown or blackish, knobs large.

♀ In this sex the eyes are separated by a wide frons equaling one-third of the head. The upper half of the frons, as also the whole back of the head, is greyish yellow, the latter with black hairs as in the ♂; the upper half of the frons with a row of hairs near the margin of the eyes. Vertical triangle distinct, dark. Two narrow fuscous vertical lines lead from the vertical triangle to an irregular transverse dark streak dividing the upper from the lower half of the frons, the latter part being more ash-grey and unmarked. Lower part of the head greyish. Proboscis and mouth larger than in the ♂, thus narrowing the cheeks considerably.

Thorax yellowish grey, with median pair of narrow fuscous lines, with an outer broader stripe, more or less divided into three

spots, the anterior one small and conical, the other two more elongate. There is also an indistinct central line between the median pair of narrow ones, and a small spot above the insertion of the wings. Sides of thorax, cinereous grey. Scutellum yellowish grey, with some yellow hairs as in ♂

Abdomen black, bare, posterior margin of segment rather broadly yellow, sides with a little less hair than in ♂. *Belly* blackish. Ovipositor pale yellow, inconspicuous.

Legs and wings as in ♂

Described (♂ ♀) from several of both sexes taken by Dr. Annandale at Simla, 16-v-09, where it was common on *Sedum roseolum* (white stone-crop); the species was not seen anywhere except on this plant.

***Usia marginata*, mihi, sp. nov.**

♂ Simla. Long. 4 mm.

Head.—Eyes contiguous for a shorter space than in *sedophila*, black, bare; upper facets larger than lower, and more sharply defined from one another than in *sedophila*. Frons ash-grey, small, with a few black hairs. Vertex prominent, with some black hairs, ocelli distinct. Front margins of eyes and cheeks with long black hair, which is considerably thicker on the under side, and which extends over the whole of the back of the head. Antennæ as in *sedophila*, but the third joint with a pale ring at the base, giving the appearance of a minute basal joint, and the tip bears on its upper side a minute style-like process, just beyond the sub-apical depression. First joint with some bristly black hairs, second with one or two minute hairs, third bare.

Thorax dull black, almost velvety, covered lightly on dorsum, and more thickly in front and at sides with long black hairs. Anterior margin of thorax broadly whitish grey, which in the centre is produced posteriorly into four narrow stripes, of which the outer pair just reach the suture, the inner pair being very slightly shorter. Sides of thorax black, with long black hairs, and the whitish grey colour of the anterior margin of dorsum extends downwards somewhat below the shoulders.

Abdomen dull black, posterior margins of segments narrowly yellowish, with the colour continued over the sides and across the belly. A row of grey hairs on posterior border of segments, and the sides of the abdomen with rather thick whitish grey hair. *Belly* concolorous.

Legs black, minutely pubescent; femora with rather long soft black hair on upper and lower sides; hind tibiæ very shortly bristly.

Wings nearly clear; subcostal cell very pale yellow. Halteres pale brown, clubs chalk-white.

Described from one ♂ taken by Dr. Annandale at Simla (16-v-09) in company with the previous species.

***Geron albescens*, mihi, sp. nov.**

♂. Orissa Province (Bengal Presidency). Long. 5 mm.

Head black. Eyes contiguous almost to the antennæ, reducing the frontal triangle almost to a point. Facets of uniform size. Vertex considerably raised, small, with some rather short black hairs; ocelli red. Mouth black, grey bordered; face small, squarish, black, a cluster of drooping snowy scales on each side of the base of the antennæ. Proboscis black, tip curled. Antennæ black, microscopically grey dusted, tips of first and second joints narrowly pale, which joints are covered with greyish hair. Back of head black, long yellow hair above and greyish below. Some white small scales on hind border of eyes.

Thorax velvet-black; dorsum covered with bright yellowish hair, which on the shoulders becomes greyish, below which can be seen the humeral calli, grey, perforated with small holes. Under side ash-grey, covered with long grey hair and some grey scales. Scutellum black, yellow-haired.

Abdomen black, covered close to the surface with small recumbent yellow hairs; each segment bearing on its extreme posterior border a row of long deflexed grey hairs. Sides with somewhat thick and long grey hair. Belly wholly covered with small silvery white scales and long grey hair.

Legs (fore legs missing) pale tawny, with a pinkish white microscopic pubescence; coxæ, tips of femora, hind tarsi wholly, and middle pair towards tip, black. Middle femora with a little soft hair below.

Wings quite clear, veins pale yellowish on basal half. Halteres yellowish, knob bright lemon-yellow.

Described from a nearly perfect ♂ in the Indian Museum collection, taken by Mr. Caunter at Balugaon, Puri district of Orissa, on the east coast of India, 14-xii-08.

NOTE ON *COMASTES*, Os. SAC.

This genus, I am convinced, is not Oriental, although the late Herr van der Wulp removed a species of his own (*pulchellus*) from *Bombylius* to this genus. Described first in the Tijds. voor Ent., xxiii, 164, with an excellent plate (plate x, fig. 8) giving the full insect, he referred it to *Comastes*, in Notes Leyd. Mus., vii, 85. It is, however, certainly not a *Comastes*, as that genus possesses three characters which are altogether absent in *pulchellus*; these are the long style, as long as the third antennal joint itself, the emarginated eyes, and the punctiform contact of the second submarginal with the first posterior cell. There can be no possible doubt that a perfect specimen, a female, captured recently in South India by Dr. Annandale, belongs to this species, being identical with van der Wulp's description and plate, and it is far too brilliant and conspicuous a species to be mistaken. Moreover that

author distinctly says an "extremely small" style, referring to his species, and the plate distinctly shows the normal venation of *Bombylius*, and not that described by Osten Sacken.

The head is as broad as the thorax in *pulchellus*, and in that character alone it differs from the typical *Bombylius*, in which genus it must therefore remain.

A second question is whether *Comastes* or *Heterostylum*, Macq., should stand. Prof. Aldrich adopts the latter in his recent Cat. N. Amer. Diptera. Osten Sacken admits the identity of the two genera (Cat. N. Amer. Dipt., Add., p. 267, 1878) but upholds his own generic name on the ground that Macquart's principal character, the pubescence of the third antennal joint, had no existence in reality, Osten Sacken having examined the type in Bigot's collection and found the supposed pubescence to be dust. The two other characters of the genus admitted by Osten Sacken, namely, the emarginate eyes and the venation mentioned above, were, however, also given by Macquart in his diagnosis.

Osten Sacken has himself remarked somewhere that a generic name founded upon an absolutely incorrect character seems justly to require alteration, as being scientifically wrong and misleading, but the name *Heterostylum* is not intrinsically incorrect, for though the alleged pubescence is not present, the antennal style is sufficiently differently formed (Macquart distinctly says "la forme du style, diferente," etc.) to justify the retention of his name.

Therefore, because it may be regarded from this point of view, I think *Heterostylum* should stand. The genus, however, has not yet been found in the Orient.

[N.B.—The types of all the new species described in this paper are in the Indian Museum collection, except where otherwise stated.]



XIV. NOTES ON THE TRICHOPTERA IN THE COLLECTION OF THE INDIAN MUSEUM.

By C. BETTEN.

This collection includes thirty species of Trichoptera of which eleven are described below as new. Among these thirty species there were some which are listed in this paper, the specimens of which were not in condition to admit of specific description. There were in addition a couple of species of Limnophilidæ and a *Rhyacophila* unfortunately so much damaged that they cannot be dealt with at all properly. In the case of most of the already described species referred to, notes and drawings are here added in the hope of improving our knowledge of these forms. The nomenclature of the wing veins adopted is not that commonly used in this order. I have therefore labelled veins only in those cases in which it was necessary to make the references in the text intelligible. In studying this collection it has been very convenient to have for reference Ulmer's list of Indian Trichoptera.¹

Fam. PHILOPOTAMIDÆ.

Gen. STENOPSYCHE.

[*Stenopsyche griseipennis*.]

- [*Stenopsyche griseipennis*, McLachlan, *Trans. Ent. Soc. Lond.* (3),
vol. v, p. 265, pl. xvii, fig. 5 (1866);
Journ. Linn. Soc. Lond., Zool., vol. xi,
p. 134 (1871).
,, ,, Ulmer, *Cat. Coll. Sélys*, fasc. 6, p. 77,
figs. 116, 117 (1907).
,, ,, Ulmer, *Genera Insectorum*, fasc. 60, p. 201.

Numerous specimens of both sexes from Sikkim, Kulu (W. Himalayas) and Kurseong, Darjiling district (alt. 5,000 ft.). At the last place I found the species common in the last week in May, in 1906.

Unfortunately Dr. Betten's MS. has been damaged in transit, and the page containing his notes on this species is missing. The

¹ Ulmer, Georg: *Notes from the Leyden Museum*, vol. xxix,

specimens referred to have been named by him. There are also specimens in the Museum which agree with them exactly, from Calcutta, Ramnee in British Garhwal, W. Himalayas (21-X-07), and Manipur, Assam.—N. Annandale.]

Fam. HYDROPSYCHIDÆ.

Subfam. MACRONEMATINÆ.

Gen. MACRONEMA.

Macronema fastosum.

(Pl. xiv, figs. 4–7.)

Macronema fastosum, Walker, *Cat. Neur. Brit. Mus.*, p. 76.

„ *fasciatum*, Albarda, *Veth's Midden-Sumatra*, vol. iv
pt. 5, pl. v, fig. 2 (1881).

„ „ Ulmer, *Stett. Ent. Zeit.*, vol. lxvi, p. 72.

„ *fastosum*, Ulmer, *Notes from the Leyden Museum*,
vol. xxviii, p. 73.

„ „ Ulmer, *Genera Insectorum*, fasc. 60, pl.
xxxix, fig. 7.

Ulmer has shown that *Macronema fasciatum*, Albarda, is a synonym of *M. fastosum*, and *fasciatum* is thus reduced to a variety. The half dozen specimens at hand all belong to the typical variety. One of the specimens is labelled “Sikkim” and they all agree in general with the description Ulmer gives of his material from that region, although there is a little variation in the extent and depth of the colour of the fore tibiæ. None of the descriptions call attention to the fact that the tips of the hind wings are black. The two veinlets in the costal area of the fore wing and the slender filaments on the posterior margin of the fourth abdominal segment seem also to have escaped notice. Figures are here added, because those by Albarda are in a publication not universally accessible and they are not wholly accurate, as Ulmer has indicated.

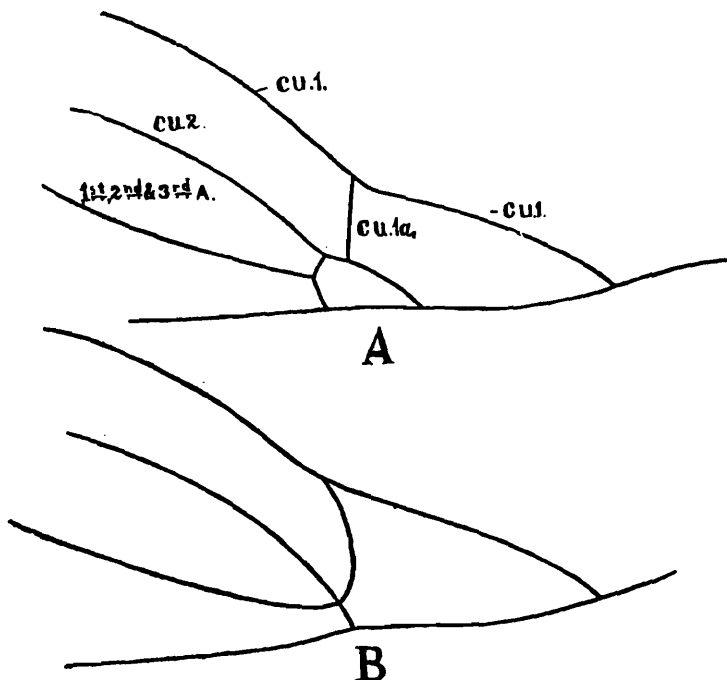
[I found this form very common at Kurseong in May, 1906. Numbers flew to the lamp in my room every evening.—N. A.]

Macronema punctatum, sp. nov.

This species is undoubtedly closely related to *M. fastosum*, from which it differs in the following particulars. The length is 10 mm., the wing expanse 31 mm. The largest specimen of *M. fastosum* I have has an expanse of 26 mm. There is no trace of black on the tips of the wings of this species, and in the middle of the fore wing there is a black spot, not much longer than wide, instead of the band which occurs in *M. fastosum*. The most decided difference is in the venation. The difference in the course of branches of cubitus and anals near the wing-margin is shown in

the text-figure. I find no differences in the genitalia of the two species.

One male specimen from Kulu, W. Himalayas.



Tips of cubitus and the anals of the fore wing of, A, *Macronema fastosum*; B, *M. punctatum*.

Gen. POLYMORPHANISUS.

Polymorphanisus nigricornis.

(Pl. xiv, figs. 8, 9.)

- Æstropsis nigricornis*, Walker, *Cat. Neur. Brit. Mus.*, p. 79.
 „ „ McLachlan, *Ann. Soc. Ent. Belg.*, 1872, p. 70.
 „ „ Brauer, *Verh. Zool.-Bot. Ges. Wien*, vol. xxv, p. 73.
Polymorphanisus nigricornis, Ulmer, *Ann. Soc. Ent. Belg.*, vol. xlix, p. 24, fig. 11.

There are in the collection a male and a female specimen of this species. They agree well enough with Walker's description. They have the two black spots on the mesonotum as described for *P. bipunctata*, Brauer, but not mentioned in the original description of *nigricornis*. I add complete figures of the venation and of the genitalia.

[One of these specimens is from Cachar, Assam.—N. A.]

Gen. *ÆTHALOPTERA*.*Æthaloptera sexpunctata*.

(Pl. xiv, figs. 10—12.)

Setodes sexpunctata, Kolenati, *Genera et Spec. Trichopterorum*,
vol. ii, p. 266, pl. iii, fig. 28.*Polymorphanisus sexpunctata*, Brauer, *Verh. Zool.-Bot. Ges.*
Wien, vol. xviii, p. 263.*Æthaloptera* „ Ulmer, *Stett. Ent. Zeit.*, vol.
lxvi, p. 50, pl. i, fig. 40.

There are several specimens from Rajshahi, E. Bengal (February, 1907), and one from Sara Ghat, R. Ganges, in the collection of the Indian Museum, the latter dated December 1st. I have given figures of venation and of male genitalia.

Gen. *PHANOSTOMA*.*Phanostoma* sp.

(Pl. xiv, figs. 13—15.)

This is probably a new species, since this genus has heretofore not been reported from India or Asia. The two male specimens from Sara Ghat in the collection are considerably damaged and hardly admit of description. I am able, however, to give figures of venation and of genitalia.

Subfam. *HYDROPSYCHINÆ*.Gen. *HYDROPSYCHE*.

Of this cosmopolitan genus four species have hitherto been reported from India and the East Indies. In the collection at hand there are two species, one of which is *Hydropsyche asiatica*, Ulmer, adequately described in *Stett. Ent. Zeit.*, vol. lxvi, p. 91, pl. iv, figs. 122—124. Of this species there are two males from Kurseong (*Annandale*, May, 1906). The other species is new.

Hydropsyche indica, sp. nov.

(Pl. xv, figs. 1—4.)

Length 9 mm. Expanse 18 mm. Head, prothorax and mesothorax covered with yellow hair. Antennæ yellow at base broadly ringed with black. Legs yellow with yellow and black hair. Fore wings brown, closely dotted with yellow, veins dark brown. Venation as usual in the genus; in the hind wing cell R_2 is very small and a median cross-vein is present (pl. xv, fig. 1). This species is distinctly smaller than *H. maligna*, Hag., and may be readily separated from the other three Indian species by the form of the genitalia (pl. xv, figs. 2, 4). In the

figure are shown two appendages of the penis, each consisting of a long membranous body, terminated by a strong chitinous hook. These appendages occur in all species of the genus I have observed, but they are not shown in figures of the genitalia heretofore published.¹ This is due to the fact that these appendages are generally retracted; they can be brought out easily by boiling in caustic soda. In this species these appendages are very long, reaching nearly to the end of the penis.

One male and one female from Kurseong (*Annandale*, May, 1906).

Gen. HYDROMANICUS.

This genus has been set apart from *Hydropsyche* mainly on two characters—the intermediate tarsi of the female are not dilated and the outer claws of the males are normal. The latter character I do not find of great value, for the claw may not be very abnormal in *Hydropsyche*. As defined, the genus *Hydromanicus* includes two groups which should in all likelihood constitute separate genera. One of these groups corresponds very closely to *Hydropsyche* except that the tibiae of the female are not dilated. Judging from the specimens before me, further points of difference are that there are no appendages (Titillatoren) on the penis as in *Hydropsyche*. Furthermore, the base of the 2nd anal vein of the fore wing is in part obsolete, as is not the case in *Hydropsyche*. Regarding both these points observations on the other species of *Hydromanicus* are desirable. The second group, while it agrees with the former in not having the intermediate tibiae of the female dilated, differs from it and from *Hydropsyche* in several points. The shape of the wings is decidedly different, the apex being markedly truncate. This difference is particularly striking when the wings are folded at rest. The jugum is well developed in the second group, while in the first, as in *Hydropsyche*, it is not so. The most striking venational difference is in the hind wings where Sc and R₁ both arch towards the sector in the region of cell 1st R₃ and then separate widely as they go to the wing-margin. In *Hydropsyche* and in its nearest allies in *Hydromanicus* Sc and R₁ have their tips fused (pl. xv, figs. 1, 5, 13).

Hydromanicus truncatus, sp. nov.

(Pl. xv, figs. 5—8.)

Length of body 8 mm. Expanse 17—19 mm. Head, prothorax, and mesothorax black with golden hair; metathorax brown, legs yellow, abdomen black. Antennae black with an oblique white mark on each segment. Wings thickly covered with brownish black and with yellow hair, the yellow dots being distributed rather equally over the wings. Some of the light spots are in the wing membrane, as may be seen when the wing is denuded. Some

¹ Ulmer's latest figures are exceptions to this.

of these occur along the anterior margin, some along the posterior margin, particularly just before the tips of the anals, and a large patch of them is found at the wing apex. The shape of the claspers (Genitalfüssen) is very characteristic, the ends being truncate, at least as seen from above. The dark spots shown in pl. xv, fig. 8, are chitinized points on the dorsum of the ninth segment that can be distinguished only in specimens that have been cleared.

This species corresponds closely to the description of *H. luctuosus*, Ulmer. Some differences will be seen in the venation. The species agree, however, in having R_2 and R_3 of the fore wing fused further towards the wing-margin in the male than in the female. The two species are easily distinguished by the genitalia, the processes on the dorsal surface of the tenth segment being very slender in *truncatus*, and the ends of the claspers more or less truncate.

Several specimens from Kurseong (*Annandale*, May, 1906).

Hydromanicus dilatus, sp. nov.

(Pl. xv, figs. 9—12.)

Expanse 19-20 mm. Head and thorax dark brown with yellow hair. Antennæ yellow, narrowly ringed with brown, basal joint darker. Wings brown, with black and yellow hair, the yellow spots being distributed rather uniformly. The venation is of the type of *Hydropsyche* with no striking peculiarity except perhaps the transverse position of the tip of R_2 of the hind wing. The shape of the genitalia is characteristic, particularly that of the claspers. These have the first joint thickened distally, while the second joint is very long and slender.

One male and one female from Salatega, Java, sent by Dr. Zehntner.

The three species next to be described belong to that division of the genus characterized above as being more distantly related to *Hydropsyche*. Their nearest allies among described forms are doubtless *H. aspersus*, Ulmer, and *H. papilionaceus*, Hagen. With these they agree in having cell 1st R_3 of both wings long and narrow. They differ, judging from Ulmer's figures of *aspersus* and of *papilionaceus*, in having a cross-vein between Sc and R_1 of the fore wing. Cell R_2 of the hind wing is equal in length to its pedicel, not decidedly less as in *aspersus* nor decidedly more as in *papilionaceus*. The cross-vein between Cu_1 and Cu_2 of the fore wing is near the middle of the wing, a little before the cross-vein $M-Cu$. In the figure of *aspersus* it appears far towards the wing-margin and in *papilionaceus* it is apposed to the cross-vein $M-Cu$.

Hydromanicus marginatus; sp. nov.

(Pl. xv, fig. 13.)

Expanse 20 mm. Head black with black hair, thorax black above, golden towards the sides. Antennæ yellow at base, ringed

black, further out the proportions of the colours change so that the antennæ appear black, ringed yellow. Legs yellow to brown, with darker hair particularly on the distal joints; coxæ brown. On the fore wing the hairs on the anterior part are dark brown with spots of yellow particularly at the apex; the posterior third of the wing is almost wholly yellow and the veins in this region are more indistinct. The difference in coloration is very slightly indicated in the wing membrane.

Two females from Kurseong (*Annandale*, May, 1906).

Hydromanicus orientalis, sp. nov.

(Pl. xv, figs. 14—16.)

This species is closely related to *H. marginatus* but does not have the peculiar coloration of the latter and is considerably smaller, the expanse being 16 mm. The hair on the head is yellow, while in *marginatus* it is black. In the fore wing the membrane is nearly uniform brown, the pubescence rather scant, forming very indistinct irrorations of yellow and black. These irrorations are more distinct on the anterior margin. In venational and other characters, I see no difference between this and the preceding species.

[Specimens from Kurseong (*Annandale*, May, 1906).]

Hydromanicus brunneus, sp. nov.

(Pl. xvi, figs. 1—4.)

Length to tip of the wings 8 mm. Head and thorax dark brown to black above with brown hair. Antennæ at base whitish ringed with brown; more distally the brown band is wider than the pale one. Legs dark brown, tarsi still darker; hind femora with long hair. Fore wings reddish brown with lighter spots particularly along the anterior margin and at apex. The alternate light and dark markings at the wing apex extend also over the marginal fringe. Venation practically as in the two preceding species. Genitalia very different from the preceding species as shown by the figures.

Several specimens from Upper Assam.

Fam. POLYCENTROPIDÆ.

Subfam. POLYCENTROPINÆ.

Gen. HYALOPSYCHODES, nov.

This genus is closely related to *Hyalopsyche*, Ulmer, reported from W. Africa. It differs from that genus mainly in having no labial palpi. The maxillary palpi are like those figured by Ulmer for *Hyalopsyche*, but the fifth joint is comparatively longer. In addition it may be noted that the disparity of length in the spurs

is more striking on the first pair of legs than on the second and third pairs as described for *Hyalopsyche*. This is the first genus described as having maxillary palpi but no labial palpi.

Hyalopsychodes rivalis, sp. nov.

(Pl. xvi, figs. 5—7.)

Length 10 mm. Expanse 20 mm. Head, prothorax, and mesothorax dark brown, metathorax yellow. Wings brown. Head, thorax and wings covered with short yellowish hair. Antennæ with globose basal joint, the others longer; the joints near the base are thicker than those at the tip and have dark brown bands near their distal ends. Legs yellow. The venation is strikingly similar to that of *Hyalopsyche palpata*, Ulmer. The abdomen of the female is modified into an ovipositor as in *Hyalopsyche*.

The specimens at hand are females taken at Rajshahi, Eastern Bengal, 1—6-ii-07 (*Annandale*).

Gen. DIPSEUDOPSIS.

(Pl. xvi, figs. 8—13.)

The species of this genus have been differentiated mainly on the form of the abnormal spur on the hind tibiæ of the male. In this collection there are four specimens of a species of this genus but they are all in bad condition. I add figures of venation, the palpi, genitalia, and of the abnormal spur. The spur is unlike any I have seen figured.

Fam. CALAMOCERATIDÆ.

Gen. GANONEMA.

Ganonema brunneum.

Ganonema brunneum, Ulmer, *Stett. Ent. Zeit.*, vol. lxvi, p. 31, pl. i, fig. 26.

Of this species there is one female specimen from Sibsagar, Assam.

Ganonema salsum, sp. nov.

(Pl. xvi, figs. 14—17.)

Length to tip of wings 9-10 mm. Expanse 21 mm. Almost wholly brownish yellow, with hair of the same colour. Basal joint of antenna thick, second very small, the third longest, the succeeding ones about equal to the first. Palpi hairy, the proportions of the segments as figured (pl. xvi, fig. 17). By Ulmer's key to the genus (*Notes from the Leyden Museum*, vol. xxviii, p. 50) this species runs to *G. brevipenne*, Ulmer. The description also agrees fairly well but there appear to be decided differences in venation and in

the genitalia. The following points in the venation may be noted as different from those in *G. brevipenne*. The cross-vein RM is at the apex of cell M_1 and does not touch cell R_1 ; cell M_3 reaches back on cell 1st M for two-thirds the length of the latter. The venation of the hind wing seems to be like that of *brevipenne* although the shape is not the same.

Several specimens from Upper Assam.

Gen. ASOTOCERUS.

Asotocerus fuscipennis.

(Pl. xvii, figs. 1—3.)

Asotocerus fuscipennis, Albarda, Veth's *Midden-Sumatra*, vol. iv, pt. 5, p. 17, pl. v, fig. 1.

Figures of the venation and of the male genitalia are here given. The venation differs from Albarda's figure mainly in the presence of the cross-vein Cu_{1a} to Cu and the cross-vein between Sc and R_1 of the fore wing. The latter is very distinctly indicated. In the hind wing also there is a cross-vein between Sc and R_1 .

[Specimens from Kulu, W Himalayas.]

Fam. ODONTOCERIDÆ.

Gen. MARILIA.

Of this family no species have yet been reported from India. In this collection there is a single specimen, too poorly preserved to admit of description, which I regard as a species of *Marilia*, in spite of the fact that it differs from other species of that genus in not having R_1 and R_2 of the fore wing fused. As in females of other species of this genus, the spur formula is 2-4-4 and the hind wings are narrow. The venation of the fore wing is somewhat more generalized than those of this genus hitherto published, but these latter are probably of males (pl. xvii, fig. 4).

The specimen is from Bhim Tal, Kumaon, 4,500 ft., 22—27-ix-06 (*Annandale*).

Fam. LEPTOCERIDÆ.

Subfam. *TRIPLECTIDINÆ*.

Gen. NOTANATOLICA.

Notanatolica magna.

Notanatolica magna, Walker, *Cat. Neur. Brit. Mus.*, p. 73.

„ „ McLachlan, *Trans. Ent. Soc. Lond.* (3),
vol. v, p. 257, pl. xix, fig. 3.

„ „ Ulmer, *Notes from the Leyden Museum*,
vol. xxviii, p. 32.

Of this species there are two female specimens from Calcutta.

Notanatolica opposita (?).

(Pl. xvii, figs. 5—8.)

Notanatolica opposita, Walker, *Cat. Neur. Brit. Mus.*, p. 73.,, ,, McLachlan, *Trans. Ent. Soc. Lond.* (3),
vol. v, pp. 257, 258.,, ,, Ulmer, *Notes from the Leyden Museum*,
vol. xxviii, p. 32.

There are two male specimens of what I take to be this species. Doubt is cast on this determination by the fact that while R_2 and R_3 of the hind wing are fused, the cell 1st R_8 of the fore wing is not of the shape described for the female of this species by Ulmer. Nor do the cross-veins connecting that cell occupy the positions indicated by him. I add figures of the genitalia.

[One specimen from Calcutta (*Alcock*).]Subfam. *LEPTOCERINÆ*.Gen. *SETODES*.*Setodes argentifera*.

(Pl. xvii, figs. 9—11.)

Setodes argentifera, McLachlan, *Journ. Linn. Soc. Lond., Zool.*, vol. xi, p. 129, pl. iii, figs. 13, 13a.

This pretty little species is easily recognized from McLachlan's description. I add figures of venation and of genitalia because they differ somewhat from those of McLachlan's paper. In the venation the chief point of difference is that I find the radial cross-vein of the hind wing running to Sc and R_1 rather than to the wing-margin. In the drawings of the genitalia there is considerable difference. McLachlan has failed to show the bristly two-pronged appendage which appears to be an upper branch of the clasper. The slender spines referred to by McLachlan I suppose are those running close alongside of the strongly curved penis.

Fam. *SERICOSTOMATIDÆ*.Subfam. *GOERINÆ*.Gen. *GOERA*.

Of this genus there appear to be at least three species, represented by material in very bad condition. But one of these species is here described.

Goera relictæ, sp. nov.

(Pl. xviii, figs. 1—5.)

Expanse about 13 mm. Distinguished from other species mainly by the venation and the genitalia. In the fore wing R_2

and R_3 separate before the middle of cell 1st R_3 , not beyond it as in *G. pilosa*. In the hind wing cell R_2 is decidedly shorter than cell R_4 , not longer as in *G. longispina*; there is no cross-vein R_2 - R_3 as in *G. conclusa*. On the sixth ventral segment there is a single blunt elongate tooth with no spines alongside of it as there are in *G. pilosa* and *G. japonica*. This tooth is about one half as long as the segment. The male palpi are difficult to make out satisfactorily. The basal joint is short, one-and-a-half times as long as wide; the second is apparently wider than long; the third is about as long as the first and second. It is densely covered with very small club-shaped striate scale hairs.

Subfam. *LEPIDOSTOMATINÆ*.

Gen. *GOERODES*.

Goerodes sp.

(Pl. xviii, figs. 6—9.)

The three specimens belonging to this species are all females hardly admitting of specific determination. Ulmer's description of *G. cornigera* and his notes on *G. vulpina*, Hag., and *G. ursina*, Hag., seem to exclude these as possible determinations for this species. The figures and notes here added may make later determination of this material possible.

Length to tip of wings 7 mm. Expanse 13 mm. First joint of antennæ covered with long yellow and fewer black hairs, succeeding joints darker at their distal ends. Legs yellow with dark hair, particularly externally. Spurs 2-4-4, subapical spurs of intermediate tibiæ three-eighths the way from the proximal end, those of the hind tibiæ three-fourths the way; hind tibiæ somewhat curved in the region of the subapical spurs. Wings light brownish with short yellow and longer black hair. The venation differs from that of *G. vulpina* figured by Ulmer (*Cat. Coll. Sélys.*, fasc. 6, p. 40, fig. 64) mainly in that cell Cu_{1a} does not extend as far back as cell 1st R , and that Cu is not arched strongly near its branching; in the hind wing Sc and R are fused beyond the apex of cell R_2 , there is no cross-vein R_3 - R_4 , cell M_2 does not extend further back than cell R_5 .

Three specimens from Upper Assam.

Gen. *DINARTHRELLA*.

Dinarthrella sp.

(Pl. xviii, figs. 10—12.)

There are two specimens (♂ and ♀) of *Dinarthrella* doubtless representing a new species but in such very bad condition that I do not propose a specific name and content myself with giving figures of venation, the first joint of the antennæ, and the genitalia

of the male. *D. destructa*, Ulmer, is apparently a close ally but the genitalia and the first antennal joint are different.

Specimens from Kurseong, May, 1907 (*N. Annandale*).

Fam. PHRYGANEIDÆ.

Gen. NEURONIA.

Three species of this genus are reported from Asia : *N. melaleuca* and *N. regina* from Japan and *N. maclachlani* from India. Of the latter there are a female and male specimens in this collection. There is besides a male specimen of a new species.

Neuronia maclachlani.

(Pl. xviii, figs. 13, 14.)

Neuronia McLachlani, White, *Proc. Ent. Soc. Lond.*, 1862, p. 26.

„ „ McLachlan, *Trans. Ent. Soc. Lond.* (3), vol. v, p. 249, pl. xvii, fig. 1.

„ „ Hagen, *Verh. Zool.-Bot. Gesellsch. Wien*, 1873, p. 395.

[Specimens from Kulu (W. Himalayas), Darjiling (E. Himalayas) and Shillong (Khasi Hills, Assam).]

Neuronia asiatica, sp. nov.

(Pl. xviii, figs. 15, 16.)

Length of body 15 mm. Expanse 41 mm.

Head and thorax dark brown, eyes black, ocelli yellow. Fore wings orange with brown spots, the largest spots along the costa and apical margins, covering the tips of the veins, a particularly large spot on the tip of Sc ; there is an irregular brown band following the line of anastomosis from the first branching of media to the tip of the anal veins. The hind wing has the basal two-thirds dark brown ; the distal third is yellow. There is an interrupted apical band of brown, the brown spots being on and along the tips of the veins. The abnormality of venation shown in the anal veins of the hind wing occurs in both wings of the specimen.

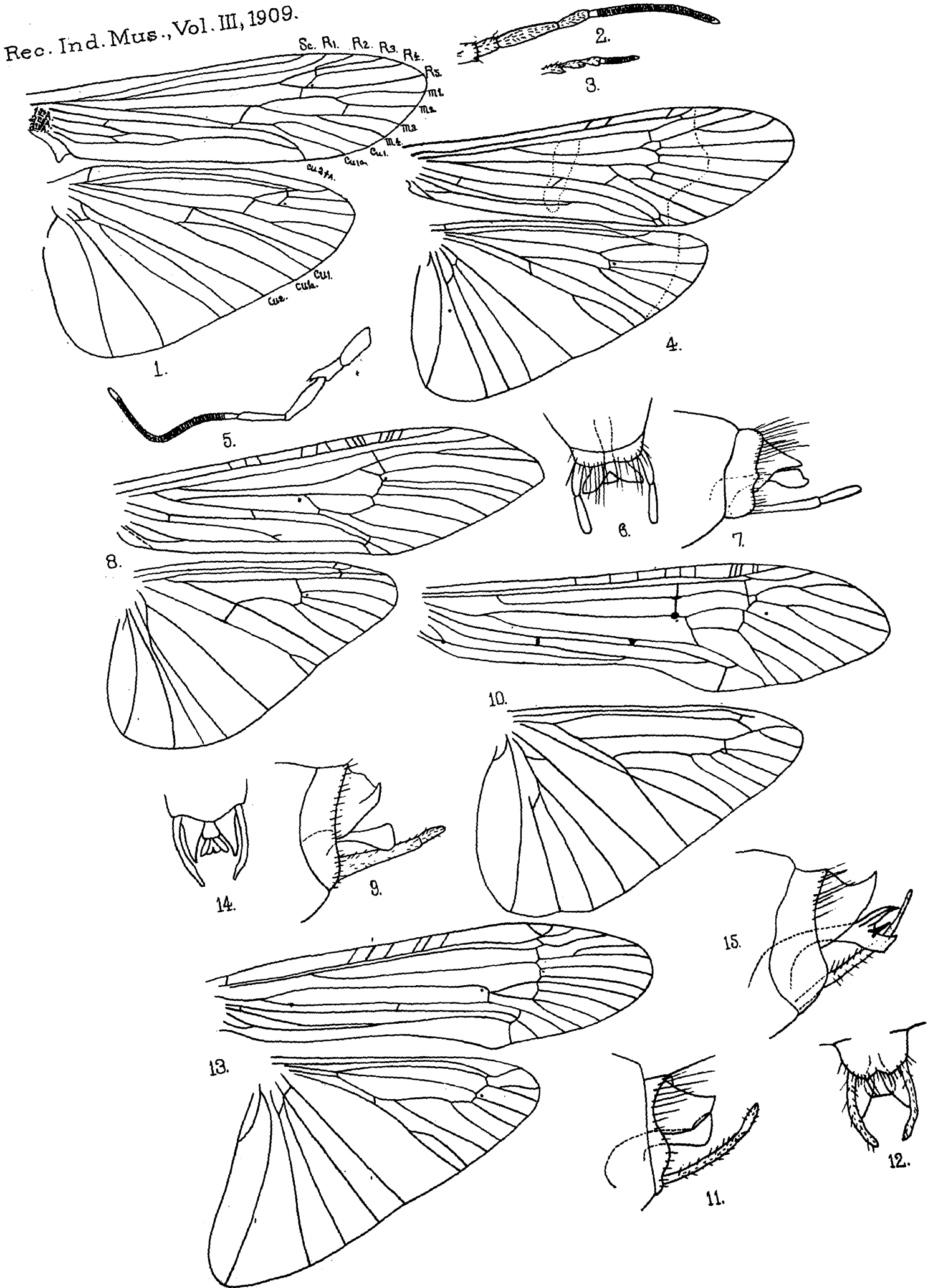
[Type from Sibsagar, Assam (*S. E. Peal*).]



EXPLANATION OF PLATE XIV

MACRONEMATINÆ.

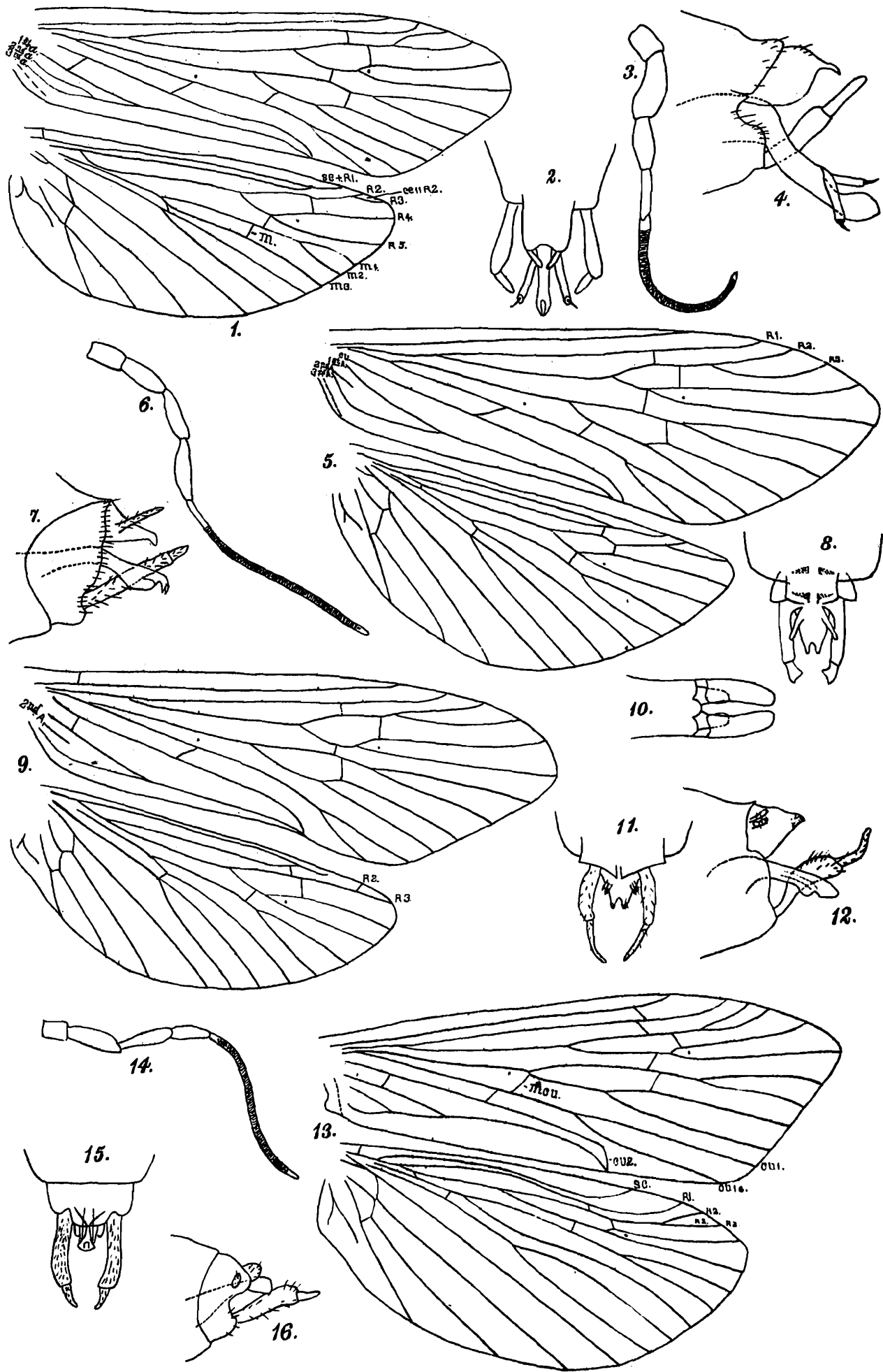
- FIG. 1.—Wings of *Stenopsyche griseipennis*, McL.
 „ 2.—Max. palpus of „ „
 „ 3.—Labial „ „ „
 „ 4.—Wings of *Macronema fastosum*, Walker.
 „ 5.—Max. palpus of „ „
 „ 6.—Genitalia of „ „ ♂ (dorsal view).
 „ 7.— „ „ „ ♂ (lateral view).
 „ 8.—Wings of *Polymorphanisus nigricornis*, Walker.
 „ 9.—Genitalia of „ „ ♂ (lateral view).
 „ 10.—Wings of *Æthaloptera sexpuncta*, Kol.
 „ 11.—Genitalia of „ „ ♂ (lateral view).
 „ 12.— „ „ „ ♂ (dorsal view).
 „ 13.—Wings of *Phanostoma* sp.
 „ 14.—Genitalia of „ „ (dorsal view).
 „ 15.— „ „ „ (lateral view).



EXPLANATION OF PLATE XV

HYDROPSYCHINÆ.

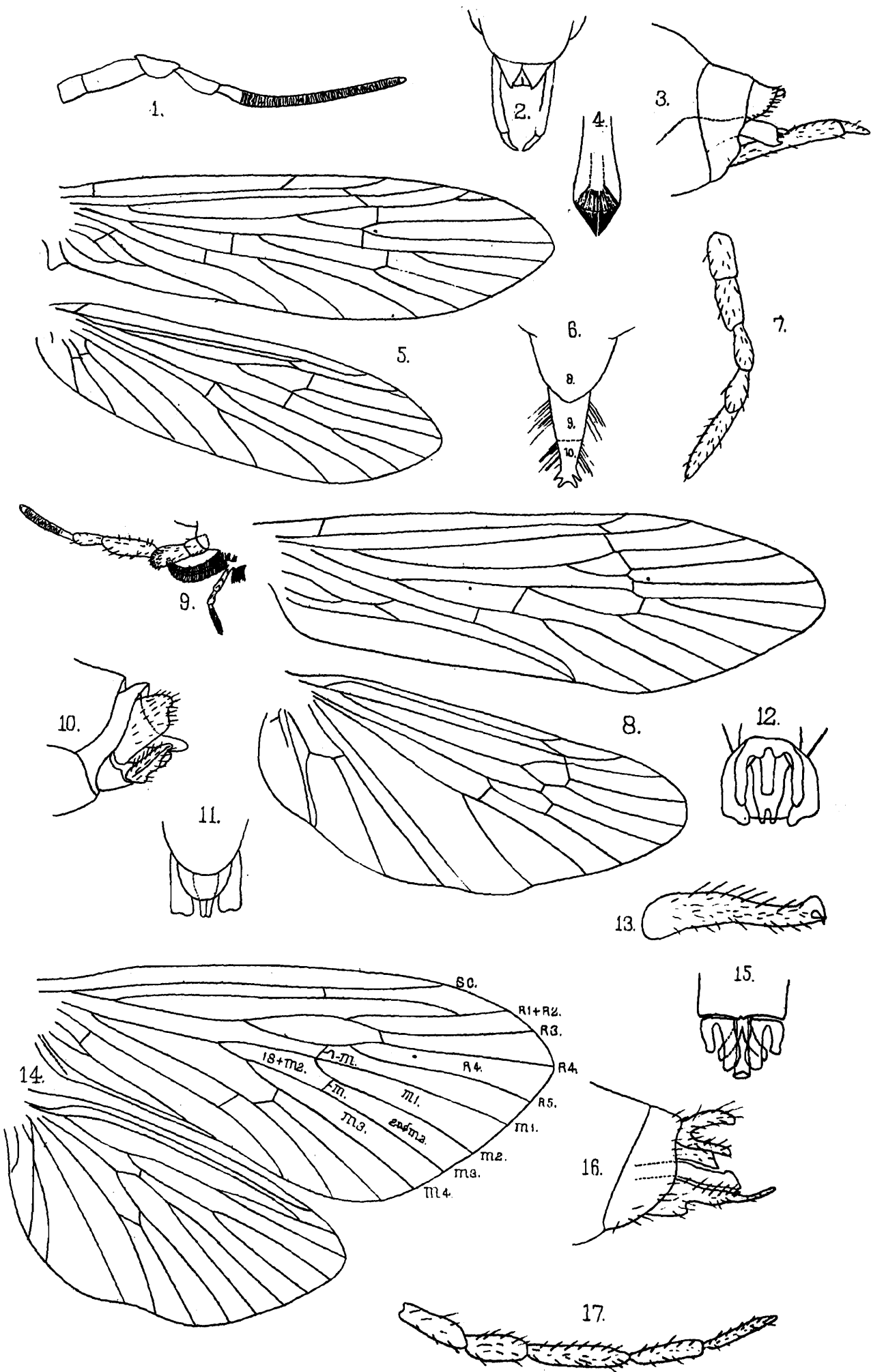
- FIG. 1.—Wings of *Hydropsyche indica*, sp. nov.
 „ 2.—Genitalia of „ „ ♂ (dorsal view).
 „ 3.—Max. palpus of „ „ „
 „ 4.—Genitalia of „ „ ♂ (lateral view).
 „ 5.—Wings of *Hydromanicus truncatus*, sp. nov.
 „ 6.—Max. palpus of „ „ „
 „ 7.—Genitalia of „ „ ♂ (lateral view).
 „ 8.— „ „ „ ♂ (dorsal view).
 „ 9.—Wings of „ „ *dilatus*, sp. nov.
 „ 10.—Penis of „ „ (ventral view).
 „ 11.—Genitalia of „ „ ♂ (dorsal view).
 „ 12.— „ „ „ ♂ (lateral view).
 „ 13.—Wings of „ „ *marginatus*, sp. nov.
 „ 14.—Max. palpus of „ „ *orientalis*, sp. nov.
 „ 15.—Genitalia of „ „ ♂ (dorsal view).
 „ 16.— „ „ „ ♂ (lateral view).



EXPLANATION OF PLATE XVI.

HYDROPSYCHINÆ, POLYCENTROPIDÆ and CALAMOCERATIDÆ.

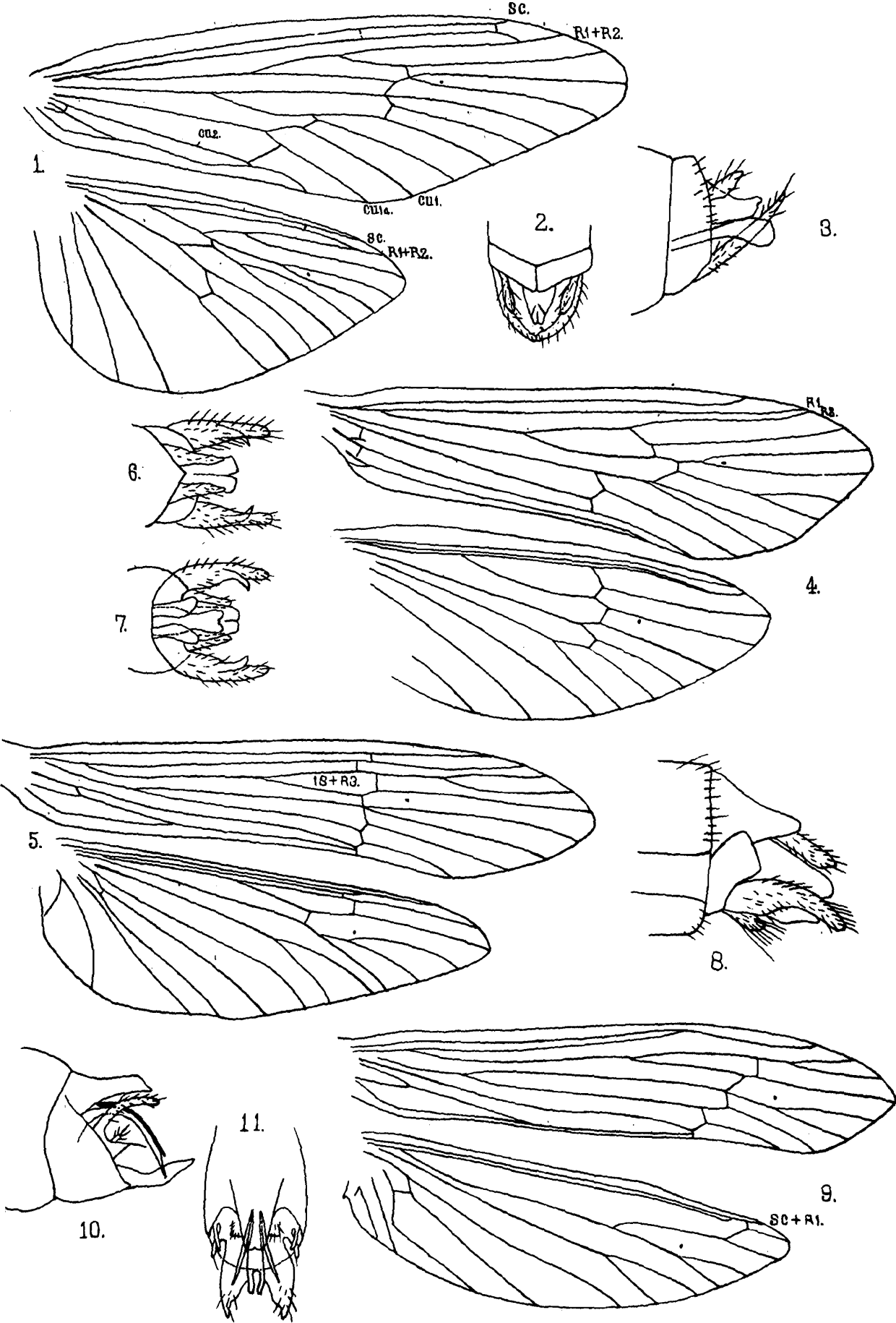
- FIG. 1.—Max. palpus of *Hydromanicus brunneus*, sp. nov.
 „ 2.—Genitalia of „ „ ♂ (dorsal view)
 „ 3.— „ „ „ ♂ (lateral view).
 „ 4.—Penis of „ „
 „ 5.—Wings of *Hyalopsychodes rivalis*, sp. nov.
 „ 6.—Ovipositor of „ „
 „ 7.—Max. palpus of „ „
 „ 8.—Wings of *Dipseudopsis* sp.
 „ 9.—Mouth parts of „ „
 „ 10.—Genitalia of „ „ ♂ (lateral view).
 „ 11.— „ „ „ (dorsal view).
 „ 12.— „ „ „ (ventral view).
 „ 13.—Abnormal spur of „ „
 „ 14.—Wings of *Ganonema salsum*, sp. nov.
 „ 15.—Genitalia of „ „ ♂ (dorsal view).
 „ 16.— „ „ „ (lateral view).
 „ 17.—Max. palpus of „ „



EXPLANATION OF PLATE XVII.

CALAMOCERATIDÆ, ODONTOCERIDÆ and LEPTOCERIDÆ.

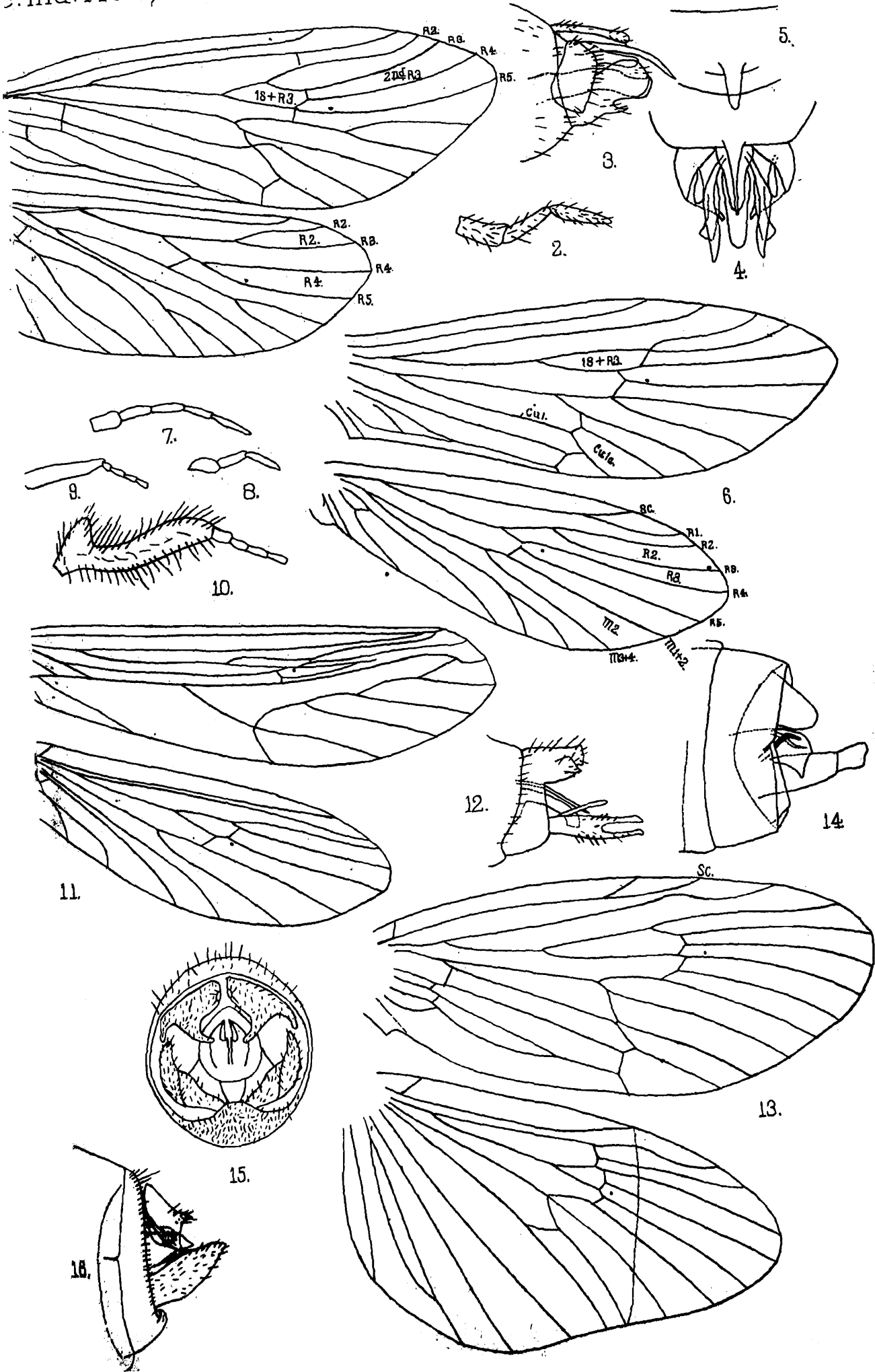
- FIG. 1.—Wings of *Asotocerus fuscipennis*, Albarda.
 „ 2.—Genitalia of „ „ ♂ (dorsal view).
 „ 3.— „ „ „ (lateral view).
 „ 4.—Wings of *Marilia* sp.
 „ 5.—Wings of *Notanatolica opposita* (?), Walker.
 „ 6.—Genitalia of „ „ (dorsal view).
 „ 7.— „ „ „ (ventral view).
 „ 8.— „ „ „ (lateral view).
 „ 9.—Wings of *Setodes argentifera*, McL.
 „ 10.—Genitalia of „ „ ♂ (lateral view).
 „ 11.— „ „ „ (ventral view, with tip
 of abdomen tilted
 upwards).



EXPLANATION OF PLATE XVIII.

SERICOSTOMATIDÆ and PHRYGANEIDÆ

- FIG. 1.—Wings of *Goera relictæ*, sp. nov.
,, 2.—Labial palpus of *Goera relictæ*.
,, 3.—Genitalia of ,, ,, ♂ (lateral view).
,, 4.— ,, ,, ,, ♂ (dorsal view).
,, 5.—Tooth on 6th ventral segment of *Goera relictæ*, ♀
,, 6.—Wings of *Goerodes* sp.
,, 7.—Max. palpus of *Goerodes* sp., ♀
,, 8.—Labial ,, ,, ,, ♀
,, 9.—Basal part of antenna of *Goerodes* sp.
,, 10.— ,, ,, ,, ,, *Dinarthrella* sp., ♂
,, 11.—Wings of *Dinarthrella* sp., ♂
,, 12.—Genitalia of ,, ,, ♂ (lateral view).
,, 13.—Wings of *Neuronia asiatica*, sp. nov.
,, 14.—Genitalia of ,, ,, (lateral view).
,, 15.— ,, ,, *maclachlani*, White (end view).
,, 16.— ,, ,, (lateral view).



XV. DIAGNOSES OF NEW SPECIES AND
VARIETIES OF FRESHWATER
CRABS Nos 1—3

By A. ALCOCK, F.R.S.

No. 1.

In examining the Indian Museum collection of freshwater crabs (Potamonidæ) I have, so far, met with the following species and varieties of the subgenus *Potamon* that seem to be "new":—

1. *Potamon (Potamon) fluviatile*, Latreille, var. *gedrosianum*.

This variety agrees with the variety *ibericum* in all but the following particulars:—(a) The carapace is broader, its length in large adults seldom exceeding $\frac{1}{3}$ ths of its breadth, owing to the greater convexity of the antero-lateral borders; (b) the cervical groove is deep-cut in all its course; (c) the epigastric crests are more tumid and more in advance of the post-orbital crests. It occurs in Baluchistán, Seistán, and the Salt Range of the Punjáb.

2. *Potamon (Potamon) atkinsonianum*, Wood-Mason,
var. *emphyseteum*.

This variety agrees with Wood-Mason's type in all but the following particulars:—(a) The antero-lateral borders of the carapace are very strongly convex, this adds to the breadth of the carapace and makes the postero-lateral borders remarkably convergent, it also makes the ripple-like tubercles of the antero-lateral part of the epibranchial regions more oblique; (b) the sixth abdominal segment of the adult male is always two-thirds as long as broad, whereas in a series of *atkinsonianum* it is a variable amount less than two-thirds. It occurs in the Punjáb Himalayas, at Bilaspur and Kangra.

3. *Potamon (Potamon) atkinsonianum*, Wood-Mason,
var. *ambivium*.

This small variety is annectant between *atkinsonianum* and Miss Rathbun's species, or variety, *koolooense*. Like the latter form it is small, the carapace of an egg-laden female being less than an inch long. It occurs at Dharampur, near Simla, 5,000 feet elevation.

4. *Potamon (Potamon) atkinsonianum*, Wood-Mason,
var. *ventriosum*.

This variety agrees in every respect with Wood-Mason's type, except in the form of the male abdomen, which is broad, the sixth segment being twice as broad as long. It is represented by a single specimen, a large male with a carapace nearly two inches broad, from Kumáon, about 6,000 feet elevation. It is possibly an aberrant individual, not a "variety" in the strict sense of the term—if terms were always used in their strict sense.

5. *Potamon (Potamon) bifarium*, sp. nov.

Belongs to the *atkinsonianum* clan, and is distinguished from *atkinsonianum* by the following characters:—(a) The carapace is distinctly convex behind the frontal slope; (b) the epibranchial arcolæ are less distinct; (c) the abdomen of the adult male is broader, the sixth segment varying in length from almost half to two thirds the greatest breadth; (d) the legs are slenderer, for instance, in the second and third legs the propodite is two-and-a-half times as long as broad. The species is represented by six males collected by Dr. W. T. Blanford either in Sikhim or in Burma.

6. *Potamon (Potamon) andersonianum*, Wood-Mason,
var. *asperatum*.

Only differs from the type in having the entire carapace very finely granulous. The specimens are young and the character specified is variable. They come from Ganjam in the Cachar Hills, about 4,000 feet elevation,—not from Ganjam on the East Coast.

7. *Potamon (Potamon) andersonianum*, Wood-Mason,
var. *manipurensis*.

In this variety the surface sculpture of the carapace has a "worn" look, and the edge of the front is a little sinuous. A male and a female from the Manipur Hills.

8. *Potamon (Potamon) andersonianum*, Wood-Mason,
var. *tritum*.

In this variety the surface sculpture is still more worn-looking, and the edge of the front is so sinuous as to suggest four faint lobes. A single female from the Kakhyen Hills, Upper Burma; in Dr. J. Anderson's Yunnan collection.

9. *Potamon (Potamon) edwardsi*, Wood-Mason, var. *hirtum*.

In this variety the tufts of bristly setæ on the dorsum of the carapace may be so numerous as to give the specimen a harsh woolly feel, and the legs are rather thickly hirsute. The pustule-like tubercles of the upper surface of the palm may be more

numerous and a little smaller. Nine males and three females from the Kakhyen Hills and Yunnan ; in Dr. Anderson's Yunnan collection.

10. *Potamon (Potamon) pealianum*, Wood-Mason,
var. *antennarium*.

In this "variety"—using the term without any definite implication—the antennular fossæ are wide fore and aft owing to an overgrowth of the epistomial portion of the inter-antennular septum. In consequence of this pushing up of the edge of the front the antennal peduncles stand quite clear of the front, being neither in contact with nor overlapped by the front. I find this abnormality in four old females only, two of them from Sibsagar, Assam, two from an unrecorded locality.

11. *Potamon (Potamon) turgidulum*, sp. nov.

Belongs to the *pealianum* and *tumidum* clan. Resembles *P. tumidum*, Wood-Mason, in form and size, but differs as follows:—(a) The grooves of the carapace are more superficial ; (b) the front—in individuals of equal size—is narrower, and its edge is distinctly bilobed ; (c) the edge of the post-orbital crests is thin and well defined, *not* thick and somewhat confused with the rugosities of the carapace as it is in *tumidum* ; (d) the merus of the external maxillipeds is as long as broad ; (e) the legs are longer—in individuals of equal growth—the second (longest) pair being considerably longer than the chelipeds. Eleven males and six females (one with eggs) from Burma. The length of the carapace in adults is less than an inch.

12. *Potamon (Potamon) tumidulum*, sp. nov.

Very close to *tumidum* and *turgidulum*, but the carapace is less convex, and the post-orbital crests are very rugose and blunt-edged. Though not so convex dorsally the carapace is hardly less deep, its depth being half its length. The front is less than a third the greatest breadth of the carapace in adults—in *turgidulum* it is a third, in *tumidum* more than a third. The chelipeds are more unequal, and they and the legs are somewhat hirsute. Eight males, eight females, and eight young from Pharping, Nepal. In the largest specimen (a mature female) the carapace is only $\frac{3}{4}$ ths of an inch long. This species could not be placed in the *Geotelphusa* group as its post-orbital crests, though blunt-edged, are tumid and bold.

13. *Potamon (Potamon) simulum*, sp. nov.

Very close to *P. austenianum*, Wood-Mason, and having the same remarkably long, slender legs, but differing in the following particulars:—(a) The carapace is shorter and wider, and its areolation is much less distinct ; (b) the front is much narrower—not

one-fourth the greatest breadth of the carapace—and is vertically deflexed.

A single female, with a carapace nearly 2 inches broad, from Burma.

14. *Potamon (Potamon) pruinorum*, sp. nov.

Belongs to the *P. larraudii* clan, but differs from this and all other related species in the profusely tuberculous carapace. The carapace is deep—its depth equals half its length—and its grooves are very faint. The cervical groove does not cut the post-orbital crests. The surface of the frontal and of the anterior half of the gastric and epibranchial regions is covered with pearly granules and transverse dentiform tubercles of a brilliant whitish colour. Smaller pearly white granules stud the chelipeds. The edge of the epigastric and post-orbital crests is broken into long transverse and oblique whitish imbricating tubercles. Its nearest relative is *P. brevimarginatum*, de Man; but it is more profusely and crisply and finely tuberculous than that species; has a deeper carapace; and, except for a very superficial and incomplete cervical groove, has no distinct areolation of the dorsum.

Locality.—Hills between Burma and Siam.

No. 2.

POTAMISCUS, gen. nov.

Potamiscus in one particular (namely, the absence of a flagellum from the exopodite of the external maxillipeds) resembles *Pseudotelphusa*; but it has no other affinities with that genus. Its closest relations are with the *Potamon fluviatile* group, as it has a simple mandibular palp—i.e., a mandibular palp with the terminal joint not bifurcate—such as is found in *P. fluviatile*, *P. atkinsonianum*, *P. koolooense*, *P. andersonianum*, *P. edwardsi*, *P. hispidum*, *P. bifarium*, *P. pealium*, *P. tumidum*, *P. turgidulum*, *P. tumidulum*, *P. austenianum*, *P. simulium*, *P. larraudii*, *P. manii*, *P. brevimarginatum*, *P. stoliczkanum*, *P. thagatense*, *P. (Geotelphusa) sikkimense*, and not in any other Indian species. The value of the mandibular palp in classifying the Potamonidæ has lately been disclosed by Dr. W. T. Calman.

1. *Potamiscus annandalii*, sp. nov.

This species has a very strong superficial resemblance to *P. pealium*, from which it is easily distinguished by the following characters:—

(1) the flagellum of the exopodite of the external maxillipeds is either quite vestigial or altogether wanting;

(2) the cervical groove is distinguishable only in the middle of the carapace, where it bounds the mesogastric areola posteriorly;

(3) the post-frontal and post-orbital crests form a continuous wavy curve from the middle line to the lateral epibranchial tooth,

as in the mixed assemblage of species to which the name *Potamonantes* has been applied.

In a large female the carapace is 1 inch long, $1\frac{1}{4}$ inch broad, and a little over $\frac{1}{2}$ an inch deep.

From Nemotha, Cachar; nine males and six females.

2. Varieties of *Potamon lugubre*, Wood-Mason.

This species is not a true *Potamon* (subgenus), since it has the terminal joint of the mandibular palp bifurcate or bilobed as in "*Potamonantes*" *jacquemontii*, "*Geotelphusa*" *lævis*, *Paratelphusa spinigera* and *Gecarcinucus jacquemontii*.

It is a very variable species. In the large series which I have examined I can distinguish five varieties (not including *P. masonianum* which seems to be but a variety) to some or all of which many naturalists, with only single specimens of each before them, might give specific rank. In none of these varieties, however, is there any constancy.

a. *Potamon lugubre*, var. *edentulum*.

In this variety the lateral epibranchial tooth is quite obsolete, the antero-lateral borders of the carapace are unusually convex, and the individual regions of the carapace are unusually tumid.

From the Naga Hills.

b. *Potamon lugubre*, var. *harpax*.

Though the carapace is flat on the whole, the individual regions are tumid, the amount of swelling being very variable: the carapace also is not quite so broad as in the type.

The lateral epibranchial tooth is usually more distinct, and the antero-lateral borders are often less arched than in the type.

The front is usually less deflexed.

The spine at the inner angle of the carpus is usually more acute.

In some large males the hand of the larger cheliped is enormously enlarged, the dactylus being much longer than the palm and strongly arched, so that when the fingers are closed only their tips are in contact and a very wide gap is left between them. In the female the fingers of both chelipeds are usually a little longer than in the type.

From Assam, Cachar, Sylhet, Khasi Hills, Garo Hills, and Naga Hills.

c. *Potamon lugubre*, var. *nigerrimum*.

As in the variety *harpax* the carapace is not quite so broad, the lateral epibranchial tooth is a spine, the individual regions of the carapace are tumid, the antero-lateral borders are less arched, and the front is less deflexed.

The colour is greenish-black to coal-black.
From North Lushai.

d. Potamon lugubre, var. *plautum*.

In comparison with the typical form of *P. lugubre*:—

The carapace is not quite so broad, and is unusually flat.

The lateral epibranchial tooth is usually more prominent, as in the variety *harpax*.

The front is less deflexed and the epigastric crests are more oblique.

The wings of the cervical groove are unusually broad.

The 6th abdominal segment of the male is slightly broader.

From Assam and the Khasi Hills.

e. Potamon lugubre, var. *falcidigitus*.

As in the three preceding varieties the carapace is not quite so broad and the front is less deflexed.

As in the variety *plautum* the carapace, in most individuals, is uncommonly flat, and the wings of the cervical groove are unusually broad.

As in typical *lugubre*, the lateral epibranchial tooth is small, indistinct, or obsolescent.

The chelipeds have the fingers remarkably broadened, so that although the upper border of the dactylus is quite as strongly curved as it is in typical *lugubre*, yet the fingers when closed are in contact, or almost so, along the whole extent of their cutting edge; but the breadth of the fingers is variable. Sometimes there is a row of two or three spines or large bead-like granules on the proximal end of the upper surface of the dactylus.

In all the legs the edges of the propodite are very strongly serrated, and the anterior edge of the carpus is also strongly serrated.

From Cachar, Cherra Punji, Khasi Hills, Garo Hills, and Naga Hills.

3. *Potamon napæum*, sp. nov.

The species differs from *P. lugubre* and *P. masonianum* (if this latter is anything more than a variety of the former) in the following characters, which are constant in five males and six females:—

The carapace has an oval outline, and the antero-lateral borders are well defined, slightly raised, and regularly beaded or crenulate.

There is no trace of a lateral epibranchial tooth, the antero-lateral borders at that point being in unbroken continuity with the post-orbital crests.

The sub-orbital lobes of the carapace are quite distinctly defined.

From Ganjam in North Cachar, 4,000 feet.

No. 3.

The Potamonidæ of the Indian fauna are included in three principal genera, *Potamon*, *Paratelphusa*, and *Gecarcinucus*.

In the genus *Potamon* the terminal joint of the mandibular palp is simple; the 6th segment of the abdomen of the adult male is short and broad, its length never being equal to its distal (least) breadth; and the cervical groove, when it is distinct, runs towards the external orbital tooth on either side.

In the genus *Paratelphusa* the terminal joint of the mandibular palp is bilobed, the anterior lobe (which is broadly oval) overhanging the ventral surface of the mandible, the posterior lobe (which is falciform) lying behind the incisor process; the 6th segment of the abdomen of the adult male is a longish joint, its length hardly ever being less, and usually being more, than its distal breadth; and the cervical groove when distinct usually runs towards the lateral epibranchial tooth on either side.

In the genus *Gecarcinucus* the terminal joint of the mandibular palp is bifurcate as in *Paratelphusa*; the 6th segment of the abdomen of the adult male is broad as in *Potamon*, but is narrowed distally in a way of its own; and the front is particularly narrow in the adult.

The Indian species of the genus *Potamon* can be grouped in four maniples or subgenera as follows:—

1. Subgenus *Potamon*. The antero-lateral borders of the carapace are crenulate or serrulate, not multispinous: there is no spine at the far end of the upper border of the merus of the chelipeds: the exopodite of the external maxillipeds carries a strong plumose flagellum: the post-orbital crests and lateral epibranchial spine of the carapace are well developed.—Type *Potamon fluviatile*, Latr.

2. Subgenus *Geotelphusa*. As *Potamon*, but the post-orbital crests and lateral epibranchial spine are ill-developed or obsolete.—Type *G. obtusipes*, Stimpson.

3. Subgenus *Potamiscus*. As *Potamon*, but the flagellum of the exopodite of the external maxillipeds is absent or vestigial.—Type *P. annandalii*, A. A.

4. Subgenus *Paratelphusula*, nov. As *Potamon*, but the antero-lateral borders of the carapace are cut into large teeth or spines, and there is a strong subterminal spine on the upper border of the merus of the chelipeds.—Type *P. dayana* (W.-M.).

[N.B.—The species of this subgenus of *Potamon* have been confused with *Paratelphusa* (type *P. tridentata*) which is a widely different form.]

The Indian species of the genus *Paratelphusa* can be grouped in six subgenera, as follows:—

1. Subgenus *Paratelphusa*. The antero-lateral borders of the carapace are usually cut into large teeth or spines, and there is always a strong subterminal spine on the upper border of the

merus of the chelipeds : the exopodite of the external maxillipeds carries a strong plumose flagellum.—Type *P. tridentata*, A. M.-Edw.

2. Subgenus *Leschenaultia*, nov. The antero-lateral borders of the carapace are *not* spinose : there is *no* subterminal spine on the upper border of the merus of the chelipeds : the epigastric crests of the carapace are in advance of and quite independent of the post-orbital crests : the exopodite of the external maxillipeds carries a strong plumose flagellum.—Type *L. hydrodromus* (Herbst).

3. Subgenus *Phricotelphusa*, nov. As *Leschenaultia*, but the flagellum of the exopodite of the external maxillipeds is either absent, or vestigial, or filamentous, or is inconstant in one and the same species ; and the antennal flagellum is minute or vestigial.—Type *P. callianira* (de Man).

4. Subgenus *Barytelphusa*, nov. As *Leschenaultia*, but the epigastric and post-orbital crests are either united to form a single ridge, or else are in the same line and are imperfectly separated only by a vague break : the cervical groove is usually very broad and very deep.—Type *B. jacquemontii* (= "*Telphusa indica*").

5. Subgenus *Liotelphusa*, nov. As *Leschenaultia*, but the epigastric and post-orbital crests are low and quite inconspicuous, and the lateral epibranchial tooth is small or obsolescent.—Type *L. lævis* (W.-M.).

6. Subgenus *Globitelphusa*, nov. As *Leschenaultia*, but the epigastric and post-orbital crests are still more inconspicuous than in *Liotelphusa*, the lateral epibranchial spine is obsolete, and the exopodite of the external maxillipeds is short and non-flagellate.—Type *G. bakeri*, A. A.

Certain new species of *Potamon* and *Potamiscus* have been briefly noticed in papers Nos. 1 and 2, the following new species of other subgenera may now be mentioned preliminary to the full diagnoses that will appear in my forthcoming report on the Indian Potamonidæ.

Genus POTAMON.

Subgenus **Geotelphusa**,

Potamon (*Geotelphusa*) *adiatretum*, sp. nov.

This species is very closely related to *P. enode*, Kingsley, from which it differs chiefly in the bilobed front, and in the restriction of the cervical groove to that portion which bounds the mesogastric area posteriorly.

In an adult female the carapace is only $\frac{5}{8}$ inch long and $\frac{7}{8}$ inch broad.

From the Kakhyen Hills and Moulmein.

Subgenus **Paratelphusula**.

Potamon (*Paratelphusula*) *jungosum*, sp. nov.

This species comes nearest to *P. milne-edwardsi* (Wood-Mason) (= *P. wood-masoni*, Rathbun). It has the exposed surface of the

ischium of the external maxillipeds longitudinally grooved; the antero-lateral borders of the carapace cut into four salient spines, exclusive of the external orbital tooth; the carapace only slightly convex, broadly corrugated transversely (as in *P. feæ*, de Man), and closely covered with a short spongy tomentum.

From Cachar.

Potamon (Paratelphusula) calvum, sp. nov.

The exposed surface of the ischium of the external maxillipeds is *not* grooved longitudinally; the antero-lateral borders of the carapace are cut into four spines, exclusive of the external orbital tooth; and the carapace convex.

It is closely related to *P. crenuliferum*, Wood-Mason, from which it chiefly differs in having a convex, somewhat orbicular carapace, with more spiniform lateral teeth.

From Upper Tenasserim.

Genus PARATELPHUSA.

Subgenus **Phricotelphusa**.

Paratelphusa (Phricotelphusa) gageii, sp. nov.

This species is allied to *P. callianira*, de Man, and *P. carinifera*, de Man, but more closely still to *P. elegans*, de Man. The carapace has the usual one pair of blunt epigastric crests: in the external maxillipeds the exopodite is as long as the ischium (which is longitudinally grooved) and is sometimes non-flagellate, and sometimes has a papillar or filiform (never plumose) flagellum: the lateral epibranchial tooth is small or obsolescent: the length of the 6th abdominal segment of the adult male is barely equal to its distal breadth: the antennal flagellum is small but distinct: and the anterior part of the front is vertically deflexed, but does not appear as a distinct facet as it does in *P. elegans*. Like all the species of this subgenus it is small.

From Sureil near Kurseong, where, thanks to the hospitality of Captain A. T. Gage, I.M.S., Superintendent of the Botanical Gardens and of the Cinchona Plantations, I collected a fine series of this species.

Subgenus **Barytelphusa**.

Paratelphusa (Barytelphusa) lamellifrons, sp. nov.

Close to *P. jacquemontii*, Rathbun (= "*Telphusa indica*" of many authors), from which it chiefly differs in the form of the front and of the post-orbital crests. The front is a thin projecting plate far overhanging the epistome: the post-orbital crests are thin, elegantly crenulate, and have their outer ends lobe-like and continuous with the edge of the carapace just in front of the lateral epibranchial tooth.

From Travancore.

Paratelphusa (Barytelphusa) pulvinata, sp. nov.

Allied to *P. cunicularis*, but having a prodigiously convex carapace, a cervical groove deep-cut in all its course, and, in the adult male, a 6th abdominal segment the greatest breadth of which is barely two-thirds its length. There is no other Indian species of this subgenus that has such a narrow abdomen.

From Coorg and Ootacamund.

Paratelphusa (Barytelphusa) pollicaris, sp. nov.

This species is, in a way, transitional between *P. (B.) jacquemontii*, Rathbun, and *P. (B.) lugubris*, Wood-Mason. The carapace is squarish and flattish and about half of its antero-lateral border lies in front of the epibranchial tooth. The epigastric and post-orbital crests are continuous, the lateral epibranchial tooth is small and not prominent: the fingers of the chelæ are very broad, particularly the fixed finger.

From South India.

In my concluding preliminary paper I hope to give brief diagnoses of some new species of *Liotelphusa* and *Globitelphusa*.

I should like to mention here that the species and varieties of the "*Potamon lugubre*" group diagnosed in my paper No. 2 do not belong to the genus *Potamon* at all: "*Potamon lugubre*," Wood-Mason, belongs to the new subgenus *Barytelphusa* of the genus *Paratelphusa*, having the terminal joint of the mandibular palp bifurcated from the base, and the 6th abdominal segment of the adult male not much broader than long.



XVI REPORT ON A SMALL COLLECTION OF LIZARDS FROM TRAVANCORE.

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

The lizards noticed or described in the following paper were collected during a trip undertaken in November, 1908, in conjunction with the Trivandrum Museum. I have to thank Lieut.-Col. F. W. Dawson; Director of that institution, for permitting Mr. R. S. N. Pillay, his chief assistant, to accompany me, and also for much other assistance. Unfortunately we had no time to visit the high mountains in the northern part of the State; but after travelling by boat down the "backwaters" from Cochin to the neighbourhood of Quilon (whence we made a detour to visit the large freshwater lake at Shasthancottah) and thence to Trivandrum, we returned along the high road at the base of the Western Ghats to Tenmalai on the western side of that range, which we crossed by rail to Shencottah on the frontier of the Tinneveli District of the Madras Presidency. Small though the collection of lizards is that we made, it throws light on some interesting problems of distribution and biology as well as including specimens of a species not previously described.

1. *Gonatodes ornatus*.

A young specimen from under a stone by the roadside, near Kulattupuzha.

The young of this lizard are much darker than the adults, the sides, limbs, ventral surface, iris, and top of the head being dark chocolate-brown. A narrow white line extends from each nostril through the upper part of the eye to the back of the neck, where it nearly meets its fellow; from this point a broad greyish band, mottled with brown, stretches along the back, becoming obscure on the tail.

2. *Gonatodes kandianus*.

A small specimen taken at the base of a tree-trunk, beside a stream at Tenmalai, in the Western Ghats.

3. *Hemidactylus brookii*.

This is the common house lizard in the extreme south of India, in which *H. flaviviridis* appears to be rare.

It is well known that *H. brookii* possesses considerable power of temporary colour change in accordance with the amount of

direct and reflected light that falls upon it; but this change consists mainly, if not entirely, in the temporary disappearance and appearance of much of the dark pigment of the integument, owing presumably to contraction of the pigment cells. Another kind of change, however, also occurs, as was very clearly demonstrated by certain specimens taken at Shasthancottah. Some of these were captured on the whitewashed wall of a bungalow and appeared to be incapable of becoming very dark on the dorsal surface even in a dark environment. The ventral surface was always white. Other specimens taken at the same place under black stones were darker on the dorsal surface, and still remain so after six months in spirit. Their ventral surface, moreover, is dotted with dark pigment. These specimens would seem to prove that habitual living in dark surroundings produces an actual and more or less permanent increase of pigment, not merely a temporary expansion of the pigment cells.

Eggs of *H. brookii* were common under stones at Shasthancottah in November.

4. *Hemidactylus leschenaultii*.

Apparently much commoner in S. India than in Bengal. I took a specimen on the outer wall of a bungalow at Shencottah on the Madras frontier of Travancore, but have never seen one indoors.

5. *Draco dussumieri*.

Common about ten miles north of Trivandrum, but apparently very local. One of my men saw one in the jungle near Kulattupuzha, at the base of the Western Ghats.

6. *Otocryptis beddomii*.

Mr. Pillay took several specimens at Aryankavu, below the western slopes of the Western Ghats.

7. *Calotes versicolor*.

This widely distributed species is common in the plains of Travancore, and ascends the Western Ghats to an altitude of at least 3,000 feet. The examination of many living specimens from S. India, from the Western Ghats in the Bombay Presidency, and from various parts of the Himalayas and Bengal, has forced me again to reconsider the question of the differences between the typical form of this species and that called by Blyth *Calotes gigas*. As I have found a certain number of specimens which it is impossible to refer with certainty to one of these forms rather than the other, it seems to be impossible to regard them as distinct species, and I am forced to fall back on my original view (*Journ. Asiat. Soc. Bengal*, 1905, p. 87), that the race which inhabits the drier parts of India at low altitudes exhibits a much greater sexual

variation than is the case of the race which occurs in Lower Bengal, the Himalayas, Assam, Burma, Malaya and Siam ; but that it is impossible to draw an exact line between the two races. *Calotes versicolor* occurs not only all over the plains of India, but all along the Himalayas as well as on isolated hills. It is common in the Darjiling district and in Nepal and Kumaon up to an altitude of over 6,000 feet, but apparently not above 7,000 feet ; in the Simla district I have seen specimens near Kasauli at an altitude of 5,000 feet. Apparently, however, it does not penetrate very far into the Himalayas from the plains. On the top of Paresnath Hill in Western Bengal it is common, the height of this hill being 4,480 feet.

8. *Calotes ophiomachus*.

A small male was taken in thick jungle near Kulattupuzha at the base of the Western Ghats (west side), and was the only living specimen I saw in Travancore, although it is said not to be uncommon in that State. This individual was disturbed while digging in the ground with its fore feet, probably in search of earthworms. Although put to flight three times at intervals between the early morning and the afternoon, it returned again and again to the same place, recommenced its digging, and was captured the fourth time it was seen. Many lizards have this habit of returning to a place whence they have been scared away.

9. *Charasia blanfordiana*.

A common species as far south as Trivandrum, and probably Cape Comorin. The furthest south that I actually saw a specimen was a few miles north of Trivandrum, but there is no geographical or faunistic separation between that locality and the extreme southern point of the Indian Peninsula. The range of this species is a peculiar one. It occurs commonly on the hills of the Hazaribagh district of Western Bengal, ascending Paresnath to the height of over 4,400 feet above sea level, and is found in many rocky localities in the centre of the Indian Peninsula ; on the western side of the Western Ghats it is common in Travancore, but whether its range extends northwards along this range into the Bombay Presidency I have been unable to ascertain. I have seen no record of its occurrence in the south of the Madras Presidency, although it is not uncommon in the northern central part. There are specimens in the Indian Museum from Ranchi, Chota Nagpur ; Paresnath, Hazaribagh district ; Chanda and Nagpur, Central Provinces ; Raipur ; the Eastern Ghats, and near Ellore, Madras, as well as those recently obtained at Maddathorai and Tenmalai in Travancore. In the high mountains to the north of Travancore it is replaced by the allied form *Ch. dorsalis*, which is essentially a mountain species.

The genus *Charasia* appears to take the place in the Indian Peninsula of the Palæarctic and Ethiopian genus *Agama*, which

extends along the Himalayas into the drier and colder parts of Nepal. *Ch. blanfordiana* is the only species of *Charasia* I have been able to observe alive. In its habits it closely resembles *Agama tuberculata*, being usually seen on rocks but occasionally entering human dwellings and running about on the walls. The male, in April and May, has the head and fore-quarters of a brilliant red colour, and displays his magnificence to the female, which remains concealed, by slowly walking along in some conspicuous position, alternately raising and nodding his head in a very solemn manner. The exact tint of the brilliant parts changes as he does so. Both sexes possess considerable powers of temporary colour change, which seem to be called into play mainly by the amount of reflected light that reaches the integument. The changes do not always assist in concealing the animal. I have seen a temporarily pale individual resting most conspicuous on a red mud wall, and another on a black rock from the surface of which the sun was reflected. On the other hand, other individuals on similar rocks and walls in the shade were much darker and less conspicuous. The fact seems to be that the number of different colours that can be brought into play by contraction or expansion of the pigment cells of this species is a very limited one. Strong reflected light causes certain of the pigment cells to contract, but does not expose others. The lizard, therefore, can become paler or darker, but cannot change its actual coloration to any great extent. Some of the pigment cells, however, are probably non-contractile, for the symmetrical markings never disappear but become more conspicuous as the general tone becomes paler. Specimens in spirit from Travancore are much blacker (*i.e.*, less brown) than specimens from Paresnath, on which the rocks are not so black as those of the Western Ghats of Travancore. It is probable, therefore, that in *Charasia* as in *Hemidactylus*, environment has more than a transitory effect on coloration.

10. *Mabuia carinata*.

Common in open country as well as in jungle at the base of the hills; often seen in pairs sunning itself on fallen tree-trunks or rocks.

11. *Lygosoma dussumieri*.

Perhaps the commonest skink in the plains of Travancore, both in open country and in jungle at the base of the hills. The form I described (*Journ. Asiat. Soc. Bengal*, 1905, p. 145) as "*var. concolor*" is the typical female, which is not only larger and stouter than the male, but much more soberly coloured and retiring in its habits. The tail in the male is bright red, while in the female it is brownish; the white lines running along each side of the back and sides in the former sex are obsolete or obsolescent in the female; and the same is the case as regards the dark spots on the dorsal surface.

12. *Lygosoma dawsonii*, sp. nov.Subgenus *Keneuxia*.

Habit lacertiform, stout; the distance between the end of the snout and the fore limb $1\frac{1}{3}$ to $1\frac{1}{2}$ times in that between the axilla and the groin. Snout short, obtuse, not depressed; loreal region vertical; lower eyelid scaly; a small supranasal, which is widely separated from its fellow, but no postnasal present; frontonasal forming a broad suture with the rostral and with the frontal, which is at least as long as the parietals and the interparietal together; interparietals forming a long median suture; a pair of enlarged nuchals present; four superoculars, of which the second is in contact with the frontal and much larger than any of the others. Twenty-eight scales round the body; the dorsals, laterals, nuchals and the scales on the dorsal surface of the limbs with from three to seven strong keels. No enlarged præanals, but the ventrals much larger posteriorly than anteriorly. Dorsal surface blackish olive, darker in the adult than in the young; many parti-coloured black-and-white scales on the sides; a narrow pale line, more or less interrupted, extending from the superciliary region to a point above and a little behind the axilla, and another similar line from below the anterior border of the eye to the fore limb; throat of adult (in life) bright pink, more or less spotted with black.

Measurements of type specimen (Regd. No. 16170).

Total length	120 mm.
Length of head and body	58 "
" " tail	62 "
" " fore limb	23 "
" " hind limb	26 "
" " snout	4 "
Breadth of head	5 "

Habitat.—Described from an adult specimen taken at Maddathorai and from three young ones, one from Tenmalai, one from Kulattupuzha, and one from Shasthancottah, the three former places being among or at the western base of the Western Ghats, and the latter near the coast.

In some respects this species resembles the common *Mabuia carinata*, but it is a true *Lygosoma*; the coloration is very distinctive.

13. *Lygosoma albopunctatum*.

A specimen from Shasthancottah.

14. *Ristella guentheri*.

A specimen from Tenmalai, in the Western Ghats.

15. *Ristella beddomii*

A small specimen from under a stone by the roadside, near Tenmalai.

XVII. DESCRIPTIONS OF THREE NEW
'CICINDELINÆ (COLEOPTERA)
FROM BORNEO

By DR. WALTHER HORN, *Berlin*.

Collyris antennalis, sp. nov.

♀ *Coll. brevilabris* simillima, differt antennarum articulis 5—11 evidenter angustioribus longioribusque (prothoracis basim fere attingentibus); labro brevi in medio perparum rotundatoprolongato, dentibus (centrali excepta) longioribus; frontis sulcis 2 longitudinalibus multo minus profundis (non profundioribus quam in *Coll. bonelli*), parte intermedia non carinato-elevata sed fere plana, partibus orbitalibus verticalioribus, minus altis (postice vix altioribus quam antice), tota parte interoculari antice (supra clipeum) angustiore quam in illa specie; elytris paullo grossius sculptis quam in *Coll. brevilabris Weyersi* (grossius quam in forma prioritatis "*Coll. brevilabris*"); tibiis, tarsis, femorum basi, genubus testaceis. Long. $7\frac{1}{2}$ —8 mm.

Two ♀♀, Martapura (S. E. Borneo), ex coll. Dr. David Sharp: one ♀ in the collection of the British Museum, one in my own. Both were collected by Doherty in 1891.

The labrum, the 3rd to 11th segments of the antennæ and the palpi (the distal half of each last segment is dark) are testaceous; the pro- and meso-episterna without distinct pubescence, metasternum impunctate. The new species differs from *Coll. linearis* and its varieties by its smaller size, the short yellow labrum, the (regular) finer and denser punctuation of the elytra, the narrower head, etc. The eyes are less divergent posteriorly and much flatter, the middle stripe between the orbital plates narrower (especially behind). At first view the little species reminds one very much of *Coll. brevilabris*, m., by the shape of the head, prothorax and elytra. The two processes of the 7th abdominal sternite take their origin close to each other and are parallel.

Collyris constricticollis, sp. nov.

Inter *Coll. sarawakensem*, T. Thoms, et *levigatam*, m. Capite ut in hac specie, prothoracis parte constricta anteriore etiam longiore, parte conica incrassata posteriore paullo brevior (et perparum crassiore), pronoto toto regulariter grosse sat sparsim transversaliter plicato, parte angustissima prothoracis vix ante medium longitudinis sita; elytris fere ut in *Coll. sarawakensi* sculptis, in parte media sat lata grosse intricato-plicatis, antea sparsim modice grosse (punctis

gradatim basim versus diminutis), postea subtilissime rarissime (hac parte fere glabra) punctatis; primo antennarum articulo nigro-cyanescente. Long. 17—17½ mm.

Two ♀ ♀, Martapura (Doherty, 1891: ex coll. Dr. David Sharp). One specimen in my collection, one in the British Museum.

The coloration of the body, antennæ and legs is exactly like that of *Coll. levigata*, m., and (the first segment of the antennæ excepted) *sarawakensis*, Thoms. The pro- and meso-epipleuræ are exceedingly finely, the lateral part of the metasternum closely and evidently, pilose. The head differs from that of *Coll. sarawakensis* by the middle stripe of the front being not at all elevated in the form of a carina and in the evidently less highly elevated wrinkles at the base of the orbital plates. The prothorax of the new species is longer than that of *Coll. sarawakensis*, the constricted anterior part much longer and narrower, the conical basal part a little shorter and more conical. Some specimens of Thomson's species have exactly the same sculpture of the elytra as the new species.

Therates erinys, Bat., *styx*, subsp. nov.

Differt a forma prioritatis colore toto et corporis supra subtusque et antennarum et pedum et palporum et labri et mandibularum nigro; elytris pone locum illum obliquum tumidum discoidalem paullulum punctatis: punctis sensim ante quartam partem apicalem evanescentibus. Long. 9½ mm. (sine labro).

One ♂, sent to me by Mr. John Hewitt, director of the Sarawak Museum. Collected at 4,500 feet elevation in May 1899, near Mount Penrissen (Borneo).

The unique specimen is in very bad condition. The slight punctuation behind the elevated oblique middle spot runs down to about three-fourths of the length of the elytra. The extreme apical part shows again some sculpture. The entire blackish coloration is very strange.



XVIII. THE RELATION BETWEEN FERTILITY AND NORMALITY IN RATS

*By R. E. LLOYD, D.Sc., Offg. Professor of Biology, Medical
College, Calcutta.*

During a recent visit to the west of India I had an opportunity of seeing the work which was being carried on by the Plague Commission at Poona and Belgaum; at both of these places large numbers of rats were being caught daily, each rat being the subject of careful observation. The results of these observations were recorded as a matter of routine, so that no detail, which might have a bearing on the questions before the Commission, might be lost. While watching the progress of the work, and admiring the thoroughness with which it was executed, I received the idea that some of the statistics which were being accumulated might be of great value to Biology. Among the facts recorded was that of the number of young contained in each pregnant female. It is well known that among mammals which produce a number of young at a birth there is an individuality as regards that number. It is the common experience among dog fanciers, that certain bitches will always produce four or five pups at a time, while others will always produce one or two. It very rarely happens that a bitch will produce a large litter at one time and a small one at another time. Therefore we may assume that the number of young produced by a rat at any one time is a fair measure of the fertility of that rat; though imperfect it would be difficult to devise a better means of measuring this important character. From both Poona and Belgaum, I obtained the records of the fertility of one thousand rats as measured in this way. It occurred to me that a definite relation had been established between fertility and normality in the case of certain organisms. Among such organisms it had been found that those which were most normal or true to the type of their race were also the most fertile. I am indebted for this information to a book entitled "Variation in Animals and Plants" by H. M. Vernon. This book quotes the observations of Professor Karl Pearson, who counted the number of stigmatic bands on a large number of poppy capsules and the number of the seeds which ripened in each capsule. The number of the seeds was regarded as a measure of the fertility of the poppies. It was found that those plants which were abnormal as regards the number of their stigmatic bands always contained a smaller number of seeds than those which were normal.

The number of the stigmatic bands varied from 5 to 19 but the most common type of capsule possessed 12 or 13 bands. It is not surprising that those plants which possessed few bands should produce few seeds, but it is most remarkable that those capsules with 18 or 19 bands should also produce few or no seeds. Similar observations were made on other plants; the following passage appears in Vernon's book: "These experiments Professor Pearson holds to illustrate a very important law, namely, 'Fertility is not uniformly distributed among all individuals, but for stable races there is a strong tendency for the character of maximum fertility to become one with the character which is the type.'" It has also been shown that certain medusæ which are abnormal as to the number of their radial canals are less fertile than those which are normal. It is plain that this law is an explanation or discovery of the means by which a race remains normal in spite of variation, for it states that normality can perpetuate itself with ease while abnormality does so with difficulty. This explanation seemed so feasible that I felt almost sure that if the fertility of these rats was to be compared with some other variable character, an interesting illustration of the law would appear. The character chosen for comparison was the weight of the rat. House rats throughout India are very variable in size; in the combined length of head and body they show a range of variation which is as wide as forty per cent. of the mean length, in weight the range is much wider even than this. The difficulties of measuring a freshly killed rat are well known to any one who has made the attempt; the length of a rat varies with the attitude it is made to assume, and the interval of time since its death. Although the weight of a rat doubtless varies according to the stage in the pregnancy reached, the contents of the stomach and the state of the nutrition, a record of the weight affords the best estimation of the total size which is available to us.

The result obtained was quite unexpected. The maximum fertility of rats (as measured by the number of young which they produce at a birth) is not one with the character which is the type, as regards size. In other words, gigantic and dwarfed rats are just as fertile as common rats of average size.

The tables I and II show the results which were obtained independently at Poona and Belgaum. The same methods were employed at both places. The rats were weighed immediately after death by chloroform, on a spring balance which was graduated to record five-gramme units. The observers had attempted to guess the weight to the nearest gramme, but it was plain from the way in which the fives and tens predominated among the records that such guessing could not be relied on. In arranging the figures, therefore, the following plan was adopted: Those numbers which ended in five or less were added to the ten group next below, while those which ended in six or more were added to the group above. A rat shown as weighing 75 gms. is placed in the seventy-gramme group, while another of 78 gms. is placed in the eighty group. It should be mentioned that the number of young within a pregnant female

rat can be counted with ease and without possibility of mistake, indeed the figures themselves are a proof of their own accuracy for the work was carried out at the two places by independent observers. In the tables the vertical column of figures on the left represents the approximate weights of the rats, the highest horizontal row of figures represents the number of the young which a female rat may carry, the other horizontal rows of figures show the numbers of rats of a particular weight which carry a particular number of young. Thus, in the case of table I the second row of figures shows that out of 1,003 rats which were examined, only 5 were nearly of fifty grammes weight, and that of these 3 carried five young, while the other 2 carried four and six respectively. It is plain that the rats of Poona are smaller than the rats of Belgaum, otherwise they resemble one another. Both races, if they should be called separate races, possess skulls of the *Mus rattus* type.

I.—*Observations made at Poona.*

Weight of the rats.	Number of the young.												Total of each array.
	1	2	3	4	5	6	7	8	9	10	11	12	
50 ..	..	..	..	1	3	1	..	..	..	..	..	..	5
60 ..	..	..	..	1	6	2	..	..	..	..	..	..	9
70 ..	..	..	2	10	17	12	4	..	1	..	..	..	46
80 ..	1	1	11	8	18	10	9	3	2	..	..	..	63
90 ..	2	5	7	18	30	28	12	5	1	..	..	..	108
100 ..	3	5	10	25	37	35	21	7	2	1	..	..	146
110 ..	1	4	12	19	38	37	29	6	2	..	..	..	148
120 ..	2	6	9	21	36	26	30	14	6	..	1	..	151
130 ..	4	4	9	12	35	29	17	17	6	1	1	1	136
140 ..	1	4	6	9	12	27	15	6	2	1	..	..	83
150 ..	..	3	..	2	13	11	6	6	2	..	..	..	43
160 ..	..	2	..	1	11	11	9	3	4	..	..	..	41
170 ..	1	..	1	1	2	4	2	2	1	..	1	..	15
180 ..	..	..	1	1	..	2	2	2	..	..	..	..	8
190 ..	..	..	..	..	..	..	..	..	1	..	..	..	1
TOTAL.	15	34	68	129	258	235	156	71	29	4	3	1	1003

II.—*Observations made at Belgaum.*

Weight of the rats.	Number of the young.										Total of each array.
	1	2	3	4	5	6	7	8	9	10	
70 ..	..	..	..	..	1	1	..	..	..	..	2
80 ..	..	..	..	10	7	5	3	..	..	..	25
90 ..	..	1	3	13	27	11	2	1	..	..	58
100 ..	2	1	1	18	43	23	14	3	..	..	105
110 ..	..	2	7	23	56	25	15	2	1	..	131
120 ..	2	2	7	23	54	40	23	1	3	..	155
130 ..	1	..	5	18	46	30	16	4	4	..	124
140 ..	2	3	7	15	39	44	18	6	3	..	137
150 ..	..	1	5	20	41	38	10	3	1	1	120
160 ..	..	2	2	4	20	18	7	7	2	..	62
170 ..	..	1	1	4	14	12	9	2	1	..	44
180 ..	..	..	..	3	9	5	4	4	..	..	25
190 ..	..	..	..	1	2	4	1	1	..	..	9
200 ..	..	..	1	2	1	..	2	..	..	..	6
210 ..	..	..	..	..	..	..	3	..	..	..	3
TOTAL ..	7	13	39	154	360	256	127	34	15	1	1006

I think that the following conclusions are justified by the figures :—

- (1) At Poona, mature female rats vary in weight from 50 to 190 gms., the mean weight being about 115 gms.
- (2) At Belgaum, they vary from 70 to 210 gms. with a mean of about 125 gms.
- (3) At both places, rats are more likely to bear five young at a time than any other number; they may bear as few as one or as many as ten (at Belgaum) or twelve (at Poona).
- (4) At both places, rats which carry other than five young are more likely to have six young than any other number; they are more likely to have six than four. This is remarkable; it is, however, shown not only by the aggregate figures *but by nearly all the separate arrays.*
- (5) As regards their fertility the rats of Belgaum are somewhat less variable than those of Poona. Not only is the range of variation among the latter wider than among the former, but rats of average fertility are more common at Belgaum than at Poona. If the values for fertility be plotted in curves, that which represented the Belgaum rats would be steeper but less wide than that which represented the rats of Poona. Both curves would be unsymmetrical in the same way
- (6) There is clear evidence that the largest and smallest rats are *quite as fertile as those of average size.*
- (7) There is no evidence that large rats are particularly fertile at Belgaum, or that small rats are particularly

fertile at Poona, to account for the difference in size of the two local races.

In conclusion I must explain my indebtedness to Captain White and Captain Kunhardt who were in charge of the research measures at Belgaum and Poona. It is obvious that the statistics which I have made use of, could only have resulted from months of steady work. In this I took no part, being privileged merely to watch its progress during the few days of my visits to those places.



XIX. DESCRIPTION OF A BARNACLE
OF THE GENUS *SCALPELLUM*
FROM MALAYSIA

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

The Malaysian Pedunculate Cirripedes in the collection of the Indian Museum were described in the *Memoirs of the Asiatic Society of Bengal*, vol. i, in 1906; but since that date an interesting new species from the Archipelago has been acquired. It is here described.

Scalpellum (Smilium) kampeni, sp. nov.

CAPITULUM with fifteen valves, subtriangular, compressed, lined with blackish membrane, which gives the shell a greyish colour externally; the valves smooth, covered with a delicate hairless

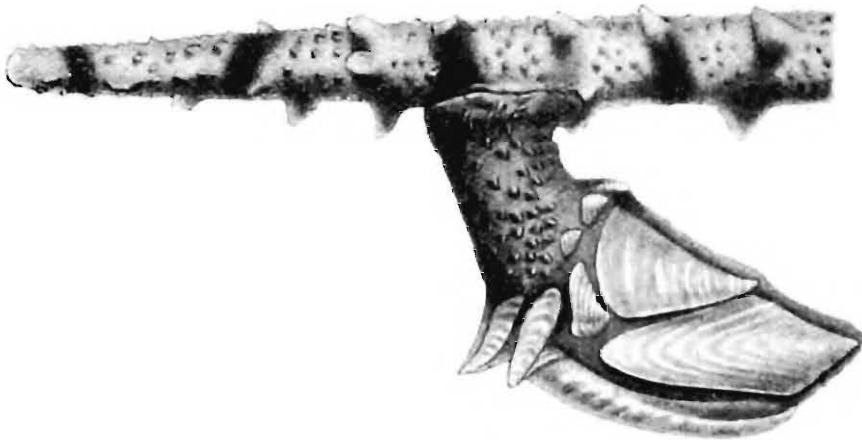


FIG. 1.—*Scalpellum kampeni*, $\times 5$, side view.

membrane. *Tergum* relatively very large, subrhomboidal, with the carinal angle subangulate and the scutal margin nearly straight; the occludent margin straight, vertical, about $\frac{2}{3}$ as long as the scutal; the umbo at the apex of the capitulum, whence a faint ridge runs diagonally down the valve to its base dividing it into two equal areas. *Scutum* large, triangular, with the occludent and tergal margins subequal, nearly straight and forming an acute angle which is faintly retroverted at the tip; the basal margin convex downwards, much shorter than either of the other two. *Rostrum* well developed, triangular, broader than long, not very prominent, with the basal margin convex and the two upper margins concave. *Carina* nearly straight, reaching almost to the top of the capitulum; the dorsum rounded, the lateral faces somewhat flattened on the

upper half; the umbo at the apex of the valve. *Subcarina* large, elongate, claw-shaped, very prominent, with a prominent *subcarinal latus* somewhat resembling it in shape on either side. *Median latus* small, situated between the scutum and the carina, irregularly triangular, with the carinal margin much shorter than either of the other two and distinctly convex towards the carina; the basal margin somewhat convex; the main axis of the valve tangential to the base of the capitulum. Two small, prominent, pointed latera beneath the base of each scutum. The valves slightly separated from one another by membrane.

PEDUNCLE short, sparsely covered with small, triangular, upwardly pointed plates arranged in about nine irregular rows.

APPENDAGES, etc.—*First cirri* with both rami slender, the anterior ramus with about ten joints and the posterior with eight; both well provided with long bristles on the distal joints. *Anal appendages* consisting of a single joint, laterally compressed, much longer than broad, somewhat curved inwards towards the abdominal surface; the sides parallel, the tip bluntly pointed, bearing a band of long hairs which extends down the ventral margin for some distance as a fringe. The *penis* slender, pointed, not very long.

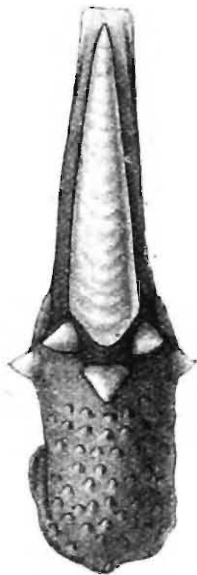


FIG. 2.—*Scalpellum kampeni*, $\times 5$, back view.



FIG. 3.—*Scalpellum kampeni*, $\times 5$, front view.

MOUTH PARTS.—*Labrum* slightly produced, without chitinous teeth. *Mandible* with the outer tooth larger than and widely separated from the second, which is rather smaller than the third; a fairly large subsidiary tooth situated at the base of the deep concavity between the first and the second; the inner angle broadly truncated, covered with short bristles, narrowly separated from the third tooth. *Maxillæ* relatively large; the free edge without a definite incisure but slightly sinuous as a whole; a pair of very

stout bristles at the outer angle and a bunch of fine hairs at the inner angle, which is rounded; the intermediate bristles of various sizes, fairly stout. *Second maxilla* not distinctly bilobed.

Length of capitulum	7 mm.
Breadth of ,,	4 ,,
Thickness of ,,	1.5 ,,

MALE.—A single male was found in the usual position at the edge of the scutum. It was attached in a little depression on the edge of the mantle and may be described as follows:—Capitulum not very clearly separated from the peduncle, which is broad above and

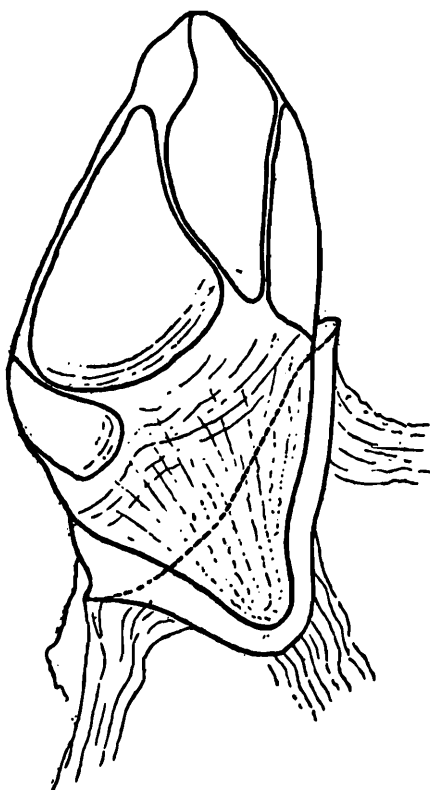


FIG. 4.—Complemental male of *S. kampeni* in pit at edge of mantle of hermaphrodite, $\times 30$.

tapers at the base. Six relatively large, closely adjacent, feebly calcified valves present—a carina and rostrum, a pair of terga and one of scuta. Tergum slightly smaller than the scutum, somewhat irregular in shape, pointed above. Scutum triangular, with its tergal margin somewhat sinuous and its basal and occludent margins convex. Carina triangular, with the base convex downwards; the apex considerably below that of the tergum, and the base situated nearer the base of the capitulum than that of the same valve. The rostrum shaped as in the hermaphrodite but relatively much larger.

Total length of male	0.92 mm.
Breadth of capitulum of male	0.44 ,,

HABITAT.—A single specimen from Lat. $0^{\circ} 14' N.$, Long. $104^{\circ} 42' E.$; between 13 and 16 fathoms. I am indebted for this specimen, which is attached to the spine of a sea-urchin, to Dr. P. van Kampen. It is numbered $\frac{5727}{10}$ in the Indian Museum register of Crustacea.

Scalpellum kampeni is a primitive form which would come in Hoek's division *Protoscalpellum* (Hoek, *Sib. Exp.*, Mono. xxxia, p. 58), and would by Pilsbry be placed in the genus *Smilium* (*Proc. Acad. Nat. Sci. Philadelphia*, lx, p. 107, 1908).

I take this opportunity to state, as has already been inferred in the explanation to plate iii, Crust. Ent., of the *Illustrations of the "Investigator,"* that *Scalpellum pellicatum*, Hoek (*op. cit.*, p. 91), is in my opinion a variety of the species previously described by me as *S. sociabile*. The anatomical differences noted by Hoek are variable characters, and the mouth parts of the specimen I figured and described were abnormal (see *Mem. Ind. Mus.*, ii, p. 84, 1909). The form of the anal appendages is very characteristic.

The same author's *S. stearnsi* var. *gemina* only differs very slightly from the form I described as *S. inerme*, which is undoubtedly a variety of the species to which Hoek referred his specimens. *S. stearnsi* is very closely related to *S. magnum*¹ of the Coralline Crag of Sudbourne, but may perhaps be distinguished by the fact that the carinal latus is not turned upwards at the tip and does not project in so marked a manner. This, however, seems to be a somewhat doubtful character in the fossil form, and, indeed, a variable one in the recent species. That *S. stearnsi* is the direct descendant of *S. magnum* there cannot, at any rate, be any doubt.

¹ Darwin, *Mon. Fossil Lepadidæ*, p. 18, pl. i, fig. 1 (1851).



XX THE HEMIPTEROUS FAMILY POLYCTENIDÆ

By DR. P. SPEISER.

There are among the parasites of bats very singular forms ; but we are far from an even nearly complete knowledge of these small animals, because bats seldom receive attention from sportsmen. Several forms of these parasites, and specially interesting ones too, are known only from a few isolated individuals. In the genus *Ascodipteron*, which forms one of the best characterised families, only five females are known, and no male ; while examples of another parasitic genus (*Polycctenes*), of which I have recently received a specimen by the great kindness of Dr. N. Annandale, of the Calcutta Museum, are likewise rarities. I take the opportunity, therefore, to give here a more complete review of the family they represent.

In 1864 Giglioli described the parasite of a Molossid from Amoy, in China, under the name "*Polycctenes*," which was proposed to the author by Westwood. At that time no other insects from bats but Diptera were known ; these Diptera were all classified together as "*Nycteribiidæ*," and therefore the new genus was placed in the family *Nycteribiidæ*. The family "*Streblidæ*," founded in 1862, contained winged species only, *Polycctenes* being wingless. Westwood took occasion later, having got a second species, to examine the first one known in the exactest manner. In his *Thesaurus Entomologicus Oxoniensis* he gives very much enlarged and carefully delineated figures of all details. He ascertained thus that *Polycctenes* undergoes an ametabolic metamorphosis, and that it has a three-jointed proboscis.

As these characters, both important, do not allow the species to be placed among the Diptera, he brought the genus into the Anoplura by the side of the true lice and the bird-lice (*Mallophaga*). C. O. Waterhouse, who was able to describe in 1880 another American species, called attention to their relationship with the Hemiptera, and not with the Diptera. But these singular parasites came by rare exceptions only into museums, and therefore few scientists knew them by a personal examination. The few notes on their systematic position were disregarded, and the *Polycctenidæ* were still enumerated as late as 1896 among the Dipterous family *Nycteribiidæ*. Finally, I was able to examine two new species myself and to point out the systematic position in a more exact manner. These insects are true Hemiptera Heteroptera, and must be placed in the strictest relationship to the bed-bug. They have,

phylogenetically speaking, taken the important step from periodical blood-sucking to parasitism for life. They form a well characterised family, Polyctenidæ, which must be placed close by the side of the Acanthiadæ (Cimicidæ).

Of the genus *Polyctenes*, Gigl., seven species are known up to date:—

P. molossus, Gigl., “from the Chinese Molossus,” from Amoy.

P. lyræ, Waterh., from *Megaderma lyræ*, from Secunderabad (Madras Presidency).

P. intermedius, Speiser, from *Taphozous perforatus*, from Egypt.

P. talpa, Speiser, from *Megaderma spasma*, L., from Nias.

P. spasmæ, Waterh., from the same bat, from Java.

P. longiceps, Waterh., from *Molossus abrasus*, Temm., from Cajabon in Guatemala.

P. fumarius, Westw., from *Molossus rufus* var. *obscurus*, Geoffr., from Jamaica.

These seven species were described each from two specimens only, and besides these typical specimens there were found very few others; as far as I know, there are two more specimens of *P. intermedius*, mihi, and two American ones in museums.

The nineteenth specimen of this rare family, which was found by Dr. N. Annandale in November, 1908, at Trivandrum in Travancore on a specimen of *Cynopterus marginatus* in the local museum, seems to be the most interesting one except those first known. It belongs most probably to my *P. talpa*. It is not, however, a mature insect, but a nymph.

If we compare the drawings given by former authors, the new specimen seems to belong to *P. lyræ*, which is to be placed as a close ally, for it has, like this species, no ctenidia on the “elytra.” The elytra, on the other hand, are longer than in *P. spasmæ*, the other species with which it must be compared particularly. The outline of the thorax agrees better with that of this latter species, but the bristles of the abdomen are in their arrangement quite different from those of any other form. A more detailed examination under the microscope showed that within the skin of this individual, which has no ctenidia on the thorax or on the elytra, was hidden as in its nymphal skin a new stage, which has such ctenidia on the thorax and on the elytra. For this reason the specimen cannot belong to *P. lyræ*, because that species has elytra without ctenidia while in a stage at which the thorax is already provided with its ctenidium. Of course it may be that the new individual is the connecting stage between *P. spasmæ* and *P. talpa*, which inhabit the same host. Then *P. spasmæ* would be the larval stage, the new specimen the nymph and *P. talpa* the full-grown insect. Be this as it may, it is now my duty to describe the peculiarities of the specimen from Travancore, which belongs certainly to the same species as *P. talpa*, mihi.

In the head and its appendages no peculiarity can be found except that the bristle at the hind angles of the dorsal surface is

wanting. The thorax has an outline somewhat different from that of the imago; it is widest a little before the middle of its length, whilst it reaches its greatest width in the imago behind this point. The arrangement of the bristles is exactly the same as in the imago, but the oblique rows of longer bristles on the anterior half contain on each side five instead of three bristles. The concave round impressions on the lateral and hinder parts are absent; they are wanting also on the elytra, which are a little shorter than in the imago. Their length is not greater than four-fifths of the width in the anterior part. The arrangement of the bristles on the abdomen is closely similar to that of *P. talpa*, mihi, as figured by me (1904) in the description of this species. The first segments are in the nymph also naked on the disk and bear on the hind border a simple row of very short bristles. But they bear at the posterior angles of the tergites on each side one longer bristle, which is not present in the imago. In this latter the segments vi to viii of the tergum are beset on their surface with many fine bristles, and on the hind border with considerably longer and stronger ones; while in the nymph they are all quite bare on their disk, and the seventh and eighth only bear the longer marginal bristles. The bristles on the sternal surface are also thinner than in the imago. The sternites bear scarcely more than a single row of very fine bristles, and in some cases in the middle before this a small group of similar ones.

A matter of peculiar importance is the structure of the tarsi. In the *Polychtenes* as yet known they must be described as four-jointed, but in this nymph they are clearly three-jointed in both the hinder pairs of feet. By this observation I find confirmed, in a very gratifying manner, what I asserted in 1904, namely, that the second and third tarsal joint of the Polychtenidæ is homologous with the second or middle tarsal joint of the other Hemiptera. For in the nymph now known this joint is, in fact, as I postulated then, the second tarsal joint not yet divided into two. From this statement arises a new and unexpected support to my views on the systematic position of the family Polychtenidæ.

The important results reached by the finding of this new specimen of the rare family may be enumerated as follows:—

- (1) The Polychtenidæ are now with greater accuracy than before put in close affinity with the Acanthiadæ (Cimicidæ).
- (2) The ctenidia on the head are phylogenetically older characters than those on the elytra, and the latter are older than those on the thorax: they appear within the individual life in this succession: the ctenidium on the elytra appears at a time when a ctenidium on the thorax is lacking (in *P. lyræ*, this being a nymphal stage).
- (3) *P. spasmæ*, Waterh., may be perhaps a larval stage of *P. talpa*, mihi; should this be proved by specimens found later, the much older name given by Waterhouse has the priority.

To solve many other questions it would be of the greatest importance that we should be able to examine more individuals of this interesting family. Collectors and scientists who have an opportunity to examine bats in the countries where *Polyctenidæ* can be found (South Asia and tropical America) may be prayed to pay attention to these ectoparasitic insects as well as others on the bats; for the *Nycteribiidæ* certainly contain within their family many questions also to be solved. Whatever is collected must be preserved in alcohol, for only in specimens so prepared can the stages of metamorphosis contained within the skin be seen and examined.

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XXI NOTES ON FRESHWATER SPONGES

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

XI.—DESCRIPTION OF A NEW SPECIES OF *Spongilla* FROM ORISSA.

Genus SPONGILLA.

Subgenus Euspongilla.

Spongilla hemephydatia, sp. nov.

Sponge soft, fragile, amorphous, of a dirty yellow colour, with large oscula, which are not conspicuously raised above the surface but open into very wide channels in the substance of the sponge. The oscular collars are fairly well developed, but the subepidermal space is not extensive.

Skeleton diffuse, consisting of very fine radiating fibres, which are crossed at wide and irregular intervals by still finer transverse ones; very little chitinous substance present.

Spicules.—Skeleton spicules smooth, slender, sharply pointed at both ends, nearly straight. No true flesh spicules. Gemmule spicules straight or nearly so, cylindrical, obscurely pointed, clothed with short, sharp, straight spines, which are very numerous, but not markedly longer, at the two ends; these spicules frequently found free in the parenchyma.

Gemmules numerous, small, free, spherical, yellow, with a well-developed granular coat (in which the spicules are arranged almost horizontally) and external to it a fine membrane, which in preserved specimens becomes puckered owing to unequal contraction; each gemmule with a single aperture, provided with a straight, rather wide but very delicate foraminal tubule.

Measurements of spicules and gemmules.

Length of skeleton spicule	0.313 mm.
Breadth ,, ,,	0.012 ,,
Length of gemmule spicule	0.062 ,,
Breadth ,, ,,	0.004 ,,
Diameter of gemmule	0.313—0.365 mm.

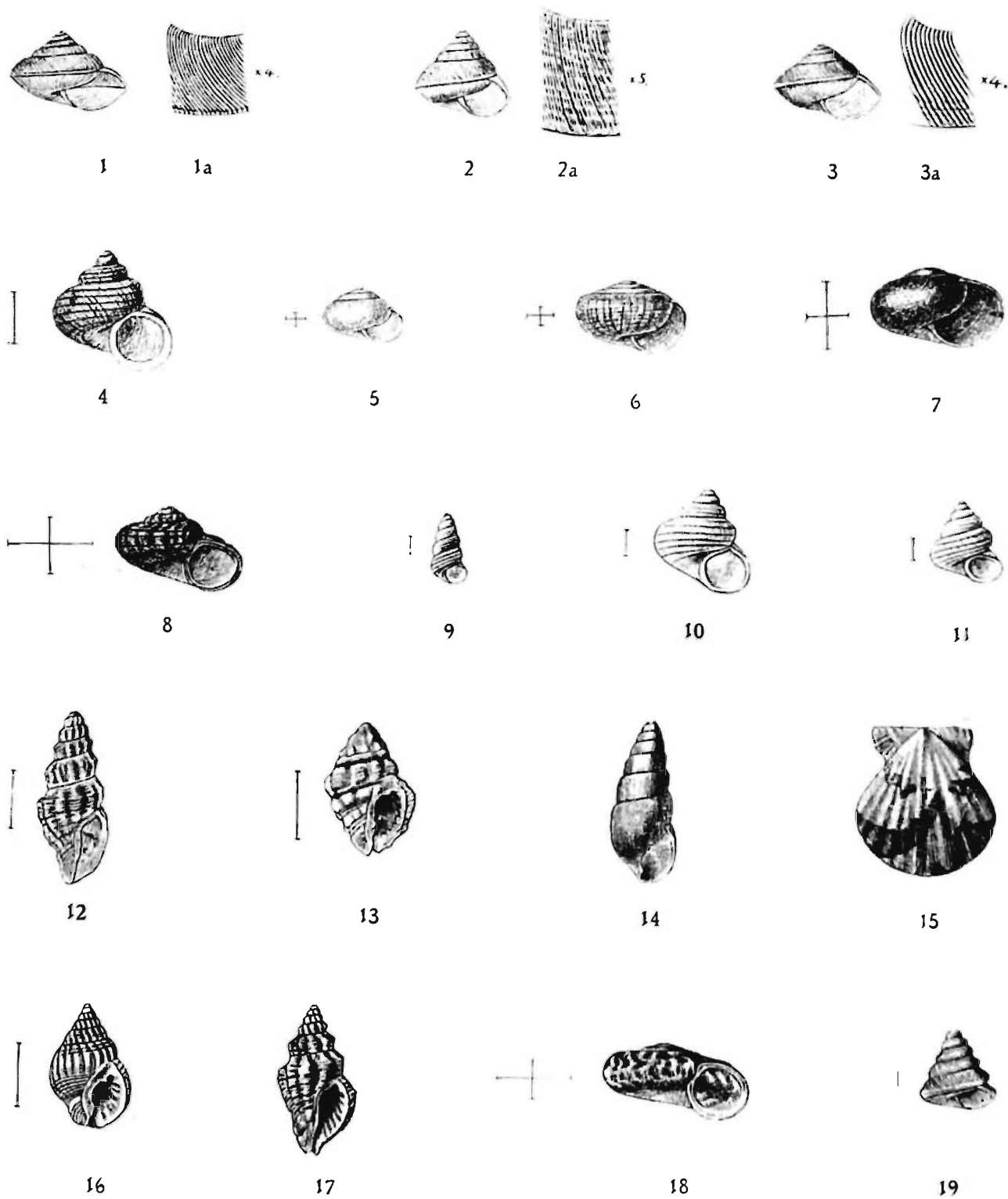
This sponge in its general structure bears a very close resemblance to *Ephydatia crateriformis*.

Habitat.—Growing on weeds at the edge of the Sur Lake, Orissa, October, 1908. Only one specimen was taken, together with many examples of *S. lacustris* subsp. *reticulata*, *S. carteri* and *S. crassissima*.

EXPLANATION OF PLATE XXII.

[N.B.—The text-matter to which this plate relates will be found at p. 133, part ii of the present volume of these “Records.”]

- FIG. 1.—*Euplecta foveolata*.
 „ 1a.— „ „ sculpture magnified.
 „ 2.— „ *lankaensis*.
 „ 2a.— „ „ sculpture magnified.
 „ 3.— „ *neglecta*.
 „ 3a.— „ „ sculpture magnified.
 „ 4.—*Leptopoma taprobanensis*.
 „ 5.—*Microcystis edithæ*.
 „ 6.— „ *thwaitesi* var. *depressa*.
 „ 7.— „ *winifredæ*.
 „ 8.—*Cyclophorus liratus*.
 „ 9.—*Cyathopoma perconoideum*.
 „ 10.— „ *uvaense*
 „ 11.— „ *ogdeniana*.
 „ 12.—*Mangilia (Daphnella) angusticincta*.
 „ 13.—*Engina purpureocincta*.
 „ 14.—*Glessula sinhila*.
 „ 15.—*Pecten helleri*.
 „ 16.—*Nassa shawi*.
 „ 17.—*Pentadactylus ceylonicum*.
 „ 18.—*Cyclophorus (Theobaldia) liliputiana*.
 „ 19.—*Thysanota elegans*.



Scale 1 2 3

Shells from Ceylon and South India.

XXII. DESCRIPTIONS OF TWO NEW SHELLS FROM SOUTH INDIA

By H. B. PRESTON, F.Z.S.

Paludomus annandalei, sp. nov.

Shell conoidal, upper whorls eroded, solid, dark olivaceous brown, a paler yellowish brown band appearing at the periphery, above this obscurely painted with regular, transverse, vertical, deep chestnut flammules and below with very oblique flammules of the same colour; remaining whorls about 3, sculptured with revolving, spiral liræ rather coarser just below the sutures and disappearing altogether or becoming obsolete towards the periphery, but re-appearing on the base of the shell, the interstices between the liræ having a somewhat punctate appearance; sutures lightly impressed; columella arched, white and diffused into a minutely granular callus which joins the upper lip and is thickened almost into a nodule above; peristome acute, scarcely serrated; interior of shell bluish white, showing the rows of flammules distinctly; operculum spirally laminiferous, with subcentral nucleus.

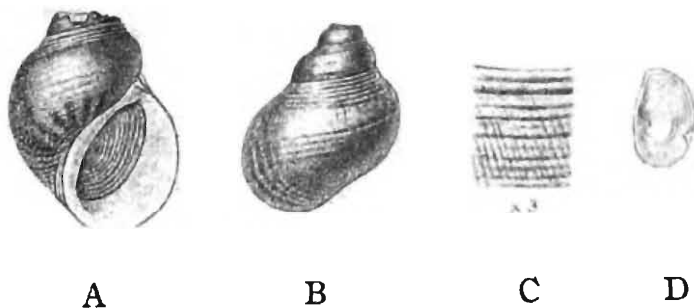


FIG. 1.—A, B, *Paludomus annandalei*, sp. nov.; C, Sculpture of same enlarged; D, operculum of same.

The dimensions of the three specimens taken as the type series are as follows:—

	(1)	(2)	(3)
Altitude	24 mm.	22 mm.	21.5 mm.
Diam., major	18 „	17 „	16 „
Aperture, alt.	16 „	13 „	12.5 „
„ diam.	9.5 „	8 „	8 „

Habitat.—Tenmalai, W. Ghats (W. side), Travancore (rocky mountain stream); N. Annandale coll., November, 1908.

Types in Indian Museum. Regd. No. M. $\frac{4610}{1}$.

Modiola cochinensis, sp. nov.

Shell subtrapezoidal, moderately swollen, brownish black marked with coarse, concentric lines of growth; umbones rather large, prominent; dorsal margin rapidly sloping anteriorly, slightly arched posteriorly; central margin curved; anterior side sharply

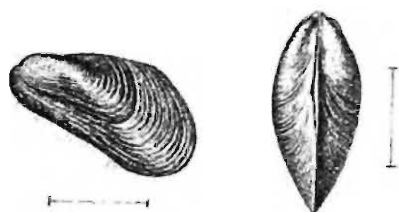


FIG. 2.—*Modiola cochinensis*, sp. nov., $\times 2$.

rounded; posterior side acuminate rounded; interior of shell bronze, nacreous showing faint traces of radiate striation.

Long.	5 mm.
Lat.	10.5 „

Habitat.—Backwater near Cochin (slightly brackish water); N. Annandale coll., November, 1908.

Types in Indian Museum. Regd. No. M. $\frac{4612}{1}$.

XXIII. PRELIMINARY NOTE ON A NEW GENUS OF PHYLACTOLÆMATOUS POLYZOA.

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

The first specimens of the new genus were sent to the Indian Museum by Major H. J. Walton, I.M.S., from Bulandshahr in the United Provinces, but others have recently been found in the outskirts of Calcutta by Mr. B. L. Chaudhuri and myself.

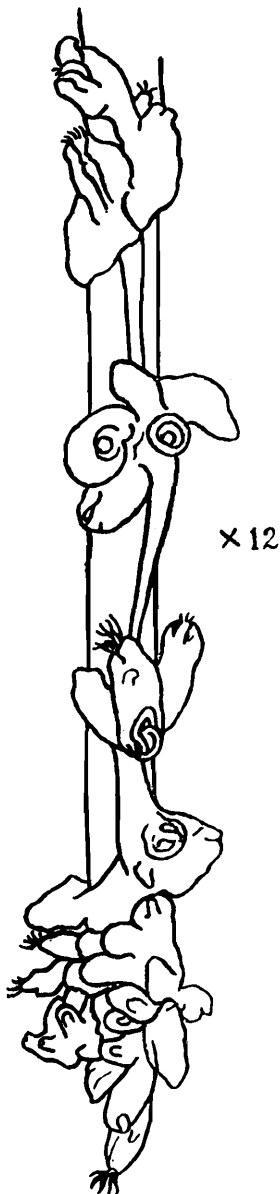
STOLELLA, gen. nov.

Phylactolæmatous Polyzoa with horse-shoe-shaped lophophores and small statoblasts (both free and fixed) resembling those of *Plumatella*; the zoarium consisting of groups of upright zoœcia (or occasionally single zoœcia) joined together by an adherent pseudostolon in a linear series, the pseudostolon consisting of a prolongation in one direction of the base of one of the zoœcia; no gelatinous investment present.

Stolella indica, sp. nov.

Ectocyst of zoœcia and pseudostolon soft, colourless and transparent but minutely roughened on the external surface.

Zoœcia short, slender, more or less cask-shaped, generally more slender at the tip than at the base, emarginate at the distal end on one side and with a furrow running down from the emargination. Daughter zoœcia arise as buds at the sides of a parent zoœcium, the base of which is produced anteriorly into a tubular outgrowth of very variable length. This forms the pseudostolon, at the extremity of which a new parent zoœcium is produced; it is generally more slender either at the distal or the proximal end than at the other, and in young colonies is often somewhat difficult to detect. The pseudostolon is not distinctly marked off from the zoœcium.



Stolella indica on stem of water plant.

Tentacles numbering 30 to 35, rather short; being stout and slightly clubbed at the tip.

Stomach short, abruptly truncated at the base.

Statoblasts.—Fixed statoblasts very variable in shape, sometimes almost circular, sometimes elongate, without external ornamentation, with a stout chitinous ring. Free statoblasts small, usually rather broad but variable in shape, oval or subrhomboidal, resembling those of *Plumatella punctata* in general appearance.

A full description of the species will be published later in a revision of the Freshwater Polyzoa of the Oriental Region now in progress.

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## MISCELLANEA

### REPTILES.

MAJOR WALL ON SOME FORMS OF *Dipsadomorphus*.—In the last part of the *Records of the Indian Museum* (vol. iii, p. 151) a paper was published by Major F. Wall, I.M.S., on some forms of *Dipsadomorphus*, in which several so called new species were described. Major Wall's accuracy of observation renders the statistics he provides of special value, but I feel bound to differ from him in the views he expresses.

After acknowledging that "Many of the forms now recognized as species in the genus *Dipsadomorphus* exhibit extremely close affinities" and stating that he has "examined no less than thirteen of the twenty-three known," he goes on to say, "I have for a long time thought that the species *ceylonensis* and *hexagonotus*, as regarded by Mr. Boulenger in his Catalogue (1896), comprise more than one form fit to rank as a species." He then proceeds to describe four of these forms which have been "identified as *ceylonensis*." Without defining in any way the old species *ceylonensis*, he gives as a description of each of these four "species" merely the number of rows of scales and of the ventrals and subcaudals. We might take it therefore that these points provide, in his opinion, all that is necessary to distinguish the four species from one another or from any of the remaining twenty odd species belonging to the genus, ten of which he has not seen. Would that the identification of snakes were so easy a matter! But perhaps he assumes Mr. Boulenger's description of *D. ceylonensis* as axiomatic.

Major Wall has examined at least six specimens of each of his four "species," and in one case as many as twenty-one; the range of ventrals and subcaudals, in the whole series, is very considerable. The rows of scales, however, only vary from 19 to 21, and if they are disregarded, the numbers of the ventrals and subcaudals overlap in the different "species." Moreover, Major Wall himself provides evidence that his different species cannot be regarded even as local races, such as we might almost expect to find in an isolated group of islands like the Andamans. I would much rather regard several of the admittedly allied forms in the genus as forms of one species than accept the four species into which *D. ceylonensis* has been divided by Major Wall.

Major Wall's views as to the question "What is a species?" appear to be those now held by so many zoologists that I do not think I would have been justified as editor of these "Records" in refusing to publish his paper. His enthusiasm is worthy of all praise. I feel, however, that some protest is necessary, not so much

against Major Wall's views as to the species of *Dipsadomorphus* (which are based on a great deal more material than is often the case) as against the tendency they illustrate. If every little difference between individuals or sets of individuals is to be regarded as of specific value, "philosophical" zoology must cease to exist, and all zoologists must busy themselves in searching for such differences as diligently as the stamp-collector counts the number of perforations on his specimens.

N. ANNANDALE.

### BATRACHIA.

Notes on Indian Batrachia :—

1. *Rana vicina*, STOLICZKA.—*Rana vicina* was described in 1872 by the late Dr. F. Stoliczka, and the type specimen, which came from Murree, is still in the Indian Museum, its registered number being 9147.

Mr. Boulenger in his volume on the Reptiles and Batrachia in the "Fauna" (1890) queried the species as a synonym of *R. liebigii*, Günther, but Mr. W. L. Sclater, in his list of the Batrachia in the collection of the Indian Museum (1892), regarded it as distinct. In 1905 Mr. Boulenger suggested that the form was identical with the species he had described in 1882 as *Rana blanfordii*, a view which he confirmed in 1907 after examining specimens of *R. blanfordii* from the neighbourhood of Naini Tal. Accepting this view, I described (1908) the tadpole of the form common at Naini Tal as that of *R. vicina*, pointing out the characters in which it differed from the larva of *R. pleskii* and *R. liebigii*. Having recently, however, had occasion to compare considerable numbers of specimens from the Western Himalayas with the type of *R. vicina*, I detected what appeared to be constant differences. Besides the type there was one other specimen in the collection from the Western Himalayas identified by Mr. Sclater as *R. vicina*, namely, a large individual from Simla presented many years ago by Lieut. A. Newnham. A careful comparison between these two specimens convinced me that they represented the same species, and that this species differed from the form common at Naini Tal. The only difference that I could detect between the two specimens was that the type of *R. vicina* was considerably smaller than the specimen from Simla. I therefore sent the latter to Mr. Boulenger, who agrees with me that it is not his *R. blanfordii* and regards it as a specimen of *R. liebigii*. Without seeing the type he naturally prefers not to express an opinion as to its identity, but he has courteously asked me to publish a note on the subject. The following is a summary of what can be discovered about the two forms; for I think that there can be no doubt that *R. vicina* is distinct from *R. blanfordii*.

*R. blanfordii* is distinguished from *R. liebigii* (1) by its smaller size, its maximum length without the limbs being 49 mm. while *R. liebigii* grows at least 90 mm. long; (2) by the fact that the males

do not develop nuptial excrescences on the fore limbs at the breeding season and are devoid of vocal sacs; (3) by its stouter habit; and (4) by its darker and more purple coloration.

From the type of *R. vicina* it differs in exactly the same characters so far as can be seen, for this specimen, not being a breeding male, provides no information as regards the nuptial excrescences. The type of *R. vicina* measures 60 mm. in length, but it agrees in all other respects with the specimen from Simla measuring 77 mm. in length. I can detect no difference between it and typical specimens of *R. liebigii* from the Eastern Himalayas.

The synonymy of *R. blanfordii*, which must be considered a "good" species, is as follows:—

- R. blanfordii*, Boulenger, *Cat. Batr. Sal. Brit. Mus.*, p. 23 (1882).  
(?) *R. vicina*, *id.*, *Ann. Mag. Nat. Hist.* (7), xvi, p. 640 (1903).  
*R. vicina*, *id.* (nec *Stoliczka*), *Rec. Ind. Mus.*, i, p. 150 (1907);  
*Annandale*, *ibid.*, ii, p. 304, and (tadpole), ii, p. 346.

The type of *R. blanfordii* came either from Arabia or from Darjiling, but the species is common in Kumaon, Garhwal and the Simla district at altitudes of between 6,000 and 9,000 feet. In wet weather and in places where there is a plentiful water-supply it is aquatic in habits. In the neighbourhood of Simla, however, it conceals itself during the dry season. If it occurs in the Eastern Himalayas, it must be very rare. Large tadpoles are common in the W Himalayas in mountain streamlets and in wells both in May and September.

*R. vicina*, on the other hand, must be regarded as a synonym of *R. liebigii*. This species is very common in the Darjiling district at altitudes of 5,000—8,000 feet. Living in a much damper climate than that of the Western Himalayas, it is not so essentially aquatic in its habits but is found in damp jungle. It also occurs in the Punjab Himalayas, but is there very rare.

2. *Bufo stomaticus*, LÜTKEN.—During the last few years I have had the opportunity of examining large numbers of living and preserved toads from Bengal, the Eastern Himalayas, the United Provinces and the Punjab. A species that has puzzled me much is the form described in 1862 by Professor Lütken, and redescribed by Mr. Boulenger in 1891 (*Ann. Mag. Nat. Hist.* (6), vii, p. 463) as *Bufo stomaticus*. This form was not described in the latter author's volume on the Reptiles and Batrachia in the *Fauna of British India* (1890), because in the original description the habitat of the species was not given. Mr. Boulenger, however, in 1891 recognized *B. stomaticus* as distinct from *B. andersonii*, while Mr. W. L. Sclater (*P. Z. S.*, 1892, p. 347) wrote that *B. stomaticus* had hitherto been confounded with *B. andersonii*. *B. andersonii* is recorded from Arabia and North-Western India (Boulenger) and from Purneah in Northern Bengal (Sclater); *B. stomaticus* from Lower Bengal, the Darjiling Himalayas up to 5,000 feet (Annandale), Assam and Burma (Sclater).

Comparing Mr. Boulenger's descriptions of the two species, the following differences appear :—

- (1) *B. andersonii* has a tarsal fold ; *B. stomaticus* has not.
- (2) In *B. andersonii* the tympanum is round ; in *B. stomaticus* vertically oval.
- (3) In *B. andersonii* the first finger extends as far as or slightly further than the second ; in *B. stomaticus* the first finger is longer than the second.
- (4) In *B. andersonii* the toes are two-thirds or half webbed ; in *B. stomaticus* three-quarters.

Mr. Boulenger regards the first of these differences as the most important, and it is the only one that has made me hesitate in uniting the two species. I have recently found, however, that it is one easily produced by the method of preservation. In living specimens from Calcutta, or in specimens preserved in weak spirit or in formalin, there is no fold ; while specimens in which the fold was absent during life develop a fold if preserved in strong spirit, owing to shrinkage of the soft tissues. Such examples are often indistinguishable from specimens from North-Western India. As regards the proportionate length of the fingers, the shape of the tympanum and the degree to which the toes are webbed, considerable variation exists even among individuals taken together in the same place, nor can any one condition as regards any of these points be correlated with any one locality, for the characters are as variable in individuals from Calcutta as they are in those from Lucknow, Allahabad or Simla. In some individuals the dorsal surface is olive-green ; more frequently it is grey. The ventral surface is occasionally splotched with black. I see no reason, therefore, to separate the two species ; and as *B. stomaticus* was described in 1862, the name has priority over that of *B. andersonii*, which was described in 1883.

*B. stomaticus* is common in Calcutta, although owing to its strictly nocturnal habits it is rarely seen ; for unlike *B. melanostictus*, which comes out in large numbers at dusk or even during the day-time in wet weather, it remains concealed until night has fallen. Large numbers may be found during the rains huddled together in the many crevices afforded by the tree-trunks of the Peepuls (*Ficus religiosa*) on the *maidan*. They make their way up these crevices to the height of five or six feet from the ground.

3. A SMALL COLLECTION FROM TRAVANCORE AND COCHIN.—The majority of the specimens here recorded were obtained in November, 1908, at or near the base of the Western Ghats in the State of Travancore. A few, however, were taken at Ernakulam in the neighbouring State of Cochin.

#### *Rana hexadactyla.*

A very common species in the plains of Travancore. Two colour varieties can be distinguished :—

Var. *a*. Dorsal surface brown, usually with a median pale stripe.

Var. *b*. Dorsal surface striped longitudinally with grey and white.

Variety *b* retains in maturity the juvenile coloration.

*Localities*.—Ernakulam, Kerumadi, Virkulai, Shasthancottah Maddathorai.

*Rana cyanophlyctis*.

As common as the last in open country.

*Localities*.—Ernakulam, Vykkam, Kulattupuzha.

*Rana verrucosa*.

Common among stones at the edge of streams running down from the Western Ghats; a jungle species.

*Localities*.—Kulattupuzha, Maddathorai, Tenmalai.

*Rana tigrina*.

A common species in open country.

*Localities*.—Vykkam, Shasthancottah, Shencottah.

*Rana limnocharis*.

Common in open country and also in jungle at the base of the hills.

*Localities* —Kerumadi, Vykkam, Trivandrum, Shencottah, Maddathorai.

*Rana beddomii*.

A single specimen taken with *R. verrucosa* at the edge of a rocky stream at Tenmalai in the Western Ghats.

*Rana leptodactyla*.

Common at Tenmalai with *R. verrucosa*.

*Rana temporalis*.

Not uncommon at Tenmalai but difficult to catch owing to its activity and wariness. Single individuals often sit on rocks in exposed situations near streams. When disturbed they leap into the streams and rapidly swim to the other side.

The colour of the back in life varies from nearly orange to dark chocolate.

*Rhacophorus maculatus*.

A specimen from Shasthancottah. Probably not uncommon.

*Micrixalus fuscus.*

A single specimen from the edge of a jungle stream at Maddathorai. The back of the thighs was bright lemon-yellow in life.

*Ixalus nasutus.*

A common species in long grass at the base of the Western Ghats.

*Localities.*—Kulattupuzha, Tenmalai.

*Microhyla rubra.*

Apparently abundant in open country. Tadpoles are common in November in little pools of rain-water in the sand near Trivandrum.

*Bufo melanostictus.*

Common all over the plains. Some specimens from Ernakulam are unusually dark, the ventral surface being black marbled with white.

*Ichthyophis glutinosa.*

A specimen was taken at Maddathorai in a hollow tree. It had the whole of the ventral surface pure white and therefore differed in appearance from the typical form. A careful comparison, however, with normal specimens, including a microscopic examination of the scales, reveals no other difference.

I propose to call the form with the white ventral surface—var. *tricolor*.

N. ANNANDALE.

## FISH.

## Notes on Indian Freshwater Fish :—

I. LIST OF FISHES FROM SUR LAKE, ORISSA.—The following species of fish were obtained by Dr. Annandale from the Sur Lake on the 22nd October, 1908. According to the Bengal District Gazetteer, Puri volume, p. 6, the Sur (or Sar) Lake is a freshwater lagoon to the east of Puri town which is formed by a backwater of the Bhargavi river. The lake is four miles long from east to west, and two miles broad from north to south. It has no outlet to the sea, from which it is separated by desolate sandy ridges :—

## TELEOSTEI—

## Physostomi—

## SYMBRANCHIDÆ—

*Amphipnous cuchia.*

## CYPRINIDÆ—

## COBITIDINÆ—

*Lepidocephalichthys guntea.*

## CYPRININÆ—

*Barbus chola.*,, *sarana.*,, *stigma.*,, *ticto.**Nuria danrica.**Chela bacaila.*

## CYPRINODONTIDÆ—

*Haplochilus panchax.*

## SCOMBRESOCIDÆ—

*Belone cancila.*

## Acanthopterygii—

## NANDIDÆ—

*Nandus marmoratus.*

## RHYNCHOBDELLIDÆ—

*Rhynchobdella aculeata.**Mastacembelus armatus.*,, *pancalus.*

## OPHIOCEPHALIDÆ—

*Ophiocephalus punctatus.*,, *gachua.*

## LABYRINTHICI—

*Anabas scandens.*

All the above are widely distributed forms and the only notable feature of the collection is the absence of Siluridæ.

2. LIST OF FISH FROM GIRIDIH.—The following fish were identified in the Giridih subdivision of the Hazaribagh district, W. Bengal, during January and February, 1909 :—

## TELEOSTEI—

## Physostomi—

## SILURIDÆ—

*Macrones cavasius.* R. Barakur.*Wallago attu* ,,

## CYPRINIDÆ—

## CYPRININÆ—

|                                |                |             |                       |
|--------------------------------|----------------|-------------|-----------------------|
| <i>Labeo bata</i> .            | R. Barakur.    |             |                       |
| „ <i>boga</i> .                | Giridih tanks. | R. Barakur. |                       |
| „ <i>boggut</i> .              | R. Barakur.    |             |                       |
| „ <i>kalbasu</i> .             | R. Barakur.    |             |                       |
| „ <i>pangusia</i> .            | Giridih tanks. |             |                       |
| <i>Catla buehanani</i> .       | Giridih tanks. |             |                       |
| <i>Cirrhina mrigala</i> .      | Pachamba tank. |             |                       |
| <i>Barbus chagunio</i> .       | R. Barakur.    |             |                       |
| „ <i>chrysofoma</i> .          | „              | „           |                       |
| „ <i>conchonius</i> .          | Pachamba tank. |             |                       |
| „ <i>stigma</i> .              | „              | „           | Barakur village tank. |
| <i>Rasbora daniconius</i> .    | „              | „           |                       |
| <i>Amblypharyngodon mola</i> . | „              | „           |                       |
| <i>Barilius bola</i> .         | R. Barakur.    |             |                       |
| <i>Chela bacaila</i> .         | Pachamba tank. |             |                       |

## Acanthopterygii—

## GOBIIDÆ—

|                        |                          |
|------------------------|--------------------------|
| <i>Gobius giuris</i> . | Tank at Barakur village. |
|------------------------|--------------------------|

## OPHIOCEPHALIDÆ—

|                                  |                |   |                       |
|----------------------------------|----------------|---|-----------------------|
| <i>Ophiocephalus punctatus</i> . | Pachamba tank. |   |                       |
| „ <i>gachua</i> .                | „              | „ | Barakur village tank. |
| „ <i>striatus</i> .              | „              | „ |                       |

3. FISH FROM TRAVANCORE AND COCHIN.—The fish here recorded were taken by Dr. N. Annandale in November, 1908.

A considerable number of the specimens are from Shasthancottah Lake, which is situated in a deep rift in the laterite rocks about twelve miles north-north-east of Quilon on the coast of Travancore. This lake is about twelve miles long and a mile to a mile and a half broad: it has no connection with the sea but lies so deep in its rift that it gives the surrounding country the appearance of being high ground although in reality but little above sea-level.

All the specimens from Tenmalai (unless otherwise stated) are from a rocky mountain stream running down from the Western Ghats to the Malabar Coast. The Courtallum specimens are from a similar stream running in the opposite direction, *i.e.*, towards the Coromandel Coast.

## TELEOSTEI—

## Physostomi—

## SILURIDÆ—

*Clarias magur.* Shasthancottah Lake.

*Macrones chryseus.* „ „

„ *vittatus.* „ „

## CYPRINIDÆ—

## CYPRININÆ—

*Homaloptera maculata.* Tenmalai.

*Discognathus lamta.*

*Amblypharyngodon melettinus.* „ Shasthancottah Lake.

*Barbus arulius.* Kulattupuzha. Tenmalai.

„ *curmuca.* Changitypaulum.

„ *lithopidos.* Nimutai.

„ *mahecola.* Shasthancottah Lake.

„ *malabaricus.* Camp Gorge, Tenmalai. Nimutai.

„ *melanampyx.* „ „ „ In small pond on roadside near Tenmalai. Kulattupuzha. Maddathorai. Kerumadi.

„ *melanostigma.* Kulattupuzha.

„ *stigma.* Kerumadi. South end of Vimbanad Lake.

„ *wynaadensis.* Tenmalai.

*Rasbora daniconius.* „ Camp Gorge, Maddathorai. Also in small pool on roadside near Tenmalai.

*Danio malabaricus.* Maddathorai. Courtallum.

*Barilius bakeri.* Camp Gorge, Tenmalai.

*Perilampus laubuca.* Shasthancottah Lake.

## COBITIDINÆ—

*Nemachilus triangularis.* River near Kulattupuzha, W base of W Ghats. Tenmalai.

## CYPRINODONTIDÆ—

*Haplochilus lineatus.* Shasthancottah Lake, 12 miles N. N. E. of Quilon.

„ *panchax.* Kerumadi. Shasthancottah Lake.

## SCOMBRESOCIDÆ—

*Belone cancila.* South end of Vimbanad Lake.

**Acanthopterygii—****PERCIDÆ—**

- Ambassis myops.* Ernakulam (Cochin).  
 „ *nalua.* Shasthancottah Lake.  
*Gerres limbatus.* Cochin, backwater (brackish water).

**NANDIDÆ—**

- Nandus marmoratus.* Travancore.

**GOBIIDÆ—**

- Gobius giuris.* Shasthancottah Lake.

**MUGILIDÆ—**

- Mugil cunnesius.* Cochin, backwater (brackish water).

**OPHIOCEPHALIDÆ—**

- Ophiocephalus gachua.* Shencottah. Shasthancottah  
 Lake. Kulattupuzha.  
 „ *striatus.* Shasthancottah Lake.

**LABYRINTHICI—**

- Polyacanthus cupanus.* Kerumadi. South end of  
 Vimbanad Lake (slightly  
 brackish water).

**CHROMIDES—**

- Etrophus maculatus.* Cochin, backwater (brackish  
 water). Shasthancottah  
 Lake.  
 „ *suratensis.* Shasthancottah Lake.

None of these species seem to call for special note, but the exact localities may prove interesting.

4. THE INDIAN SPECIES OF THE GENUS *Discognathus*.—*Discognathus* is a widely distributed genus of the subfamily Cyprininae. It occurs in rivers, especially in mountain streams, in Asia and Africa,<sup>1</sup> and extends throughout India, Ceylon and the Tenasserim provinces.

The difficulty of satisfactorily identifying specimens of the Indian species of this genus according to either Günther<sup>2</sup> or Day<sup>3</sup> induced me to look through the collection in the Indian Museum, with the following results :—

<sup>1</sup> *Cat. of the Freshwater Fishes of Africa*, vol. i, p. 343 *et seq.*, Brit. Mus. 1909.

<sup>2</sup> *Cat. Fish. Brit. Mus.*, vol. vii, p. 69 *et seq.*, 1868.

<sup>3</sup> *Fishes of India*, vol. ii, p. 527 *et seq.*

- (1) According to Günther there are three Indian species of *Discognathus*—

*Discognathus lamta*.  
 „ *macrochir*.  
 „ *nasutus*.

- (2) According to Day there are also three, viz.—

*Discognathus lamta*.  
 „ *jerdoni*.  
 „ *modestus*.

One would, however, not be correct in imagining from this that there are five distinct species of this genus, since Günther, writing in 1868, includes both of Day's species *lamta* and *jerdoni* (1867) in his *lamta*. He says: "Having fortunately numerous examples from the most distant localities, I have convinced myself that they ought to be referred to a single species only."

Apparently the chief points on which Day relies for the separation of *lamta* and *jerdoni* are—

- (1) The convexity or concavity of the interorbital space.
- (2) Ratio of length of head to total length.
- (3) The number of lateral transverse rows of scales, these being  $4-4\frac{1}{2}$ —5 in *lamta* and  $4\frac{1}{2}$ — $2\frac{1}{2}$  in *jerdoni*.

With regard to the first two points Günther says: "This species (*i.e.*, the *lamta* and *jerdoni* of Day combined) extends from Syria to Assam, and, as may be expected in a species of so wide a range, it is subject to some variation." The points which Günther takes as subject to variation and therefore to be omitted as specific distinctions are just those which Day relies on as affording him firm ground for such separation. Günther writes: "The parts most subject to variation are the snout with regard to form, width and prominence and the eye." So that we have to fall back on the third of the above points, which at first sight seems of sufficient importance to justify Day's distinction.

Unfortunately there is no specimen of Day's *Discognathus jerdoni* in the Indian Museum; apparently the only specimens of this form were sent to the British Museum. There is, however, a large number of *D. lamta* here, and in these the number of rows of scales from the lateral line to the ventral fin<sup>1</sup> is  $3\frac{1}{2}$  and not 5 as Day states. This number is uniform in a large number of specimens from widely different localities and is the number given for *modestus*.

*Discognathus modestus*, Day, was first described in 1869 under the name of *Mayoa modesta*, *i.e.*, subsequently to the appearance of Günther's work. This so-called species is stated by Day to differ from the others principally in—

<sup>1</sup> For Day's method of counting the L. tr. rows of scales, see *Fauna of India Fishes*, vol. i, p. 6.

- (1) Having six rays in the anal fin instead of seven.
- (2) Having a lateral transverse formula of  $4\frac{1}{2}-3\frac{1}{2}$  instead of  $4-4\frac{1}{2}-5$  or  $4\frac{1}{2}-2\frac{1}{2}$ .
- (3) The fact that the pectorals extend to the ventrals.

There are at present three specimens in the Indian Museum labelled *D. modestus*. Day in his *Fishes of India* speaks of two, probably from Northern India, the longest measuring  $3\frac{1}{2}$  inches. These two specimens are numbered 710 and 1426 in the Museum books, and the latter is that figured in Day's work as *D. modestus* (pl. 122, fig. 5). In both these specimens the number of lateral transverse rows of scales agrees with that given by Day, but as it also agrees with all the other specimens of *lamta*, its value as a specific character is not evident. In both specimens the pectoral does not reach the ventral, and in fact Day's own figure does not agree with his description. The figure is correct in so far as it shows the pectorals not extending to the ventrals. This feature therefore is of no use as a specific distinction. The anal fin ray formula is correctly given as 6 (1-5) but this also is quite commonly the case in *lamta*.

There is unfortunately no type of *jerdoni* left, but Day's figure shows the lateral transverse rows of scales to be  $4\frac{1}{2}-3\frac{1}{2}$ , his description, however, gives  $4\frac{1}{2}-2\frac{1}{2}$ . The figure therefore of *jerdoni* agrees with the description of *modestus*. The figure of *modestus* is not sufficiently clear to enable any comparison to be made. Day's figure for *lamta* shows a lateral transverse formula of  $4\frac{1}{2}-4\frac{1}{2}$ , his description gives  $4-4\frac{1}{2}-5$ ; but his type shows unquestionably that the real numbers are  $4\frac{1}{2}-3\frac{1}{2}$ .

The only difference between the types of Day's *lamta* and *modestus* is the concavity or convexity found in front of the dorsal fins and leading down towards the head, but as this difference is found in specimens collected at Paresnath (Chota Nagpur) in April, 1909, which are otherwise absolutely identical in form and colour, its value as a specific distinction can be disregarded.

Now while Günther gives his reasons for including Day's species of *lamta* and *jerdoni* together, Day retaliates by including two of Günther's species—namely, *lamta* and *macrochir*—together, without assigning any reasons.

Günther (*op. cit.*, p. 69) admits three Indian species of *Discognathus*, namely, *lamta*, *macrochir* and *nasutus*. As already explained, Günther's *lamta* comprises Day's *lamta* and *jerdoni*. There are no specimens of *macrochir* or *nasutus* in the Indian Museum. *Macrochir* has been described as a species by Günther from two specimens, one from the collection of the East India Company, the other from Griffith's collection, the locality given being Assam.

*Nasutus* is admitted by Günther to specific rank from McClelland's description of a specimen from the Khassiyah Mountains<sup>1</sup> (now known as the Khasi Hills); but both *macrochir*

<sup>1</sup> *Journ. As. Soc. Bengal*, vol. vii, p. 947, tab. 55, figs. 2a and b.

and *nasutus* are included by Day in his *lamta*. This specimen of McClelland's was described under the name of *Platycara nasuta* and incidentally has only six anal rays, the number which Day gives as distinguishing his *modestus* from *lamta* and *jerdoni*, but which I have already shown to be frequent in *lamta* (of Day). Evidently Day considers McClelland's *D. nasutus* to be really *D. lamta* with the snout constricted, a secondary sexual modification. Consequently the three Indian species of *Discognathus* according to Günther are included by Day in his *lamta*. Now Day gives for *lamta* a very wide distribution, for *jerdoni* and *modestus* on the other hand a very limited one, namely, the Bhavani River at the foot of the Nilgiris for the former and "probably Northern India" for the latter.

In conclusion there are no specimens of *Discognathus* in the Indian Museum which justify me in considering that there is more than one Indian species of this genus, but probably the examination of large numbers of specimens from different districts might lead to the establishment of well-defined varieties.

J. T. JENKINS.

## INSECTS.

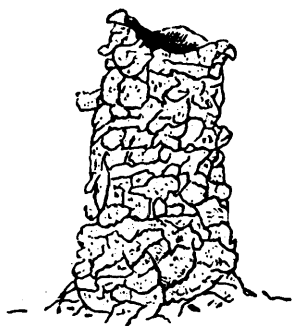
### Field Notes on Indian Insects:—

I. THE OCCURRENCE OF THE MYRMECOPHILOUS CRICKET *Myrmecophila quadrispina* IN INDIA.—One evening in July, 1907, I noticed a minute apterous cricket moving about on the top of a wall on the outskirts of Calcutta, surrounded by ants. Although its posterior femora were much thickened, it ran with great swiftness, much in the same manner as an ant. Having secured the cricket and some of the ants, I sent them for identification to the late Colonel Bingham, who returned them shortly before his lamented death, identifying the ant as *Iridomyrmex anceps*, Roger, and saying that Mr. Kirby had compared the cricket with the type of *Myrmecophila quadrispina*, Perkins, and found that it agreed fairly well with that species, with which he regarded it as specifically identical. The cricket was originally described from Hawaii, into which the ant has been introduced by man.

2. CURIOUS HABIT OF AN INDIAN JASSID.—Dr. D. Sharp, in his account of the insects in the *Cambridge Natural History* (vol. vi, p. 577), refers to the "phenomena known as weeping-trees," and states that these phenomena are due to the activities of Homopterous insects of the family Cercopidæ. In India, however, a similar phenomenon is sometimes produced by a common Jassid (*Tetigoniella ferruginea*, Fabr.), although it is not always easy to trace it to its proper source. While collecting insects on Paresnath Hill in Western Bengal last April, I was surprised on more than one occasion to feel what I thought to be rain dripping from a clear sky through the foliage of the trees, until a careful search revealed

the fact that the apparent rain fell directly from the leaves, and was produced by enormous numbers of Jassidæ settled on their lower surface. All these Jassids belonged to the species named; they were fully adult and existed in countless numbers on shrubs and trees of all kinds. A favourite tree was the common fig *Ficus cunia*. Each insect sat with its proboscis buried in the substance of the leaf, to the lower surface of which it clung, and apparently sucked in the sap, for at regular intervals (roughly three minutes) several drops of a honey-like liquid was squirted with some force from the tip of its abdomen. The number of individuals was sufficiently great to give rise to the phenomenon described, but they did not appear to be in any way banded together and took flight in all directions on the slightest disturbance.

3. THE NEST OF THE BEE *Podalirius pulcherrimus*.—During a short collecting trip in the Western Himalayas round Simla at the beginning of May, 1907, I noticed that a



Entrance to nest of *Podalirius pulcherrimus*.

hard clay bank near the bungalow at Matiana (28 miles north-east of Simla) was riddled with round holes about 20 mm. in diameter. Some of these holes were surmounted by small turrets of rough clay pellets of various shapes and sizes, the turrets being about 30 to 40 mm. in height. Bees were constantly entering and emerging from the tops of the turrets, and the holes were obviously their burrows. Each burrow ended at a depth of a few inches, after one or more turns, in a small oval chamber, the base of which was lined with pollen kneaded into a paste. No eggs were found, but probably the time for oviposition had not yet come. The bees were identified for me by the late Col. Bingham as *Podalirius pulcherrimus*. Most of the turrets were washed away by a shower of rain during the night, and the bees made no attempt to rebuild them; indeed they probably would have been unable to do so without making fresh excavations. Owing to the direction in which the burrows opened, however, the rain did not enter them to any great extent. The figure has been drawn from a specimen in the collection of the Indian Museum that has been preserved by means of glue.

N. ANNANDALE.

## XIPHOSURA.

THE HABITS OF INDIAN KING CRABS.—Two somewhat variable species of King Crab (*Limulus moluccanus* and *L. (Carcinoscorpius) rotundicauda*) are common in Indian waters; but little information is available as regards their habits, which seem to differ considerably from those of the Japanese and American forms. Observations made in 1901 on the east coast of the Malay Peninsula and recently

in Bengal show that whereas *L. moluccanus* is essentially a marine species, occurring on sandy and muddy bottoms from the tide-line to a depth of 20 fathoms, *L. rotundicauda* is mainly if not entirely estuarine. It ascends the river Hughli at least as far as Calcutta, that is to say, for a distance of about 90 miles from the open sea, and can live in water that is practically fresh. On the coast of Bengal *L. moluccanus* breeds at the end of the cold weather, *i.e.*, in March. The eggs, which are not very numerous, have a green colour and measure about 3 mm. in diameter, are carried on the ventral surface of the abdominal appendages, to which they adhere lightly. Further information as regards the habits of the Indian *Limuli* would be of interest.

N. ANNANDALE.

### CRUSTACEA.

THE RATE OF GROWTH IN *Conchoderma* AND *Lepas*.—Dr. J. T. Jenkins has given me the information on which the following note is based; it is of interest as illustrating the relative rate of growth in two species of barnacles. A clean buoy was placed in the sea off the coast of Ganjam, on February 23rd, 1909, by the Fisheries Steamer "Golden Crown," and was lifted on March 3rd. Numerous specimens of *Lepas anserifera* and *Conchoderma virgatum* var. *hunteri* were found adhering to it. Those of the former species were all small, the largest having a capitulum 8 mm. long, whereas it is usually about 20 mm. long in fully grown examples of the species from the Bay of Bengal. The specimens of *C. virgatum* var. *hunteri* were, however, much larger, and appeared to be already adult. The capitulum of the largest measured 15 mm. in length. This individual is actually the largest specimen of the variety I have seen, although it had reached this size in eight days from that on which the larva probably settled. It is of interest to note, therefore, that the rate of growth in *C. virgatum* var. *hunteri* is considerably greater even than it is in the common *L. anserifera*. It may be noted that whereas the latter species is usually found attached to inanimate objects, *C. virgatum* var. *hunteri* is frequently taken on the skin of turtles and sea-snakes.

N. ANNANDALE.

### POLYZOA.

LARGE COLONIES OF *Hislopia lacustris*.—In volume i (page 177) of the *Records of the Indian Museum*, I described the two forms of colonies of *Hislopia* that I had found in the United Provinces (Bulandshahr). Of these, one was a more or less linear arrangement of the zoecia on leaves and twigs, and the other, and more common, form was an encrusting sheath on the outer surface of the shells of *Paludina*. During the present "rains" (July 1908) I have found many examples of what may be considered a much exaggerated extension of the latter form. These colonies

have been on bricks, tiles and other submerged objects. The largest colony that I have seen so far was on a tile; one side of the tile was exposed above the mud of the bottom of the tank, and its area measured about 120 square inches: the entire surface was almost completely covered by a continuous growth of *Hislopia*. Another large colony was on a piece of bark which measured 7 inches by 3 inches: both sides were practically everywhere covered by *Hislopia*.

These specimens suggest that, within reasonable limits, the size a colony may attain is only determined by that of the object on which it grows.

In these giant colonies the zoöcia are somewhat compressed: the typical oval shape is in a measure lost, and they become somewhat polygonal or circular and are of comparatively small size.

The rainy season is evidently the time at which the growth of *Hislopia* is at its maximum. The particular tank from which I have obtained most of my specimens has been kept full of water all through the hot weather; the exuberant growth of *Hislopia* during the "rains" cannot, therefore, in this case be attributed to a larger area being available at this season.

Now as usual almost every *Paludina* in the tank, except quite small ones, is covered with *Hislopia*, and in this situation the zoöcia retain their oval form.

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#### COELENTERATES.

*Branchiocerianthus imperator* VON DER KÜSTE VON OMAN UND BALUCHISTAN.—Wie aus einer kurzen Notiz von R. E. Lloyd (s. *Rec. Ind. Mus.*, vol. i, p. 1-2, 1907) bekannt ist, wurde der bilateral symmetrische *Branchiocerianthus imperator* im Jahre 1906 durch den "Investigator" (1) an der Küste von Oman, nahe dem östlichsten Punkt Arabiens unter  $21^{\circ} 49' 50''$  N. Lat. und  $59^{\circ} 48' 0''$  E. Long., und (2) an der Küste von Baluchistan unter  $24^{\circ} 45' 0''$  N. Lat. und  $63^{\circ} 50' 15''$  E. Long. aus 900 Meter (492 Fath.), resp. 995 Meter (544 Fath.) gedredgt. Durch die grosse Liebenswürdigkeit von Dr. Annandale in Calcutta ist es mir möglich gewesen, beiderlei Material zu untersuchen.

Dies Material hat deshalb ein besonderes Interesse, weil hier zum ersten Male ganz jugendliche Exemplare von *Branchiocerianthus* vorliegen, und weil diese von den bisherigen Fundorten (Japan, Nördl. Pacific, Golf von Panama und Ostafrika) so entfernte Lokalität über die geographische Verbreitung des Genus ganz neue Perspektiven eröffnet. Leider sind sämtliche Exemplare sehr schlecht erhalten, offenbar auch nur in starkem Alkohol konserviert, sodass sie stark geschrumpft und sehr hart und brüchig geworden sind. Das Material besteht aus 10 Exemplaren von Baluchistan, deren Grösse zwischen 60 und 120 mm. schwankt, und 1 Exemplar

von der Oman-Küste von 160 mm. Länge. Die Bilateralität ist bei allen *sehr* deutlich; der Hydrocaulus sitzt der Mundscheibe *sehr* excentrischen, so dass sie darin eine vollkommene Übereinstimmung speciell mit *Branchiocerianthus imperator* (Allm.) zeigen; denn bei *B. urceolus* Mark sitzt der Hydrocaulus an der Mundscheibe noch nahezu Central. Blastostyle und Radiärkanäle sind nirgends mit Sicherheit zu erkennen, was indessen seinen Grund wohl mir in dem schlechten Erhaltungszustand hat. Die aboralen Tentakel sind je nach der Grösse des Hydranthen 20 bis 30 mm. lang. Das Diaphragma an der Grenze von Hydrocaulus und Hydranth ist an einigen Exemplaren nachweisbar. Die lederartig straffe Stützlamelle des Hydrocaulus gleichtvollständig der an den Exemplaren des "Challenger" und denen, die Prof. Doflein im Jahre 1904 im der Sagami-bai (Japan) gefischt hat.

Ein dichter Wurzelschopf fehlt an sämtlichen Stücken von Baluchistan; es machte mir aber den Eindruck, als ob die Wurzelscheide mit dem an ihr sitzenden Wurzelschopf überall, wohl beim Herausreissen aus dem Boden, abgestreift war. Dagegen war der Wurzelschopf bei dem Exemplar von der Oman-Küste in der charakteristischen Form vorzüglich ausgebildet. Im Ganzen scheint es mir durchaus möglich, dies Material, obwohl es sich nicht auf Einzelheiten prüfen und vergleichen liess, als *Branchiocerianthus imperator* (Allman) zu bezeichnen.

Sämtliche Exemplare, besonders die von Baluchistan, sind noch sehr jung. Da aber auch sie schon die charakteristische excentrische Ansatzstelle des Hydrocaulus am Hydranthen zeigen, so wird die frühere Vermutung hinfällig dass diese Bilateralität erst im Laufe des Lebens durch ungleichmässiges Wachstum entstünde. Der Hydranth wird vielmehr von vornherein bilateral angelegt.

Ein Vergleich sämtlicher bisher bekannten Exemplare von *Branchiocerianthus* und eine Zusammenstellung von allem, was wir bisher über dies Genus wissen, erscheint in den *Beiträgen zur Naturgeschichte Ostasiens*, herausgegeben von F. Doflein. E. Stechow, "Hydroidpolypen der japanischen Ostküste." München, 1909.

E. STECHOW,  
München.

