

RECORDS
of the
INDIAN MUSEUM

(A JOURNAL OF INDIAN ZOOLOGY)

Vol. XI, 1915.

EDITED BY
THE SUPERINTENDENT
OF THE
INDIAN MUSEUM.

Calcutta :

PUBLISHED BY ORDER OF THE TRUSTEES OF THE INDIAN MUSEUM,
BAPTIST MISSION PRESS.

1915.

ERRATA.

Page 567, line 5. *For " ployps" read " polyps."*
,, ,, ,, 13. *For " gemmatta" read " gemmata."*
,, 568, ,, 1. *For " Hillard" read " Billard."*

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I INDIAN BORING SPONGES OF THE FAMILY CLIONIDAE

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(Plate i.)

Among the sponges found in excavations in shells and corals by far the best known are those of the family Clionidae. Having recently had occasion to inquire, in connection with other work, into the species that occur in Indian seas (that is to say, the Bay of Bengal with its subordinate gulfs and straits and the Arabian Sea, with which it is convenient to include the Persian Gulf and those parts of the Indian Ocean that lie immediately south and south-west of the Indian Peninsula), I found in our collection so large a proportion of the species known from Oriental waters—as well as several hitherto undescribed—that it seems worth while to bring together in a single paper references to all the former, with such notes as my material suggests, with keys to species and genera and descriptions of new forms.

The specimens examined have included a large part of the collection made by the late Dr. John Anderson in the Mergui Archipelago off the coast of Tenasserim, and described by the late Dr. H. J. Carter in Vol. XXI of the *Journal of the Linnean Society* (Zool). in 1887¹; as well as examples of sponges extricated from shells and corals from various sources in the general collection of the Indian Museum and specimens specially collected in the Gulf of Manaar and Palk Straits and in lagoons on the east coast of India by Mr. S. W. Kemp, Mr. J. Hornell and myself. I have to thank Messrs. Kemp and Hornell for valuable assistance in this direction.

Fam. CLIONIDAE.

The taxonomy and systematic position of the Clionidae have been considered most fully by Topsent in his papers on the family in vols. V² and IX of the *Archives de Zoologie expérimentale et générale* (1887 and 1891) and I have little to add to the general conclusions there set forth. References to more recent literature are given below in connection with the different species discussed.

Six genera are now recognized by Topsent as constituting the family, namely *Cliona*, Grant, *Clionopsis*, Thiele, *Alectona*,

¹ This paper, with many others originally published in the same Journal, was re-issued by Anderson in 1889 in vol. i of his *Fauna of the Mergui Archipelago*.

Carter, *Thoosa*, Hancock, *Dotona*, Carter and *Cliothosa*, Topsent; but the last seems to me of doubtful validity.

Of these six genera all but *Clionopsis* are known to occur in Oriental waters. *Clionopsis*¹ is at present recorded only from the Pacific Coast of S. America and from an unknown locality probably in the Tropics. *Alectona*² and *Dotona*³ both occur in the Gulf of Manaar, although I have not been so fortunate as to find examples of either. *Cliona* and *Thoosa* are well represented in the Indian marine fauna, while a specimen that would be assigned by Topsent to his genus *Cliothosa* has been found in a shell from the Andamans. I am not satisfied that this last "genus" represents more than a phase of certain species of *Thoosa* (see p. 22, *postea*).

KEY TO THE GENERA OF CLIONIDAE.

I. Microscleres essentially spirasters.

A. Macroscleres both amphioxi and styli (usually tylostyli), or either alone; if both present the amphioxi never the larger. Microscleres often variable and sometimes divisible into two groups but never of two quite distinct kinds

Cliona.

B. Macroscleres amphioxi and tylostyli, of which the former are the larger. Microscleres slender, elongate, zig-zag spirasters and short, stout, irregularly contorted ones

Clionopsis.

C. Macroscleres reduced to minute simple styli or amphioxi and confined to the external papillae. Microscleres relatively large spiral spirasters and minute straight ones of amphiaster-like form

Dotona.

II. Microscleres essentially amphiasters.

A. Macroscleres, if present straight or regularly curved amphioxi or tylostyli, occurring in the internal galleries. Typical amphiasters consisting of a cylindrical stem bearing at or near both ends a ring of relatively large bosses and terminating in similar bosses.⁴ Other forms

¹ Thiele, *Zool. Fahrh.*, suppl. VI, Vol. III, p. 412 (1905): Topsent, *Bull. Mus. Océanog. Monaco*, No. 120 (1908).

² The fullest description, illustrated by numerous figures, is that given by Topsent in his "Etude monographique des Spongiaires de France" (*Arch. Zool. expér.* VIII, p. 24: 1900). The original description, by Carter, is in *Fourn. Roy. Micro. Soc.* II, p. 493 (1879).

³ Carter, *Ann. Mag. Nat. Hist.* (5) VI, p. 57 (1880): Topsent, "Spongiaires des Açores," *Res. Camp. Sci. Monaco*, XXV, p. 108 (1904).

⁴ In *Thoosa laeviaaster*, described on p. 22, both lateral and terminal bosses are reduced to smooth conical projections.

of microscleres present also, but never spiny diactinial spicules of relatively large size and of polyactinial origin . *Thoosa*.

- B. [Macroscleres normal tylostyli, occurring as in *Thoosa*. The only microscleres amphiasters consisting of a cylindrical stem bearing at the ends a circle of relatively long horizontal branches which are inflated at the tip or terminate in several minute hooks; the whole spicule smooth and slender *Cliothosa*.]
- C. Macroscleres entirely absent; their place taken in the external papillae, but not in the galleries, by relatively large spiny or nodular diactinial spicules some of which, reveal their polyactinial origin by being definitely bent or geniculate in the middle, or even by bearing extra rays, complete or rudimentary, in this position. Amphiasters like the typical ones of *Thoosa* but with the lateral bosses far removed from the extremities, which are not always capitate . *Alectona*.

Genus *Cliona*, Grant.

1826. *Cliona*, Grant, *Edinb. Phil. Journ.* I, p. 78.
 1849. „ Hancock, *Ann. Mag. Sci. Nat.* (2) III, p. 305.
 1888. „ Topsent, *Arch. Zool. expériment.* (2) V², p. 76.
 1891. „ *Id., ibid.*, IX, p. 556.
 1900. „ *Id., ibid.*, (3) VIII, p. 32.
 1900. *Dyscliona*, Kirkpatrick, *Ann. Mag. Nat. Hist.* (7) VI, p. 353.
 1907. *Cliona*, Topsent, *Arch. Zool. expériment.* (4) VII, p. xvii.

Further references will be found in Topsent's papers, which are essential for a study of the Clionid genera and particularly for that of *Cliona*. In 1891 he arranged the species in six groups as follows :—

- Group I. Spicules including tylostyles, diactinial macroscleres and spirasters (microscleres).
 Group II. Spicules consisting of tylostyles and diactinial macroscleres only.
 Group III. Spicules consisting of tylostyles and microscleres only.
 Group IV. Spicules consisting of amphioxi and microscleres only.
 Group V. Spicules consisting of tylostyles only.
 Group VI. Spicules consisting of amphioxi only.

This grouping is convenient for the purposes of a provisional classification, which is all that is possible until the life-histories of the species are known; but it must be remembered that in at least one species (*Cliona celata*, Grant) phases occur in the life of an individual sponge that would fall respectively into groups I, II and V. The sponge in its younger stage possesses tylostyles, diactinial spicules and microscleres, but as it grows it loses first the diactinial spicules and then, sometimes, the microscleres, so that in its mature form it has only tylostyles. It is possible, and indeed probable, that other species resemble it in this respect, so that groups V and VI may actually consist of species whose earlier stages are unknown and if known would fall into other groups, or even in some cases of species known by other names and assigned to other groups at different phases of development.

Taking the groups as they stand, we find that among the species known from Indian seas all but group VI are represented. Group V, so far as hitherto described species are concerned, has not withstood recent criticism and research¹, but a new species belonging to it is described here on p. 14. In the following key to the species found in the Indian Ocean (including the Red Sea, the Bay of Bengal with its appurtenances and the western part of the Malay Archipelago) I have found it more convenient to make the primary division between species that possess and those that do not possess microscleres. Even so, it is necessary to include *C. celata* under three separate headings in accordance with its three phases of development.

Of the sixteen species now known from the Indian Ocean at least twelve have been found in the Bay of Bengal or the Gulf of Manar. Of these, four are of very wide distribution (*C. celata*, *C. vastifica*, *C. carpenteri*, *C. viridis*): *C. carpenteri* is essentially a circumtropical sponge, but the other three are cosmopolitan. Three species have a wide distribution in the Indo-Pacific Region, namely *C. margaritiferae*, *C. mucronata* and *C. orientalis*; while five (*C. annulifera*, *C. indica*, *C. ensifera*, *C. acustella* and *C. warreni*) have been definitely recorded only from the Bay of Bengal and Ceylon. Of the four species not known from these seas, two were originally described, or are only known definitely, from the "Indian Ocean," namely *C. michelini* and *C. millepunctata*, but the original specimen of the latter was doubtfully ascribed to the N. Atlantic. One species (*C. mussae*) has been found only in the Red Sea, and one (*C. patera*) in the western part of the Malay Archipelago.

I have not included *C. gracilis*, Hancock, among the species known from the Indian Ocean, although Topsent (1887, p. 77) has done so; because the latter author's brief description of his specimen from that area ("Spicules en épingle= 150μ de long, spic. en zigzag= $15-20\mu$ ") is totally at variance with Hancock's original diagnosis, which is supported by good figures, and some mistake

¹ See Topsent, *Arch. Zool. expériment.* (3) VIII, p. 78 (1900).

in the identification must have occurred. The *Cliona* ? *sceptrellifera*, of Carter¹, if he rightly associated the isolated spicules on which it was based, is probably a *Thoosa* or an *Alectona*, but I have been unable to find these spicules in that part of his original material at my disposal.

The names of species on which notes are given are distinguished by an asterisk in the key. I have not seen the following forms:—

C. indica, Topsent, *Arch. Zool. expér. (2)* IX, p. 574 (1891).

C. michelini, *id. ibid.*, vol. V², p. 79 (1887).

C. mussae (Keller), *Zeitschr. wiss. Zool.* III, p. 321 (1891).

*C. warreni*² Carter, *Ann. Mag. Nat. Hist.* (5) VII, p. 370 (1881).

C. millepunctata Hancock, *Ann. Mag. Nat. Hist.* (2) III, p. 341 (1849); Topsent, *op. cit.*, 1887, p. 78.

Cliona has a wide bathymetric range. In the Bay of Bengal one species has been found at a depth of over 700 fathoms³ (*C. annulifera*, p. 9) and another (*C. vastifica*, p. 8) in lagoons of brackish water actually above sea-level. The genus is, however, best represented in comparatively shallow water below low tide. On beds of gregarious sedentary molluscs such as *Ostrea* or *Margaritifera* a single species usually predominates and becomes very abundant, but in the less vigorous parts of coral-reefs several are sometimes found together in a flourishing condition. More than one may also occur in a single shell, either Gastropod or Lamelli-branch, that is of suitable size, thickness, etc., but does not belong to a markedly gregarious species.

KEY TO THE SPECIES OF *Cliona* KNOWN FROM THE INDIAN OCEAN.

I. Species with microscleres.

A. Macroscleres both diactinial and tylostyle.

1. Diactinial spicules smooth, hair-like, fasciculated *C. celata* (A).*
2. Diactinial spicules granular, spindle-shaped, moderately stout, not fasciculated.
 - a. Microscleres sinuate, truncate. *C. vastifica*.*
 - b. Microscleres straight, spindle-shaped *C. carpenteri*.*
3. Diactinial spicules cylindrical, irregularly spiny *C. margaritiferae*.*

¹ *Fauna of Mergui I* (Fourn. Linn. Soc. (Zool.) XXI: 1887), p. 76. "Spongiaires des Açores," Rés. Camp. Sci. Monaco, XXV, p. 108 (1904).

² Topsent (*Arch. Zool. expér.* (3) VIII, p. 54) regards this species as identical with *C. quadrata*, Hancock.

³ *C. abyssorum*, Carter was taken at the mouth of the English Channel in 500 fathoms (*Ann. Mag. Nat. Hist.* (4) XIV, p. 249, 1874). This is apparently the only other species as yet recorded from depths of like magnitude.

B. *All the macroscleres tylostyles.*

1. Shaft of macroscleres bearing a single convex ring a short distance below the head . *C. annulifera*.*
2. Shaft of tylostyles normally smooth.
 - a. Tylostyles definitely of two sorts; one sort normal, the other very short and bearing a sharp subsidiary spine at its point . . . *C. mucronata*.*
 - b. No "mucronate" spicules of this type.
 - i. Spines on all the microscleres very small and set close together; two groups of zigzag microscleres, one very slender *C. indica*.
 - ii. Spines on microscleres stout, very irregular, often blunt but never widely separated; microscleres not divisible into two groups . . . *C. michelini*.
 - iii. Spines of microscleres relatively long, sharply pointed, normally arranged in a spiral band winding round the spicule.
 - a. Some of the macroscleres conspicuously but gradually expanded before narrowing to the point; hair-like tylostyles not present. *C. ensifera*.*
 - β. None of the macroscleres of expanded form; hair-like tylostyles, sometimes with spiny heads, often present. *C. viridis*.*
 - iv. Spines of microscleres as in iii, but arranged in a sinuous band outlining one side of the spicule *C. orientalis*.*

C. *All the macroscleres amphioxi.*

- (Microscleres short, straight, approaching the amphiaster type in different degrees) *C. acustella*.*

II. *Species without microscleres.**Macroscleres both diactinial and tylostyle.*

- 1 Diactinial spicules hair-like, fasciculated . *C. celata*. (B).*

2. Diactinial spicules moderately stout, (smooth), spindle-shaped. *C. mussae*.

B. *All the spicules tylostyles.*

1. Sponge forming a gigantic free cup; spicules relatively stout *C. patera*.*
2. Sponge confined to its excavations or forming a small rounded mass; spicules relatively slender.
 - a. Head of spicules spherical *C. warreni*.
 - b. Head of spicule elliptical *C. millepunctata*.
 - c. Head of spicule usually trilobed. *C. celata* (C).*

Cliona celata, Grant.

1900. Topsent, *Arch. Zool. expér. (3)* VIII, p. 32, pl. i, figs. 5, 6-9, pl. ii, fig. 1.
1909. Hentschel, "Tetraxonida" in Michaelsen and Hartmeyer's *Faun. Südwest. Australiens*, p. 386.
1911. Row, *Journ. Linn. Soc. (Zool.)* XXXI, p. 305.

Topsent, in the paper cited after his name (1900), has discussed the structure and synonymy of this species in detail. As he had shown in previous papers, the spiculation undergoes great changes in the life of the individual sponge. At first three kinds of spicules are present—tylostyles, diactinial macroscleres and microscleres of the zigzag spiraster type. The last disappear first, and then, in some cases, the diactinial microscleres, which, even in the young sponge, are much reduced and have the form of hair-like bodies adhering in bundles. There are three specimens from the Bay of Bengal in the collection of the Indian Museum which illustrate three different phases of growth in an interesting manner. One of them is clearly young and retains the full spiculation. It consists of a few galleries, with about half a dozen apertures, in a nodule of calcareous alga dredged by the "Investigator" in 28 fathoms off the coast of Burma.

The other two specimens are both in chank-shells (*Pyrula rappa*, L.) from the east coast of India. One was taken at the town of Madras in shallow water by Prof. K. Rammuni Menon, who has kindly given it to me. The shell was apparently vacant when collected but still retained its horny epidermis. The whole of its substance is permeated by the sponge, in which only tylostyle spicules remain. The external apertures are, however, small (about 1 mm. in diameter) and the sponge is wholly confined in the thickness of the shell.

The third specimen was dredged by Mr. J. Hornell of the Madras Fisheries, whom I have to thank for it, in the Gulf of Manaar near Tuticorin in 6½ fathoms. The shell in this case had evidently been "dead" for some time and its epidermis had wholly disappeared. The apertures made by the sponge are much larger (2 to 3.25 mm. in diameter) and it has begun to grow out over the

inner surface of the shell in the form of a uniform crust, much as in a specimen figured by Topsent (1887, pl. i. fig. 3).

Cliona celata probably occurs in all seas. It was originally described from the British coasts and has since been found at several places on the Atlantic side of North America, in the Red Sea and the adjacent parts of the Indian Ocean, off the south and south-west coasts of Australia, off New Guinea, Ceylon, Singapore, etc. I have examined specimens from several of these localities.

Cliona vastifica, Hancock.

1900. Topsent, *Arch. Zool. expérim.* (3) VIII, p. 56, pl. ii, figs. 3-9.

1909. Hentschel, "Tetraxonida" in Michaelsen and Hartmeyer's *Faun. Südwest Australiens*, p. 387.

This is another cosmopolitan species described at length by Topsent in his "Étude Monographique des Spongiaires de France" (*op. cit. supra*) as well as in his previous papers on the family (1887 and 1891) in the same journal. *Cliona velans*, Hentschel (*op. cit.*, p. 388, fig. 19) from S. W. Australia is evidently very closely related to *C. vastifica*, but is apparently distinguished by its method of growth and by having the heads of the tylostyles imperfectly differentiated.

In the littoral zone of Indian seas *C. vastifica* appears to be by far the commonest species and, as already stated, makes its way well into brackish water. I have found it in that medium in the Chilka Lake in Orissa and the Ganjam district of the Madras Presidency (in shells of *Ostrea* and *Purpura*), in the Adyar River at Madras and in the Ennur Backwater in the same district, in both places in shells of *Ostrea*. In the Persian Gulf it is common in, and apparently destructive to, pearl-shells (*Avicula* and *Margaritifera*); I have seen it in a *Placuna*-shell from Palk Straits (5½ fathoms), in shells of *Oliva* and *Malleus* from the Andamans, of *Voluta* and *Ostrea* from New South Wales. In Indian seas it occurs most frequently in the shells of gregarious sedentary bivalves, to which it probably causes great damage, but only in very shallow water. In European seas it is common; it has been recorded by Topsent and others from many widely separated regions.

Cliona carpenteri, Hancock.

1887. *Cliona carpenteri*, Topsent, *Arch. Zool. expérim.* V² (suppl.), p. 77, pl. vii, fig. 4.

1887 (1889). *Cliona bacillifera*, Carter, *Faun. Mergui Arch.* I: *Journ. Linn. Soc. (Zool.)* XXI, p. 76.

This species, as Topsent has pointed out, is easily distinguished from its allies, and in particular from *C. vastifica*, by its straight, spindle-shaped microscleres. Carter's *Cliona bacillifera* from Mergui, of which the type (or a schizotype) is in the Indian

Museum, falls well within the limits of the species as defined by the former author.

C. carpenteri is a tropical sponge distributed all round the globe. Topsent found it more frequently than any other in shells he examined from the Gulf of Mexico, the Pacific coast of Central America, the Gaboon, the Indian Ocean, etc. It does not appear, however, to be common in the Bay of Bengal. In addition to the type-specimen of Carter's species, which is in a dead oyster-shell, I have examined specimens in a shell of *Malleus* from Singapore and in one of *Voluta* from New South Wales.

Cliona margaritiferae, Dendy.

1905. Dendy, "Porifera" in Herdman's *Rep. Ceylon Pearl Oyster Fish.* V, p. 128, pl. v, fig. 9.
1909. Hentschel, "Tetraxonida" in *Faun, Südwest Australiens*, p. 386.

I have included this species (p. 5) among those that possess macroscleres of two kinds, but Dendy evidently regards the larger amphioxi as modified spirasters and points out that there are transitional forms of spicules between them and the small microscleres. This is true; but there seems to me to be a slight but definite break in the series and it is at any rate more convenient to regard the large spiny amphioxi for the present as the equivalents of the granular amphioxi of such species as *C. vastifica*.

C. margaritiferae was originally described from the shell of the pearl-oyster of the Ceylon banks (*Margaritifera vulgaris*). I have found it in the same shell from the type-locality (*T Southwell*) and also in a piece of Madreporarian coral from the Palk Straits (off Tondi, 5½ fathom: *J Hornell*). Hentschel examined specimens in a shell of *Chama*, sp., from Michaelsen and Hartmeyer's Australian collection.

Cliona annulifera, sp. nov.

(Plate i, figs. 1-4.)

A *Cliona* with tylostyle macroscleres and spirasters of the normal type, the former bearing a single convex ring round the shaft; some of the latter unusually large. The gemmules are provided with spirasters of a specialized form.

The only known specimen is in a dead Gastropod shell (*Xenophora pallidula*, Rve.).

General structure. The sponge consists of a series of sub-spherical or ovoid chambers connected by short horizontal tubules and bearing the papillae on short vertical ones. The chambers form a single horizontal layer. The greatest longitudinal diameter of the larger chambers is about 1.3 mm. and their greatest depth about 0.9 mm. The average length of the connecting tubules (which, of course, represent the thickness of the wall of shell

left between the chambers) is about 0.425 mm. and the diameter 0.119 mm. The papillae as a rule are borne only on the surface nearest the outer surface of the shell. The tubules connecting them with the chambers are longer than the horizontal tubules, but always much shorter than any diameter of the chambers. The chambers are by no means solid, their internal structure being coarsely reticulate. Delicate cellular diaphragms can sometimes be detected at or near one extremity of the connecting tubules.

Papillae. I have been able to find only two kinds of papillae, corresponding to those styled "poriferous" and "mixed" by Topsent (1887). The largest poriferous papillae have a diameter of about 0.225 mm. They are readily distinguished by the

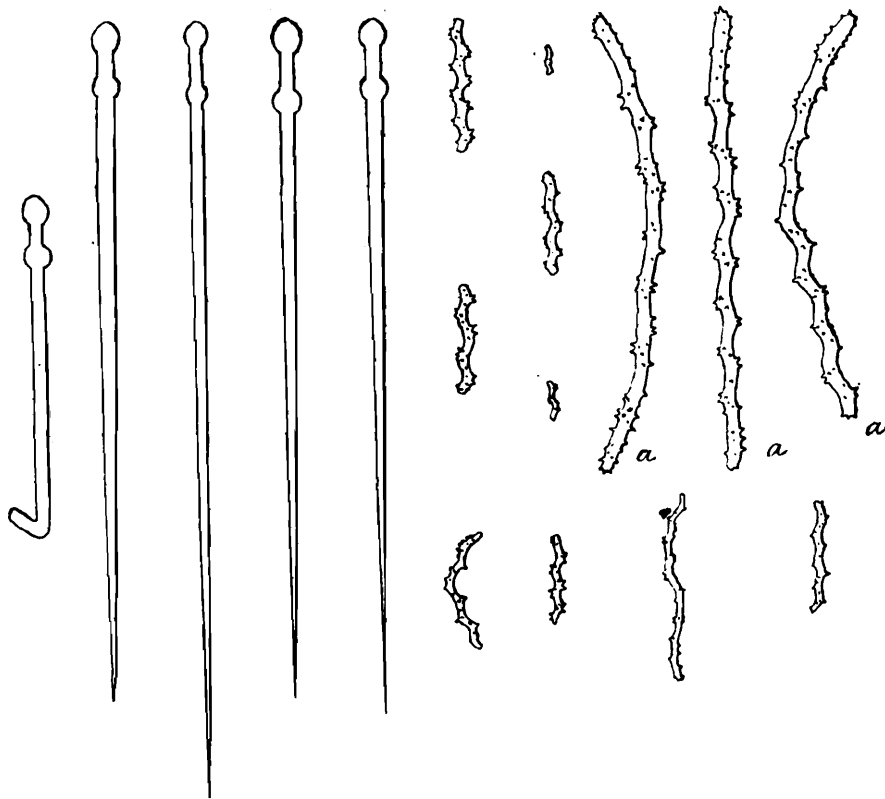


FIG. 1.—Spicules of *cliona annulifera*.
a. Gemmule-spicule.

absence of a central orifice and by the absence or paucity (at any rate when they are contracted) of projecting spicules upon their surface, which is flat and horizontal. It is closed by a minutely perforate membrane on and in which the calcareous particles derived from the shell and carried out through the oscula lie in considerable numbers, being too large to enter the pores. In profile these papillae are flat and table-like, extending beyond their supporting tubules, which are cylindrical, for a considerable distance on either side; the free surface forms an acute angle with the projecting lateral margin. The mixed papillae are about the same size but have a central star-shaped or oval orifice of relatively large diameter. This is surrounded by a number of por-

ferous lobes through which tylostyle spicules project upwards and outwards (pl. i, figs. 2, 3, 4). In profile these papillae, with their supporting tubule, are trumpet-shaped. Their outer walls (pl. i, fig. 4) are coated with minute calcareous particles considerably smaller than those which lie scattered in the interior of the sponge and on the poriferous papillae. They are covered by a delicate cortex, which protects the calcareous particles against strong acid unless the surface is subjected to its action for a considerable period. The mixed and the poriferous tubules are about equally abundant.

Skeleton.—In the chambers the macroscleres lie scattered, irregularly and somewhat sparsely, parallel to the outer walls. As a rule they are more abundant in the upper than in the lower parts. Occasionally they seem to radiate from the chambers into the connecting tubules, but this arrangement is never of a very regular nature and no trace of it can often be detected. In the vertical tubules the macroscleres form supporting columns, their heads resting in a more or less complete, and more or less regular, ring at the base of the tubule and their points directed upwards. In the case of the mixed papillae the heads are rarely on anything like a uniform level and the points project outwards as well as upwards. The ordinary (*i.e.* the smaller) microscleres lie scattered, somewhat sparsely and almost uniformly, throughout the sponge, but their main axis is always approximately parallel to the outer surface. The gemmules have a special skeleton, which is described below.

Spicules.—The macroscleres are small, slender tylostyles, as a rule quite straight, sharply and gradually pointed at one extremity and bearing a well-differentiated head at the other. The head is most frequently somewhat heart-shaped, but in many cases almost spherical and occasionally with a tendency to be trilobed. It contains as a rule a single minute expansion of the axial tubule of the spicule. There is no distinct contraction of the shaft below the head but, at about $1/10$ the distance between it and the point, the shaft is surrounded by a single convex ring. The extent to which this ring is developed varies somewhat, but its presence and position seem to be practically constant features of the species. The average length of the macroscleres is 0.2 mm., the extremes being 0.148 and 0.234 mm.

The microscleres are all slender spirasters of the normal zig-zag type, but they differ greatly in size and two groups may be distinguished amongst them in accordance with this character. Those of the small type are, when well developed, from 0.008 mm. to 0.042 mm. in length and have as a rule from 4 to 8 bends, but are sometimes irregularly sinuous. Their spines are arranged in a regular spiral. These spicules lie scattered throughout the sponge.

The larger microscleres (fig. 1A). are as much as 0.126 mm. long, or even longer. They have more numerous and as a rule less well-defined whorls. The spicules of this type are found only on the gemmules.

Gemmules.—Gemmules are abundant in the only specimen examined, most of the chambers containing from one to three (pl. i, fig. 1). They lie at the periphery of the lower part of the chamber and are as a rule somewhat lenticular in shape. The external surface is frequently flattened by pressure against the wall of the excavation. The greatest diameter rarely exceeds 0.56 mm. The internal structure is that of a typical sponge-gemmule, that is to say, each gemmule consists of a mass of cells closely packed together and filled with granules of food-substance. There is a thin horny external coat. The most remarkable feature, however, lies in the spicular coat that occurs on the surface of the gemmule in contact with the sponge, for the spicules of which it consists differ considerably from those of the general choanesome. The spicules have already been described. They lie embedded horizontally in the horny coat on one side of the gemmule only, being completely absent on the side that is in contact with the wall of the excavation.

Locality.—Off the coast of Ceylon: 703 fathoms (*R.I.M.S.* “*Investigator*”).

Type. No. Z.E.V 6424/7, *Ind. Mus.*: in spirit.

C. annulifera. is related to *C. viridis* (Schmidt), from which it differs in the form of its megascleres. It is remarkable for the regularity and distinctness of its chambers and especially for the peculiar spiculation of its gemmules, a feature in which it apparently differs from all other known marine sponges. That a deep-sea sponge should possess gemmules at all is a remarkable fact, and one to the signification of which I hope to devote attention in a later paper.

***Cliona mucronata*, Sollas.**

1878. Sollas, *Ann. Mag. Nat. Hist.* (5) I, p. 54, pl. i, figs. 1, 2-7, 9, 10, 15, 17, pl. ii, figs. 1-9.
 1887. Topsent, *Arch. Zool. expériment.* (2) V², p. 37.
 1897. *Id.*, *Rév. Suisse Zool.* IV, p. 440.

The peculiar short, stout, mucronate tylostyles that form a considerable element in the spiculation of this species are quite characteristic. In the only specimen I have examined, they seem to be grouped together at certain points in the interior of the sponge, but this specimen is very imperfect, having been overwhelmed in its excavations by other sponges. Many of the tylostyles are of the normal type, but very slender.

C. mucronata was originally described from a coral (*Isis*, sp.) of unknown *provenance*. Topsent found it common in corals from the Bay of Amboina, and the only specimen in our collection is in a fragment of dead Madreporarian from the Indian shore of the Gulf of Manaar (Kilakarai: *S. W. Kemp*).

***Cliona ensifera*, Sollas.**

1878. Sollas, *Ann. Mag. Nat. Hist.* (5) I, 61, pl. i, figs. 1, 18; pl. ii, figs. 10-5.

1887 (1889). Carter, *Faun. Mergui*, I, p. 75.

1891. Topsent, *Arch. Zool. expériment.* (2) IX, p. 570.

This species is closely allied to *C. mucronata*, with which it has been found on more than one occasion, including that on which the type-specimens of both species were discovered. Its tylostyles are, like those of *C. mucronata*, of two types, one of which is remarkable for the great expansion of the lower part of the shaft. The tapering of the point is, however, regular and the spicules is never mucronate. The other type of tylostyles is slender and in no way remarkable. The species is apparently more robust in its growth than *C. mucronata*.

C. ensifera, which was originally described as occurring in the coral *Isis* from an unknown locality, is abundant in dead reef-corals from the Mergui and Andaman archipelagoes.

Cliona viridis (Schmidt).

1887 (1889). *Cliona*? *stellifera* (in part), Carter, *Faun. Mergui* I, p. 75.

1900. *Cliona viridis*, Topsent, *Arch. Zool. expériment.* (3) VIII, p. 84, pl. ii, figs. 11-14; pl. iii, figs. 2, 3; pl. iv, fig. 2.

Topsent has discussed this species and its synonymy in great detail and further references are unnecessary. It may be noted, however, that Carter's provisional species *Cliona stellifera* was founded on the macroscleres of this *Cliona* and the microscleres of a parasitic *Chondrilla*. I have found the two sponges in close association in his original specimen of dead coral from Mergui.

C. viridis is a cosmopolitan species evidently common in dead coral in the Mergui Archipelago and off the coast of the mainland of Burma. It was originally described from the Mediterranean and is known from the Gulf of Mexico, the Red Sea and many other widely separated localities.

Cliona orientalis, Thiele.

1887 (1889). *Suberites coronarius*, Carter (*nec. id.*, 1882) *Faun. Mergui* I, p. 74, pl. vii, figs. 4, 5.

1900. *Cliona orientalis*, Thiele, *Abh. senckenb. Natur. Gesellsch.* XXV, p. 71, pl. iii, fig. 24.

Thiele pointed out in 1900 (*op. cit.*) that the sponge described by Carter from Mergui under the name of *Suberites coronarius* was not identical with the species the latter had previously described under the same name from the West Indies, but actually a species of *Cliona*. He redescribed it with fresh figures of the spicules and named it *Cliona orientalis*. A re-examination of a part of Carter's Burmese material shows that Thiele was right in both contentions.

C. orientalis is closely allied to *C. viridis*, from which it may be distinguished by the arrangement of the spines on the microscleres. These, instead of running in a spiral round the spicule, are confined to its outline on one side. Carter's figures, although they illustrate this point clearly, are poor and misleading in other respects. The free form of the sponge closely resembles that of *C. viridis*.

C. orientalis has been found only in the Mergui Archipelago (in dead coral) and off Ternate in the Malay Archipelago.

***Cliona acustella*, sp. nov.**

This is a species belonging to Topsent's fourth group, having microscleres and amphioxus macroscleres only. The latter, al-

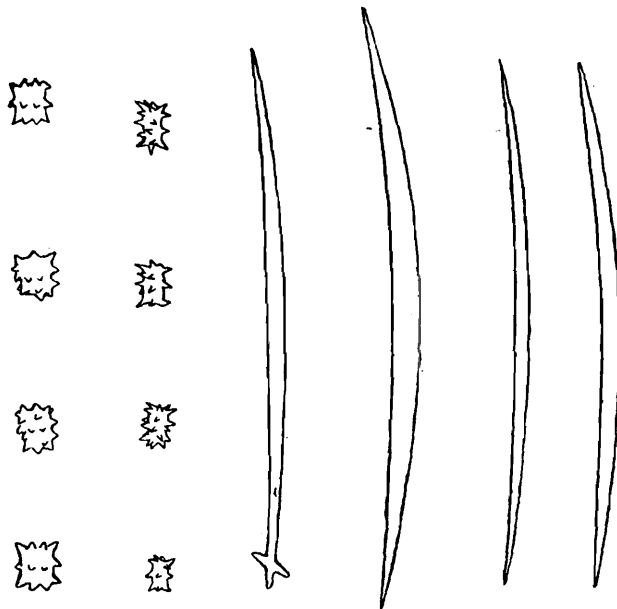


FIG. 2.—Spicules of *cliona acustella*.

though many of them can be referred to the spiraster type, exhibit a marked tendency to assume a simple amphiaster-like form.

General structure.—Only dried specimens are available for examination, and of these I have been able to extract only minute fragments lacking the external papillae. Chambers excavated apparently by this sponge are, however, abundant in oyster-shells from several adjacent localities. The apertures on the surface of the shell are small and sparsely scattered; their diameter does not exceed 0.4 m. These apertures are connected with the chambers by very short vertical tubules. The chambers are subcircular or polygonal, not more than 3 mm. in diameter and separated only by very narrow partitions of shell. They are arranged in several horizontal layers. The tubules connecting them horizontally and vertically are very slender as well as short.

Spicules.—The macroscleres are smooth, slender, sharply-pointed, somewhat spindle-shaped amphioxi on an average 0.1447

mm. long by 0.008 mm. broad. They are never strongly arched or geniculate. Spicules of this type are fairly abundant.

The microscleres are minute, straight, truncate, cylindrical bodies bearing relatively large spines which often show a tendency to group themselves in three rings (two terminal and one median), but sometimes cover the spicule quite irregularly. Their average length is 0.012 mm. and breadth, with the spines, 0.008 mm.

Distribution.—Apparently common in shells of *Ostrea imbricata* and *O. cuculata* in from 15 to 30 fathoms of water off the coast of Orissa and the Ganjam district of Madras in the Bay of Bengal (S.S. 'Golden Crown').

Type.—No. Z.E.V 6415/17, *Ind. Mus.*

The microscleres of this species appear at first sight to be in many cases amphiasters rather than spirasters, but actually exhibit (fig. 2) a fairly regular transition between the two types. Some of them are not unlike the small spicules of *Dotona*. The species at present stands alone in the genus so far as its spiculation is concerned, but I have little doubt as to its validity, although the circumstances in which it was found seem at first sight a little suspicious. Large numbers of oyster-shells, all of which were unfortunately cleaned and dried before being examined, were obtained by the trawler 'Golden Crown' off the east coast of India in 1909. The majority of them were found, on recent examination, to be perforated and in many cases partially disintegrated by the burrows of a *Cliona*, of which minute fragments were extracted from broken shells. Spicule-preparations made from other pieces of the same shells contained in some cases only spicules identical with those which occurred in the fragments of sponge extracted, viz. smooth amphioxi and microscleres of the type described and figured above. No tylostyles could be found either in the spicule-preparation or in the fragments of sponge. Other fragments of sponge extracted from shells were clearly no part of a Clionid but represented two species of *Eurypon*. Many spicule-preparations contained a mixture of the spicules of the *Cliona* with those of one or other representative of the latter genus. No actual confusion is possible, however, between the two very different genera thus associated.

Cliona patera (Hardwicke).

- 1822. *Spongia patera*, Hardwicke, *Asiat. Researches* XIV, p. 180, pl. i.
- 1858. *Poterion neptuni*, Schlegel, *Handleid. Dierkunde* II, p. 542.
- 1880. *Poterion patera*, Sollas, *Ann. Mag. Nat. Hist.* (5) VI, p. 441.
- 1908. *Poterion patera*, Vosmaer, *Versl Gew. Verg. Wis-en-Naturk. Afd.* XVII (1), p. 16.
- 1909. *Cliona patera*, Topsent, *Arch. Zool. expériment.* (4) IX, p. lxix.

Although this large and conspicuous sponge has been known, so far as its external form is concerned, for nearly a century, its true systematic position has only been discovered, by Vosmaer and Topsent, in the last few years. There is a fine series of dried specimens from Singapore, the original locality, in the Indian Museum; but they do not include the type. The species seems to me to be very closely related to *Cliona celata*, from which it differs in its stouter spicules but which it resembles in its general structure and in particular in that of the papillae. So far as these are concerned it agrees more closely with *C. celata* than with *C. viridis*, of which Vosmaer was apparently prepared to regard it as a variety.

Some of our specimens contain at the base both Lamellibranch and Gastropod shells, as well as many small pebbles. The latter, being of hard stone, are intact, as are also some of the shells. Others, however, both of bivalves and of Gastropods, have had ramifying grooves excavated on their surface by the sponge. In one Lamellibranch shell that was partially embedded in it the grooves are entirely confined to the embedded position. At least one Gastropod shell, which was extracted from the centre of the basal portion of a large specimen, is wholly permeated and nearly destroyed by excavations filled with sponge substance. I am convinced by these facts that the excavations in shells found in large specimens of *C. patera* are of a secondary nature, and it seems improbable, in any case, that so large a sponge, if it commenced life in the thickness of any Molluscan shell, should not have completely destroyed that shell before reaching its full size.

So far as I am aware, *C. patera* has as yet been found only in the neighbourhood of Singapore and Java, where it is abundant. If it occurred in the Gulf of Manaar, where several large collections of sponges have been made, so conspicuous an object could hardly have escaped notice. Indeed, its place seems to be taken in the seas round Ceylon and India by the Halichondrine sponge *Petrosia testudinaria* (Lamarck), which bears a considerable superficial resemblance to it, although the "cup" and the "stalk" are not so clearly differentiated.

Genus *Thoosa*, Hancock.

1849. *Thoosa*, Hancock, *Ann. Mag. Nat. Hist.* (2) III, p. 345.
 1887. „ Topsent, *Arch. Zool. expériment.* (2) V², p. 88.
 1891. „ *id.*, *ibid.*, (2) IX, p. 577.
 1905. ? *Cliothesa*, *id.*, *Bul. Mus. Hist. Nat. Paris*, XI, p. 95.

This genus is much less well known than *Cliona*. Most of the species, being of tropical origin and having a very inconspicuous appearance externally, have been described from dried specimens extracted from shells or corals, and many of these have been imperfect. Possibly it will ultimately be proved that several quite

distinct genera are included under the name. The genus as at present constituted is remarkable for the great diversity of its microscleres, which always include some form of amphiaster, as well as, in many cases, degenerate forms of euasters. True spirasters seem to be invariably absent.

The typical spicule is characteristic. It consists of a relatively stout cylindrical stem, as a rule quite straight, and of two circles of horizontal branches, which surround the stem at or near its extremities. The stem is quite smooth. In most cases the lateral branches are very short and greatly inflated at their tips, so that they have actually the form of subspherical bosses or prominences. They are never numerous, four to six being the normal number in each ring. In the more highly developed forms the prominences are covered with short spines, and the extremities of the stem are inflated and spiny also. Both the terminal and the lateral prominences may, however, be greatly reduced and take the form of smooth rounded or conical projections.

Another form of amphiaster that is often, though not invariably, present also consists of a smooth cylindrical stem surrounded at the ends by a ring of horizontal branches. Both the stem (as a rule) and the branches (always) are, however, more slender and the latter are much produced. The extremities of neither are regularly spiny, but each branch terminates either in a minute inflation or in several small hook-like spines.

A third form of microscleres that often occurs has been shown to be a degenerate oxyaster, although in its common form it has little resemblance to that type of spicule. As a rule it consists merely of two slender, more or less strongly curved spines attached to a minute centrum and having the appearance of the horns of some Ruminant attached to a fragment of the skull, or that of a sea-gull in flight as seen from a distance, or rather as conventionally represented in pictures. Occasionally more than two spines are present, and the spicule may assume a star-like form. Other microscleres, which resembles toxa but probably have the same origin, also occur in some species.

Yet another type of aster is often found. It has the form of a flat, spiny plate or a spiny cylinder and is referred to by Topsent as a pseudosteraster. I have not come across this form of spicule myself in the specimens I have examined.

The macroscleres, if present, are either amphioxi or tylostyles, but they are often absent.

The distribution of *Thoosa* is essentially tropical, but several of the species are as yet recorded only from specimens of unknown history. They appear to occur mainly in shells of solid structure or reef-corals from shallow water, but one species described here (*T. investigatoris*, p. 18), was found in a thin Gastropod shell from a depth of over 700 fathoms.

The following species have been recorded, or are here recorded for the first time, from the seas of British India and Ceylon:—

Thoosa radiata, Topsent.*T socialis*, Carter.*T armata*, Topsent.*T hancocci*, Topsent.*Thoosa investigatoris*, nov.*T fischeri*, Topsent.*T laeviaster*, nov.

Of these I have not seen *T socialis*¹ and *T fischeri*,² both of which are only known from Ceylon.

It does not seem advisable at present to attempt to draw up a key to the Indian species. One to all those known in 1891 is given by Topsent on pp. 585-586 of his paper cited after that date on p. 16, and no new species have been published since. Two are described in this paper.

***Thoosa investigatoris*, sp. nov.**

(Plate i, figs. 5, 6).

This is a species with megascleres in the form of pin-like tylostyles and with three types of amphiasters as microscleres, viz. (1)

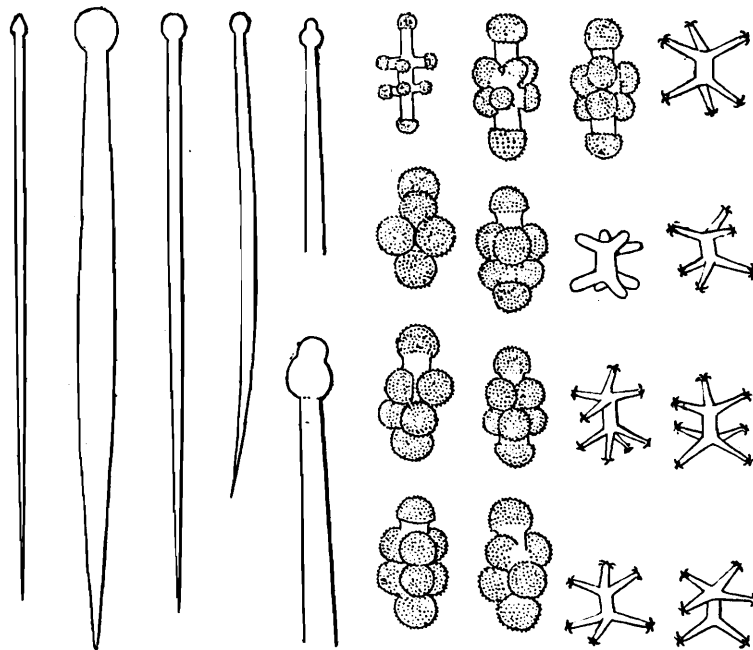


FIG. 3.—Spicules of *Thoosa investigatoris*.

nodular amphiasters typical of the genus, (2) smooth amphiasters with horizontal branches ending in a circle of hooklets, and (3) much stouter smooth amphiasters without hooks or spines of any kind.

General structure.—The sponge consists of a number of tubules which anastomose in one plane and swell out at intervals into not very clearly differentiated chambers of a flattened form and of irregular outline. The whole structure is fragile and delicate, offering in this respect a strong contrast to *Cliona annulifera*,

¹ Carter, 1880, p. 56 (v. p. 2, footnote 3).

² Topsent, 1891, p. 582 (v. p. 16).

which was taken at the same station. The papillae are borne on very short pedicels, as a rule only on what may be called the upper surface of the sponge; occasionally they are also found on the lower surface. I have not been able to detect cellular diaphragms.

Papillae.—Two kinds of papillae have been observed, one of which is apparently inhalent, while the other is probably of a mixed nature. The latter is considerably larger than the former; its diameter is on an average, in normal circumstances, about 1 mm., whereas that of the smaller papillae is only about 0.4 mm. In both cases the vertical walls are straight and the actual papilla does not expand much beyond them. The exhalent apertures are circular and are protected, as is explained below under the heading "Skeleton", by a peculiar arrangement of spicules.

Spicules.—The macroscleres are tylostyles with well differentiated heads usually spherical in form and frequently containing a single large vacuole. The stem is usually curved and spindle-shaped, tapering considerably towards both extremities and considerably swollen in the middle. More slender tylostyles occur in which the stem is much less swollen, but there are also intermediate forms. The shape of the head is not constant, for, especially in the more slender macroscleres, it is sometimes trilobed and sometimes flattened above; occasionally it is even acorn-shaped or quite asymmetrical. In the stouter tylostyles the total length is on an average about 0.34 mm., the greatest thickness of the shaft about 0.02 mm. and that of the head slightly less.

The nodular amphiasters have both the lateral and the terminal nodules or bosses relatively large, nearly spherical and covered densely with minute straight spines. They are joined to the stem, which they often conceal almost completely, by very short smooth pedicels. The average length of the spicule of this type is about 0.0369 mm. and the greatest breadth across the lateral nodules 0.0164 mm.

The smooth amphiasters with terminal hooks on the lateral branches are of the habitual form. Their stem is rather stout and the lateral branches taper straightly towards the tip, which usually bears about six hooklets. The greatest length of the spicule is on an average about 0.0164 mm. and the greatest breadth from tip to tip of the branches 0.0246 mm.

The third type of amphiaster, which is very scarce, is about the same size as the second, which it resembles considerably, but the branches are stouter and bear no terminal hooklets, nor are they inflated at the tips.

Skeleton.—The spicules are arranged to form a skeletal structure in a somewhat more regular manner than is the case in most species of Clionidae.

In the horizontal tubules the macroscleres lie parallel to the surface and in a large proportion of cases point in the same direction. They exhibit, in quite a definite manner, evidence of fasciculation, although in this part of the sponge they do not appear to

be bound together by any horny substance. At certain points, probably where the aperture for a new papilla is about to be excavated, a stout chitinoid covering is secreted over the sponge and the macroscleres adopt a convergent arrangement and are densely massed together. At such places the nodular microscleres are sometimes present in large numbers and form a layer several spicules thick over the protecting mass. The papillae are protected by a dense ring of vertical macroscleres fortified with chitinoid substance and arranged concentrically in several or many circles with the heads resting at the base of the very short vertical tubule. Within this ring, in the case of exhalent orifices, there is an arrangement of convergent macroscleres with their tips meeting almost horizontally and their heads set in a broad spiral of about $1\frac{1}{2}$ turns. Presumably the tips can be separated in the living sponge by rotation of the heads. The whole arrangement is strikingly reminiscent of the diaphragm in the stage of a compound microscope. The smooth amphiasters are scattered in the flesh of the tubules and chambers. Neither they nor the nodular amphiasters play any part in the protection of the external papillae.

Gemmules.—I have found several gemmules in the specimen examined. They are spherical masses of cells of the usual type, but have no horny protective membrane. Each is about 0.374 mm. in diameter. Each gemmule occupies a separate chamber which it fills completely. There is a slender strand of cells connecting it with the active part of the sponge.

Type.—No. Z.E.V 6430/7, *Ind. Mus*, in spirit: in a dead Gastropod shell.

Locality.—Off Ceylon: 703 fathoms (*R.I.M.S. 'Investigator'*).

The form of the nodular microscleres is characteristic, in particular in the large size of the lateral and terminal bosses; otherwise they resemble those of *T. socialis*, Carter. The species is evidently related to *T. armata*, which, however, has the spicules of this type with the bosses perfectly smooth as well as relatively smaller.

A noteworthy feature of *T. investigatoris* is its power of secreting a horny covering for its growing-points when they come in contact with foreign bodies. I hope to show in a subsequent paper that it protects itself in this manner against aggression on the part of a sponge of the genus *Coppatias* that is parasitic in its burrows. At most of the points at which new galleries are being formed in the shell no such covering can be detected, but at some, probably where the sponge is in contact with the outer layers of the shell, and is about to form a new exhalent or inhalent papilla, there is a thick one. It is only where such a covering occurs that the nodular amphioxi are found, and if the covering is very thick, a number of these spicules can usually be discovered in which the spines on the nodules seem to be completely worn away and the nodules themselves even to some extent destroyed. Such spicules lie in or on the outer or distal part of the covering. These facts would

suggest that spicules of this peculiar type play an important part in the perforation of the compact outer layers of the shells in which the sponge constructs its burrows.

***Thoosa armata*, Topsent.**

1887. Topsent, *Arch. Zool. expér. (2)* V², p. 81, pl. vii, fig. 9.
1891. *Id.*, *ibid.* IX, p. 579.
1904. *Id.*, "Spongiaires des Açores" *Res. Camp. Sci. Monaco*, fasc. XXI, p. 106, pl. xi, fig. 5.

In preparations of *Cliona vastifica* from a shell of *Malleus* from the Andaman Is., I find, mingled with the spicules of that species, others of three types that agree well with those of *Thoosa armata* as described and figured by Topsent. They are nodular amphiasters, reduced oxyasters consisting of a pair of long horn-like spines arising from a minute centrum, and smooth, sharply pointed amphioxi. The spicules of other types figured by Topsent I have not found in this very imperfect specimen.

As to the smooth amphioxi, they certainly do not belong to the *Cliona* and no trace of any other sponge but the *Cliona* and the *Thoosa* is present in some of my preparations. Topsent in his original description of *T. armata* described amphioxi of the kind as an essential element in the spiculation of the species, but did not find them in the specimen from the Azores he described in 1904. In my specimen, in parts of which they seem to be definitely associated to form a skeletal structure, they are on an average 0.09 mm. long and 0.002 mm. broad at the thickest part. They are thus rather larger than in Topsent's original example.

Thoosa armata was described from a dried sponge in an oyster-shell from the Gaboon (West Africa), and has also been found in a dead coral in the Azores. It has not hitherto been known from the Indian Ocean. The extraordinary larva was described and figured by Topsent (*op. cit.*) in 1904.

***Thoosa hancocci*, Topsent.**

1887. Topsent, *Arch. Zool. expér. (2)* V², p. 80, pl. vii, fig. 12.
1891. *Id.*, *ibid.*, IX, pp. 577, 580.
1898. Lindgren, *Zool. Jahrb. (Syst. Abth.)* XI, p. 320.
1905. Topsent, *Bull. Mus. Hist. Nat. Paris*, XI, p. 94.

Topsent and Lindgren have described this species as having spicules of three types, (a) tylostyles, (b) nodular amphiasters, and (c) slender amphiasters—Lindgren calls them spirasters—with lateral branches terminating in minute hooks. Topsent (*op. cit.*, 1905) has also described a closely similar species without spicules of the last type (c), and founded for its reception the new genus *Cliothesa*. The only known species of this supposed genus (*C. seurati*, Topsent) only differs from *T. hancocci*, apart from the

supposed generic character, in having the head of the tylostyle oval (instead of usually spherical) and with a group of minute vacuoles in its centre.

In the collection of the Indian Museum there are two shells from the Andamans, one of a *Tridacna* and one of a *Malleus*,¹ that contain the burrows of a Clionid which agrees well with Topsent's description of *T. hancocci* so far as the general structure and the colour are concerned. In the *Tridacna*-shell the papillae of the sponge have been destroyed, but they are well preserved in that of the *Malleus*. In neither specimen have I been able to find a single nodular amphiaser, although there has been no difficulty in removing the papillae for microscopic examination from one of them. The slender amphiasers are abundant in both specimens, scattered in the galleries of the sponge, and the majority of the tylostyles in the galleries have spherical heads, but those in the papillae are variable in shape. In no single spicule can I detect a group of vacuoles in this part.

The question naturally arises, Is *Cliothesa* a distinct genus or merely a phase of *Thoosa*? In considering this question the facts known in reference to other species of the family must be noted. In the first place, it is known that *Cliona celata*² may lose two types of spicules in the course of its latter development and that *Thoosa armata*³ does the same at an earlier stage. Secondly, we know that the nodular amphiasers are sometimes scarce in *T. hancocci* itself and, apparently, may be either confined to the papillae⁴ or scattered throughout the sponge.⁵ Thirdly, in the type-specimens of *T. investigatoris* (*antea*, p. 18) and *T. laeviaster* (p. 23, *postea*) these spicules were not found in the fully formed papillae but in what were apparently papillae in the process of formation. Furthermore, in the case of the former species, they sometimes exhibited distinct traces of wear in that position. All these facts seem to me to point to the possibility of there being a stage, perhaps but seldom attained, in the life-cycle of *Thoosa* at which the characteristic spicules of the genus disappear and the sponge gains nominal generic distinction under the title *Cliothesa*. If I am right, there can, I think, be no doubt that at least one of my specimens from the Andamans has reached this stage.

Thoosa hancocci was originally described from a *Tridacna*-shell from the Indian Ocean. It is apparently common in coral from shallow water in the neighbourhood of Java and was taken by Prof. Stanley Gardiner, also in coral, in the Maldives (*vide* Topsent, 1905, p. 94).

***Thoosa laeviaster*, sp. nov.**

Spicules and fragments of the sponge of this species were found in the piece of dead coral referred to by Carter, whose

¹ One valve of the individual in the other valve of which *Thoosa armata* was found intermingled with *Cliona vastifica*.

² Topsent, 1900, p. 42, etc.

³ Topsent, 1904, p. 111: see synonymy of *T. armata*, p. 21.

⁴ Topsent, 1905, p. 94.

⁵ Lindgren, 1898, p. 321.

notice they apparently escaped, in his account of the sponges of the Mergui Archipelago: *Fauna of the Mergui Archipelago* I, p. 75. It is remarkable in the form of its nodular amphiasters, the "nodules" of which are reduced to short, slender, blunt or pointed branches totally devoid of spines. Reduced spirasters of the type common in the genus are also present, while the macroscleres are smooth amphioxi.

General structure.—Nothing is known of the general structure except that the sponge consists, in part at any rate, of slender apparently cylindrical branches ramifying in dead coral.

Papillae.—The papillae, of which several imperfect examples were extracted, are evidently very small, probably not more than 0.3 mm. in diameter. They are protected by dense masses of upright macroscleres.

Spicules.—The macroscleres are small, slender, smooth, sharply pointed, spindle-shaped amphioxi; a large proportion of them are definitely geniculate in the middle. The average length is 0.08 mm. and the average breadth in the middle 0.003 mm.

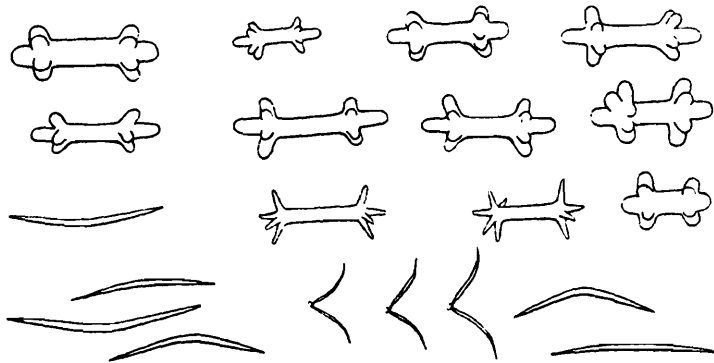


FIG. 4.—Spicules of *Thoosa laeviaster*.

Only two types of microscleres can be distinguished; (a) smooth, rather slender amphiasters surrounded at some little distance from each extremity by a circle of several (normally 4) horizontal branches, which are also smooth and relatively slender. These are usually blunt but sometimes pointed; they are always stouter at the base than at the tips. The length of each branch is usually equal to the distance of its base from the nearest extremity of the shaft, which terminates in the same manner as the branches, and the distance apart of the two circles is considerably greater. The average length of the spicule of this type is from about 0.041 to 0.08 mm.; the average thickness of the shaft from about 0.0065 to 0.013 mm. and the breadth from tip to tip across the branches from 0.0246 to 0.0328 mm., but all these measurements are variable. (b) The second type of microsclere is a reduced oxyaster consisting of a pair of relatively long and slender curved horn-like spines attached close together to a minute centrum.

Skeleton.—From the fragment of sponge extracted from the coral it is evident that the macroscleres are arranged much as in

T. investigatoris. The reduced oxyasters are scattered in the main body of the sponge, while the amphiasters are collected in small groups and associated with films of horny substance in the interior. They also appear, therefore, to have been arranged in the same manner as their homologues in *T. investigatoris*.

Type.—A microscopic preparation mounted in Canada balsam. No. Z.E.V 6639/7. *Ind. Mus.*

Locality.—King Id., Mergui Archipelago; in dead coral (*J. Anderson*).

The form of the amphiaster is unlike that of any other species in the genus, for the "nodules" of these spicules, even when they are smooth as in *Thoosa armata*, are usually short, stout and rounded. It is clear, however, that their form in *T. laevias* does not depart very widely from the generic type and is really nearer that of the normal amphiaster of *T. radiata* (Topsent, 1887, pl. vii, fig. 11) than that of the homologous spicule of *T. armata*.

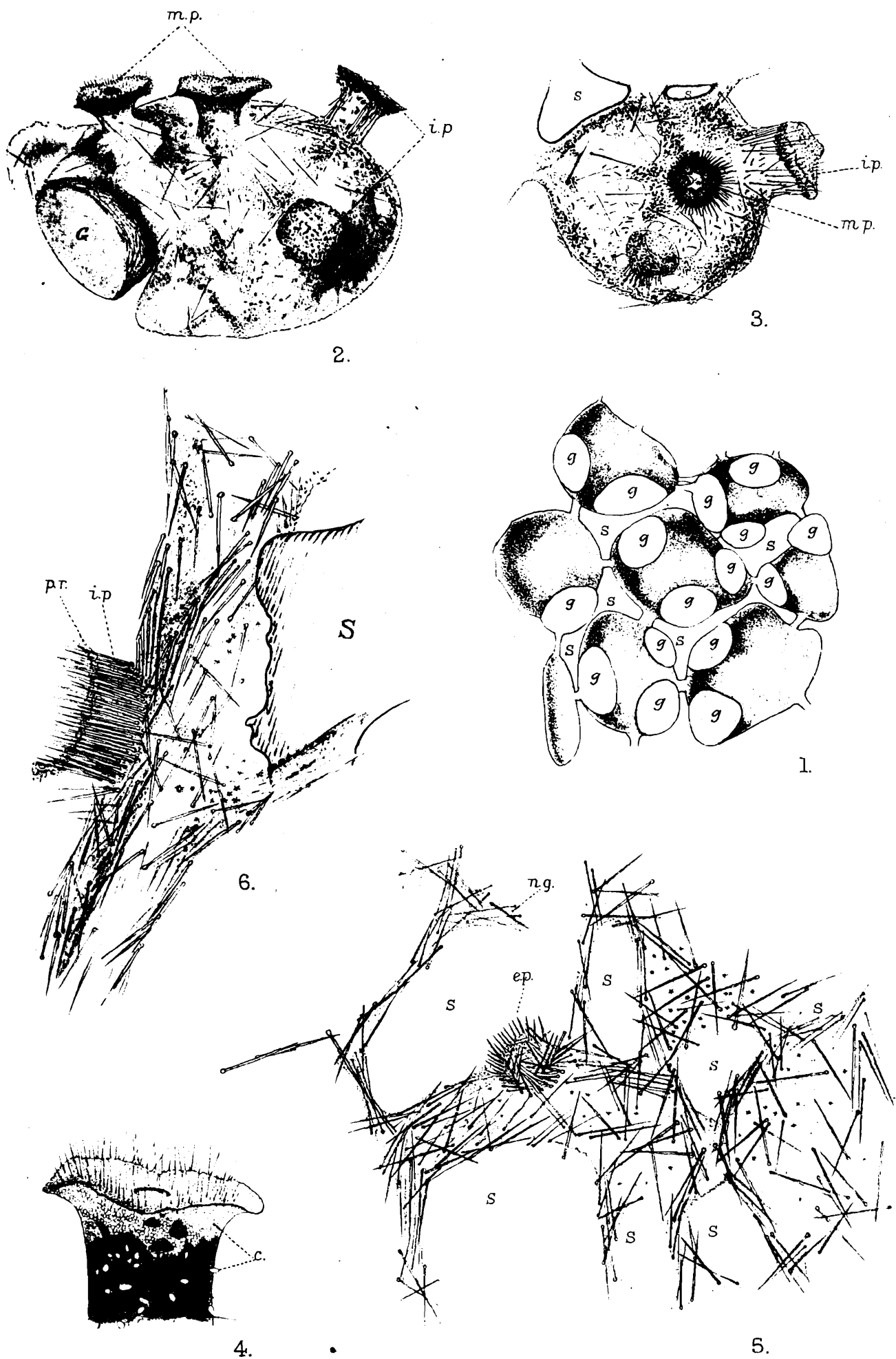
EXPLANATION OF PLATE I.

FIGS. 1, 2, 3, 4. *Cliona annulifera*, sp. nov.

- 1.—Part of type-specimen extricated from the shell in which the sponge had burrowed, viewed from below as an opaque object, $\times$ ca. 30. g. = gemmule: s. = space from which shell-substance has been removed.
- 2.—A single chamber mounted, without staining, in Canada balsam and viewed from one side by transmitted light, $\times$ ca. 57. i.p. = inhalent papilla: m.p. = mixed papilla: G.=gemmule.
- 3.—Another chamber stained with borax carmine and similarly mounted, seen from above by transmitted light, $\times$ ca. 57. Lettering as in figs. 1 and 2.
- 4.—A mixed papilla, viewed obliquely from one side as a solid object, more highly magnified. c. = calcareous granules.

„ 5, 6. *Thoosa investigatoris*, sp. nov.

- 5.—Part of type-specimen extricated from the shell in which the sponge had burrowed, viewed from above by transmitted light, $\times$ ca. 35. e.p. = exhalent papilla: h.r. = horny ring surrounding papilla: n.g. = commencement of a new gallery: s. = space from which shell-substance has been removed.
- 6.—Another part of the same sponge only partially extricated, viewed obliquely by transmitted light, and more highly magnified. i.p. = inhalent papilla: S. = fragment of shell.



A.C. Chowdhary, del.

Bennrose, Collo, Derby.

Figs. 1-4. *Cliona annulifera*. Figs. 5. 6. *Thoosa investigatoris*.

II HERMIT-CRABS FROM THE CHILKA LAKE

By J. R. HENDERSON, M.B., C.M., F.L.S., *Superintendent,
Madras Government Museum.*

The small collection of Paguridæ which forms the subject of this paper was obtained by Dr. N. Annandale and Mr. S. W. Kemp, during their survey of the Chilka Lake, on the Orissa Coast in the Bay of Bengal. Of the five species taken it has only been found necessary to describe one as new. In each of the previously known species reference is made to Col. A. Alcock's "Catalogue of the Indian Decapod Crustacea in the collection of the Indian Museum," part II, Anomura, Fasc. I, Pagurides (1905), where a full bibliography will be found.

Clibanarius padavensis, de Man.

Alcock, p. 44, pl. iy, fig. 2.

Station 22¹, 8698/10. Five specimens of moderate size, including a female with ova.

Station 75, 8700/10. A young specimen with the carapace measuring only 7 mm. in length, yet possessing all the characteristic colour markings.

Station 82, 8705/10. A male, and a female with ova, of moderate size, the carapace of the former measuring 16 mm. in length; also a very young specimen.

Station 83, 8696/10. Six individuals of moderate size, the carapace of the largest (a female) measuring 18 mm. in length.

This species, which shows a special predilection for brackish water, occurs in suitable localities round the Indian coast from Burma to Bombay. It has also been recorded from Singapore, Queensland, New Guinea and New Caledonia.

Clibanarius longitarsis, de Haan.²

Alcock, p. 158.

Station 142, 8968/10. In *Purpura* shells. Two specimens, male and female, the latter which is slightly larger with the carapace 11 mm. long.

¹ An explanation of the station numbers will be given in a subsequent paper dealing in a general manner with the results of our survey of the Lake. (N. A.)

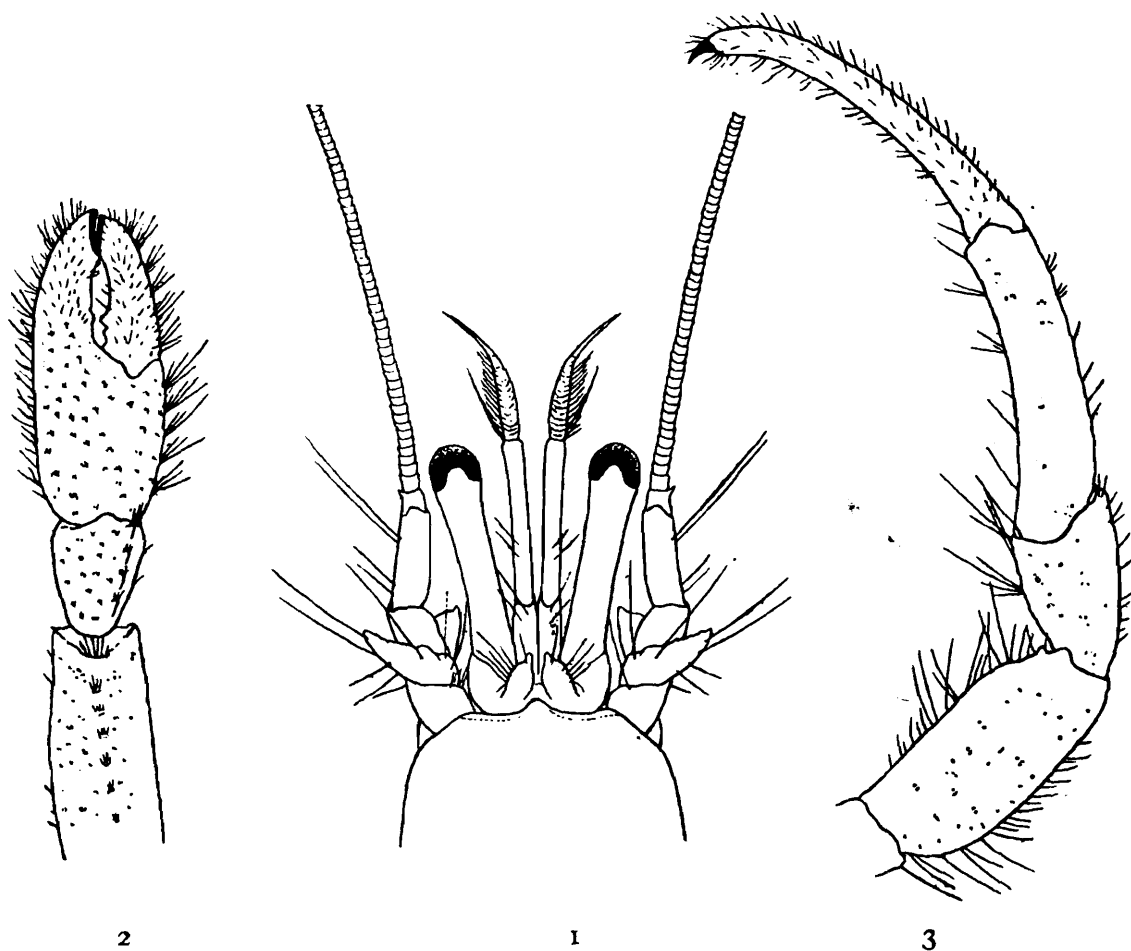
² I take this species as characterized by de Man in his account of the Crustacea collected by Dr. Brock in the Malay Archipelago (Archiv. f. Nat. LIII, p. 441, 1887).

This record is interesting as it tends to show that the species, which was previously known only from the southern part of the east coast so far as India is concerned, probably occurs in suitable localities all along this coast. It is the commonest brackish-water pagurid on the Coromandel coast.

C. longitarsis has been found in various localities from East Africa to Japan.

***Clibanarius olivaceus*, n. sp.**

Station 22, 8698/10. Two males and two females. Also 8710/10, a male, and 8708/10 a very young specimen in a fragmentary condition which probably belongs to the present species.



Clibanarius olivaceus, n. sp.: 1. anterior part of carapace, eyestalks, etc. from above; 2. left cheliped from above; 3. last four segments of second leg from above.

Station 142, 8967/10. A female with the carapace 9 mm. long.

Some small individuals of this species were taken by Dr. Annandale near the mouth of the Adyar River, Madras, in October 1913.

Carapace with the usual tufts of setae, which are most numerous towards the sides and immediately behind the cervical groove. Rostrum moderately prominent, reaching a little beyond the antennal angles of the carapace.

Eyestalks distinctly longer than the anterior border of the carapace and almost as long as the antennular peduncles; the eye occupies about one-tenth of the length of the stalk. Ophthalmic scales with the outer edge setose and faintly spinose.

Antennal acicle setose and slightly spinose, the proximal spinule being most prominent, scarcely reaching the terminal joint of the peduncle; flagellum about one and a half times as long as the carapace.

Chelipeds subequal and similar; merus with the upper margin obscurely serrulate and two spinules at the distal end of the outer lower margin; carpus with a distinct spinule at the distal end of the upper margin and two or three smaller spinules further back on the margin; hand only slightly roughened and comparatively free of setae, with no spines anywhere on its palmar surface; fingers rougher and more setose than the palm, the projections almost becoming spinose towards the finger-tips, when closed exhibiting an intervening hiatus. The length of the hand, including the fingers, is about twice its breadth.

The second and third legs exceed the chelipeds on both sides by the length of the dactyli and nearly half the propodi; a spinule is present at the lower distal end of the merus and another at the upper distal end of the carpus in both pairs of legs. The dactylus of the third leg is about one-fourth longer than the corresponding propodus; the dactylus of the second leg while shorter is still distinctly longer than its propodus.

The colour of spirit specimens is yellowish, with the chelipeds and second and third pairs of legs olive green. The only distinct bands of colour are three pale red lines, on the inner upper and outer surfaces of the eyestalks, though in the specimen from station 142 the upper line is obsolescent. The meral and carpal joints of the second and third legs, particularly the former, show a faint bluish green colour near the upper posterior surface and a reddish brown tinge near the lower margin, but these colours are not sufficiently circumscribed to constitute bands. The dactyli of the second and third legs are buff-coloured.

Length of carapace (in a male) 12 mm., breadth of anterior border of the carapace 4 mm., length of eyestalk 5.5 mm., length of dactylus of second left leg 9.5 mm., length of propodus of second left leg 7.5 mm. The left eyestalk of the type specimen is shorter than the right and is evidently in process of regeneration.

This species is closely related to *C. padavensis*, de Man, and *C. longitarsis* (de Haan), both of which commonly occur in brackish water in India. It agrees with them in the long dactyli of the second and third legs, and in the long eyestalks, which are longer than the anterior border of the carapace, but is readily distinguished from both by its colouration.

In *C. padavensis*¹, there are very distinct deep red or

¹ My remarks on *C. padavensis*, in the Journ. As. Soc. Bengal, LXV pt. ii, p. 520, 1896, were made in error and really apply to *C. longitarsis*.

crimson lines on the second and third legs, eyestalks and chelipeds. In *C. longitarsis*, a pale blue band bordered above and below by red brown occurs on the joints of the second and third legs, being best marked on the propodi, and there are no colour lines on the eyestalks or chelipeds. These distinctive marks are present at all stages of growth, and I am of opinion that colour is a fairly reliable character in separating the species of *Clibanarius*.

In addition to the colour differences, the hand of *C. olivaceus* is much smoother and less hirsute on the upper surface, while the inner margin is devoid of the spinules which occur in the two other species.

Clibanarius sp.

Station 82, 8709/10. Five very small individuals which are too young to identify satisfactorily. They perhaps belong to the last species.

Diogenes miles (Herbst).

Alcock, p. 67, pl. vi, fig. 5.

Ganjam Coast outside the southern part of the Chilka Lake, in a *Voluta* shell, 8706/10. A female with ova in which the carapace measures 15 mm. in length.

This species, which is common on the east coast of India, but so far as I know does not affect brackish water, has a characteristically flattened carapace, and the hand of the left or larger cheliped can be bent almost at right angles to the wrist, the result of living in shells with a long narrow aperture.

Diogenes avarus, Heller.

Alcock, p. 68, pl. vi, fig. 6.

Station 71, 8703/10. Three small specimens.

Station 91, 8764/10. Eleven small specimens, including several females with ova in which the carapace measures less than 5 mm. in length. Also 8707/10; two small specimens.

Station 93, 8701/10. Seven small specimens, one of which, a female with ova, has the carapace 5 mm. long.

Station 94, 8702/10. Two minute specimens.

This small species is common in the South Indian backwaters, but also occurs in the sea, both between tidemarks in places such as the shores of the Gulf of Manar where the surf is not excessive, and in shallow water. As was first pointed out by de Man the lengthening of the carpus and band of the larger cheliped, which is so characteristic a feature of adult males, is much less marked in females and young males. Some individuals appear to attain maturity while of small size; in the present collection there are several females with ova in which the carapace measures 5 mm. in length or even less, while individuals from other localities are found at least double this size.

***Cœnobita rugosus*, Milne-Edwards.**

Alcock, p. 143, pl. xiv, fig. 3.

Station 107, 8966/10. A small specimen in a *Natica* shell.

Station 123, 8965/10. A small specimen.

These specimens, which are evidently immature, as the carapace of the larger one measures only 10 mm. in length, appear to belong to this common Indo-Pacific species. They possess a stridulating organ composed of an oblique row of elongated parallel teeth, on the outer surface of the left palm, and the outer surface of the propodite of the third left leg is separated from the anterior surface by a distinct ridge.

***Cœnobita cavipes*, Stimpson.**

Alcock, p. 146, pl. xiv, fig. 1.

= *C. violascens*, Heller, and *C. compressus*, Ortmann.

Station 79, 8699/10. Three young specimens.

Station 82, 8695/10. A number of young specimens, the largest of which is a female with the carapace 14 mm. long.

Station 95, 8697/10. A half-grown male.

The lower part of the outer surface of the left palm is smooth, and as pointed out by Stimpson is mahogany coloured.

This species is very common in the neighbourhood of the backwaters along the east coast of India, and is frequently found at some distance from the water. It is most active at night.

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III. NOTES ON SOME SOUTH INDIAN BATRACHIA

By C. R. NARAYAN RAO, *Central College, Bangalore.*

I. The Larvae of *Microhyla rubra* and *Rana breviceps*.

These tadpoles have been described by Mr. H. S. Ferguson, F.L.S., late Director of the Trevandrum Museum, in his paper on "A List of Travancore Batrachians," published in the *Journal of the Bombay Natural History Society* (Vol. XV, p. 499). I am of opinion that Mr. Ferguson has mixed up the larvae of *M. rubra* with those of the allied species *M. ornata*, and there is considerable difference between his account of the tadpoles of *R. breviceps* and the specimens I have collected. These facts sufficiently justify the publication of the following notes, in which I purpose to describe the specimens in full and at the end indicate the chief points wherein I differ. I might add here that examples of all these larvae have been sent to Dr. N. Annandale whom I have to thank for examining them.

Larva of *M. rubra*.

H. S. Ferguson, *J.B.N.H.S.*, Vol. XV, 1904, p.506; Boulenger, *Fauna*, p. 491.

Towards the middle of July, a few specimens of this tadpole were obtained at Bangalore from a pond in which rain water had collected. Other tadpoles found in their company were those of *M. ornata*, *R. breviceps* and *Rhacophorus maculatus*. The tadpoles were allowed to complete their metamorphosis in the college aquarium. They may be described as follows :—

The head and body.—Head depressed and almost flat, snout broadly rounded but not squarish. Both dorsal and ventral surfaces of trunk flat. In horizontal section, the body is nearly elliptical. Skin smooth.

Eye and nostril.—Nostrils nearer to the snout than the eyes, and are dorsal. The inter-orbital space nearly six times the inter-nasal. Eyes lateral, visible from below and by no means prominent. Pupil round. (It is vertical in the adult).

Mouth.—Very small, nearly terminal or dorsal: broadly triangular or nearly oval. Upper lip better developed, with a horny edge. Beaks, horny teeth and papillae absent.

Sensory glands and pits.—A conspicuous white glandular area, somewhat dome-shaped, just behind the mouth or between the nostrils. A number of sensory pits round the mouth, especially

about the corners. A fine white glandular streak from nostrils to the outer angle of the eyes, extending along the sides of the body. In a few specimens a similar dorso-median streak is occasionally present.

Spiracle.—Situated in the midventral line, large and broadly "Λ"-shaped, opening directed backwards and is far from the snout. Behind, another pore involved in the lower caudal crest is present, marked abdominal pore in figure B. There is reason to suppose this to represent a secondary spiracle. Water comes out in two streams as may be experimented with carmine solution.

Vent.—Slightly sinistral, inconspicuous, covered over by the lower tail lobe.

Tail.—Muscular portion thick at the root and ends in a very

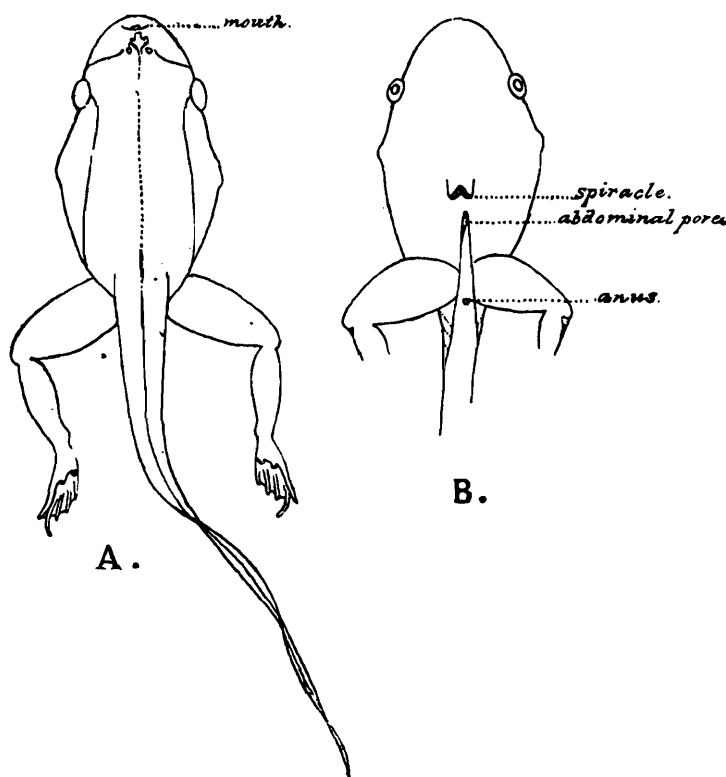


FIG. 1.—Tadpoles of *Microhyla rubra*.

A. Dorsal view. B. Ventral view.

fine flagellum. At the greatest width, i.e. between the thighs, the ventral crest is more than four times the upper membrane. The former begins behind the spiracle and surrounds the second pore. The lobes are delicate and transparent.

Colour.—Live specimens are olive above, beautifully marbled. Spirit specimens do not, however, show this delicate scheme of colour. Following the glandular line of the head and body, is a dark band which throws it in relief. Limbs barred. A brown band across the thighs. Abdomen immaculate, occasionally the throat is bronzed.

Dimensions.—The following are the average measurements of four tadpoles with well-developed hind limbs:—

Total length	40 mm.
Length of head and body	15 mm.
Maximum width of body	9 mm.
Do. depth do.	7 mm.
Do. do. tail	9 mm.

Biological.—The period occupied by development in the aquarium is roughly twenty days, and it must also represent the time taken in nature. *Microhyla* like the other genera of the family Engystomatidae spawns in localities which dry up very soon, and the tadpoles are also otherwise exposed to attacks by ducks and geese. Rapid metamorphosis is apparently a provision, in the case of these thoroughly terrestrial forms, for the preservation of the species.

The larvae float on the surface and the highly contractile mouth is a character which they share in common with the other species, *M. ornata*, noticed by Capt. S. S. Flower and Mr. Ferguson. The food of the tadpoles consists of small micro-organisms such as water fleas, Infusoria and Rotifers. The fine flagellum at the end of the tail is kept lashing the water. As soon as the forelimbs develop, the larvae leave the water and squat on the stones in the aquarium, and if these are removed they easily perish. The metatarsal tubercles are well-developed and the baby frogs with short stumpy tails use them in burrowing. The web which completely invests the toes in the larval stage atrophies when the tadpoles leave the water.

Points of Difference.

I shall next proceed to enumerate briefly the points in which I differ from Mr. Ferguson.

(1) He remarks that the nostrils are nearer the eye than the end of snout.

I make out in my specimens that the converse is true; the distance between the eye and the nostril is at least $1\frac{1}{2}$ mm. greater than that between the nostrils and snout.

(2) The spiraculum is described by him as being directed *downwards* and backwards.

I notice that the spiracle is directed *downwards* and backwards in the larvae of *M. ornata* in which the abdomen is laterally compressed; while in *M. rubra*, the body being dorso-ventrally depressed, the spiraculum opens backwards as a rule.

(3) Again Mr. Ferguson observes that the spiraculum is close to the anus which also opens in middle line in the lower edge of the subcaudal crest.

It is obvious that he mistakes the abdominal pore for the anus which for anatomical reasons cannot occupy that position. The anus, however, is normal in position between the hind legs and is slightly sinistral.

(4) In describing the colour, Mr. Ferguson observes that in life the body is almost transparent.

I am perfectly certain that the tadpoles of *M. rubra* are opaque while the transparent character of the larvae of *M. ornata* is noticed by Capt. S. S. Flower and Mr. A. L. Butler.

(5) Further down Mr. Ferguson notices that the dark marks form a more or less diamond-shaped figure on the back.

This is again a feature characteristic of the tadpoles of *M. ornata* and not met with in the allied form, viz. *M. rubra*. In the former species, if we follow the progress of metamorphosis, we may notice the diamond-shaped figure developing in the adult into "a large dark marking on the back, beginning between the eyes and widening as it extends to the hind part of the body." Boulenger (*Fauna*, p. 412).

Habits of the Adult.

This frog does not appear to extend into the Malay Peninsula as may be judged from Mr. A. L. Butler's account of the batrachians of that region (*J.B.N.H.S.*, Vol. XV, p. 387), nor does it occur in such abundance as the other little frog *M. ornata*. It is a deep digger as is evidenced by the presence of two powerfully developed metatarsal tubercles, and I have myself obtained specimens nearly two feet from the surface. The frog does not come out of the burrow during the hot weather and only a very heavy shower of rain, an inch and a half or two, can induce it to leave its hiding place. During the breeding season which in Madras comes off between November and January, and in Bangalore between June and September, the batrachian generally remains on the surface hiding by day under stones, flower pots or in hedges and coming out to feed or spawn by night. The frogs are very good jumpers, but if kept long in water show signs of distress. They feed voraciously on young termites and can stand captivity well. The call notes resemble the shrill chirping of a tree cricket from which they however differ in being an interrupted cry. It is by no means difficult to distinguish the cry of this species in the general babel of amphibian voices that ensue a heavy shower of rain in the night.

Larva of *R. breviceps*.

H. S. Ferguson, *J.B.N.H.S.*, Vol. XV, 1904, p. 502; Boulenger, *Fauna*, p. 451.

These tadpoles were taken in conjunction with the larvae of *M. rubra* and were reared in the college aquarium. They differ from Mr. Ferguson's account in so many particulars that I have no doubt that he is describing some other species. My specimens may be described thus:—

The head and body.—Body short and oval. Dorsal and ventral surfaces moderately flat or slightly arched. Snout obtuse or

rounded. Length of body about one and a half times the breadth. Mouth ventral.

Nostril and eye.—Small, not prominent, nostrils dorsal, nearer to eyes than to mouth. The inter-orbital space is slightly more than twice the distance between the nostrils. Eyes dorso-lateral.

Mouth.—Ventral, small. Lower lip better developed and directed forwards. Both lips are bare of papillae, which, however, are large and are aggregated in two or three rows in the corners of the mouth. Occasionally in a few cases a small ovoid gland may be present in the same region. Beaks horny and not powerful; both finely serrated; lower jaw broadly V-shaped and the upper crescentic. Dental formula, 1 : 1/3.

Sensory pits and glands.—Occur generally scattered on the head. A fine row of whitish glands from the eyes to the tympanum. A dorso-median streak sometimes found.

Spiracle.—Tubular, sinistral, pointing upwards and slightly backwards; a fairly circular opening; somewhat low on the side, nearer to eye than to root of tail.

Vent.—Also sinistral, a fairly prominent tube.

Tail.—Tip not pointed; dorsal lobe beginning much behind the root of legs, is strongly arched. The ventral poorly developed, the outer margin of which is almost parallel to the long axis of the muscular portion. The greatest depth of tail is $\frac{1}{5}$ of the total length, and at this part the lower membrane is only $\frac{1}{3}$ of the upper. Muscular portion strongly developed.

Skin and colouration.—Skin either granular or warty with strongly developed tubercles. Dorsal surface deep grey with broadly V-shaped dark mark between the eyes, and M-shaped, sometimes broken, marks on the back. Ventral surface whitish and sides finely dotted in a few specimens. The muscular portion and lobes and tail deeply blotched. Limbs barred.

Limbs.—Short, toes poorly webbed at the base. The metatarsal tubercle well-developed, about the size of the first toe. Subarticular tubercles well formed.

Dimensions.—A fully grown tadpole measures as follows :—

Total length	50 mm.
Length of body	20 mm.
„ „ tail	30 mm.
Maximum breadth of body	13 mm.
„ depth „ „	9 mm.
„ „ „ tail	8 mm.

Biological.—The time occupied by the development of this frog is almost the same as that taken by the other burrowing types, viz. 18 to 20 days. I have noticed that these larvae remain at the bottom of the aquarium, occasionally coming to the surface to breathe air. When disturbed, they would move on their legs, rather than swim. They were fed on weeds and also on dead tadpoles. Foul water is death to them. Like the larvae of other

Engystomatidae, they leave the water as soon as the front limbs sprout.

Points of Difference.

The particulars in which the above description differs from Mr. Ferguson's may be briefly indicated below.

(1) He states at page 502 of the journal cited above, that the length of the body is one and three quarters its breadth.

I have measured ten full-grown specimens and I find the average ratio of length to breadth is as 15 : 10 mm, in other words the length is one and a half times the breadth.

(2) Further he describes that the distance between the eyes is one and a quarter that between the nostrils and is equal to the width of the mouth.

In measuring the same ten specimens, I find that the inter-orbital space is more than twice the internasal, and is one and two-thirds of the width of the mouth.

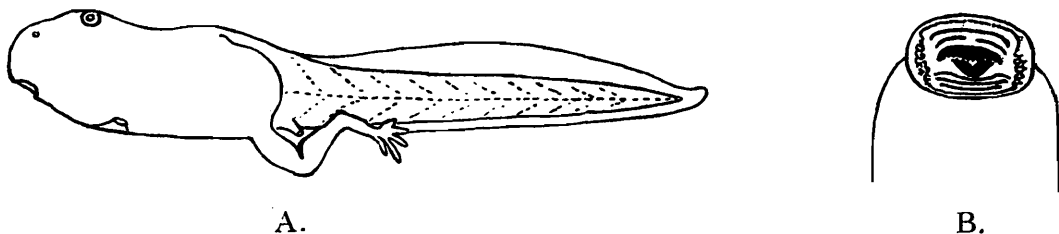


FIG. 2.—Tadpoles of *Rana breviceps*.
A. Lateral view. B. mouth.

(3) Mr. Ferguson states in regard to the spiraculum that it is visible above and below.

In all my specimens the spiracle is so low on the side that it is visible from neither view.

(4) He makes out that the anal opening is on the middle line.

All the adult tadpoles in my collection possess a sinistral vent.

(5) The tail is described in the Travancore specimens as being acutely pointed.

Almost all the specimens in my collection show a rounded tip.

(6) In the description of mouth parts, Mr. Ferguson states that the upper mandible has a blunt tooth-like prominence and that the outermost row of teeth on the lower lip is less than half the length of the middle row which again is shorter than the upper.

The prominence spoken of, perhaps such as is met with in the larva of *R. tigrina*, is not discoverable and as regards

the rows of horny teeth, the first two rows are nearly equal, while the third is only slightly shorter than either the first or the second.

(7) The total length of Mr. Ferguson's specimens is 41 mm.

The maximum length of my specimens exceeds this by at least 9 mm.

Habits of the Adult.

The adult frog is thoroughly terrestrial and the burrowing habits have produced an external appearance not unlike that of *Cacopus systoma*: a rounded snout, small mouth, a stout body, short hind limbs, a powerful metatarsal tubercle and very slight web. It leads a solitary life and congregates only during the pairing season. A light vertebral line is present in most specimens and its occurrence is purely arbitrary. It is not one of the concert-giving frogs like *R. cyanophlyctis* and the call notes may be expressed by the short syllables "Rut-Rut-Rut," uttered in quick succession. The batrachian is entirely nocturnal in its habits and young frogs stand captivity much better than adult examples.

II. II The Distribution and Habits of *Bufo fergusoni*.

This little toad has been described by Dr. G. A. Boulenger, (*J.B.N.H.S.*, Vol. VII, p. 317).

In the article quoted above (*viz.* "A list of Travancore Batrachians"), Mr. Ferguson makes the following remark in the opening lines: "There have been so far thirty-four species of Batrachians described as occurring in Travancore, three of which have not been found elsewhere as yet. They are *Rana aurantiaca*, *Ixalus travancoricus* and *Bufo fergusoni*" (*J.B.N.H.S.*, Vol. XV, 1904, p. 499).

I have no doubt that this species of *Bufo* enjoys a much wider distribution. In 1903, two specimens were taken in the compound of the then residence of Dr. William Miller in Nungambakam, Madras; one of which was sent to Dr. G. A. Boulenger, who in acknowledging receipt of the toad, mentions that it is also known from Ceylon. Since then specimens have been obtained from S. Malabar and the outlying districts of Mysore. It is possible that the little toad may be found in North India, though, however, its occurrence is not yet reported.¹

The following is a short account of the observations made on the habits of this animal. It is entirely nocturnal and does not appear to occur in any large numbers and is certainly one of the rare toads. When given loose earth, it burrows with great ease. It feeds almost exclusively on termites. It does not touch black ants, smaller beetles and earthworms which form the staple

¹ I think that this toad is replaced in Northern India by *B. stomaticus*, Lütken.—N. A.

food of the bigger toads like *B. melanostictus*. Walking is the normal mode of progression and it can also run, especially if quarry is sighted at a distance. When the animal walks, the body is lifted from the ground, but is still underhung from the limbs, and the movement has all the awkwardness of a *Calotes*, which arises from the inequalities of the limbs. In trying to take a wider range of view of the surroundings, the body is supported on the four legs and the animal may move in that condition somewhat mammal-wise. In running the head is kept low. When left on the table it gently crawls round the edge (body almost touching the surface) measuring the height, and prefers to remain quiet in the centre to performing the heroic feat of jumping off. Even if pressed under the arm pit, it does not utter the plaintive metallic cry characteristic of the common toad. When held, it does not struggle to escape, but will remain quiet and even pick up white ants from off one's hand. If thrown in water, especially if it is deep, it darts here and there and then is easily drowned if not rescued in time.

IV SOME ORIENTAL SAWFLIES IN THE INDIAN MUSEUM.

By S. A. ROHWER, *Bureau of Entomology, United States
Department of Agriculture, Washington, D.C.*

In the fall of 1912 the writer received, on his request, the unnamed sawflies of the Indian Museum for study. This collection contained some new species and genera and certain species previously described. A report of the named species and descriptions of the new species and genera will be found on the following pages. With permission of the authorities of the Indian Museum certain duplicates were retained; these have been placed in the collections of the United States National Museum. Thanks are due the authorities of the Indian Museum for the privilege of studying this collection, for their generosity in giving duplicates, and for the extending of the original time limit.

Superfamily *SIRICOIDEA*.

Genus *Sirex*, Linnaeus.

Sirex imperialis, Kirby.

One male from Shillong, Assam (*La Touche*).

This male has the apical margins of the tergites rufous and the wings more yellowish than the description of the female indicates.

Genus *Xiphydria*, Latreille.

Xiphydria orientalis, Westwood.

One female from Kurseong, East Himalayas, collected May 21-29, 1906, at an altitude of 5,000 feet (N. A.).

This specimen differs from the original description in the antefurcal second recurrent vein, but is no doubt Westwood's species. The mandibles are quadridentate; the head around the ocelli is striato-punctate.

Superfamily *TENTHREDINOIDEA*

Family CIMBICIDAE.

Genus *Abia*, Leach.

Abia melanoceros, Cameron.

One male from Khasi Hills, Assam.

Family ARGIDAE.

Genus *Cibdela*, Konow.*Cibdela janthina* (Klug)

One male from Sadiya, Assam.

Genus *Athermantus*, Kirby.

In 1882 (List Hym. Brit. Mus., vol. I, p. 54) Kirby characterized his genus *Athermantus* for *Hylotoma imperialis*, Smith. Kirby's description is brief and the figure is in part incorrect, so this genus has not been well understood. Konow in his table in the Genera Insectorum (fasc. 29, 1905, p. 13) separates Kirby's genus from the other Argini without a superapical spur on the hind tibiae, by the compressed hind tibiae. In his table of the genera of Argidae in Zeit. Hym. Dipt., vol. 7, 1907, p. 185, Konow abandons the character of compressed hind tibiae and separates *Athermantus* from the other genera on venational characters. Due to the inaccuracy of the artist and the probability that Konow had never seen a specimen of *Athermantus*, this separation cannot be used. Mr. Meade-Waldo has kindly examined the type of *Athermantus imperialis* (Smith) and from his notes and the descriptions there can be no doubt that the specimen before me is correctly determined. The following descriptive notes are given to more properly establish the identity of this genus:—

Closely allied to *Cibdela*, Konow, but may be separated from that genus by the following comparison:—

ATHERMANTUS, Kirby.

Facial quadrangle much broader than the length of the eye.

Posterior orbits much broader than the cephalo-caudad diameter of the eye.

Malar space longer than the length of pedicellum.

Postocellar area well defined.

Lateral ocelli behind the supra-orbital line.

Propodeum without a median furrow.

Posterior tibiae compressed.

CIBDELA, Konow.

Facial quadrangle with its width subequal or but little greater than the length of the eye.

Posterior orbits much narrower than the cephalo-caudad diameter of the eye.

Malar space narrower than the length of pedicellum.

Postocellar area obsolete.

Lateral ocelli with their anterior margins on the supra-orbital line.

Propodeum with a faint median furrow.

Posterior tibiae not compressed.

In Konow's table in Zeit. Hym. Dipt., vol. 7, 1907, p. 185, this should fall next to *Cibdela*, but would be separated by the above comparison.

Athermantus imperialis (Smith).

One female from Kurseong, East Himalayas, collected August 6, 1909, at an altitude of 6,000 feet (*E. D'Abreu*). Indian Museum No. $\frac{4630}{19}$.

Genus **Arge**, Schrank.

Arge fumipennis (Smith).

Two females from Almora, Kumaon, collected September 3-12, 1911, at an altitude of 5,500 feet (*C. Paiva*).

Arge luteiventris (Cameron).

Fourteen specimens, males and females, from Shillong, Assam (*La Touche*).

Arge xanthogastra (Cameron).

Two specimens from Almora, Kumaon, collected June 27, 1911, at an altitude of 5,500 feet (*C. Paiva*).

Arge albocincta (Cameron).

Hylotoma albocincta, Cameron, Trans. Ent. Soc. London, 1876, p. 459.

It may be advisable to make a new genus for this characteristic species which has the large eyes almost touching the base of the mandibles, but until more material has been studied the author feels loath to propose such a genus. The following characters apply to the specimen at hand: Emargination of the clypeus sub-V-ed; supraclypeal foveæ deep, elongate; frontal basin well defined, two and one-third times as long as its dorsal width; a shallow depression in front of the anterior ocellus; postocellar furrow angulate anteriorly; postocellar area not defined laterally; head and thorax shining, with sparse, fine punctures; basal vein almost the length of the intracostal vein basad of cubitus; second cubital cell parallel-sided, about three times as long as apical width; apical abdominal segment with dense white hair.

One female, Shillong, Assam (*La Touche*) in the Indian Museum Collection No. $\frac{4709}{19}$.

Genus **Pampsilota**, Konow.

Pampsilota sinensis (Kirby).

Hylotoma microcephala, Cameron, Trans. Ent. Soc. London, 1876, p. 460. (*nec* Vollenhoven).

Hylotoma sinensis, Kirby, List Hym. Brit. Mus., vol. I, 1882, p. 72, pl. 5, fig. 2.

Eight specimens, males and females, from Assam (Sadiya, 5 specimens, "Sibs" (Sibsagar) N.E. Assam 1 specimen, and 2 without definite locality) forwarded by the Indian Museum, agree well with Cameron's and Kirby's accounts. They belong to the

genus *Pampsilota* which easily explains Kirby's inability to detect superapical spurs.

***Pampsilota nigriceps*, sp. n.**

This species is probably more closely allied to *sinensis* (Kirby) than any other described species of this genus, but it may be differentiated from Kirby's species by the black legs and black tergites.

Female.—Length 11 mm. Anterior margin of the clypeus very slightly incurved; supraclypeal area black; frontal fovea open below, extending parallel until it reaches the anterior margin of the anterior ocellus, with an accentuated triangular-shaped depression opposite the upper margin of the antennae; postocellar line distinctly shorter than the ocellocular line; postocellar furrow well defined, about the width of the posterior ocellus behind the posterior ocelli; postocellar area strongly convex, slightly parted by a median furrow; antennae typical for the genus, extending to the posterior margin of the scutellum. Rufo-ferrugineous; head except the palpi black; scutellum, metanotum, tergites except the lateral margin and the apical portion of the posterior ones, the sheath above, mesosternum and legs black; the anterior legs beneath are piceous; wings dusky hyaline, venation black.

Male.—Length 8 mm. What appears to be the male of this species has the frontal fovea closed below and differs in colour in having the scutum and the basal portion of the prescutum black, and in the piceous stigma and paler wings.

India. Described from two females, one type, and one male, allotype: the type female from Mungphu, Sikkim; the paratype female from Sikkim, May 1912; the allotype from Sadon, Upper Burma, collected at an altitude of 7,000 feet, April, 1911 (*E. Colenso*).

Type and allotype in Indian Museum, type No. $\frac{7921}{8}$, allotype $\frac{4760}{19}$.

Paratype—(Female) Type Cat. No. 18530, U.S.N.M.

Family TENTHREDINIDAE.

Genus *Xenapates*, Kirby.

***Xenapates incerta* (Cameron).**

Two females from Sikkim, East Himalayas; collected May, 1912. One female from Ghumti, Darjiling district, East Himalayas, collected July, 1911, at a calculated altitude of 4,000 feet, by F. H. Gravely. One male from Kurseong, East Himalayas, collected June 29, 1910, at an altitude between 4,000 and 8,000 feet (*N. Annandale*). One female from Sadiya, Assam.

***Monostegidea*, gen. n.**

This genus belongs to the tribe Allantini where it is related to *Monostegia*, Costa and *Monsoma*, MacGillivray. It may be

separated from both of these by having the antennae long and slender and the third and fourth joints subequal.

Malar space distinct; clypeus arcuately emarginate (the depth of the emargination varies considerably); antennal furrows complete but not strong; orbital carina obsolete; posterior orbits narrower than or subequal with cephalo-caudad diameter of the eye; antennae long and slender, pedicellum wider than long, third and fourth joints subequal; head and thorax shining, almost impunctate; tarsal claws cleft, inner tooth shorter; first transverse cubitus present; nervulus its length from the basal; hind wings with one discal cell, nervellus at right angles with the anal vein; apical joints of the hind tarsi shorter than the two preceding.

Type.—*Poecilosoma nigriceps*, Cameron.

***Monostegidea nigriceps* (Cameron) Rohwer.**

Poecilosoma nigriceps, Cameron, Jn. Bombay Nat. Hist. Soc., Vol. XIV, 1902, p. 442.

This species is represented in material received from the Indian Museum from the following localities:—

Darjiling, altitude 7,000 feet. Two males collected by C. Paiva. Kurseong, altitude 5,000 feet. Two females and three males; collector not given.

Siliguri, base of the East Himalayas. Three females collected by Museum collector.

Ghumti, altitude 4,000 feet. One female collected by F. H. Gravely.

***Monostegidea leucomelaena*, sp. n.**

This resembles to some extent *Taxonus fulvipes* as described by Cameron, but it is not in agreement with Cameron's description in many characters. It can readily be separated by the pale spot on the scutellum.

Female.—Length 6 mm. Anterior margin of the clypeus deeply, narrowly, arcuately emarginate, the lobes broad, obtusely rounded apically; supraclypeal area rectangular in outline, strongly convex; supraclypeal foveae greatly reduced, below the antennal fovea; middle fovea crescent-shaped; antennal furrows uninterrupted, not complete dorsally; no depression in front of the anterior ocellus; postocellar furrows distinctly defined, angulate anteriorly; postocellar line less than one half as long as the ocellocular line, shorter than the ocelloccipital line; third, fourth and fifth antennal joints subequal; stigma gently rounded on the lower margin; transverse radius joining the radius slightly beyond the middle of the third cubital cell; sheath straight above, obtuse at apex and obliquely rounded below. Black with white markings; head black; mouth parts except the apices of the mandibles, face below the antennae, inner orbits to the top of the eye, posterior orbits to above the upper margin of the eye, white; pronotum

black; tegulae white; mesoscutum black; scutellum black with a small white spot anteriorly; mesepisternum white except along the dorsal margin; entire ventral part of the insect white; abdomen black above, except the narrow lateral margin of the segments; venter white; legs yellowish; white posterior tarsi dusky; antennae black; wings hyaline, iridescent; venation dark brown, stigma pale brown, paler at base.

Male.—Length 5 mm. Agrees with female except in the sexual characters.

Darjiling, East Himalayas. Described from one female and six males collected at an altitude of 7,000 feet, May 25-29 (*E. Brunetti*).

Type, *allotype* and *paratype* in the Indian Museum. *Type* No. $\frac{4673}{19}$; and *allotype*, No. $\frac{4683}{19}$.

Paratype in U.S.N.M.

Genus *Tenthredella*, Rohwer.

Tenthredella assamensis (Konow).

One female from the Khasi Hills, Assam, which agrees very well with the original description. The basin is shallow, bounded by low rounded walls; clypeal lobes obtusely triangular; post-ocellar area slightly wider than long.

Tenthredella carinifrons (Cameron).

One female from Darjiling, collected May 28, 1910, at an altitude of 7,000 feet (*E. Brunetti*).

Tenthredella segregata (Konow).

Two females from Sikkim, Eastern Himalayas.

Tenthredella turneri, Rohwer.

One female from Shillong, Assam.

Tenthredella xanthoptera (Cameron).

One female from Kurseong, East Himalayas, collected September 7, 1909, at an altitude of 5,000 feet.

This specimen, which agrees well with the original description, has the scutellum pyramidal; anterior ocellus in a well defined, shining basin which is deeper than the rest of the frontal basin; labrum longer than wide, rounded apically; sheath subparallel-sided, with apex regularly rounded; mesepisternum strongly angulate below.

Tenthredella annandalei, sp. n.

This species may be readily separated from the other species of this group by the black posterior tibiae, the pale posterior

femora, the pyramidal scutellum, and in having the postocellar area broader than long.

Female.—Length 14 mm.; length of the antennae 10.5 mm. Labrum broadly rounded, surface subopaque with a few large setigerous punctures; clypeus shining with a deep, narrow, arcuate emargination, the lobes broad, truncate; supraclypeal foveae deep, punctiform; supraclypeal area flat, slightly carinate dorsally; head concave in front; a deep longitudinal depression from the base of the antenna to the anterior ocellus, but below the anterior ocellus broadens into a diamond-shaped area which meets immediately behind the anterior ocellus; antennal furrows poorly defined; ocelli little less than an equilateral triangle; postocellar area sharply defined laterally, and defined anteriorly by shallow postocellar furrow, one-fifth longer than the latrad width; head shining, practically impunctate; antennae slender, the third and fourth joints subequal; ~~thorax~~ shining; scutellum pyramidal; stigma long and narrow, tapering apically; transverse radius strongly curved, received in the third cubital cell distinctly beyond the middle but not in the apical third; third cubital cell on the radius longer than the first and second; second recurrent vein strongly bullated, joining the cubitus a little less than the length of the curved second transverse cubitus beyond the base of the third cubital cell; spurs of the posterior tibiae of equal length, about half as long as the posterior basitarsus; sheath straight above, apex rounded, the lower margin convex. Rufo-ferrugineous with distinct, erect black hairs; clypeus, labrum, mandibles except apices, inner orbits of the eyes and tegulae rufo-stramineous; antennae black; scape stramineous beneath; apical three abdominal segments black; legs colour of the body except the posterior tibiae beyond the basal third and the posterior tarsi which are black; wings yellow hyaline, strongly dusky beyond the apex of the stigma; most of the venation colour of the wing but the median and basal veins black; stigma yellow.

Kurseong, East Himalayas. Described from one female collected at an altitude between 4,500 and 5,000 feet, on June 22, 1910 by Dr. N. Annandale, after whom the species is named.

Type.—Indian Museum No. $\frac{4608}{19}$.

Genus *Parastatis*, Kirby.

This is hardly more than a species group of *Tenthredo*, Linnaeus.

Parastatis indica, Kirby.

Four specimens from Sikkim.

Genus *Pëus*, Konow.

Pëus privus, Konow.

One female from Kurseong, East Himalayas, collected August 14, 1909, at an altitude of 6,000 feet (*D'Abreu*).

Genus *Fethalia*, Cameron.

Konow in the *Genera Insectorum*, 1905, Fasc. 29, p. 132, places the genus *Fethalia*, Cameron, as a synonym of *Tenthredo* (*Allantus*), but a careful examination of Cameron's description indicates that this genus is good and is more closely allied to the genera *Pëus*, Konow, and *Jermakia*, Jakovlev. Cameron says that there is no "blotch" on the abdomen. This is taken to mean that the first tergite is without a longitudinal furrow. The three genera of the Tenthredinini which do not have longitudinal furrows are *Jermakia*, *Fethalia* and *Pëus*. *Jermakia* can be readily separated from *Fethalia* and *Pëus* by the obsolete malar space. The only character in Cameron's description which will separate *Fethalia* from *Pëus* is the short antennae. Until examination of Cameron's type has been made these two genera had best be regarded as distinct. It may be, however, that they are not separable as the relative length of the antennae when taken alone can hardly be considered as a generic character in this group.

Genus *Pachyprotasis*, Hartig.*Pachyprotasis versicolor*, Cameron.

Three females and four males from Darjiling, East Himalayas, collected May 25, 1910, at an altitude of 7,000 feet (*E. Brunetti*).

Genus *Athalia*, Leach.*Athalia infumata* (Marlatt).

One male from Bijrani, Naini-Tal District, base of West Himalayas, collected March 10, 1910.

Athalia proxima (Klug).

Six specimens from Calcutta; two from Shillong, Assam (*La Touche*); one from Mangaldai, Assam; two from Bangalore, South India; and one from Sonali, Purneah District, Behar.

Genus *Anapeptamena*, Konow.*Anapeptamena viridipes* (Cameron).

One female from Siliguri, base of East Himalayas, collected July 18-20, 1907.

In the original description, fifth line from the bottom of page "second" should be changed to "third", and in the fourth line from bottom of page "third" should be changed to "second".

Busarbidea, gen. n.

Type.—*Busarbidea himalaiensis*, new species.

Clypeus arcuately emarginate; malar space wanting; inner margins of the eyes parallel; pentagonal area large, well defined

and with a transverse carina from its lateral margin to near inner margin of eye; posterior orbits rather narrow, with a strong, well defined carina; antennae slender, the third joint distinctly longer than the fourth; pedicellum subequal in length with the scape, much longer than wide; basal vein curved, joining the subcosta well basad to the origin of the cubitus, somewhat divergent with the first recurrent; nervulus at about middle of cell; costa enlarged apically; lanceolate cell with a nearly straight cross-vein; hind wings with two discal cells and a petiolate anal cell; claws cleft, inner tooth shorter; hind basitarsus subequal with following joints.

This genus, which belongs to the Selandriinae, is very closely related to *Anapeptamena*, Konow, but may be distinguished by the presence of a cross-vein in the lanceolate cell.

***Busarbidea himalaiensis*, sp. n.**

Female.—Length 5 mm. Anterior margin of the clypeus depressed, rather deeply arcuately emarginate, basal portion convex; supraclypeal area uniformly convex; supraclypeal foveae deep, punctiform; middle fovea nearly quadrate in outline, not sharply separated from the pentagonal area; pentagonal area broader on its ventral margin than the dorsad-ventrad length; from its dorsal margin is a short rather poorly defined carina which extends posteriorly one-third the length of the postocellar area; postocellar area sharply defined laterally narrowing anteriorly; posterior margin subequal with the median cephalo-caudad length; postocellar line one-fifth shorter than the ocellocular line; antennae distinctly compressed beyond the fifth joint; fourth and fifth joints subequal; the third slightly longer than the fourth; head and thorax shining, impunctate; stigma evenly rounded below; second cubital cell shorter on both radius and cubitus than the third; transverse radius strongly curved, received at the apical third; third transverse cubitus twice as long as the second; sheath robust, straight above, obtuse apically, oblique beneath. Black; clypeus, labrum, palpi, first two joints of the flagellum, tegulae, posterior angles of the pronotum, legs yellowish; wings hyaline, faintly dusky; venation dark brown; head and thorax with short black hair.

Male.—Length 4 mm. Differs from the description of the female in having the body markings piceous; hypopygidium truncate apically, the angles rounded.

East Himalayas. Described from one female (type) collected at Siliguri, April 18-20, 1907, by a Museum collector, and from one male (allotype), and one female (paratype) from Kurseong, at an altitude of 5,000 feet.

Type and *allotype* in the Indian Museum. Type No. $\frac{4600}{9}$, allotype $\frac{2601}{12}$.

Paratype in U.S.N.M.

Genus *Aneugmenus*, Hartig.*Aneugmenus annandalei*, sp. n.

This species is related to the European *morio* but may be separated from it by head characters, judging from specimens of *morio* determined by Konow, now in the National Museum.

Female.—Length 5 mm. Labrum truncate, convex; clypeus convex; anterior margin shallowly arcuately emarginate, its surface with scattered punctures; supraclypeal area low, flat; supraclypeal elongate, not connected with the antennal foveae; middle fovea well defined, quadrate in outline; frontal foveae punctiform, deep, lower margin slightly below the line drawn tangent to the dorsal margin of the middle fovea; pentagonal area indicated by a U-shaped raised area the dorsal margin of which is inside of the lateral ocelli; posterior orbits and genae without carinae; postocellar area convex, poorly defined laterally by short furrows, not defined anteriorly; postocellar line subequal with the ocellocular line; pedicellum wider apically, longer than its apical width; third antennal joint little shorter than the fourth and fifth; head and thorax shining; nervulus less than its length from the end of the cell; first transverse cubitus obsolete; stigma broad, uniformly rounded beneath; transverse radius oblique, joining the radius at about the apical third or a little beyond that; third transverse cubitus about three times as long as second; lanceolate cell of the hind wings petiolate, petiole half as long as the nervellus; posterior basitarsus somewhat shorter than the following joints; claws cleft. Black; palpi and legs, except the infusate apical joints of the tarsi, yellow; head and thorax with short gray hair; wings dusky hyaline; venation black.

Male.—Length 3.5 mm. Differs from the female in having the bases of the coxae black.

Bangalore, South India. Described from one female (type) and one male (allotype) collected at a calculated altitude of 3,000 feet, October 15, 1910 by Dr. N. Annandale, after whom the species is named.

Type.—In the Indian Museum No. $\frac{4750}{19}$.

Allotype in U.S.N.M.

Genus *Nesoselandria*, Rohwer.*Nesoselandria rufiventris*, sp. n.

Readily separated by the fulvous abdomen.

Female.—Length 4 mm. Anterior margin of the clypeus truncate; supraclypeal area convex; supraclypeal foveae obsolete; middle fovea transverse, well defined; lateral foveae punctiform with their lower margin tangent with the upper margin of the middle fovea; head above the antennae without transverse carinae; pentagonal area obsolete; postocellar area indicated anteriorly by punctiform foveae; ocellocipital line distinctly longer

than the intraocellar line; postocellar line a trifle longer than the ocellocular line; fourth antennal joint slightly longer than the fifth; stigma gently rounded below, broader at the basal third; sheath subacuminate, narrow. Black; apical margin of the clypeus, legs and abdomen fulvous; wings dusky hyaline; venation dark brown; head and thorax with thin gray hairs.

Male.—Length 3.75 mm. Differs from the above description of the female in having the apical three abdominal segments black and having the clypeus entirely black; hypopygidium nearly rounded apically.

India and Assam. Described from two females, one type, from Calcutta, collected November 22, 1907, and from one male collected at Mazbat, Mangaldai, Assam, January 8, 1911 (*S. W. Kemp*). One male from Margherita, Assam.

Type and *allotype* in Indian Museum; type No. $\frac{4596}{19}$; allotype No. $\frac{4586}{19}$.

Paratype.—Cat. No. 18910, U.S.N.M.

Genus *Neostromboceros*, Rohwer.

Neostromboceros coeruleiceps (Cameron).

One female from the Assam-Bhutan Frontier, Mangaldai District, N.E., collected December 26, 1910 (*S. W. Kemp*); two males from the same locality collected by the same collector January 1-2, 1911; and two males from Sadiya, Assam.

Neostromboceros similaris, sp. n.

From *trifoveatus*, Cameron, to which this species runs in Enslin's table, this species may be separated by the white labrum.

Female.—Length 7 mm. Anterior margin of the labrum broadly rounded; anterior margin of the clypeus truncate; supraclypeal area rectangular in outline, flat; supraclypeal foveae connected with the antennal foveae; median fovea a U-shaped depression around a median tubercle, the ends of the U deeper; frontal foveae punctiform, their lower margins tangent to a line drawn through the median fovea; antennal furrow distinct above crest; postocellar area wider posteriorly, the anterior lateral part sharply defined, the posterior lateral part poorly defined; flagellum somewhat flattened; first transverse cubitus wanting; sheath truncate apically; inner tooth of claws smaller than outer. Blue-black; labrum, posterior margin of pronotum, tegulae and perapteron white; palpi whitish, infusate; legs yellowish white, bases of coxae and femora, and the posterior tarsi more or less infusate; wings hyaline, slightly dusky; venation dark brown; head and thorax with short gray hair.

Male.—Length 6 mm. Hypopygidium broadly rounded apically. Very like female.

Mazbat, Mangaldai, Assam. Described from three females (one type) and two males (one allotype) collected January 8, 1911 (*S. W. Kemp*).

Type, *allotype* and *paratype* in Indian Museum; type No. $\frac{4741}{19}$, allotype No. $\frac{4736}{19}$, paratype $\frac{4734}{19}$.

Paratypes (male and female) in U.S.N.M.

Genus *Stromboceros*, Konow.

Stromboceros tarsalis (Rohwer).

Three females from Sadiya, Assam; and two females from Margherita, Assam.

This is a good species.

Stromboceros phaleratus, Konow.

One male from Sikkim collected by Knyvett; and one male from Margherita, Assam.

Stromboceros ruficornis, sp. n.

This species is readily separated from all other species of *Stromboceros* occurring in the oriental region by having the basal joints of the flagellum rufous.

Female.—Length 8 mm. Anterior margin of the clypeus depressed, the middle very slightly emarginate, the basal portion subconvex; supraclypeal area flat; supraclypeal foveae oblique, deep, not connected with the antennal foveae; middle fovea represented by an inverted U-shaped furrow around a flattened tubercle; frontal foveae deep, rounded, the lower margins tangent to a line drawn across the top of the median tubercle; postocellar area well defined laterally, not defined anteriorly; postocellar line but little more than half the length of the ocellular line; head shining, impunctate; antennae slightly tapering apically; the third joint slightly longer than the fourth; thorax shining; stigma uniformly rounded below; first transverse cubitus obsolete; nervulus slightly basad of the middle; transverse radius oblique, received at the apical third; third transverse cubitus oblique at about the same angle as the transverse radius, slightly more than twice as long as the second transverse cubitus; posterior basitarsus subequal in length with the following joints. Black; three basal joints of the flagellum rufous; anterior knees, bases of the posterior coxae, posterior trochanters and the band on the posterior tibiae white; head and thorax with dense gray hair; wings hyaline; venation black.

Darjiling, Eastern Himalayas. Described from one female collected May 27, 1910, at an altitude of 7,000 feet (*E. Brunetti*),

Type.—In the Indian Museum No. $\frac{4682}{19}$.

Genus *Canonias*, Konow.*Canonias assamensis*, sp. n.

This species differs in minor colour characters from *inopinus*, Konow.

Female.—Length 8 mm. Anterior margin of the clypeus slightly arcuately emarginate, the angles sharp; supraclypeal area flat; supraclypeal foveae elongate, deep; antennal foveae obsolete, middle fovea quadrate in outline, open above; pentagonal area well defined, from its broadest portion there is a transverse carina which touches the inner margin of the eye; postocellar area depressed, sharply defined laterally by deep foveae, not defined anteriorly, about four times as wide as the cephal-caudad length; postocellar line about one-fourth longer than the ocellocular line; antennae long and slender, tapering apically; third joint distinctly shorter than the fourth; head and thorax shining, impunctate; stigma broadest at middle, tapering each way; transverse radius strongly oblique joining the radius slightly before the apical third; second cubital cell longer on both radius and cubitus than cubital third. Black; scape, pedicellum, sixth, seventh and eighth antennal joints, tergite, posterior margin of the angles of the pronotum, tegulae, perapteron, palpi, anterior legs, intermediate legs (except a fuscous band on the tibiae and the basitarsus), the posterior legs (except the tibiae and basitarsus) *white* or *yellowish white*; venter and the sides of the tergites and the apical two tergites fulvous; wings hyaline, iridescent; venation dark brown; head and thorax without pubescence.

Margherita, Assam. Described from three females (one type).

Type and *paratype* in Indian Museum; type No. $\frac{260}{9}$, paratype No. $\frac{261}{9}$.

Paratype in U.S.N.M.

Genus *Beleses*, Cameron.*Beleses nigriceps*, sp. n.

This species is readily separated from the other species of this genus by the black head. As far as the males and females have been associated it is the only species in which colour antigeny occurs. Except for the colour of the legs and having only one discal cell in the hind wings the female agrees with Cameron's *Sunoxa purpureifrons*.

Female.—Length 6 mm. Anterior margins with the clypeus truncate, surface coarsely irregularly punctured; supraclypeal area flat, narrow; supraclypeal foveae deep, confluent with the antennal foveae; middle fovea represented by the shallow transverse impression; front and posterior orbits shining, impunctate; postocellar area sharply defined laterally but not defined anteriorly; postocellar line subequal with the ocellocular; flagellum gradually thickened until it reaches the apex of the second joint; the second joint one-fourth longer than the third; the fourth and following

joints compressed; thorax shining, impunctate; stigma gently rounded below; second cubital cell longer on both radius and cubitus than third, which is twice as wide apically as basally; the transverse radius curved, joining the radius about the same distance from the second transverse cubitus as the second recurrent is from the same vein; claws cleft with the inner teeth exceeding the outer; sheath straight above, truncate apically, oblique below. Head and posterior femora beyond middle, four posterior tarsi and the antennae black, the rest of the insect rufous; head and thorax covered with short gray hairs; wings distinctly hyaline, venation dark brown.

Male.—Length 5 mm. Differs from the above description of the female in having the abdomen, thorax and legs, except the anterior tibiae and the trochanter which are fulvous, dark piceous and the hairs on the thorax and the head blackish; hypopygidium rounded apically.

South India. Described from one female from Marikuppam, collected October 19, 1910, at an altitude of 3,500 feet; and from two males, one allotype, from Bangalore, collected September 12, 1910, at an altitude of 3,000 feet.

Type and *allotype* in the Indian Museum; type No. $\frac{4756}{19}$, allotype No. $\frac{4753}{19}$.

Paratype.—Cat. No. 18909, U.S.N.M.

Genus *Entomostethus*, Enslin.

Entomostethus assamensis (Rohwer).

One male and two females from Ghumti, Darjiling District, East Himalayas, collected July 1911, at an altitude of 4000 feet (*F. H. Gravely*); five females and four males from Kurseong, East Himalayas, collected July 1908, at an altitude of 5,000 feet; five females and eleven males from Darjiling, East Himalayas, collected September 29, 1908, at an altitude of 6,000 feet (*E. Brunetti*); nine females and ten males from the same locality, collected May 29, 1910, at an altitude of 7,000 feet (*E. Brunetti*); one female collected at the same locality and elevation, August 11, 1909 (*J. T. Jenkins*); one male from the same locality and elevation, collected August 9, 1909 (*C. Paiva*); and one male from Gangtok, Sikkim, collected September 8, 1909, at an altitude of 6,750 feet.

Two males from Kurseong have the legs slightly darker than typical; and all the specimens indicate that the basitarsi are usually black. The female has the sheath straight above and broadly rounded from the tip.

This species differs from *laticarinatus*, Cameron, which may belong to the same genus, by the colour of the legs, as Cameron's species is said to have the femora pale beneath.

Entomostethus hirticornis (Rohwer).

One female from Kurseong, East Himalayas, collected September 7, 1909, at an altitude of 5,000 feet; four females from Ghumti,

Darjiling District, East Himalayas, July 1911, at a calculated altitude of 4,000 feet (*F. H. Gravely*); one female from Gangtok, Sikkim, collected September 9, 1909, at an altitude of 6,150 feet; and one female from Kurseong, East Himalayas, collected July 3, 1908, at an altitude of 5,000 feet.

Genus *Cladius*, Rossi.

Cladius orientalis, Cameron.

One female from Simla, collected July 20, 1911, at an altitude of 7,000 feet (*N. Annandale*).

Genus *Hemichroa*, Stephens.

Hemichroa major, sp. n.

This species is readily separated from all the other species of *Hemichroa* by its larger size, general colour and yellow wings.

Female.—Length 11.5 mm.; length of the anterior wings 12 mm. Labrum obtusely pointed; clypeus obtusely, arcuately emarginate, the arcuation conforming in outline with the obtusely triangular lobes, surface shining; supraclypeal area more convex dorsally; median fovea rectangular in outline, open above, being confluent with the ocellar basin, the middle with a small punctiform pit; ocellar basin pentagonal in outline, well defined, meeting on the postocellar line, in front of the anterior ocellus it has a shallow, poorly defined depression; head shining with only setigerous punctures; postocellar area well defined laterally but not well differentiated anteriorly as the postocellar furrow is subobsolete and angulate anteriorly; postocellar line subequal with ocellocular line; antennae strongly tapering, the third joint distinctly longer than the fourth; thorax shining; inner tooth of the claws longer than the outer; stigma broader at base, gradually tapering to the apex; third cubital cell nearly parallel-sided, one-fourth longer than its apical width; nervellus in the middle of the cell; sheath stout, straight above; truncate apically, tapering below, the upper angle sharp, the lower angle rounded. Rufo-ferrugineous; head and antennae piceous; thorax beneath and on the sides black to piceous; legs black; wings bright yellow, venation ferrugineous.

Darjiling, Eastern Himalayas. Described from one female.

Type.—Indian Museum No. $\frac{5666}{5}$.

V INDIAN TETRIGINAE (ACRYDIINAE).

By J L. HANCOCK.

(Plate xiv.)

Several months ago the extensive collection of these small Orthoptera in the Indian Museum was placed in my hands for study by Dr. N. Annandale, Superintendent of the Museum. At the time I received the collection Dr. Annandale stated in a letter that: "a large proportion of the collection was named by the late Mr. Kirby just before his death, and I am sending these specimens also." A considerable number of the remaining specimens, not seen by Mr Kirby, were named by Saussure and others. I find after going over the collection that the part examined by Mr. Kirby bears evidence that he had not passed final judgment on many of the specimens. This is shown from a number of cases where a hastily written label, with a specific name, is attached to one insect among a series containing from one to several species, so that the remaining ones were left undetermined.

The Indian Museum collection contains such a large percentage of the described species of the Indian Empire, besides so many new ones, that I concluded to give a review of the recorded Indian species of this Orthopteran family. I have given a synopsis of the subfamilies, and the genera; and in most cases in the large genera I have given tables for the separation of species. The literature of all the species has been added, but in conjunction with this part Kirby's remarkable Catalogue of Orthoptera, Volume III, will be found invaluable for reference. The latter, however, includes the literature only to the end of 1898. Since then, a number of Indian species have been described, which are recorded in the present paper. Included at the end are some species in the Indian Museum outside the Indian Empire. Those from Ceylon are for the sake of convenience incorporated in the text with the Indian species.¹

Synoptical Table of Subfamilies and Genera of India.

1. Antennae with all the articles excepting
the basal and the small atrophied apical

¹ As the proofs of this article come to hand I find that Kirby's volume on Orthoptera has just been published in the "Fauna of British India" 1914. It refers to a number of Tettigid species described in the present paper, and in order to clarify the confusion that may arise from the difference in determinations the names given by Kirby, and those that I have applied, are placed in parallel columns on p. 132 of this article.

articles deplanate triquitrous, composed of eight to ten joints; vertex transverse, very broad, or strongly acuminate produced

TRIPETALOCERINAE.

1. Gen. *Birmanana*, Brunn.

1. 1. Antennae filiform.
2. Anterior femora more or less compressed carinate above.
3. Frontal costa widely forked, the rami forming a frontal scutellum . CLADONOTINAE.
4. Pronotum extremely compressed, above wholly foliaceous 2. Gen. *Oxyphyllum*, Hanc.
4. 4. Pronotum acute tectiform, anteriorly angulate 3. Gen. *Deltonotus*, Hanc.
5. Dorsum of pronotum bearing a ramose process; body and legs ornate with spiniform tubercles 4. Gen. *Cladonotus*, Sauss.
5. 5. Dorsum of pronotum not at all ornate with a ramose process.
5. 5a. Elytra and wings wanting.
6. Posterior angles of the lateral lobes of pronotum widely laminate expanded, erose, and produced in spiniform tubercles; pronotum truncate anteriorly, dorsum fossulate-reticulate, between the shoulders cristulate 5. Gen. *Tettilobus*, Hanc.
6. 6. Posterior angles of the lateral lobes of pronotum laminate obliquely truncate behind, setose; dorsum compressed gibbose between the shoulders, posteriorly abbreviated, the apex truncate-emarginate . 6. Gen. *Gignolettix*, Hanc.
5. 5b. Elytra minute; wings wanting; median carina of pronotum cristulate. 7. Gen. *Potua*, Bolivar.
3. 3. Frontal costa furcillate, but the rami diverge only moderately, or parallel, very frequently separated by a sulcus.
7. Pronotum truncate anteriorly, posterior angles of the lateral lobes of pronotum laminate produced outwards, acute, or posteriorly obliquely truncate, rarely turned down.
8. Posterior angles of the lateral lobes of the pronotum acute produced outwards, often spined; the first joint of the posterior tarsi longer than the third; posterior tibiae strongly ampliate, or margins dilated toward the apices; very frequently not or sparingly spinose . SCELIMENINAE.

9. Antennae inserted slightly or distinctly below the eyes.
10. Margins of hind tibiae strongly expanded, the first joint of the posterior tarsi dilated and much wider than the third.
11. Paired ocelli placed nearly between the lower third of the eyes; anterior and middle femora very narrow elongate; posterior angles of the lateral lobes of the pronotum turned down but the margin on each side armed with a straight more or less cylindrical sharp spine 8. Gen. *Amphibotettix*, Hanc.
11. 11. Paired ocelli placed nearly on a line with the lower border of the eyes; humeral angles of pronotum unarmed; posterior angles of the lateral lobes laminate and on each side produced in a curved spine; hind tibial margins distinctly membraneous expanded 9. Gen. *Scelimena*, Serv.
10. 10. Margins of posterior tibiae little expanded; first joint of hind tarsi not widely expanded; but little wider than the third, rarely narrow.
- 12 Stature large, body prolongate.
13. Pronotum with the dorsum often lightly gibbulate and fossulate; humeral angles often armed with denticles or tubercles; vertex unarmed; margins of hind tibiae bearing minute denticles 10. Gen. *Eugavialidium*, Hanc.
13. 13. Pronotum with the dorsum distinctly deplanate, more or less reticulate punctate; vertex armed on each side with an elevated tubercle; margins of hind tibiae serrulate 11. Gen. *Gavialidium*, Sauss.
12. 12. Stature moderate not so prolongate.
14. Vertex very narrow, often one half the width of one of the eyes or even narrower; head exserted; posterior angles of the lateral lobes of the pronotum either unarmed, angulate and prominent or produced in a spine on each side. 12. Gen. *Bolotettix*, Hanc.
14. 14. Vertex equal to or wider than one of the eyes; pronotum above rugose tuberculate; lateral carinae behind the humeral angles compressed sinuate; median carina gibbose 13. Gen. *Thoradonta*, Hanc.
9. 9. Antennae inserted between the lower part of the eyes.

15. Vertex narrower or subequal to one of the eyes.
16. Head lightly exserted; posterior angles of the lateral lobes of the pronotum prominent, acute, or produced in a spine more or less transverse, or directed obliquely forward .. 14. Gen. *Criotettix*, Bol.
16. 16. Head not at all exserted; frontal costa roundly produced in advance of the eyes; posterior angles of the lateral subspiniiform produced, or oblique and obtuse .. 15. Gen. *Loxilobus*, Hanc.
15. 15. Vertex as wide or wider than one of the eyes.
17. Dorsum of pronotum little rugose, or rugulose; head not at all exserted; eyes not elevated; antennae short; spine on each side of the lateral lobes of pronotum obliquely directed backward. .. 16. Gen. *Acanthalobus*, Hanc.
17. 17. Dorsum of pronotum subsmooth, punctate, spine on each side of the lateral lobes directed obliquely forward and curvate .. 17. Gen. *Tettitellum*, Hanc.
8. 8. Posterior angles of the lateral lobes of the pronotum little produced outwards, obliquely truncate behind, very rarely acute spinose; first and third joints of the hind tarsi nearly equal in length .. METRODORINAE.
18. Head distinctly exserted; vertex very narrow, the eyes strongly approximated and elevated .. 18. Gen. *Systolederus*, Bol.
18. 18. Head little exserted; lateral lobes with the inferior margins widely and roundly dilated; posterior angles behind transversely widely truncate; vertex very narrow; stature small, apterous. .. 19. *Eurymorphopus*, Hanc.
19. Vertex strongly produced, median carina prominently projecting from the front border; in profile acute angulate produced; face strongly oblique; frontal costa sinuate between the eyes. .. 20. Gen. *Spadotettix*, Hanc.
19. 19. Vertex little produced, in profile obtuse angulate; body apterous. .. 21. Gen. *Apterotettix*, Hanc.
20. Body very small, apterous; vertex very wide and not advanced as far as the front border of the eyes; pronotum sub-tectiform forward, deplanate posterior-

- ly, hind process abbreviated, apex truncate; first joint of hind tarsi much longer than the third . . . 22. Gen. *Amphinotus*, Hanc.
20. 20. Body larger, moderately crassate; vertex wider than one of the eyes; first and third articles of the hind tarsi equal in length; paired ocelli placed little below the middle of the eyes; posterior angles of the lateral lobes of the pronotum straight or obtuse, behind widely truncate 23. *Mazarredia*, Bol.
21. Body narrow elongate; posterior angles of the lateral lobes of pronotum subrounded; vertex cuspidate on each side or elevated styliform Gen. 24. *Xistra*, Bol.
22. Posterior angles of the lateral lobes of pronotum not at all produced outwards, narrowed, toward the apex rounded; pronotum between the shoulders strongly elevated in an obtuse gibbosity. 25. Gen. *Xistrella*, Bol.
22. 22. Posterior angles of the lateral lobes of pronotum laminate, prominent, acute produced or obliquely truncate; median carina of the pronotum and the disc on either side bearing gibbosities. 26. Gen. *Lamellitettix*, Hanc.
21. 21. Body strongly crassate; vertex wider than one of the eyes, imperfectly marginate; eyes more or less conoidal in form, antennæ inserted between the lower part of the eyes; lateral lobes of the pronotum with the posterior angles laminate dilated, widely truncate behind, prominent subacute, or rarely not reflexed outward, obliquely truncate behind 27. Gen. *Hyboella*, Hanc.
7. 7. Pronotum anteriorly truncate, or rarely angulate produced; posterior angles of the lateral lobes of pronotum turned down, more or less rounded; first articles of the hind tarsi longer than the third TETTIGINÆ.
23. Vertex viewed in profile not at all produced.
24. Vertex very narrow, strongly narrowed forward drawing the eyes near together in front; eyes not elevated; pronotum above smooth, carinae not at all elevated 28. Gen. *Terederus*, Hanc.

24. 24. Vertex narrower than one of the eyes, anteriorly truncate; frontal costa often sinuate between the eyes; pronotum granulate or little rugose, the carinae little compressed elevated; first article of the posterior tarsi longer than the third 29. Gen. *Paratettix*, Bol.
23. 23. Vertex viewed in profile produced before the eyes, angulate, viewed from above wider than one of the eyes, not at all narrowed forward 30. Gen. *Acrydium*, Goeffr.
25. Antennae inserted between the eyes, slender filiform.
26. Pronotum above little rugose, often bearing round or abbreviated lineate tubercles; frontal costa arcuate or roundly produced between the eyes; body moderately slender; vertex narrowed forward, fossulate on each side 31. Gen. *Coptotettix*, Bol.
26. 26. Pronotum above granulate, or barely punctate, rarely rugose; median carina of pronotum percurrent, not at all interrupted 32. Gen. *Hedotettix*, Bol.
25. 25. Antennae inserted between the lower border or angles of the eyes or below the eyes.
27. Head more or less exserted; frontal costa arcuate produced between the middle of the eyes; vertex narrower than one of the eyes and truncate; paired ocelli placed nearly on a line with the middle of the eyes. 33. Gen. *Euparatettix*, Hanc.
27. 27. Head distinctly exserted; paired ocelli placed between the lower third of the eyes; antennae inserted below the eyes; frontal costa little arcuate elevated between the antennae, but not above between the middle of the eyes; median carina of pronotum often undulate or sinuate; hind process with the lateral carinae toward the apex entire or frequently minutely crenulate, or bearing very small dilated lobes. 34. Gen. *Indatettix*, Hanc.
2. 2. Anterior femora above distinctly sulcate; pronotum anteriorly produced over the head in a cornute process; antennae having sixteen to twenty-two articles. BATRACHIDINAE.
35. Gen. *Saussurella*, Bol.

TRIPETALOCERINÆ.

Genus **Birmana**, Brunner.

Brunner, Ann. Mus. Genova, xxxiii, p. 113, 1893.

Hancock, Gen. Ins. Orth. Acrid. Tetr., p. 4, 1906.

Birmana gracilis, Brunner.

Brunner, Ann. Mus. Genova, xxxiii, p. 114, pl. 5, fig. 47, 1893.

Habitat.—Burma. Not represented in the material under consideration.

CLADONOTINÆ.

Genus **Oxyphyllum**, Hancock.

Hancock, Trans. Ent. Soc. London, p. 393, 1908.

Oxyphyllum pennatum, Hancock.

Hancock, Trans. Ent. Soc. Lond., pp. 393, 394, pl. xxii, fig. 3, 1908.

Habitat.—Darjiling, India. Not in the present collection.

Genus **Deltonotus**, Hancock.**Deltonotus subcullatus**, Walker.*Tettix subcullatus*, Walk., Cat. Derm. Salt. Brit. Mus., V, p. 830, 1871.*Deltonotus tectiformis*, Hancock, Spol. Zeylan., ii, p. 154, pl. i, fig. 2, 1904.

Hanc., Gen. Ins. Orth. Acrid. Tetr., p. 14, pl. i, fig. 1, 1906.

Habitat.—Kandy, Ceylon, June 12, 1900; one example, Ind. Mus. coll.

Deltonotus gibbiceps, Bolivar.*Poecilotettix gibbiceps*, Bol., Ann. Soc. Ent. France, lxx, p. 580, 1902.*Deltonotus gibbiceps*, Hanc., Gen. Ins. Orth. Acrid. Tetr., p. 14, 1906.

Habitat.—Madura. Not in the present collection.

Genus **Cladonotus**, Saussure.

The three described species of this Ceylonese genus may be distinguished by the following table:—

1. Pronotal cornu curved forward at the middle, and furcate at the apex *humbertianus*, Saussure.
1. 1. Pronotal cornu not distinctly curved forward.

2. Cornu obliquely ascendant, truncate, and dentate in front and behind *turrifer*, Walker.
 2. 2. Cornu nearly vertically ascendant, dentate in front and distinctly broadened toward the apical half *latiramus*, Hancock.

Cladonotus humbertianus, Saussure.

Sauss., Ann. Soc. Ent. France, i, p. 478, 1861; Bolivar, Ann. Soc. Ent. Belg., xxxi, p. 209, pl. 4, fig. 10. 1887; Hanc., Spol. Zeylan., ii, p. 113, 1904.

Habitat.—Ceylon

Cladonotus turrifer, Walker.

Walker, Cat. Derm. Salt. Brit. Mus., p. 843, 1871.

Habitat.—Ceylon.

Cladonotus latiramus, Hancock.

Hanc., Spol. Zeylan., ii, p. 114, pl. i, fig. 1, 1904; Hanc., Gen. Ins. Orth. Acrid. Tetr., p. 16, pl. i, fig. 3, 1906.

Habitat.—Ceylon. Author's coll.

Genus Tettilobus, Hancock.

Tettilobus spinifrons, Hancock.

Hanc., Trans. Ent. Soc. London, pp. 396, 397, pl. xxii, fig. 4, 1908.

Habitat.—Ceylon. Not in the present collection.

Tettilobus pelops, Walker.

Cladonotus pelops, Walk., Cat. Derm. Salt. Brit. Mus., p. 843, 1871.

Habitat.—Ceylon. Not in the present coll.

Genus Gignotettix, Hancock.

Gignotettix burri, Hancock.

Hancock, Trans. Ent. Soc. Lond., p. 398, pl. xxii, fig. 5, 1908.

Habitat.—Ceylon. Not in the present coll.

Genus Potua, Bolivar.

Potua sabulosa, sp. nov.

Body very small, rugose scabrous; ferrugineous. Head not at all exserted: face large; eyes moderately small, not prominent, subconoidal in profile. Vertex rugose, distinctly wider than one of the eyes, the frontal carinulae laterally rounded and little ele-

vated on each side, subhigher than the eyes, fossulate on each side, the short median carina little produced. Pronotum anteriorly truncate; median carina of the pronotum strongly elevated forward in a compressed gibbosity, reaching from the front border to the humeral angles, rounded forward and abruptly sloping backward; behind the humeral angles elevated in a lower second gibbosity, posteriorly tuberculate; disc little elevated at the middle and bearing a short oblique gibbulate carina on each side, behind the shoulders depressed; posterior process abbreviated, extended to the knees of the hind femora, and above strongly rugose-tuberculate; elytra minute, elongate; wings wanting; posterior femora stout, externally scabrous and obtuse tuberculate; margin below curvate and subtuberculate-erose; the three pulvilli of the first joint of the hind tarsi subequal in length.

Entire length of male 6.5 mm; pronotum 5 mm.; posterior femora 3.8 mm.

Habitat.—Yenna Valley, Satara Dist., Bombay Pres., 2500–3500 ft., Apr. 17, 1912 (*F. H. Gravely*).

SCELIMENINAE.

Genus *Amphibotettix*, Hancock.

Hancock, Ent. News, xviii, p. 86, 1906; Hanc., Gen. Ins. Orth. Acrid. Tetr., p. 22, 1906.

Amphibotettix rosaceus, sp. nov.

Allied to *A. longipes*, Hancock, but larger in stature, the spines of the pronotum being little stouter and not quite so long produced. Body coloured fuscous or black, the sides of the pronotum and dorsum obscurely suffused with rose, the lateral carinae forward, the tubercles and the spines of the lateral lobes bright rose colour. Head scarcely at all exerted; eyes slightly elevated and strongly globose. Vertex narrower than one of the eyes, narrowed forward, not advanced as far as the eyes; frontal costa protuberant between the antennae, produced little beyond the eyes; antennae inserted below the eyes; lower part of face strongly obliquely retreating. Pronotum deplanate above, strongly elongate, irregularly depressed forward before the shoulders at the sulci, transversely fossulate behind the shoulders, lengthily produced backward beyond the apices of the hind femora; dorsum rather smooth, minutely granulate, between the shoulders little elevated, behind the shoulders bearing a pair of obtuse subcarinated nodes, and further backwards on base of process presenting another pair of very obtuse rounded nodes; humeral angles bicarinate, hind process above subrounded; median carina of pronotum very low, following the inequalities, and forward near the convex margin turned upward but not produced in a tubercle, yet very slightly subtuberculate; lateral carinae on the shoulders obscurely subtuberculate and marked with rose colour in the type, the late-

female in the present series measures : entire length 19-22.5 mm.; the pronotum 18-21 mm. Serville (*l c.*) gives the entire length of male and female as 21 mm.

***Scelimena gavialis*, Saussure.**

Scelymena gavialis, Sauss., Ann. Soc. Ent. France, iv, p. 845, 1861; *Scelymena nodosa*, Walker, Cat. Derm. Salt. Brit. Mus., p. 840, 1871; *Scelimena gavialis*, Hancock, Spol. Zeylan., ii, p. 154, pl. i, fig. 4, 1904.

Habitat.—Labugama, W. P. Ceylon (Hancock coll.); Madulima, Ceylon (*T. B. Fletcher*, Hancock coll.). Ind. Mus. coll.

This black species has the pronotum in front, the tip of the hind process, and the lateral spine on each side bright coral-red. In the Ceylonese species *logani*, Hanc., the coral-red is replaced with yellow, and the posterior angles of the lateral lobes of the pronotum are armed on each side with a spine and a denticle as indicated in the table.

***Scelimena* ? *producta*, Brunner.**

Brunner reports this species from Carin Cheba in Rev. Syst. Orth., p. 103, 1893, and the previously reported habitat of this species is Java. The female representative which Brunner referred to, is much larger than the typical *S. producta*, Serville, and I think it is the species which I have described as *Eugavialidium discalis*, Hancock.

***Scelimena spinata*, sp. nov.**

Near *Scelimena harpago*, Serv. Body above on the pronotum ferrugineous and greyish-fuscous, often more reddish on the disc, marked with ochre or yellow, the femoral denticles below light yellow. Vertex toward the front narrower than one of the eyes, not so distinctly narrowed forward as in *gavialis*, widened backward between the eyes; paired ocelli placed between the lower part of the eyes; antennae inserted distinctly below the eyes; frontal costa protuberant between the antennae. Pronotum truncate anteriorly, the front margin devoid of produced tubercles, but the lateral margins below the eyes bearing a minute tubercle, subelevated, on each side; dorsum rather smooth, not at all deeply fossulate, between the shoulders convex, the disc before the shoulders bearing two short supernumerary carinulae and minute side offshoots forward; behind the disc depressed, and on the dorsum above the hind femora bearing two pairs of very low nodes more or less carinated, the hind pair longer and nearer together; median carina of pronotum very low, thin, and percurrent; lateral carinae extended forward but less distinct on the shoulders, and barely behind the apices of the humeral angles the margin little compressed obtuse dentate; the lateral carinae at the terminus forward subdentate; hind process very long pro-

duced backward beyond the apices of the extended hind tibiae, the apex bifid; posterior angles of the lateral lobes turned outwards and produced in a moderately strong spine distinctly curved forward. Elytra moderately wide, elongate, the distal fourth narrowed to the apices and angulate, externally impresso-punctate; wings fully explicate, extended backward to the apex of the pronotal process. Anterior femora little compressed elongate, margin above little compressed at the basal half, and bearing a small subacute tubercle, below bidentate; middle femora above undulate, below acute bidentate; posterior femora moderately stout, the superior carina crenulate and bearing an acute antegenicular denticle, below strongly dentate, often quadridentate, the three denticles at the middle strongly produced spinose; hind tibial margins and first joint of posterior tarsi widely expanded, the first two pulvilli acute and placed backward leaving a wide basal space, the three pulvilli subequal in length.

Entire length male and female 21.7 mm.; pronotum 21-25 mm.; post. femora 9 mm.

Habitat.—Trevandrum, Travancore, Aug. 1890; Kellar, Travancore; Trevandrum State. Ind. Mus. coll.

Scelimena uncinata, Serville.

Tetrix uncinata, Serv., Hist. Nat. Ins. Orth., pp. 763, 764, 1893; *Scelimena uncinata*, Bol., Ann. Soc. Ent. Belg., xxxi, p. 218, 1887.

Judging from the description of this questionable species which has a length of only six millimetres, it appears that the type was a larva or pupa. This leaves the identity of the species in doubt. The type came from Bombay. In the Indian Museum collection are two specimens from Sibsagar, N. E. Assam, which are labelled *Scelimena uncinata*, Serville, by Saussure. These are pupa of some species near *Eugavialidium india*, Hanc.

Genus *Eugavialidium*, Hancock.

The members of this genus have the paired ocelli placed between the extreme lower part of the eyes; the dorsum of pronotum deplanate, the front margin of the pronotum more or less ornate with denticles or tubercles, often armed with a produced tubercle at the middle above the occiput, or when absent there, they appear in front on either side of the lateral lobes; the femoral margins more or less tuberculate; the lateral carinae on either side of the shoulders often tuberculate or dentate, and the median carina of the pronotum sometimes tuberculate; the hind process strongly prolonged backward beyond the hind femoral apices; the margins of the hind tibiae and first joint of the posterior tarsi moderately expanded, but not so strongly membraneous dilated as in *Scelimena*; the lateral lobes have the posterior angles outwardly produced, acute, triangular, or on either side bearing a spine often curved forward.

Table separating the Indian species and one from China.

1. Posterior angles of the lateral lobes of pronotum produced in a sharp spine more or less distinctly curvate forward.
2. Lateral carinae on each side of the disc of dorsum provided with more than one distinct denticle.
3. Lateral carinae on each side of dorsum including hind process ornate with many small denticles throughout; dorsum bearing distinctly elevated nodes; pronotum of female 21 mm *multidentatum*, sp. nov.
4. Dorsum of pronotum somewhat smoother.
3. 3. Lateral carinae on each side of disc of dorsum provided with denticles, and often tuberculate backward as far as the base of process only; hind process very long produced; median carina of pronotum not at all tuberculate over occiput at the front margin; pronotum of female 29.5 mm. *discalis*, sp. nov.
2. 2. Lateral carinae on each side of disc of dorsum entire, not at all dentate, but pale bimaculate, or very indistinctly subtuberculate; body and legs often adorned with yellow spots: front margin of pronotum bearing a tubercle on each side below the eyes, and one at the middle above the occiput; pronotum of female 19.5 mm. *indicum*, Hancock.
4. 4. Dorsum above rugose, reticulate; front margin of pronotum at the middle over the occiput and on each side below the eyes ornate with a tubercle; humeral angle on each side bearing a small pale denticle; pronotum strongly prolonged: pronotum of female 29 mm. *chinensis*, sp. nov.¹
1. 1. Posterior angles of the lateral lobes of pronotum more or less triangular or acute produced, straight, not at all curvate.
5. Lateral lobes of pronotum with the posterior angles slender spiniform produced; anterior border of pronotum on each side bearing three tubercles, but the middle of dorsum over the occiput

¹ For description of this Chinese species, see report of species outside of India, at the end of this paper.

not tuberculate ; lateral carinae on each side of disc forward bidentate, the denticles at the humeral angles obtuse crenulate ; pronotum of female 22·8 mm.

kempi, sp. nov.

5. 5. Lateral lobes of pronotum with the posterior angles little prominent, triangular, not aculeate.

6. Anterior border of the lateral lobes of pronotum dentate ; humeral angles very obtuse crenulate, provided with a pale tubercle on each side ; longitudinal carinae ornate with pale crenules ; pronotum of female 17 mm.

birmanicum, Brunner.

6. 6. Anterior border of the lateral lobes of the pronotum entire, not at all dentate but rounded ; humeral angles obtuse and acute marginate ; posterior angles of the lateral lobes of pronotum produced in an acute triangular lobe, profoundly abruptly sinuate behind ; pronotum of male 17 mm.

feae, Bolivar.

7. Pronotum bearing large tubercles on the disc ; humeral angles obtuse, provided with abbreviated external carinulae ; dorsum with two tubercles behind the humeral angles, and four at the middle of the process ; posterior angles of the lateral lobes produced, but not at all spinose, margin behind with a profound subrectangular sinus ; pronotum of female 19·5 mm.

flavopictus, Bolivar.

7. 7. Pronotum not bearing elevated tubercles on the disc.

8. Dorsum above smooth punctate, little subreticulate ; humeral angles very obtuse ; median carina little elevated, percurrent, tuberculate in front at the middle over occiput ; lateral and median carina not at all appreciably tuberculate ; margins of first joint of posterior tarsi somewhat dilated ; pronotum of female 21·7 mm.

angulatum, sp. nov.

8. 8. Dorsum very lightly rugose, coarsely granulose ; median carina bearing three small tubercles forward before the humeral angles and tuberculate backward in a subindistinct series to the base of process ; lateral carinae subindistinctly bituberculate on each side

of shoulders and barely subtuberculate backward to base of process; margins of first joint of hind tarsi not at all expanded; pronotum of male 19 mm. *saussurei*, sp. nov.

Eugavialidium multidentatum, sp. nov.

Near *E. birmanicum*, Brunner. Body and legs marked with fuscous and yellow, and yellow tubercles dot the course of the lateral carinae throughout each side of the dorsum, the three tubercles in front yellow, the spines of the lateral lobes pinkish-yellow, and underneath the body darker pinkish-yellow. Head not at all exserted, eyes globose; vertex subwider than one of the eyes; paired ocelli placed between the extreme lower part of the eyes; antennae long, very slender filiform, inserted distinctly below the eyes; frontal costa protuberant between the antennae. Pronotum deplanate, strongly inequal; median carina of pronotum irregularly undulate, and at the front margin terminating in a produced elevated tubercle; dorsum minutely punctate or bearing pale granulations, between the shoulders on the disc provided with short elevated subcarinate tubercles, behind the shoulders depressed, and above the apices of the elytra on each side of the dorsum provided with an elevated subcarinate boss, further backward on base of process bearing two elongate elevated nodes; hind process acuminate, subrounded above toward the apex, but flattened forward toward the base; lateral carinae throughout on each side dotted with a series of small and rather widely separated obtuse denticles, the one at the humeral angle scarcely more distinct and obtuse, and those backward toward the apex becoming smaller and less distinct, but marked by minute pale maculae; lateral lobes at the front margin produced in a denticle on each side; the posterior angles produced in a strong spine slightly curvate forward and moderately broad at the base; elytra acuminate toward the apices; wings extended to or barely beyond the apex of the hind process. Anterior femoral carinae above subtuberculate, two toward the base often subacute, margins below bituberculate; middle femora above subtrilobate, below bidentate; posterior femoral carinae above indistinctly minutely trilobate, below provided with small obtuse denticles very slightly produced; margins of hind tibiae sparingly minutely dentate on outer margins, the margins moderately expanded; the first articles of the posterior tarsi moderately expanded, the three pulvilli nearly equal in length.

Entire length of female 20.5–22.5 mm.; pronotum 19.5–21.5 mm.; post. femora 8.5 mm.

Habitat.—Sukli, east side of Dawna Hills, 2100 ft., Nov. 22, 1911 (*F. H. Gravely*); Dawna Hills, 2000–3000 ft., Tenasserim, Mar., 1909 (*N. Annandale*).

This species may be distinguished from *E. birmanicum*, Brunner, by the curvate spines of the lateral lobes; the longer pro-

notum, and the shorter hind femora, the tuberculate margins of the femora, and the dentate lateral carinae of the pronotum. In *birmanicum* the longitudinal carinae are ornate with pale crenules, and the humeral angles are provided with a pale obtuse tubercle on each side, the lateral spines straight and triangular, not at all aculeate.

Eugavialidium discalis, sp. nov.

Near *Scelimena producta*, Serville. Colour greyish-ferrugineous. Vertex wider than one of the eyes, scarcely at all narrowed forward; eyes little prominent, subsessile, viewed from above reniform, from the side globose; paired ocelli placed between the extreme lower angles of the eyes: antennae inserted far below the eyes; frontal costa protuberant between the antennae. Pronotum truncate anteriorly; the front margin on either side of the lateral lobes bearing a produced tubercle, not tuberculate at the middle above the occiput; dorsum deplanate, between the shoulders on the disc bearing low, short, lineate tubercles, depressed behind the shoulders, and backward provided with four very low obtuse nodes; median carina very low; lateral carinae on each side bearing a series of denticles often placed as far back as the base of the hind process but here very minute; humeral angles ornate with a distinct obtusely elevated tubercle on each side; the denticles or tubercles each side of the forward disc larger than those backward; hind process lengthily produced backward beyond the apices of the extended hind tibiae; posterior angles of the lateral lobes produced in a curved spine on each side, strongly produced in the male, rather stout in the female. Elytra elongate, acuminate, externally impresso-punctate; wings extended backward almost to the apex of process. Anterior femora elongate, margins crenulate, above undulate and compressed-sublobate toward the base, below subtri-tuberculate; middle femora above subtrilobate, below subbituberculate; hind femora elongate, the superior carinae crenulate and more or less quadricompressed, with two acute denticles toward the knees, margins below often quadridentate but little produced; hind tibial margins and first joint of the hind tarsi moderately expanded, but not so widely dilated as in typical *Scelimena*; inner margins of hind tibiae entire; the first and second pulvilli of the first joint of posterior tarsi small, acute, more widely separated than the second and third.

Entire length of male and female 25–30.5 mm.; pronotum 24–29.5 mm.; hind femora 7–9 mm.

Habitat.—Sibsagar, N.-E. Assam (S. E. Peal); Upper Assam (Doherty).

This species differs from *Scelimena producta*, Serville, in the larger stature, and in being wider between the shoulders, in the dentate humeral angles and lateral carinae of pronotum, and in the tuberculate femora. It is readily distinguished when it is compared with a series of *S. producta*, Serv., from Java.

Eugavialidium indicum, Hancock.

Scelimena idia, Hanc., Trans. Ent. Soc. London, p. 219, 1907; Hanc., Rec. Indian Museum, viii, p. 311, 1913.

Habitat.—Assam (*H. H. G. Austen*).

The type in the author's collection is from Cherrapungi, Assam. The type is conspicuously ornate with small yellow spots forward on the greyish-fuscous dorsum, and also on the legs; the median carina of the pronotum at the front bears a tubercle; the lateral carinae of the dorsum of pronotum are not furnished with denticles or tubercles; the lateral lobes at the front under the eyes bear a tubercle on each side; the spines of the posterior angles of the lateral lobes are little curvate forward at the apices and more slender in the male; disc of the pronotum above provided on each side with a more or less distinct short branching carinula. In the specimens in the Indian Museum collection the bright yellow maculae are more or less obscured; the hind femora are missing, but in the type the hind tibiae and first joint of the posterior tarsi show moderate expansion of the margins but not nearly so strongly dilated as in typical *Scelimena*; the outer margins of the hind tibiae bear small acute denticles. In the two females in the Indian Museum the pronotum measures 20 and 22 mm. in length.

Eugavialidium kempi, sp. nov.

Near *E. birmanicum*, Brunner. Greyish-fuscous, yellow maculate, pronotal process suffused with, and spotted with chrome yellow. Vertex little wider than one of the eyes. Pronotum at the front border trituberculate, but the middle of the dorsum behind the occiput not at all tuberculate; median carina of pronotum irregularly compressed, spotted with yellow; just behind the sulci, and behind the shoulders gibbulate; dorsum fossulate behind the shoulders, on either side above the base of the hind femora obtuse nodulose, and further backward bearing a pair of elevated nodes; lateral carinae subcompressed and on each side of disc at the humeral angles and before the angles bearing a pale yellow denticle, backward yellow maculate; anterior and middle femora slender elongate, margins of anterior femora above subentire, bearing one very small tubercle, below subentire or bearing two minute tubercles; middle femora yellow maculate, and subtrilobate above, below subbituberculate; hind femora elongate, superior margin crenulate and above the middle and at the distal fourth subacute dentate, below subentire.

Entire length of female 23.5 mm.; pronotum 23 mm.; post. femora 8.7 mm.

Habitat.—Above Panji, 4000 ft., "Rebang stream under stones" (*Kemp*).

This species was mistaken for females of *E. indicum*, Hancock, in my former paper in the Records of the Indian Museum, VIII, p. 311, 1913. I have since examined two females of *E. indicum*, which are mentioned under the preceding heading. In *E. kempi*

the posterior angles of the lateral lobes of the pronotum are produced outwards on each side in a straight narrow spine, whereas in *E. indicum* the spine on each side of the lateral lobes is curvate forward. In *E. birmanicum* the posterior angles are triangularly produced, not aculeate, and the body is shorter.

***Eugavialidium birmanicum*, Brunner.**

Gavialidium birmanicum, Brunn., Ann. Mus. Genova xxxiii, p. 104, pl. 5, fig. 37, 1893; Hanc., Gen. Ins. Orth. Acrid. Tetr. *E. birmani* (cum), p. 25, 1906.

Habitat.—Burma (*Brunner*).

***Eugavialidium feae*, Bolivar.**

Bol., Real. Soc. Espan. Nat. Hist., ix, p. 396, 1909.

Habitat.—Carin Cheba (*Bolivar*).

***Eugavialidium flavopictum*, Bolivar.**

Bol., Real. Soc. Espan. Nat. Hist., ix, pp. 394, 395, 1909.

Habitat.—Calcutta, India (*Bolivar*).

***Eugavialidium angulatum*, sp. nov.**

Colour ochreous. Vertex subequal in width to one of the eyes, on either side dentate but not elevated above the eyes; dorsum of pronotum plain, punctate, and minutely subreticulate; between the shoulders provided with a short elevated line or ruga on each side; humeral angles very obtuse-convex; the lateral and median carinae unarmed, not at all tuberculate; median carina little elevated subgibbose at the sulci forward and terminating in front over the occiput in a tubercle; prozonal carinae forward behind the front margin compressed parallel; the front lateral margin on either side armed with a tubercle; posterior angles of the lateral lobes of the pronotum turned outwards and little triangulate protuberant, not spined; hind process of pronotum produced beyond the apices of the hind femora about the length of the femora; wings fully explicate, reaching to the apex of the process; posterior femora rather stout, margins above crenulate with indistinct antegenicular lobe, margin below entire; posterior tibial margins dentate, a little expanded toward the apices, the first joints of the posterior tarsi with the margins little expanded; the three pulvilli equal in length and planate below.

Entire length of female 23 mm.; pronotum 21.5 mm.; post. femora 8.5 mm.

Habitat.—Calcutta.

This species is labelled: "*Gavialidium philippinum*, Bol.," evidently in Saussure's handwriting. It is much smaller than that species and it differs in the shape of the posterior angles of the lateral lobes.

Eugavialidium saussurei, sp. nov.

Similar to the preceding. Ferrugineous. Vertex subequal in width to one of the eyes, on either side dentate, barely elevated. Dorsum of pronotum above barely rugose, coarsely granulate; median carina of pronotum before the humeral angles provided with three small tubercles and also tuberculate backward as far as the base of the hind process; humeral angles very obtuse; posterior angles of the lateral lobes of the pronotum little acute triangulate produced outwards, not spined; front margin of pronotum on either side of the lobes bearing a small tubercle; wings fully explicate reaching nearly to the apex of process; anterior and middle femora little compressed, margins undulate; posterior femora stout, margins crenulate otherwise unarmed; hind tibial margins dentate, very moderately expanded toward the apices; first articles of the hind tarsi not at all expanded, narrow, the first pulvillus very small, the second and third longer and equal in length.

Entire length of male 20 mm.; pronotum 19 mm.; posterior femora 7.5 mm.

Habitat.—Calcutta, India.

This species like the preceding is labelled, "*Gavialidium philippinum*, Bol.," by Saussure. It is allied to *E. angulatum*, Hanc., but differs in the tuberculate median carina of the pronotum and as shown in the table of species. This species as well as the preceding somewhat resemble members of the genus *Gavialidium* in the dentate character of the vertex, but the lateral carinulae on each side are not elevated above the eyes.

Genus Gavialidium, Saussure.**Gavialidium crocodilus**, Saussure.

Sauss., Ann. Soc. Ent. France, iv, p. 481, 1861; Bol., Ann. Soc. Ent. Belg., xxxi, p. 219, 1887; Hanc., Spol. Zeylanica, ii, pp. 122, 123, pl. 2, fig. 11, 1904; Hanc., Gen. Ins. Orth. Acrid. Tetr., pp. 22, 25, pl. 2, fig. 16, 1906.

Habitat.—Peradeniya, Ceylon; Pundaluoya, Ceylon.

One of these examples is labelled and the species determined by Saussure, which helps to authenticate this species.

In regard to the species *Gavialidium alligator*, Saussure (*Scelymena alligator*), its status is in doubt. It appears to me that the pupa of *crocodilus* served as a type for Saussure's *alligator*. I have a large series of the former species collected in Ceylon by Fletcher and Green, which show diverse variations, some being smaller than the normal size. From an examination of these specimens some of the immature pupa agree with the description of *alligator* given by Saussure. I am not sure, but the latter seems to be the pupa of *crocodilus* and therefore is synonymous.

Genus *Bolotettix*, Hancock.

This genus occupies a position midway between *Criotettix*, Bolivar, on the one hand, and *Systolederus* on the other. The representatives are small in stature, the eyes more or less exserted and near together, the vertex viewed from above very narrow, often one half or even one-third the width of one of the eyes, whereas, in *Systolederus*, the eyes are still closer together, separated only by the very narrow vertex as viewed in front and from above. In *Criotettix* the vertex is wider, and the antennae inserted between the eyes. The lateral lobes in *Bolotettix* have the posterior angles either turned down, or laterally reflexed outwards, little prominent, or produced in a spine on each side. Represented by a number of species in India, and other sections in the oriental region.

Table for the separation of Bolotettix of India.

1. Pronotal process shortened, not extended beyond the hind femoral apices; dorsum little rugose above; posterior angles of the lateral lobes obliquely sublunate produced, apex of angle subacute; pronotum of female 9 mm. *anomalous*, Hancock.
1. 1. Pronotal process subulate, posteriorly extended beyond the knees of the hind femora.
 2. Lateral lobes of the pronotum with the posterior angles acute spinate.
 3. Legs distinctly fusco-annulate; posterior femora bearing oblique grey fascia; pronotum of male and female 11-14 mm. *oculatus*, Bolivar.
 3. 3. Legs not distinctly fusco-annulate.
 4. Sides of the pronotum and the four anterior femora testaceous-yellow; posterior femora below bearing a deep black longitudinal fascia; pronotum of male and female 11.5-13.5 mm. *armatus*, sp. nov.
 4. 4. Sides of pronotum yellowish, legs yellowish obscurely marked with fuscous; pronotum of female 12 mm. *pictipes*, sp. nov.
 2. 2. Lateral lobes of pronotum with the posterior angles either turned down, or obliquely reflexed outward but not acute spined.
 5. Posterior angles of the lateral lobes of the pronotum turned down, not at all reflexed outward, rounded below; pronotum of female 12.5 mm. *inermis*, sp. nov.
 5. 5. Posterior angles of the lateral lobes reflexed outwards.

6. Posterior angles of the lateral lobes subquadrate, little reflexed outwards, obliquely truncate behind; pronotum of male and female 12.5-13.5 mm. *lobatus*, Hancock.
 Pronotum of female 10 mm. *exsertus*, Bolivar.
 Pronotum of female 14 mm. *quadratus*, sp. nov.
6. 6. Posterior angles of the lateral lobes triangulate produced, margin behind sub-sinuate-truncate, pronotum of male and female 12-15 mm. *triangularis*, sp. nov.

***Bolotettix anomalus*, Hancock.**

Systolederus anomalus, Hanc., Spolia Zeylanica, vi, p. 146, 1910.

Habitat.—Madulsima, Ceylon (*Hancock*).

***Bolotettix oculatus*, Bolivar.**

Criotettix oculatus, Bol., Ann. Mus. Civ. di Genova, xxxix, p. 71, 1898.

Habitat.—Kodaikanal, S. India (*Bolivar*).

The type came from Sumatra, and this species is reported from Java.

***Bolotettix armatus*, sp. nov.**

Near *lobatus*, Hancock. A graceful-bodied species. Head fuscous, pronotum above dark reddish-ochre forward, and backward on the hind process becoming very pale toward the apex, the four anterior legs, sides of the pronotum, and the lower part of the lateral lobes and spines light testaceous-yellow, the hind femora pale yellow with a deep black longitudinal fascia below the lower external carina. Vertex strongly narrower than one of the eyes, narrowed forward toward the front tricarinate, the median carina very little projecting; head and eyes distinctly exserted; eyes strongly elevated above the dorsum of pronotum and globose; antennae inserted below the eyes; frontal costa rather widely arcuate-elevated between the antennae and depressed between the eyes. Pronotum above plain, the dorsum little turned up in front; between the shoulders barely rugulose, behind the shoulders depressed subfossulate; median carina of pronotum percurrent substraight but little compressed forward between the sulci; lateral carinae little compressed subbicarinate on the shoulders; hind process long acute subulate, surpassing the hind femoral apices; posterior angles of the lateral lobes of the pronotum laminate and produced in a straight acute spine on each side, spine subcarinate and transverse, behind the spine the margin sinuate. Elytra small, elongate; wings extended barely beyond the pronotal apex, coloured black-infumate. Anterior and middle femoral margins entire; posterior femora elongate, externally bearing distinct ob-

lique rugae, and above with a series of rounded tubercles; the three pulvilli of the first joint of the hind tarsi subequal in length, or the first barely longer than the second.

Entire length of male and female 12.5–14.5 mm.; pronotum 11.5–13.5 mm.; posterior femora 5.2–6.3 mm.

Habitat.—Sukli, Dawna Hills, 2100 ft., Nov. 22, 1911 (*F. H. Gravely*).

This species has the head and eyes more exserted than in *lobatus*, Hanc.; the vertex narrower, and it, moreover, has strongly produced spines arming the lateral lobes directed at a right angle to the body. This species approaches *Systolederus* in the exserted and very narrow vertex.

***Bolotettix pictipes*, sp. nov.**

Near *armatus*, Hancock. Above obscure yellowish-fusca, the lower sides of the body and legs light yellow, obscure fusco-variegated, the hind femora pale fasciate at the middle and dark below. Head exserted; eyes globose; frontal costa distinctly produced between the eyes; vertex strongly narrower than one of the eyes in front, on either side of the mid-carina the space very little wider than in *armatus*, in the latter species the space on either side very narrow sulcate and the vertex tricarinate. Pronotum above with the dorsum planate, granulose, between the shoulders bearing two short carinulae, behind the shoulders subfossulate, posteriorly planate and obscurely subtuberculate; median carina of pronotum percurrent, very thin and low, subundulate posteriorly, forward behind the front margin depressed; hind process long acute subulate, surpassing the hind femoral apices; posterior angles of the lateral lobes of pronotum outwardly reflexed on each side and produced in a very narrow acute spine subtransverse, very slightly directed backward, the margin behind the base of spine rectangulate sinuate. Elytra short, ovate; wings extended to the apex of the pronotal process; femoral margins entire; the three pulvilli of the first joint of the hind tarsi equal in length.

Entire length of female 13.2 mm.; pronotum 12.5 mm.; posterior femora 5.8 mm.

Habitat.—Madras, Shevaroy, 4000 ft., Aug. 1907 (*C. W. M., T. B. Fletcher*) in author's collection.

***Bolotettix inermis*, sp. nov.**

Body above fuscous, sides and legs paler and variegated with fuscous, the hind femora mottled with yellow and fuscous, dark toward the apices and light basally, below the lower external carina black. Head very little exserted; eyes globose; vertex scarcely narrowed toward the front, subnarrower than one of the eyes, middle carinate, on each side fossulate, frontal carinulae laterally little elevated-acute, front subrounded truncate; antennae very long filiform, inserted far below the eyes; frontal costa

compresso-elevated between the antennae, depressed above between the eyes and distinctly sinuate at the median ocellus as viewed in profile. Pronotum above plain; median carina percurrent, elevated little arcuate between the sulci forward; between the shoulders provided on each side with a very distinct oblique rugula or line; lateral carinae percurrent on the shoulders, and before the shoulders distinctly compressed elevated; prozonal carinae behind the front border forward distinctly compressed, subparallel; hind process subulate, extended beyond the hind femoral apices; posterior angles of the lateral lobes of pronotum turned down, lower margin rounded. Elytra short, ovate, in the type black, with pale yellow apices; wings extended little beyond the pronotal apex; the four anterior femora elongate, compressed, margins entire; posterior femora stout, superior margins minutely serrulate-granose; the three pulvilli of the first joint of hind tarsi subequal in length.

Entire length of female 13.5 mm.; pronotum 12.5 mm.; posterior femora 6.5 mm.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July, 1911 (*F. H. Gravely*).

In one of the specimens the hind process of pronotum is slightly less produced beyond the apices of the hind femora.

***Bolotettix lobatus*, Hancock.**

Systolederus lobatus, Hanc., Mem. Dept. Agric. India, iv, pp. 143, 144, 1912.

This species has the body above infusate, sides and legs paler, variegated with light ochre, hind femora with a pale median stripe, and below the lower external carina longitudinally black fasciate. Vertex strongly narrower than one of the eyes, distinctly narrowed forward between the curvate frontal carinulae; middle carinate between the forward half of the eyes and very slightly projecting, on either side of the mid-carina elongate fossulate; head exserted; eyes prominent and globose, higher than the dorsum of pronotum; antennae inserted far below the eyes; paired ocelli placed between the lower fourth of the eyes; frontal costa compressed arcuate between the antennae, little depressed between the eyes; strongly sinuate at the median ocellus in profile. Pronotum above plain subcylindrical forward, shining granulose, between the shoulders the dorsum convex, disc on either side presenting somewhat distinct oblique lines, behind the shoulders depressed subfossulate; lateral carina very slightly compressed, often reddish in colour; median carina percurrent, little elevated; prozonal carina forward behind the front margin very thin and parallel; posterior process extended beyond the hind femoral apices; posterior angles of the lateral lobes of the pronotum little obliquely laminate, reflexed outward, and obliquely truncate behind, the angles subacute. Elytra small, elongate, margin above substraight, below widely rounded and both extremities rounded,

externally punctate, the upper third part light ochreous, lower part infusate; wings nearly reaching to the apex of the pronotal process, infumate. Femora elongate; anterior femoral margins subundulate; posterior femoral margins granose; the three pulvilli of the first joint of the hind tarsi acute, subequal, or the third barely longer than the second.

Entire length of male and female 13.5–14.5 mm.; pronotum 12.5–13.5 mm.; posterior femora 6.2–7 mm.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July, 1911 (*F. H. Gravely*); Kurseong, E. Himalayas, 5000 ft., July 5, 1908 (*N. Annandale*).

The type in the author's collection is from Lebong, Darjiling Dist., 5000 ft. As it is an imperfect specimen, I have drawn the above description from fresh examples.¹

***Bolotettix exsertus*, Bolivar.**

Criotettix exsertus, Bol., Ann. Soc. Ent. France, lxx, p. lxx, 583, 1902.

Habitat.—Kodaikanal, S. India (*Bolivar*).

***Bolotettix quadratus*, sp. nov.**

Body pale grey or yellow, more or less marked with fuscous or black, on each side of the lower part of the pronotal lobes pale, posterior femora with a median longitudinal light fascia, and externally above marked with fuscous and with a longitudinal black fascia below but the fascia interrupted with yellow at the distal third; hind tibiae annulate with light and dark; underneath the body black and pale variegated. Head and eyes exserted, eyes higher than the dorsum of pronotum; vertex strongly narrower than one of the eyes, equal to about one-third the width, tricarinate forward; frontal costa between the antennae roundly compressed-elevated, depressed above between the eyes, sinuate at the median ocellus. Pronotum with the dorsum plain, little rugose between the shoulders; prozonal carina behind the anterior margin parallel; median carina percurrent, little compressed-elevated before the shoulders, behind the anterior margin concave, the margin anteriorly slightly elevated; lateral carinae in front of the shoulders barely compressed; humeral angles subbicarinate; hind process long subulate, extended beyond the hind femoral apices; posterior angles of the lateral lobes subquadrate, obliquely reflexed, and truncate behind, the apices little prominent. Elytra elongate, the apices rounded; wings black or infumate, extended beyond the pronotal apex. Anterior and middle femora elongate, margins entire; hind femora slender, margins minutely serrulate, hind

¹ Kirby had examined these specimens in the Indian Museum, and on one of the specimens he placed a label bearing the name: "*Systolederus cinereus*, Bol.," while on the second specimen he had affixed a label with the determination: "*Mazarredia lugubris*, sp. nov."

tibiae little curvate toward the base; the three pulvilli of the first joint of the hind tarsi subequal in length.

Entire length of female 15 mm.; pronotum 14 mm.; posterior femora 6 mm.

Habitat.—Singla, Darjiling District, 1500 ft., June, 1913 (*Lord Carmichael coll.*); Sikkim, Darjiling Dist. (*L. Mandelli*).

This species resembles *triangularis* in the narrow vertex, but differs in the lateral lobes which are subquadrate and little prominent as compared to the triangulate produced angles in *triangularis*. The exserted head suggests its approach to *Systolederus*, but the vertex is wider than in typical representatives of that genus.

***Bolotettix triangularis*, sp. nov.**

Allied to *armatus*, Hancock, slightly larger in stature. Body reddish-ochreous, front of head and the sides of the lateral lobes mottled with black, underneath the body black, femora pale yellow, the hind femora marked with a longitudinal black fascia below the lower external carina, and faint traces of fuscous bars on the upper part. Vertex strongly narrower than one of the eyes, tricarinate, the median carina very little projecting; head and eyes exserted; frontal costa arcuate-elevated between the antennae, sinuate at the median ocellus. Pronotum plain above, dorsum rugulose between the shoulders; humeral angles bicarinate; median carina of pronotum substraight, percurrent, and subobsolete near the front border; posterior process subulate, long surpassing the hind femoral apices; posterior angles of the lateral lobes of the pronotum laminate dilated laterally and distinctly triangulate produced, subacute, the margin behind subsinuate truncate. Elytra small, elongate-ovate; wings extended little beyond the pronotal apex. Anterior and middle femoral margins entire; posterior femoral margins granose or entire; the third pulvilli of the first joint of the hind tarsi little longer than the second.

Entire length of male and female 13.5-16 mm.; pronotum 12-15 mm.; posterior femora of the male 6 mm.

Habitat.—Sibsagar, N.-E. Assam (*S. E. Peal*).

The two specimens in the Indian Museum collection were determined as "*Systolederus angusticeps*, Stal," presumably by Saussure. It is hardly necessary to state that the latter, a Philippine species, is of much larger stature and has acute spines arming the lateral lobes of the pronotum.

Genus *Thoradonta*, Hancock.

Hancock, Trans. Ent. Soc. London, p. 407, 1907.

***Thoradonta spiculoba*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, p. 138, 1912; Hanc., Records Ind. Mus., viii, pp. 312, 313, 1913.

Habitat.—Calcutta (*N. Annandale*; *Brunetti*; and *F. H. Gravely*); Rangoon, 1905 (*Brunetti*); Kandy, Ceylon (*Hancock coll.*). I have previously reported this species from: Bihar, Pupri, Muzaffarpur; Pusa; Durbhanga; Dibrugarh, N. E. Assam.

***Thoradonta sinuata*, sp. nov.**

Colour ferrugineous. Head not at all exserted; vertex wider than one of the eyes; frontal costa compresso-elevated between the antennae. Pronotum above rugose, tuberculose; median carina strongly sinuate, tuberculate, in front of the shoulders and behind the humeral angles gibbulate; prozonal carinae forward behind the anterior margin convergent backward; lateral carinae behind the humeral angles sinuate and compressed; dorsum on the disc between the shoulders widened, tuberculose, and bearing a short carinula on each side, behind the shoulders bifossulate; humeral angles with the carinae compressed; posterior process subulate, extended little beyond the hind femora apices; posterior angles of the lateral lobes of the pronotum laminate expanded and abruptly constricted and produced in a narrow transverse sharp spine on each side, sinuate in front and behind the angle; margins of the lateral lobes minutely serrulate. Elytra wide at the middle, narrowed forward and strongly narrowed toward the apices; wings extended nearly to the apex of the pronotal process. Anterior femoral margins undulate; middle femoral margins subtrilobate above and below; posterior femora externally rugose; margins serrulate; the first two pulvilli of the first article of the hind tarsi spinose, the third acute.

Entire length of female 9 mm.; pronotum 8 mm.; posterior femora 5 mm.

Habitat.—Moleswar, W of Yenna Valley, Satara Dist. 3200 ft., April 23, 1912 (*F. H. Gravely*).

This species differs from *spiculoba*, Hancock, in having the forward gibbosity in front of the shoulders on the pronotum lower and smaller, and in the less dilated posterior angles of the lateral lobes of the pronotum, and in the abruptly contracted and transversely produced narrow sharp spine, in contrast with the less contracted suboblique spine on each side in *spiculoba*, the spines in the latter having the bases wider.

***Thoradonta apiculata*, sp. nov.**

Near *spiculoba* and *sinuata*, Hancock. Colour greyish-rufescent, sometimes infusate, the hind tibiae pale annulate. Head not at all exserted; vertex wider than one of the eyes; frontal costa distinctly protuberant between the antennae. Pronotum above rugose-granulose; median carina of the pronotum compressed-gibbulate before the shoulders, but not so elevated as in *spiculoba*, and posteriorly sinuate; hind process subulate and extended much beyond the hind femoral apices; posterior angles

of the lateral lobes of the pronotum little dilated-laminate, and produced on each side in a small sharp spine with a wide base, the margin in front oblique and not at all sinuate, but behind right-angle sinuate; wings extended to the apex of the pronotal process.

Entire length of male and female 10-11 mm.; pronotum 9.5-10.5 mm.

Habitat.—Upper Assam; Sukli, Dawna Hills, 900-2100 ft., Oct. 23, 1911 (*F. H. Gravely*); Tenasserim Valley, Lower Burma (*Doherty*); Darjiling Dist. Singla, 1500 ft., May, 1913 (*Lord Carmichael coll.*); Sibsagar, N. E. Assam (*S. E. Peal*).

Thoradonta nodulosa, Stal.

Tettix nodulosa, Stal, *Eugenies Resa, Orth.*, p. 348, 1860; *Criotettix nodulosus*, Bol., *Ann. Soc. Ent. Belg.*, xxxi, p. 230, 1887; *Brunn.*, *Rev. Syst. Orth.*, p. 105, Genova, 1893.

Habitat.—Carin Cheba (*Brunner*).

The habitat of this species is Java and Malacca, and Brunner's record may refer to one of the species I have just described. Specimens of *Thoradonta nodulosa*, Stal, are in my collection taken in Java by Jacobson, and they differ from any of the Indian species, in the posterior angles of the lateral lobes of the pronotum. In *nodulosus*, Stal, the angles are shortly acuminate, while in the above mentioned species they are spined, though in *apiculata* and *spiculoba* the base of the spines is widened.

Genus Criotettix, Bolivar.

Plate xiv.

Table for separating the Indian species of Criotettix.

1. Vertex not at all produced.
2. Hind process of pronotum not, or very little surpassing the hind femoral apices: wings shorter than the process: frontal costa arcuate produced before the eyes: dorsum narrow between the shoulders; pronotum of male 9 mm. *rugosus*, Bolivar.
2. 2. Hind process of pronotum lengthily surpassing the hind femoral apices; wings extended to the apex of the pronotal process.
3. Stature moderately small; pronotum of female not exceeding 13 or 14 mm. in length.
4. Vertex very narrow, strongly narrower than one of the eyes; spine on each side of the posterior angles of the lateral lobes of pronotum long, straight, and sharp: pronotum of male and female 10.5-12.5 mm. *tricarinatus*, Bolivar.

4. 4. Vertex subequal in width to one of the eyes: dorsum between the shoulders convex; spine on each side of the lateral lobes transverse slender elongate and sharp.
5. Lateral lobes of pronotum with the posterior angles spined.
6. Spine on each side of the lateral lobes straight; pronotum of male 11 mm.
indicus, Bolivar; *orientalis*, Hancock.
6. 6. Spine on each side of the lateral lobes curvate; base of pronotal process above tuberculose; pronotum of male and female 9·8-12 mm. *spinilobus*, Hancock.
5. 5. Lateral lobes of pronotum with the posterior angles laminate, subquadrate, the angle but little prominent; hind process above subnodulose; vertex narrower than one of the eyes; pronotum of male and female 10·8-11 mm. *pallidus*, sp. nov.
3. 3. Stature larger, above little rugose subtuberculose; posterior angles of the lateral lobes subquadrate, obliquely truncate behind, the angle little prominent, not at all spined; colour ferrugineous; vertex narrower than one of the eyes; pronotum of male and female 13-15·5 mm. *dohertyi*, sp. nov.
7. Lateral lobes of the pronotum with the posterior angles barely produced.
8. Pronotum slender subulate posteriorly, strongly produced backward; dorsum above somewhat smooth, behind the shoulders lightly fossulate; posterior angles of the lateral lobes little prominent, sinuate behind; pronotum 17 mm. sex? *aequalis*, Hancock.
8. 8. Pronotum wider between the shoulders, behind the shoulders strongly fossulate; hind process produced beyond the hind femora 4 mm.; apices of the posterior angles of the lateral lobes little prominent, not at all produced or spined; pronotum of male 15 mm. *montanus*, Hancock.
7. 7. Lateral lobes at the posterior angles produced, acute.
9. Spines of the posterior angles of the lateral lobes of the pronotum more or less obliquely directed backward; vertex subnarrower than one of the eyes.

10. Stature of moderate size; above dull rugose-granulate; dorsum behind the shoulders fossulate, tuberculose on the base of process; colour fuscous, or sometimes marked with ochre, the hind femora obscurely marked, or with bars of ochre; pronotum of male and female 13.5-17 mm. . *annandalei*, sp. nov.
10. 10. Stature large, above shiny; rather broadly depressed behind the shoulders and on either side between the shoulders; colour often ochreous-brown above; pronotum of male and female 16.7-20.5 mm. . *gravelyi*, sp. nov.
9. 9. Spine on each side of the posterior angles of the lateral lobes of pronotum directed at a right angle, transverse, not oblique.
11. Posterior femoral margins above tri- or quadridentate; dorsum moderately wide between the shoulders; abdomen yellow maculate; pronotum of male 17 mm. *flavopictus*, Bolivar.
11. 11. Posterior femoral margins above subcrenulate, or barely lobate; dorsum wider between the shoulders; abdomen often white maculate.
12. Body above greyish-ochreous; sides of the body and hind femora covered with pale granulations; hind process often pale maculate toward the apex; body below fuscous and light, palpi white; pronotum of male and female 17.5-21 mm. *grandis*, Hancock.
12. 12. Body above fuscous or greyish-fuscous; hind femora obscurely mottled or with bars of ochre; pronotum of male and female 17.5-20.5 mm. . *maximus*, Hanc.
Pronotum of female 18 mm.
race or var. *extremus*, Hancock.
1. 1. Vertex little produced; dorsum of pronotum rugulose; posterior angles of the lateral lobes of pronotum depressed, acute, barely produced; pronotum of male and female 14 mm. . *vidali*, Bolivar.

Criotettix rugosus, Bolivar.

(Fig. 2, Plate xiv.)

Bol., Ann. Soc. Ent. Belg., xxxi, p. 228, 1887; Brunn., Ann. Mus. Genova, xxxiii, p. 105, 1893.

Habitat.—Rangoon, Burma (*N. Annandale*). Brunner records this species from Lower Burma.

***Criotettix tricarínatus*, Bolivar.**

(Fig. 14, Plate xiv.)

Bol., Ann. Soc. Ent. Belg., xxxi, p. 224, 1887; Hanc., *Spolia Zeylanica*, ii, p. 128, pl. 3, fig. 15, 1904.

Habitat.—Sigiriya, Ceylon, Sept. 1909 (*E. E. Green*); Kandy, Ceylon, Apr. 1907; Peradeniya, Ceylon, July 1913 (*A. R.*). Bolivar records this species from Kodaikanal, S. India, in Ann. Soc. Ent. France, lxx, p. 583, 1902.

***Criotettix spinilobus*, Hancock.**

(Fig. 13, Plate xiv.)

Hanc., *Spol. Zeylan.*, ii, p. 130, pl. 3, fig. 12, 1904; Hanc., Gen. Ins. Orth. Acrid. Tetriginæ, p. 28, fig. 13, 1906.

Habitat.—Pundaluoya, Ceylon; Vurkalay, Travancore coast, S. India (*N. Annandale*).

This small species has the vertex subequal in width to one of the eyes, and the posterior angles of the lateral lobes on each side have a strongly produced sharp spine, curvate forward. The specimen from Travancore in the Indian Museum bears Kirby's label on which is written "*Criotettix obscurus* Kb. type." The specimen is identical with the type of *spinilobus* in the author's collection. This species resembles *indicus*, Bol., but may be distinguished by the curved spines.

***Criotettix indicus*, Bolivar.**

Bol., Ann. Soc. Ent. France, lxx, p. 581, 1902.

Habitat.—? S. India (*Bolivar*). Not represented in the Indian Museum coll.

***Criotettix orientalis*, Hancock.**

(Fig. 12, Plate xiv.)

Hanc., Records Ind. Mus., vii, p. 312, pl. xv, fig. 4, 1913.

Habitat.—Dibrugarh, N. E. Assam.

***Criotettix pallidus*, sp. nov.**

(Fig. 5, Plate xiv.)

Near *indicus*, Bolivar. Stature small; vertex distinctly narrower than one of the eyes, little narrowed forward; eyes globose; head not at all exserted; antennæ inserted between the lower part of the eyes; frontal costa compresso-elevated between the antennæ. Pronotum little rugose-granulose, between the shoulders little convex, disc on each side bearing a short carinula; pro-

zonal carinae behind the anterior border convergent backward; dorsum behind the shoulders, depressed, fossulate, and backward on the process bearing subelevated nodules; hind process subulate, extended beyond the hind femoral apices; median carina of the pronotum very low, thin, and sinuous; posterior angles of the lateral lobes laminate expanded, little triangulate and prominent, behind truncate, but the hind margin concave. Elytra ovate, apices rounded; wings fully explicate extended backward to the end of the pronotal process. Anterior femoral margins entire; middle femoral margins above and below undulate; hind femora somewhat stout, margins entire, minutely crenulate, externally above with a series of obtuse tubercles, and at the middle bearing distinct oblique rugulae; the pulvilli of the first joint of hind tarsi acute spiculate.

Entire length of male and female 11.5 mm.; pronotum 10.8 mm.; hind femora 5 mm.

Habitat.—Tenasserim Valley, Lower Burma (*Doherty*).

Criotettix dohertyi, sp. nov.

(Fig. 4, Plate xiv.)

Colour ferrugineous. Vertex strongly narrower than one of the eyes, little narrowed forward; eyes globose; head not at all exserted; antennae inserted between the lower angles of the eyes, not wholly between the eyes, and lower than in *tricarinatus*. Frontal costa compresso-elevated between the antennae, a little depressed above between the eyes, and distinctly sinuate at the median ocellus. Pronotum with the dorsum rugose-granulate, behind the shoulders depressed, between the shoulders convex and rather wide; on each side bearing a very thin carinula; on the process rugose-granulate, and bearing more or less irregular sub-elevated obtuse tubercles; posterior process subulate, long produced beyond the hind femora apices; median carina of pronotum very low, thin, and sinuous; prozonal carinae forward behind the front margin convergent backward, indistinctly expressed; posterior angles of the lateral lobes of the pronotum laminate expanded, little acute, prominent, margin behind the angle truncate, but very slightly concave. Elytra ovate, apices rounded-truncate; wings extended to the apex of the pronotal process. Anterior femoral margins entire; middle femoral carinae above entire, below sub-undulate; middle femora of male stouter, less elongate; hind femoral margins granulose, entire, the external face below subinfusate; hind tibiae plain dark brown; the third pulvillus of the first joint of the hind tarsi little longer than the second, the first two pulvilli acute spinose.

Entire length of male and female 13–16.5 mm. pronotum 12–15.5 mm.; posterior femora 5.5–7.3 mm.

Habitat.—Upper Assam (*Doherty*).

Two specimens in the Indian Museum have labels apparently in Saussure's handwriting, bearing the name "*Paratettix varia-*

balis, Bol." This species recalls the genus *Paratettix* in the characters of the vertex, yet the lateral lobes at the posterior angles are laminate, the angle truncate behind and the apex prominent. It materially differs from *Paratettix variabilis*, Bol., in many respects.

***Criotettix aequalis*, Hancock.**

(Fig. 3, Plate xiv.)

Hanc., Mem. Dept. Agric. India, iv, p. 136, 1912.

Habitat.—Bengal, Probsering, Lebong, 5000 ft. (Author's coll.)

***Criotettix montanus*, Hancock.**

(Fig. 1, Plate xiv.)

Hanc., Mem. Dept. Agric. India, iv, pp. 133, 134, 1912.

Habitat.—Punjab, Simla, 7000 ft. (Author's coll.)

***Criotettix annandalei*, sp. nov.**

(Fig. 6, Plate xiv.)

Near *graveleyi*, Hancock. Stature smaller; coloured fuscous, obscurely variegated with lighter brown, hind femora obscurely pale mottled. Vertex narrower than one of the eyes, subgranulose, fossulate on each side of the median carina, widened backward; head not exserted; antennae inserted between the lower angles of the eyes, not wholly between the eyes; frontal costa compresso-elevated arcuate between the antennae, not so roundly produced as in *graveleyi*. Pronotum deplanate on the dorsum, little convex between the shoulders, dull rugose-granulose, behind the shoulders bifossulate and the surface on the base of the process more or less pitted and tuberculose as in *Eugavialhdium*, prozonal carinae forward behind the front border lightly expressed, subparallel; posterior process subulate and acute produced much beyond the hind femoral apices; median carina of pronotum very low and thin, following the inequalities, obsolete forward behind the anterior margin; elytra elongate-ovate, apices rounded; wings extended to the apex of the pronotal process; posterior angles of the lateral lobes laminate and produced in an oblique acute spine on each side, anterior femoral margins subentire; middle femoral margins above minutely crenulate, subundulate, below undulate, very indistinctly bilobate; hind femora rather stout, margins above crenulate and often bearing very indistinct pale crenulate lobes, or absent, below margins subentire; pulvilli of the first joint of the hind tarsi subacute, not at all spinose, the third pulvillus longer than the second and planate below.

Entire length of male and female 14.5–17 mm.; pronotum 13.5 mm.; posterior femora 6–7 mm.

Habitat.—Paresnath, W. Bengal (Chota Nagpur), 4300 ft., April 15, 1909 (*N. Annandale*).

Two of the specimens in the Indian Museum collection were labelled by Kirby "*Criotettix exsertus*, Bol." The latter species has the head more exserted, and is otherwise very different from *Criotettix annandalei*, sp. nov., described above, and as noted under the genus *Bolotettix*, Hancock.

***Criotettix gravelyi*, sp. nov.**

(Fig. 9, Plate xiv.)

Stature large, dorsum ochreous or dark ochreous-brown, and subglabrous, the sides of the body, the under parts, legs, and wings, more or less black; posterior femoral carinae pale maculate, externally the hind femora marked with ochre, vertex smooth, in front subnarrower or subequal in width to one of the eyes, very slightly subnarrowed forward, median carina little expressed at the front; frontal costa roundly compressed between the antennae; eyes not exserted; antennae inserted between the lower angles of the eyes. Pronotum with the dorsum deplanate, rather smooth, little convex between the shoulders, broadly depressed behind the shoulders, posteriorly long subulate; prozonal carinae behind the front margin subparallel or indistinctly convergent backward; median carina of pronotum substraight, very low, obliterated forward behind the front border, little rounded subnodulose forward between the sulci; hind process produced much beyond the apices of the hind femora; posterior angles of the lateral lobes laminate, the apices produced in suboblique spines; elytra oblong-ovate, apices rounded-truncate; wings reaching to the apex of the pronotal process; margins of four anterior femora subentire; the superior carina of the middle femora granulate subundulate, below biundulate, or entire; posterior femoral margins above minutely crenulate, with very indistinct elevated pale lobes; externally above bearing a series of rounded tubercles, and at the middle bearing oblique rugulae; the three pulvilli of the first joint of hind tarsi subequal in length, the third subplanate below.

Entire length of male and female 17.5—20.5 mm.; pronotum 17–20 mm.; hind femora 7–9 mm.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July 1911 (*F. H. Gravelly*); Sikkim, Darjiling Dist. (*L. Mandelli*).

***Criotettix flavopictus*, Bolivar.**

(Fig. 10, Plate xiv.)

Bol., Ann. Soc. Ent. France, lxx, p. 582, 1902.

Habitat.—Thingannyinaung to Sukli, Dawna Hills, 900–2100 ft., Nov. 23, 1911 (*F. H. Gravelly*); Misty Hollow, W. side of Dawna Hills, 2200 ft., Nov. 22, 1911 (*F. H. Gravelly*): Ind. Mus. coll. Anamalais, about 2500 ft., Jan. 21, 1912 (*T. B. Fletcher author's coll.*). Kodaikanal (Castets, Decoly; *Bolivar*).

***Criotettix maximus*, Hancock.**

(Fig. 7, Plate xiv.)

Hanc., Records Indian Museum, viii, pp. 311, 312, pl. xv, fig. 1, 1913.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July, 1911 (*F. H. Gravely*). Yembung, 1100 ft.; Janakmukh, 600 ft. (*author's coll.*).

Note: In the figure given in the Rec. Ind. Mus. the elytra are drawn too large by the artist.

***Criotettix extremus*, Hancock.**

(Fig. 11, Plate xiv.)

Hanc., Mem. Dept. Agric. India, iv, pp. 132, 133, 1912.

Habitat.—Madras, Shevaroy, 4000 ft. (*author's coll.*).

It is quite probable that this is a variety or race of *maximus* Hanc., and I have so regarded it in the table separating the species of *Criotettix*.

***Criotettix vidali*, Bolivar.**

Bol., Ann. Soc. Ent. Belg., xxxi, p. 227, 1887; Brunn. Ann. Mus. Genova, xxxiii, p. 105, 1853.

Habitat.—Carin Cheba (*Brunner*). This species was described by Bolivar from Philippine specimens, and I am including it here on the authority of Brunner.

***Criotettix grandis*, Hancock.**

(Fig. 8, Plate xiv.)

Hancock, Mem. Dept. Agric. India, iv, pp. 134, 135, 1912.

Habitat.—Darjiling Dist., Singla, 1500 ft., Mar., 1913 (*Lord Carmichael coll.*).

The type in the author's collection is from Assam, Chera-punji, Khasi Hills. The specimens in the Indian Museum do not differ from the type, except in the colour of the body. In these specimens the colour is grey above, the sides of the body and hind femora covered with pale granulations, the pronotal process toward the apex darker and often minutely pale spotted; the anterior and middle tibiae annulate with white; body below fuscous and light; palpi white; hind femora with obscure pale bars; spines of the lateral lobes of pronotum acute, but not long produced. In the males the spines narrower. In one specimen from Upper Burma, Shan Hills (*J. C. Brown*), the spines of the lateral lobes are more acutely produced. The type specimen is somewhat faded with age, and the colour of the fresh specimens add materially to the original description.

Genus **Loxilobus**, Hancock.

Hancock, Spol. Zeylan., ii, p. 134, 1904.

The members of this genus have the vertex subequal or wider than one of the eyes, and narrowed forward; the frontal costa roundly produced before the eyes; the antennae inserted between the eyes, and the head not at all exserted. The pronotum above little rugose, often tuberculate, and with elongate lines; the posterior angles of the lateral lobes laminate, triangulate, and acute, the margin of lobes behind truncate or obtuse sinuate; wings often extended backward little beyond the pronotal apex. This genus seems to occupy a place between *Criotettix* on the one hand and *Coptotettix* on the other.

Loxilobus acutus, Hancock.

Hanc., Spol. Zeylan., ii, p. 134, figs. 3 and 16, 1904; Hanc., Gen. Ins. Orth. Acrid. Tetr., p. 29, pl. ii, fig. 17, 1906; Hanc., Mem. Dept. Agric. India, iv, p. 137, 1912.

Habitat.—Ceylon. Author's coll.

Loxilobus subulatus, Bolivar.

Criotettix subulatus, Bol., Ann Soc. Ent. Belg., xxxi, p. 227, 1887.

Habitat.—“Indes Orientalis” (*Bolivar*).

Loxilobus hancocki, Kirby.

Loxilobus rugosus, Hanc., Spol. Zeylan., ii, p. 135, 1908; Kirby, Syn. Cat. Orth. Brit. Mus., iii, p. 18, 1910.

Habitat.—Bombay, India; Ceylon. Author's collection.

Loxilobus assamus, Hancock.

Hanc., Trans. Ent. Soc. Lond., p. 223, 1901; Hanc. Mem. Dept. Agric. India, v, p. 136, 1912.

Habitat.—Assam; Bengal, Lebong. Author's coll.

Loxilobus parvispinus, sp. nov.

Resembling *acutus*, Hancock, but having the dorsum of pronotum little rugose; median carina of the pronotum thin, very low, irregularly compressed backwards, the rugae not so distinctly elevated; the posterior angles of the lateral lobes of the pronotum laminate, the apex on each side bearing a very small minute acute spine, the margin behind sinuate; the lateral carinae and the median carina of the pronotum much thinner and not so compressed as in *acutus*; colour dark ferrugineous, the sides of the abdomen and wings black, the hind femora with an obscure longitudinal black fascia below on the outer face: wings extended little beyond the pronotal apex.

Entire length of male 13 mm.; pronotum 12 mm.; posterior femora 5 mm.

Habitat.—Pusa, Bihar, July 9, 1910 (*T. B. Fletcher*). Author's coll.

This species was taken for *L. acutus*, and the male was described as that species in my report in the Mem. Dept. India, IV, p. 137, 1912. The present description is supplemental to that account, and refers to *parvispinus* instead of *acutus*.

Loxilobus striatus, sp. nov.

Near *acutus*, Hancock. Greyish-fuscous above, sides of body, and legs, paler reddish-ochre; hind femora below the lower external carina marked with a longitudinal black fascia; wings black or infumate. Vertex wider than one of the eyes, slightly narrowed forward, granulose; frontal costa arcuate produced between the eyes; antennae inserted distinctly between the lower fourth of the eyes. Pronotum granose, interspersed with very small tubercles; dorsum between the shoulders little convex, moderately wide, behind the shoulders deplanate, subulate posteriorly, surpassing the hind femoral apices; median carina of pronotum very low, thin, and irregularly interrupted and compressed; posterior angles of the lateral lobes of the pronotum laminate and obliquely truncate behind, the apices subacute, little prominent. Elytra elongate, the apices rounded-truncate; wings extended little beyond the pronotal apex. Anterior and middle femoral margins above entire, the inferior margins subundulate; hind femora moderately stout, margins minutely crenulate, the antegenicular spine acute, the third pulvilli of the first joint of the hind tarsi nearly as long as the first and second united, the first and second pulvilli spinose.

Entire length of male 11.5 mm.; pronotum 10.5 mm.; posterior femora 5.5 mm.

Habitat.—Calcutta, Aug. 26, 1904 (*Brunetti*); Thinganny-naung to Sukli, Dawna Hills, Lower Burma, 900–2100 ft., Nov. 23, 1911 (*F. H. Gravely*).

This species differs from *parvispinus* in the posterior angles of the lateral lobes being obliquely truncate behind, instead of sinuate and spined; while in *acutus* the angle of the lobes has the margins behind subtransverse.

Genus *Acanthalobus*, Hancock.

Table for the separation of the Indian species.

1. Vertex little wider than one of the eyes,
lateral lobules in front marginate; spine
on each side of the posterior angles of
the lateral lobes of pronotum acute and
obliquely produced, the margin behind
widely concave-sinuate *miliarius*, Bolivar.
cuneatus, Hancock

1. 1. Vertex distinctly wider than one of the eyes, narrowed toward the front, imperfectly marginate, or subtruncate.
2. Hind femora with the superior margin above distinctly lobate-serrulate, and toward the base costate; inferior margin subtuberculate; spine on each side of the lateral lobes of the pronotum moderately produced, acute, and subtransverse, the margin behind strongly sinuate *curticornis*, sp. nov.
2. 2. Hind femoral margins above not at all or scarcely dentate; spine on each side of the lateral lobes of the pronotum acute and oblique, and strongly produced.
3. Median carina of the pronotum behind the shoulders depressed, dorsum between the humeral angles convex; posterior femora above sparingly lobate .. *saginitus*, Bolivar.
3. 3. Median carina of the pronotum behind the shoulders not or barely depressed; dorsum between the humeral angles subdeplanate; posterior femora above entire, not at all dentate *bispinosus*, Dalm.

***Acanthalobus miliarius*, Bolivar.**

Criotettix miliarius, Bol., Ann. Soc. Ent. Belg., xxxi, p. 226, 1887.

Acanthalobus miliarius, Hanc. Spol. Zeylan., ii, p. 155, pl. 2, fig. 8, 1904.

Hanc. Gen. Ins. Orth. Acrid. Tetr., p. 29, pl. 2, fig. 19, 1906.

Habitat.—Trincomalee, Nov. 1906; Colombo; Ceylon. Ind. Mus. coll.

Acanthalobus cuneatus, Hancock, l. c. 1904, is apparently the short-wing form of *miliarius*.

***Acanthalobus curticornis*, sp. nov.**

Yellowish-rufescent, darker on the dorsum of pronotum forward and on the front of the head. Vertex strongly wider than one of the eyes, narrowed forward toward the front, subfossulate on each side, front imperfectly marginate, subtruncate, median carina very small, little elevated and subproduced; antennae very short, inserted between the lower part of the eyes; frontal costa arcuate-elevated between the antennae and depressed at the vertex. Pronotum with the dorsum deplanate, between the shoulders convex and rather wide, bearing rounded tubercles irregularly dis-

tributed; median carina low, interrupted and sparingly tuberculate, forward between the sulci elevated-crassate, subnodulose; prozonal carinae behind the anterior border convergent backward, and distinctly expressed; hind process of pronotum strongly crassate and rounded, strongly produced backward beyond the hind femoral apices; posterior angles of the lateral lobes of the pronotum laminate expanded, the angle contracted and acute produced in a spine on each side, subtransversely directed, the margin behind distinctly right-angulate sinuate. Elytra oblong, narrowed toward the apices and rounded; wings largely covered by the hind process, and extended to the apex of the pronotum, the part showing narrow; anterior femoral carinae entire; middle femoral margins above subundulate, below indistinctly bituberculate; posterior femoral margins above with the forward half costate, backward dentate, and minutely serrulate; in the type two of the denticles very distinct, and two less distinct, margin below provided with a series of barely elevated tubercles; hind tibiae sinuate-curved; pulvilli of the first joint of the hind tarsi elongate, acute

Entire length of female 19 mm.; pronotum 18.5 mm.; posterior femora 7 mm.

Habitat.—Medha, Yenna Valley, Satara Dist., Bombay Pres., 2200 ft., Apr. 17, 1912 (*F. H. Gravely*).

The spines of the lateral lobes in this species are shorter than in *saginitus*, or in *miliarius*, and they are more transverse; moreover, there are none of the series of short lines on the dorsum of pronotum, though tubercles are distinctly evident.

***Acanthalobus saginitus*, Bolivar.**

Criotettix saginitus, Bol., Ann. Soc. Ent. Belg., xxxi, pp. 225, 226, 1887; Brunner, Ann. Mus. Genova, xxxiii, p. 104, pl. 5, fig. 38, 1893.

Habitat.—S. India (*Bolivar*); Rangoon, L. Burma (*Brunner*). Not in the present collection.

The name *Acanthalobus saginitus* is given as a synonym for *Tettix inornata*, Walker, in Kirby's Cat. Orth., III, p. 17, 1910. This does not seem justified from Walker's description in which he states in referring to the pronotum: "three spines on each side, the hind spine longer than the two others, and inclined obliquely backward." As there is only one spine on each side of the pronotum in *saginitus*, Walker's species cannot be interpreted as this species, but it may belong to the genus *Hexocera*.

***Acanthalobus bispinosus*, Dalm.**

Acrydium bispinosum, Dalm., Vet.-Akad. Handl., p. 77, 1818; Kirby, Cat. Orth., iii, p. 18, 1910; Syn. *Tettix pallitarsus*, Walk.; *Tettix armiger*, Walk.; *Tettix latispinus*, Walk.

Habitat.—Sibsagar, N. E. Assam (*S. E. Peal*); Assam. Ind. Mus. coll.

Genus **Tettitelum**, nov.

Head not at all exserted; vertex very wide, strongly wider than one of the eyes, on each side fossulate, and provided laterally with a rounded compressed carinula; middle subcarinate forward barely subproduced; face broad, in profile little oblique; eyes viewed from above little prominent, but viewed from the side moderately small; paired ocelli placed between the middle of the eyes; antennae inserted between the lower part of the eyes, or barely lower; frontal costa widely sulcate between the paired ocelli, the rami subparallel, in profile scarcely elevated between the antennae; apical articles of palpi narrow. Pronotum above plain, subcylindrical forward, anteriorly truncate, posteriorly long acuminate, the apex acute subspinate; humeral angles wanting, the dorsum forward roundly sloping at the sides; prozonal carinae behind the anterior margin obsolete; posterior angles of the lateral lobes of the pronotum laminate-expanded, with the inferior margin before the angle, or the angle produced in an acute spine, curvate forward. Elytra elongate, apices rounded; wings fully explicate and reaching to the pronotal apex; anterior and middle femora elongate, margins entire, minutely serrulate. Blades of the female ovipositor rather short and straight, not at all curvate at the apices, hirsute, but not at all dentate, the upper blade rather broad. Near *Acanthalobus*, Hancock.

Tettitelum hastatum, sp. nov.

Colour yellowish, variegated with fuscous, the base of the pronotal process above suffused with black, lower margins of the lateral lobes, the elytra, and underneath the body pale yellow, abdomen greyish-fuscous, backward densely white maculate toward the extremity. Face robust; vertex not advanced as far as the eyes, strongly wider than one of the eyes, marginate in front, on either side fossulate, subampliate on the occiput; frontal costa compressed but scarcely elevated between the antennae. Pronotum above plain, minutely rugulose-granose and punctate; dorsum between the shoulders very obtuse tectiform, little subdepressed behind; median carina of pronotum very low, percurrent, and barely elevated forward before the shoulders; lateral carinae before the shoulders and also the prozonal carinae behind the anterior border wanting: the forward part of the pronotum cylindrical; posterior process long subulate, the apex sharply pointed; posterior angles of the lateral lobes of pronotum laminate expanded, the lower margin produced laterally in a curvate acute spine on each side, directed forward; anterior and middle femora elongate, margins minutely serrulate.

Entire length of female 17.5 mm.; pronotum 16 mm.: (hind femora missing).

Habitat.—Kawkareik, Amherst Dist., Lower Burma, Mar. 5, 1908 (*N. Annandale*).

The type bears a label on which Kirby has written: “*Eugavialidium hastatum*, Kb., Type.”

METRODORINÆ.

Genus *Systolederus*, Bolivar.

Systolederus greeni, Bolivar.

Bol., Ann. Soc. Ent. France, lxx, p. 584, 1892; Hanc., Spol.

Zeylan., ii, p. 155, pl. 2, fig. 9, 1904; Hanc., Gen. Ins.

Orth. Acrid. Tetr., p. 34, pl. 2, fig. 14, 1906.

Habitat.—Nilgiris, S. India; Maskeliya, Ceylon; Pundaluoya, Ceylon; Madulsima, Ceylon, July 13, 1908 (*T. B. Fletcher*; *Hancock*). Ind. Mus. coll.

Systolederus cinereus, Brunner.

Brunn., Ann. Mus. Genova, xxxiii, p. 105, 1893.

Habitat.—Carin Cheba (*Brunner*).

Genus *Eurymorphopus*, Hancock.

Eurymorphopus latilobus, Hancock.

Hanc., Spolia Zeylanica, v, pp. 113, 114, fig. 1, 1908.

Habitat.—Kandy, Ceylon, May 29, 1910; Undugoda, Ceylon, Sept 1909. Ind. Mus. coll.

This small species is easily recognized by the narrow vertex, and the strongly dilated margins of the lateral lobes of the pronotum.

Genus *Spadotettix*, Hancock.

Hanc., Spol. Zeylan., vi, pp. 146, 147, 1910; Hanc., Mem.

Dept. Agric. India, iv, pp. 141, 142, 1912.

Spadotettix fletcheri, Hancock.

Spol. Zeylan., vi, pp. 147, 148, figs. 1, 2, 1910.

Habitat.—Ceylon. Author's coll.

Spadotettix provertex, Hancock.

Mem. Dept. Agric. India, iv, pp. 142, 143, 1912.

Habitat.—Madras, India. Author's coll.

Genus *Apterotettix*, Hancock.

Hanc., Spol. Zeylan., ii, pp. 108, 140, 1904; Hanc., Gen.

Ins., pp. 30, 35, 1906.

Apterotettix obtusus, Hancock.

Hanc., Spol. Zeylan., ii, p. 155, pl. 3, fig. 13, 1904; Gen. Infs., p. 35, fig. 16, 1906.

Habitat.—Peradeniya, Ceylon. Ind. Mus. coll.

Genus **Amphinotus**, nov.

Stature small and apterous, with the head moderately exserted. Vertex wide, subwidened forward, strongly wider than one of the eyes, bifossulate forward, submammilate between the posterior part of the eyes, the frontal carinulae laterally little compressed, abruptly terminated but not cuspidate, open each side of the mid-carina, middle carinate forward, compressed and little produced; face little oblique; eyes prominent, rather small, viewed from above subpedunculate and reniform; frontal costa strongly sinuate between the eyes, rather widely furcillate, not forked above the paired ocelli, the rami compresso-elevated between the antennae; paired ocelli placed nearly on a line with the lower border of the eyes; antennae rather short, filiform and inserted below the eyes. Pronotum truncate anteriorly, subtectiform forward, deplanate posteriorly, hind process abbreviated and truncate at the apex; median carina compressed, strongly elevated between the shoulders; humeral angles wanting; lateral carinae of the posterior process compressed; posterior angles of the lateral lobes of the pronotum oblique, the angle little prominent outwards and obliquely truncate behind. Elytra and wings wanting; legs elongate; the anterior and middle femoral margins undulate; posterior femora armed with denticles on the external longitudinal carina, the middle denticle compressed obtuse triangularly elevated; hind tibiae armed with spines; the first joint of the posterior tarsi strongly longer than the first, the three pulvilli often planate below and equal in length.

The type is *Amphinotus pygmaeus*, sp. nov.

This genus recalls the Cladonotinae in some respects, yet it is near *Mazarredia*, Bol. It differs in the subsessile eyes, wider vertex, lower position of the paired ocelli, absence of the humeral angles, less laminate posterior angles of the lateral lobes of the pronotum, the absence of elytra and wings, and long first joint of the hind tarsi.

Amphinotus pygmaeus, sp. nov.

Body very small, one of the smallest known Tettigids; coloured greyish, with two black bars marking the sides at the base of the hind process, divided by an oblique lighter line. Head little exserted; vertex very wide, front not advanced as far as the eyes, widened forward between the anterior carinulae, about twice the width of one of the eyes, bifossulate forward, and bearing small submammilate ridges just behind the fossae, frontal carinulae rounded, but abruptly terminated at the inner sides of the eyes

and angulate, but not elevated above the eyes; median carina of the vertex compressed-rounded, little produced; frontal costa in profile strongly sinuate between the eyes, little protuberant between the antennae. Pronotum truncate anteriorly, or barely obtuse angulate; dorsum little compressed at the sides; the short prozonal carinulae behind the anterior margin distinctly compressed, elevated; median carina of the pronotum thinly compressed subcrisate, highest forward between the sulci, sloping forward and little sloping backward; hind process strongly abbreviated, truncate, with the lateral angles obtuse, on each side of process bearing a compressed convex carina: humeral angles wanting, but instead the dorsum bearing an expressed lineate tubercle on each side, and two between the shoulders; posterior angles of the lateral lobes oblique, little prominent laterally and obliquely truncate behind. Anterior and middle femoral margins undulate; posterior femoral carinae bidentate on the outer face, the middle denticle larger, compressed, and produced, the superior and inferior margins entire; hind tibiae armed with spines and narrow; the first joint of the hind tarsi nearly twice the length of the third.

Entire length of male and female, 5-7.5 mm.; pronotum 3-4 mm.; posterior femora 3.7-4 mm.

Habitat.—Hakgala, Ceylon, Mar. 1907 (*E. E. Green*); Punduluoya, Ceylon, Feb. 1899. Two adults and a larva in the author's collection.

Genus *Mazarredia*, Bolivar.

Table for separating the Indian species.

1. Disc of pronotum above strongly unequal, somewhat elevated between the shoulders and bearing high subcarinate tubercles.
2. Dorsum of pronotum behind the shoulders profoundly fossulate.
3. Frontal costa not at all sinuate between the eyes.
4. Posterior angles of the lateral lobes of the pronotum little produced, apex subrounded; elytra oblong ovate; length of male and female pronotum 17.2-17.8 mm. *inequalis*, Brunner.
4. 4. Posterior angles of the lateral lobes of the pronotum widely dilated, subobtusely-truncate; elytra elliptical acuminate toward the apices; median carina of pronotum forward between the sulci strongly gibbose-crenulate; length of female pronotum 13.5 mm. *singlaensis*, sp. nov.
1. 1. Disc of pronotum between the shoulders lower.

2. 2. Dorsum of pronotum behind the disc distinctly though moderately fossulate.
3. 3. Frontal costa sinuate between the eyes.
5. Median carina of the pronotum lightly cristate before the shoulders, but depressed in front; posterior angles of the lateral lobes of the pronotum little expanded, obtuse; length of male and female pronotum 13.5-15.5 mm *sikkimensis*, Bolivar.
5. 5. Median carina of the pronotum subcristate before the shoulders, but not depressed in front; posterior angles of the lateral lobes of pronotum little produced, obtuse; length of female pronotum 17 mm. *.. sculpta*, Bolivar.
6. Disc of the pronotum plain, convex between the shoulders; median carina lightly and subequally elevated.
7. Vertex nearly twice the width of one of the eyes; (8 and 8.8).
8. Pronotal process subulate, surpassing the hind femoral apices; length of female pronotum 14.7 mm. *lativertex*, Brunner.
8. 8. Pronotal process not reaching to the knees of the hind femora; length of female pronotum 10.5 mm. *ghumtiana*, sp. nov.
9. Head little exserted, lateral carinulae not angulate or cuspidate.
10. Stature very small, body apterous but with small elytra; vertex subnarrower than one of the eyes, not at all produced; pronotum of male 5 mm., of female 7.3 mm. *. perplexa*, sp. nov.
10. 10. Stature larger.
7. 7. Vertex subwider than one of the eyes.
11. Pronotum above granose, subrugose; eyes strongly exserted; length of pronotum 12 mm. *laticeps*, Bolivar.
11. 11. Pronotum above granose, and bearing irregular lineate tubercles on the process; eyes moderately exserted; frontal costa strongly protuberant between the antennae; length of pronotum male and female 14-16 mm. *dubia*, Hancock.
- Length of pronotum male and female 13-15 mm. *convergens*, Brunner.
6. 6. Disc of the pronotum deplanate.
12. Median carina of the pronotum gibbose only between the sulci forward; dorsum rugulose; vertex strongly wider

- than one of the eyes; length of female pronotum 13.5 mm. *latifrons*, Hancock.
12. 12. Median carina of the pronotum behind the anterior margin forward compresso-elevated, cristate and entire, vertex very little wider than one of the eyes; length of female pronotum 13 mm. *cristulata*, Bolivar.
9. 9. Head distinctly exerted.
13. Vertex on each side bearing a minute angulate lobe, narrowed toward the front; antennae inserted far below the eyes; elytral apices yellow; lateral lobes of pronotum with the posterior angles outwardly produced, obtuse; length of female pronotum 11.8 mm. *ophthalmica*, Bolivar.
13. 13. Vertex on each side cuspidate; head little exerted; pronotum above rugulose, carinae subacute; dorsum depressed behind the shoulders; length of male and female pronotum 10-11.8 mm. *insularis*, Bolivar.

***Mazarredia inequalis*, Brunner.**

Brunn., Ann. Mus. Genova, xxxiii, p. 106, pl. 5, fig. 39, 1893.

Habitat.—Burma (*Brunner*).

***Mazarredia singlaensis*, sp. nov.**

Near *inequalis*, Brunner. Yellowish-grey sparingly marked with fuscous. Body rugose; vertex very little wider than one of the eyes, subnarrowed forward, not at all produced at the middle, imperfectly marginate, elongate fossulate on each side of the mid-carinula; frontal costa not sinuate between the eyes but depressed, between antennae distinctly protuberant, viewed in front rather widely sulcate, branching above the paired ocelli, in profile sinuate at the median ocellus; antennae inserted little below the eyes; palpi compressed and white. Pronotum deplanate, above coarsely granulate and sparingly tuberculate; dorsum between the shoulders moderately dilated; median carina of the pronotum very unequal, forward between the sulci compressed-elevated in a rough gibbosity which gradually slopes forward, uneven, and subdepressed just behind the front border, strongly and abruptly sinuate and crenulate behind, the median carina posteriorly sinuate and subtuberculate; the dorsum between the shoulders little elevated, and bearing on each side of the middle an elongate elevated carinula; behind the shoulders strongly fossulate; posterior angles of the lateral lobes expanded laminate, the angle obliquely truncate behind, the apex somewhat prominent; elytra

subelliptical; wings reaching to the pronotal apex; the four anterior femora compressed, margins of anterior above and below undulate; middle femoral margins above and below subtrilobate, minutely crenulate; hind femoral margins above serrulate, and sublobate, inferior carina very narrow, thin, and minutely undulate-crenulate; the third pulvilli of the first joint of the hind tarsi equal in length to the first and second combined, the first and second speculate, the first minute.

Entire length of female 14 mm.; pronotum 13 mm.; post. fem. 6 mm.

Habitat.—Singla, Darjiling Dist., 1500 ft., June 1913 (*Lord Carmichael's coll.*), Ind. Mus. coll.

Mazarredia sikkimensis, Bolivar.

Bol., Bol. Soc. Espan., ix, pp. 398, 399, 1909.

Habitat.—Sikkim, E. Himalayas. Ind. Mus. coll.

Mazarredia sculpta, Bolivar.

Bol., Ann. Soc. Ent. Belg., xxxi, p. 238, 1887; Brunn., Ann. Mus. Genova, xxxiii, p. 107, 1893; Hanc., Trans. Ent. Soc. London, p. 405, 1908.

Habitat.—Sukna, Darjiling Dist., 1000 ft., May 1913 (*Lord Carmichael's coll.*), Ind. Mus. coll. Also reported from Tenasserim; Pegu; Assam; Oriental India.

Mazarredia lativertex, Brunner.

Brunn., Ann. Mus. Genova, xxxiii, p. 108, pl. 5, fig. 41, 1893.

Habitat.—Burma (*Brunner*).

Mazarredia ghumtiana, sp. nov.

Near *lativertex*, Brunner. Ferrugineous-fuscous. Head large; body somewhat smooth granulose, devoid of a gibbosity and elevated tubercles. Vertex very wide, nearly twice the width of one of the eyes, horizontal, on each side fossulate, the lateral carinulae rounded, the front margin barely advanced beyond the eyes; frontal costa scarcely sinuate between the eyes; antennae inserted below the eyes. Pronotum truncate anteriorly, transversely rounded before the shoulders; hind process cuneate, not reaching or barely extended to the hind femoral knees; dorsum above deplanate, little convex between the shoulders, subfossulate behind the shoulders; median carina very low undulate; prozonal carinae behind the front border merely granulose lines convergent backward, not at all expressed; antehumeral carinae on each side low and not at all compressed, behind the shoulders laterally bicarinate; the hind process above toward the apex tricarinate and planate, and above little rugulose; posterior angles of the lateral lobes oblique, very little prominent, subnarrowed, obliquely trun-

cate behind; elytra very small, elongate, apices rounded; wings present, but not reaching to the pronotal apex; anterior and middle femora subentire, granose; hind femora large, margins granose, minutely serrulate, antegenicular lobe acute; the three pulvilli of the first joint of the hind tarsi subequal in length, subobtusate.

Entire length of female 11.5 mm. (to end of pronotum): pronotum 10.5 mm.; hind femora 8 mm.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, Mar. 27, 1910 (*F. H. Gravely*); a larval specimen which may be this, or an allied species, is from Kurseong, 5000 ft., E. Himalayas (*N. Annandale*). The latter is labelled apparently by Kirby: "*Coptotettix acuteterminatus*, Brunn."

***Mazarredia perplexa*, sp. nov.**

Stature small; coloured grey obscurely variegated with fuscous; head little exserted; eyes prominent somewhat elevated; vertex subnarrower than one of the eyes, narrowed forward, not at all produced, elongate fossulate on each side, laterally the carinulae little roundly elevated; antennae inserted distinctly below the eyes; paired ocelli placed between the lower third of the eyes: frontal costa depressed above between the eyes, rounded and protuberant between the antennae. Pronotum truncate anteriorly, posteriorly abbreviated, distinctly flattened backward and cuneate produced only to the knees of the hind femora; median carina little compresso-elevated forward between the sulci, depressed-undulate between and behind the shoulders; pronotal carinae forward behind the front margin parallel or subdivergent backward; on either side of the disc bicarinate; the lateral carinae becoming obsolete toward the apex; hind process little rugulose on the base; posterior angles of the lateral lobes subrounded truncate, not at all laminate outward nor prominent; elytra small and elliptical; wings wanting or undeveloped; anterior and middle femora elongate, margins entire; the third pulvilli of the first joint of the hind tarsi as long as the first and second combined, the first and second spinose.

Entire length of male 6.5 mm.; female 8.5 mm.; pronotum 5.7 mm.; hind femora female 5.2 mm.

Habitat.—Sikkim (*Knyvett*). Ind. Mus. coll.

***Mazarredia dubia*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, p. 139 1912.

Habitat.—Bengal, Proobsering, Lebong, Darjiling, 5000 ft. Author's coll.

***Mazarredia convergens*, Brunner.**

Brunn., Ann. Mus. Genova, xxxiii, p. 107, pl. 5, fig. 40, 1893.

Habitat.—Burma (*Brunner*).

Mazarredia laticeps, Bolivar.

Bol., Bol. Soc. Espan., ix, p. 399, 1909.

Habitat.—Upper Assam (*Bolivar*).

Mazarredia latifrons, Hancock.

Hanc., Mem. Dept. Agric. India, iv, p. 139, 1912.

Habitat.—Bengal, Proobsering, Lebong. Darjiling Dist., 5000 ft. Author's coll.

Mazarredia cristulata, Bolivar.

Bol., Ann. Soc. Ent. France, lxx, p. 584, 1902.

Habitat.—S. India (*Bolivar*).

Mazarredia ophthalmica, Bolivar.

Bol., Bol. Soc. Espan., ix, p. 399, 1909.

Habitat.—“Sibsagar, N. E. Assam (S. E. P.)” (*Bolivar*).

Mazarredia insularis, Bolivar

Bol., Ann. Soc. Ent. Belg., xxxi, p. 239, 1887; Hanc., Spol.

Zeylan., ii, p. 155, pl. 2, fig. 7, 1904.

Habitat.—Kandy, Ceylon, July 1910. Ind. Mus. coll.

Genus **Xistra**, Bolivar.**Xistra stylata**, Hancock.

Hanc., Trans. Ent. Soc. London, p. 231, 1907.

Habitat.—Ceylon. Author's coll.

Xistra dubia, Brunner.

Brunn., Ann. Mus. Genova, xxxiii, p. 108, pl. 5, fig. 42, 1893.

Xistra sikkimensis, sp. nov.

Near *sagittata*, Bolivar. Colour pale ochreous above, with two narrow black markings behind the shoulders. Head little exserted; eyes elevated higher than the dorsum of pronotum; vertex subequal in width to one of the eyes, little narrowed forward, middle carinate, subtruncate in front, the anterior carinae laterally reflexed, angulate-subcuspidate, but not elevated higher than the eyes; antennae inserted below the eyes; paired ocelli placed between the middle of the eyes; frontal costa moderately produced between the eyes, arcuate, slightly sinuate above between the eyes, and distinctly sinuate below at the median ocellus. Pronotum lengthily subulate; dorsum tectiform, punctate and granose; median carina of the pronotum percurrent, little compressed, sinuate behind the anterior border, and distinctly

compressed forward on either side at the median sulcus, and the dorsum strongly depressed; elytra ovate, apices rounded; wings caudate; middle femora elongate, margins entire; posterior angles of the lateral lobes of the pronotum hebitate.

Entire length of female 14 mm.; pronotum 10.8 mm.

Habitat.—Sikkim. Ind. Mus. coll.

This species differs from *sagittata* in the subcuspidate frontal carinulae of the vertex; in the tectiform dorsum, and slightly elevated undulate median carina forward. It is not at all typical of the genus *Xistra*, and approaches *Paratettix* in some respects. This species, like *sagittata* and *tricristata* belong to a series by themselves which really form a subgenus.

Genus **Xistrella**, Bolivar.

Bol., Real. Soc. Espan. Nat. Hist., ix, pp. 400, 401, 1909.

Xistrella dromadaria, Bolivar.

Bol., Real. Soc. Espan. Nat. Hist., ix, p. 401, 1909.

Habitat.—Sikkim (*L. M.*). Indian Museum coll.

The type came from the same locality. The female in the Ind. Mus. coll. has the pronotum lengthily subulate, and the median carina between the shoulders strongly elevated in an obtuse gibbosity. The length of the pronotum 17 mm.

Genus **Lamellitettix**, Hancock.

Lamellitettix fletcheri, sp. nov.

Near *acutus*, Hancock. Differing in the smaller stature: the vertex on either side more acute cuspidate; the frontal costa less protuberant between the antennae; median carina of the pronotum bigibbulate, the first gibbosity very small and rounded placed between the sulci forward, the second gibbosity joined on either side with a strongly compressed subtransverse ruga; median carina on the hind process sinuate. The strongly elevated carinate tubercles on each side between the shoulders in *acutus* reduced in *fletcheri* to short compressed carinulae; the posterior angles of the lateral lobes of the pronotum little acute produced in this species, whereas, in *acutus*, they are strongly transversely acute produced, the triangulate spine on each side having a broader base.

Entire length of male 9.5 mm; pronotum 8.7 mm; hind femora 4.5 mm.

Habitat.—Anamalais, Castlecroft Estate, India, 400 ft., Jan. 23, 1912 (*T. B. Fletcher*). Author's coll.

Lamellitettix pluricarinatus, Hancock.

Hancock, Trans. Ent. Soc. Lond., p. 404, 1908.

Habitat.—Deltota, Ceylon. Author's coll.

Genus **Hyboella**, nov. (*Coptotettix* in part).

Body more or less crassate; head not at all exserted; vertex wider than one of the eyes, narrowed forward, granose, imperfectly marginate, on either side bearing a very small looped carinula, more distinct next to the eyes, very lightly fossulate, middle minutely carinate; frontal costa produced, often depressed between the eyes, compressed-arcuate between the antennae; eyes more or less conoidal in form; paired ocelli placed little below the middle, or between the middle of the eyes; antennae filiform, of moderate length, and inserted between the extreme lower part of the eyes, or barely below. Pronotum anteriorly truncate, or subconvex, or barely produced at the middle; hind process posteriorly cuneate, not extended beyond the knees of the hind femora; or subulate and extended beyond the apices of the hind femora; median carina of the pronotum compressed elevated forward between the sulci, the dorsum tectiform forward, behind the shoulders depressed or planate, the median carina often bearing tubercles: middle of front border not at all or little produced over the occiput; posterior angles of the lateral lobes of the pronotum laminate dilated, subtransversely truncate behind, the angles subacute produced, or the posterior angles more or less reflexed outwards and obliquely truncate behind, rarely not reflexed outwards. Elytra and wings wanting, or when present the elytra elongate lanceolate, narrowed toward the apices, and the wings abbreviated, or extended beyond the pronotal apex. Anterior femora elongate, margins entire; middle femoral margins entire or undulate; posterior femora distinctly crassate, strongly widened toward the base, external face above bearing large tubercles, the superior carina minutely serrulate, entire, or bearing denticles toward the apices; the first joint of the posterior tarsi distinctly longer than the third.

This genus differs from *Coptotettix*, Bolivar, in the stouter stature, the often depressed frontal costa between the eyes; the position of the antennae; the dilated or reflexed posterior angles of the lateral lobes of the pronotum, which are truncate behind; the compressed tectiform pronotum forward; and in the frequent imperfect development or absence of the wings. In the character of the posterior angles of the lateral lobes, this genus resembles *Mazarredia* somewhat. It includes a number of species in India, and some species in the Oriental Region outside of India. The type is *Hyboella tentata*, sp. nov.

Table for separating the Indian species.

1. Elytra and wings wanting.
2. Antennae inserted below the eyes; disc of pronotum elevated; lateral lobes of pronotum strongly arcuate backwards; pronotum of male 9.3 mm. *latifrons*, Brunner.

- Stature smaller, pronotum of male
6.5 mm. *acuteterminata*, Brunner.
2. 2. Antennae inserted between the lower part of the eyes; lateral lobes of pronotum moderately expanded, the posterior angles obliquely truncate; disc of pronotum very little elevated; pronotum of female 10 mm. *nullipennis*, Hancock.
1. 1. Elytra present, of moderate size.
3. Pronotum viewed in front not quadrate.
4. Dorsum of pronotum somewhat smooth, tumid; median carina of the pronotum not produced at the front border; body crassate; pronotum of male and female 10-11 mm. *tumida*, Hancock.
4. 4. Dorsum of pronotum tuberculate, strongly tectiform forward; front border subangulate; the median carina of pronotum little produced; posterior angles of the lateral lobes of the pronotum widely dilated, triangulate produced; pronotum of male and female 11-13.8 mm. *tentata*, sp. nov.
- Front border of pronotum truncate; pronotum of female 14 mm. *dilatata*, de Haan.
3. 3. Pronotum viewed in front subquadrate, above tectiform, sides concave; body strongly crassate; hind femora wide; frontal costa barely elevated; hind process of pronotum cuneate; wings reaching to the apex of pronotal process or little beyond; pronotum of male and female 12-15 mm. *obesa*, sp. nov.
5. Vertex viewed from above planate, little produced, in profile angulate produced; eyes strongly conoidal; posterior process of pronotum subulate distinctly surpassing the hind femoral apices; stature large; pronotum of female 17.5 mm. *angulifrons*, sp. nov.
5. 5. Vertex viewed from above fossulate on each side; stature smaller; frontal costa arcuate produced before the eyes.
6. Posterior angles of the lateral lobes of pronotum oblique, apices obtuse; pronotum little wide between the shoulders, behind the shoulders subfossulate; median carina arcuate forward and backward sinuate-tuberculate; pro-

notum of male and female 10.5-12.5 mm.

conioptica, sp. nov.

6. 6. Posterior angles of the lateral lobes of the pronotum subexpanded outwardly, behind widely truncate; pronotum of male and female 11.5 and 9 mm. *problematica*, Bolivar.

Hyboella latifrons, Brunner.

Coptotettix latifrons, Brunn., Ann. Mus. Genova xxxiii, p. 112, pl. 5, fig. 44, 1893.

Habitat.—Burma (*Brunner*).

Hyboella acuteterminata, Brunner.

Coptotettix acuteterminatus, Brunn., Ann. Mus. Genova, xxxiii, p. 112, 1893.

Habitat.—Pegu (*Brunner*).

Hyboella nullipennis, Hancock.

Coptotettix nullipennis, Hanc., Records Ind. Mus., viii, p. 314, pl. xv, fig. 2, 1913.

Habitat.—Janakmukh, India (*Kemp*). Ind. Mus. coll.

Hyboella tumida, Hancock.

Coptotettix tumidus, Hanc., Records Ind. Mus., viii, pp. 313, 314, pl. xv, fig. 3, 1913.

Habitat.—Dibrugarh, N.-E. Assam (*Kemp*). Ind. Mus. coll.

Hyboella tentata, sp. nov.

Body crassate; face large: head not at all exserted, little retracted under the pronotum. Colour yellowish-ferrugineous, or subinfusate. Vertex wider than one of the eyes, narrowed forward, subampliate backward, in front imperfectly marginate, open either side of the mid-carina, bearing very small subcompressed flexed carinulae laterally next to the eyes, and little subfossulate on each side; antennae inserted between the lower margin of the eyes; paired ocelli conspicuously placed before the middle of the eyes; frontal costa compressed arcuate between the antennae, depressed above, and sinuate at the median ocellus. Pronotum tuberculose granose above, the dorsum tectiform forward, the disc somewhat tumose, posteriorly planate; hind process acute cuneate abbreviated and not reaching to, or extended to the hind femoral knees; median carina of pronotum forward crassate and compressed-elevated arcuate, from the front to a point backward above the articulation of the hind femora, backward very low and bearing compressed tubercles; at the front margin the median carina crassate and little obtuse produced over the occiput; prozonal carinae behind the anterior border small, imperfectly developed;

humeral angles strongly depressed; posterior angles of the lateral lobes of the pronotum strongly laminate dilated laterally, apex subacute, widely transversely truncate behind: elytral sinus shallow; elytra narrow, elongate, lanceolate; wings undeveloped, but not entirely wanting; anterior femora elongate, margins entire, subundulate; middle femora little compressed, margins undulate; hind femora strongly crassate, very wide toward the base, superior margin granose and minutely serrulate, subbidentate toward the knees, the antegenicular spine acute; hind tibiae with both margins armed with strong spines; first article of the posterior tarsi strongly longer than the third, the third pulvillus as long as the first and second combined, planate below, the first and second spiculate.

Entire length of male and female 12-14.5 mm. (to end of process); pronotum 11-13.8 mm.; posterior femora 8-9 mm.

Habitat.—Sibsagar, N.-E. Assam (*S. E. Peal*); Upper Assam (*Doherty*).

Two examples are labelled with the name "*Tettix dilatatus*." This species is quite different from *dilatata*, de Haan, as evidenced by comparison with specimens of this species from Java in my collection.

***Hyboella dilatata*, Haan.**

Acridium (Tetrix) dilatatum, de Haan, Bijdr., pp. 167, 169, pl. xxii, fig., 1843.

Habitat.—Carin Asciiui (*Brunner*).

***Hyboella obesa*, sp. nov.**

Body strongly crassate, above granose, little rugose; head little retracted under the pronotum; face large; eyes strongly conoidal in profile. Colour fuscous, variegated with dull yellow, hind femora often bearing vertical bars of yellow. Vertex wider than one of the eyes, barely emarginate in front, median carina very small and low, slightly fossulate on each side; paired ocelli placed scarcely below the middle of the eyes; antennae rather short, and inserted barely between the lower margin of the eyes, apical articles of palpi compressed; frontal costa barely arcuate elevated between the antennae, and little depressed between the eyes; vertex in profile angulate. Pronotum anteriorly very obtuse angulate, when viewed in front the body quadrate, on either side of pronotum concave, and above tectiform; median carina of pronotum in profile elevated forward, and arcuate compressed from the front border to a point backward above the articulation of the hind femora, then strongly depressed irregularly sinuate backward; the dorsum backward planate, broadly fossulate opposite the elytral apices; hind process acute cuneate, the lateral carinae compressed, the apex reaching to the extremities of the hind femora or surpassing them; humeral angles widely arcuate, the humeral carinae subobliterated, not at all compressed; elytra sinus shallow; posterior angles of the lateral lobes of the pronotum widely

dilated, obliquely truncate behind; elytra elongate, widened at the middle, acuminate toward the apices; wings shortened, not reaching to the pronotal apex, or little surpassing the apex. Anterior and middle femora elongate, granulose, margins subentire; middle femora little compressed bearing a row of rounded tubercles at the middle; hind femora strongly crassate, very wide, the superior carina entire, minutely subsulcate serrulate, below entire; hind tibiae black, pale annulate at the anterior fourth; margins narrow and armed with strong spines; the first joint of the hind tarsi distinctly longer than the third, the first and second pulvilli of the first joint acute, the third longer than the second.

Entire length of male and female 12.5-16 mm.; pronotum 12-15 mm.; posterior femora 8-9 mm.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July, 1911 (*F. H. Gravely*).

A series of adults and larvae in the Indian Museum. The nymphs have the dorsum of pronotum strongly compressed, the median carina rounded-cristate as in some of the adult Cladonotinae.

***Hyboella angulifrons*, sp. nov.**

Body moderately crassate, above granose-rugose; head very little exserted, in profile angulate; face oblique; eyes conoidal; colour fuscous, variegated with yellow on the hind process and hind femora; vertex viewed from above little produced and rounded at the sides, granose, wider than one of the eyes, widened backward and subampliate, little ascendant forward; antennae yellow, inserted between the extreme lower part of the eyes; paired ocelli placed little below the middle of the eyes; frontal costa slightly elevated arcuate between the antennae. Pronotum very little convex at the front margin; dorsum deplanate, between the shoulders little convex, behind the shoulders depressed and broadly fossulate; hind process above planate, rugose and subulate extended backward beyond the hind femoral apices; median carina of the pronotum compressed slightly arcuate and crassate forward extending only as far backward as the sulci; posteriorly indistinct but irregularly compressed-tuberculate; lateral carinae of process compressed; humeral angles very obtuse; posterior angles of the lateral lobes of the pronotum oblique very little dilated, the apices obtuse, the margin behind obliquely truncate; elytra lanceolate, widest at the middle, acuminate toward the apices; wings extended backward to the pronotal apex; anterior and middle femora elongate; margins of the anterior entire; margins of the middle femora undulate; hind femora crassate, the superior carina minutely serrulate, at the anterior half strongly rounded, the inferior margins entire; the first article of the posterior tarsi longer than the third; the first and second pulvilli acute, the third distinctly longer than the second.

Entire length of female 17.5 mm.; pronotum 16.5 mm.; posterior femora 9 mm.

Habitat.—Dawna Hills, Lower Burma, "third camp to misty hollow" 400–2400 ft., Nov. 22–30, 1911 (*F. H. Gravely*). Ind. Mus. coll.

This species is not so robust in stature as *obesa*, the vertex is more angulate in profile; the median carina of the pronotum forward is lower; and the hind process is lengthily subulate, instead of shortened and cuneate.

***Hyboella conioptica*, sp. nov.**

Body slightly robust; colour greyish, the hind femora obscurely marked with yellow; head not at all exserted, in profile subrounded; vertex nearly equal in width to one of the eyes, not at all advanced beyond the eyes, narrowed forward and fossulate on each side, little ampliate backward; antennæ inserted between the lower part of the eyes; paired ocelli placed between the middle of the eyes; frontal costa viewed in front sulcate above the paired ocelli, in profile arcuate produced before the eyes. Pronotum anteriorly truncate or very slightly convex, posteriorly subulate extended beyond the hind femoral apices; dorsum rather smooth granulate-tuberculate, between the shoulders convex, but forward subtectiform, and behind the shoulders planate; median carina very low, elevated forward and little arcuate behind the anterior margin between the sulci; depressed between the humeral angles, and depressed sinuate backward, irregularly compressed; humeral angles obtuse and roundly depressed; posterior angles of the lateral lobes of the pronotum little dilated, obliquely truncate behind, the apices dull; elytra elongate, widened at the middle, narrowly rounded at the apices; wings extended barely beyond the pronotal apex; anterior and middle femora elongate, little compressed, margins entire; posterior femora stout, externally granose, margins entire; the four anterior tibiae and tarsi black and pale annulate; first joint of the hind tarsi longer than the third, the first and second pulvilli acute, the third longer than the second.

Entire length of male and female 11.5 mm.; pronotum 10.5–12.5 mm.; posterior femora 5.6–7 mm.

Habitat.—Singla, Darjiling Dist., 1500 ft., Mar. 1913 (*Lord Carmichael's coll.*); Assam (*H. H. Godwin-Austen*). Ind. Mus. coll.

***Hyboella problematica*, Bolivar.**

Coptotettix problematica, Bol., Real. Soc. Espan., ix, p. 401, 1909.

Habitat.—Upper Assam (*Bolivar*).

TETTIGINÆ.

Genus *Teredorus*, Hancock.

Hancock, Gen. Ins. Orth. Acrid. Tetr., pp. 51, 52, 1906.

The genus *Teredorus*, Hancock, was based on a Peruvian (S. American) species, *stenofrons*. The new Indian species described

below have the frontal costa somewhat depressed, whereas, in *stenofrons*, it is roundly protuberant between the antennae; the dorsum of pronotum is rounded between the shoulders instead of being convex as in *carmichaeli*.

***Teredorus carmichaeli*, sp. nov.**

Near *stenofrons*, Hancock. Body wholly white, or grey and pale variegated, tibiae fuscous, annulate with white, wings black or infumate. Head not at all exserted, viewed from above very small; vertex strongly contracted forward drawing the eyes very near together, minutely tricarinate; frontal costa barely subproduced beyond the eyes, sinuate at the median ocellus; antennae inserted little below the eyes; eyes distinctly globose, pronotum smooth glabrous, minutely granose, subcylindrical forward, widened between the shoulders; median carina very indistinct; prozonal carinae behind the front border mere obsolete lines and parallel; antehumeral carinae indistinct; hind process long subulate surpassing the hind femoral apices; posterior angles of the lateral lobes of the pronotum turned down, the apices rounded or subtruncate; elytra moderately large, externally reticulate, rather wide forward and acuminate backward and narrowly rounded at the apices; wings extended to the pronotal apex; the four anterior femoral margins entire, minutely serrulate; middle femora little compressed and externally bicarinate; posterior femoral margins entire, minutely serrulate, the antegenicular denticle acute; the three pulvilli of the first joint of the hind tarsi equal in length, the first and third tarsal joints equal in length.

Entire length of female 17 mm.; pronotum 16 mm.; hind femora 7 mm.

Habitat.—Singla, Darjiling Dist., 1500 ft., Apr., June, 1913 (*Lord Carmichael's coll.*). Ind. Mus. coll.

***Teredorus frontalis*, sp. nov.**

Near *carmichaeli*, differing as follows: stature smaller, body coloured fuscous, variegated with ochre, the underparts, fusco-variegated, lower half of the lateral lobes of the pronotum pale ochre; the four anterior femora little more compressed, subrugose; the hind femora stouter; elytra smaller and punctate, not so reticulate; the antennae inserted little lower; the hind process of the pronotum not so long subulate, but the wings extended to the pronotal apex.

Entire length of female 11 mm.; pronotum 10.5 mm.; posterior femora 5.8 mm.

Habitat.—Dharampur, Simla Hills, 5000 ft., May, 1907 (*N. Annandale*).

***Teredorus ridleyi*, Hancock.**

Systolederus ridleyi, Hanc., Trans. Ent. Soc. Lond., p. 401, 1908.

Habitat.—Singapore, Botanical Gardens (*Hancock*).

Genus **Paratettix**, Bolivar.*Table for separating the Indian species.*

1. Wings strongly caudate, 3.5-5 mm. longer than the pronotal process.
2. Dorsum wide between the shoulders; body crassate; frontal costa little produced, arcuate.
3. Median carina of pronotum percurrent, not at all undulate; vertex equal in width to one of the eyes; dorsum of pronotum rugulose, slightly scabrous; posterior femora above strongly serrulate toward the apices, bearing an acute elevated denticle; pronotum of male and female 11.8-14 mm. *hirsutus*, Brunner.
3. 3. Median carina of pronotum compressed subgibbose forward behind the front border, and depressed just before the shoulders; vertex wider than one of the eyes; dorsum rugose-tuberculose, subtumid forward; the front border obtuse-angulate; hind femoral carinae above toward the knees minutely subserrulate, antegenicular denticle little prominent; pronotum of female 12 mm. *rotundatus*, sp. nov.
2. 2. Dorsum much narrower between the shoulders, body slender; vertex distinctly narrower than one of the eyes; median carina of pronotum percurrent, little compressed, and longitudinally low arcuate forward, highest between the shoulders, barely sinuate before the shoulders; head not at all exserted; pronotum of female 8.6 mm. *latipennis*, sp. nov.
1. 1. Wings caudate but less than 3 mm. longer than the pronotal apex, or abbreviated.
4. Median carina percurrent, undulate before the shoulders, but not behind; vertex equal in width to one of the eyes; posterior tibiae fuscous at the basal part, the apical part pale; pronotum of female 11 mm. *semihirsutus*, Brunner.
4. 4. Median carina of pronotum distinctly undulate, compressed gibbose forward between the sulci; vertex subnarrower or subequal to one of the eyes.
5. Hind process of pronotum acute, not ex-

tended beyond the hind femoral apices;
pronotum of male and female 7-9.5
mm.

curtipennis, Hancock.

5. 5. Hind process of pronotum long subulate,
extended beyond the hind femoral apices;
pronotum of female 12.8 mm.;
wings 1.5 mm. longer than the pronotum *alatus*, sp. nov.

***Paratettix hirsutus*, Brunner.**

Brunn., Ann. Mus. Genova, xxxiii, p. 110, fig. 43, 1893.

Habitat.—Sibsagar, N. E. Assam (*S. E. Peal*). Ind. Mus. coll.

***Paratettix rotundatus*, sp. nov.**

Colour ferrugineous; body moderately stout, hirsute below, head not at all exserted, eyes and vertex not at all elevated; vertex wider than one of the eyes, not produced, on either side fossulate, little ampliate behind the fossae on the occiput, frontal carinae laterally reflexed and little rounded compressed; paired ocelli placed little in advance of the eyes between the middle; antennae inserted barely on a line with the lower border of the eyes; frontal costa moderately arcuate produced beyond the eyes. Pronotum above rugose-tuberculose, anteriorly very obtuse angulate, posteriorly acute subulate, little surpassing the hind femoral apices; dorsum forward between the shoulders little tumid, backward planate; median carina behind the anterior border compressed, little arcuate subgibbose, between the shoulders depressed, backward very slightly subundulate compressed; humeral angles obtuse depressed; lateral carinae posteriorly little compressed on base of process; the two prozonal carinae behind the front margin parallel; posterior angles of the lateral lobes of the pronotum with the apices rounded, and somewhat narrowed; elytra widest near the middle, narrowed toward the apices and rounded; wings strongly caudate, extended 4.5 mm. beyond the pronotal apex in the type; anterior and middle femora elongate and compressed, hirsute, margins subparallel; posterior femora elongate, moderately broad, with a prominent antegenicular denticle, and a minute lobe anterior to it, the superior margin also being minutely serrulate-granose; hind tibiae with two light and two black annulations; the three pulvilli of the first joint of the hind tarsi spiculate, the third pulvillus little longer than the second.

Entire length of female 16.5 mm.; pronotum 12 mm.; posterior femora 7 mm.

Habitat.—Tezpur, Mangaldai Dist., Assam, Oct. 8, 1910 (*Kemp*).

This species resembles *hirsutus*, Brunn., differing in the wider vertex; the compressed subgibbose median carina of the pronotum forward; the wider sulcation of the frontal costa; and in the superior carina of the posterior femora being subentire, but minutely

serrulate, whereas, in *hirsutus* the carina above is strongly serrulate toward the knees and the antegenicular denticle more strongly elevated and acute. Even with these differences however, this may be a variety of *hirsutus*, which fact can only be determined by a study of more extensive series.

***Paratettix latipennis*, sp. nov.**

Stature slender; colour pale ferrugineous; body slightly rugose, little hirsute below; head not at all exserted; vertex distinctly narrower than one of the eyes; antennae inserted little below the eyes; frontal costa moderately arcuate produced, very lightly sinuate at the median ocellus. Pronotum anteriorly truncate, posteriorly acute subulate, produced about one millimetre beyond the hind femoral apices; dorsum between the shoulders convex; median carina of the pronotum percurrent, little compressed, and forward forming a low gentle arc, highest between the shoulders, and little compresso-elevated forward between the sulci; humeral angles obtuse angulate; the two short prozonal carinae behind the anterior margin indistinctly divergent backward; posterior angles of the lateral lobes of the pronotum rounded-truncate; elytra moderately small, elongate, apices narrowly rounded, externally reticulate; wings strongly caudate produced nearly 3.5 mm. beyond the pronotal apex in the type; anterior and middle femora little compressed, elongate; middle femoral margins in the female parallel, pilose; posterior femora stout, the apical half of the superior carina minutely serrulate; antegenicular denticle prominent, acute; first article of the hind tarsi longer than the third; the three pulvilli spiculate, the third pulvillus distinctly longer than the second.

Entire length of female 13.8 mm.; pronotum 8.6 mm.; posterior femora 4.8 mm.

Habitat.—Moradabad, U.P., July 21, 1911 (*T. B. Fletcher*). Author's coll.

***Paratettix semihirsutus*, Brunner.**

Brunn., Ann. Mus. Genova, xxxiii, pp. 110, 111, 1893.

Habitat.—Carin Cheba (*Brunner*).

***Paratettix curtipennis*, Hancock.**

Coptotettix curtipennis, Hanc., Mem. Dept. Agric. India, iv, pp. 146, 147, 1912.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July, 1911 (*F. H. Gravely*). Ind. Mus. coll.

***Paratettix alatus*, sp. nov.**

Colour obscure fuscous; body moderately stout; head not at all exserted; eyes and vertex very little elevated; vertex subequal in width to one of the eyes, anteriorly truncate, frontal carinulae laterally reflexed and rounded-compressed, front not advanced beyond the eyes; antennae inserted below the eyes; paired ocelli

placed little below the middle of the eyes; frontal costa widely sulcate, in profile not produced at the vertex between the eyes, but little arcuate produced between the antennae, sinuate at the median ocellus; face slightly oblique. Pronotum anteriorly truncate, posteriorly lengthily acute subulate; dorsum between the shoulders convex, rugose, backward depressed planate and somewhat rugulose, bearing small tubercles; median carina very thin, gibbose forward between the sulci, depressed and sub-straight between the shoulders, backward depressed and irregularly undulate; the two short prozonal carinae behind the front margin distinctly convergent backward; humeral angles carinate, little compressed; lateral carinae backwards compressed and towards the apex serrulate; posterior angles of the lateral lobes of the pronotum little obliquely dilated, the apices dull, rather widely obliquely truncate behind; elytra oblong, widest behind the middle, but the apices narrowly rounded; wings surpassing the pronotal apex 1.3 mm.; anterior femora elongate, little compressed, the superior carina strongly curved, outer face and below sparingly hirsute; middle femora rather broad, compressed, elongate, sparingly hirsute, margins subundulate; posterior femora moderately stout, externally subscabrous, the apical third above serrulate-lobate, antegenicular lobe acute spinate first article of the hind tarsi longer than the third; the first and second pulvilli acute, subspinose, the third distinctly longer than the second.

Entire length of female 15 mm.; pronotum 12.8 mm.; hind femora 6.3 mm.

Habitat.—Ghumti, Darjiling Dist., E. Himalayas, 4000 ft., July, 1912 (*F. H. Gravely*).

This species may be the long-wing form of *curtipennis*. It is near *semihirsutus*, but differs in the frontal costa not being produced above between the eyes, and in the distinctly undulate median carina of the pronotum.

Genus *Acrydium*, Geoff.

(*Tettix*; *Tetrix* of authors.)

Acrydium bipunctatum, Linn.

Kirby, Syn. Cat. Orth. Brit. Mus., iii, pp. 39-42, 1910.

Habitat.—Sikkim, Darjiling Dist.; Europe. Indian Mus. coll.

This species was previously reported from India by Bolivar as occurring at Kodaikanal, S. India. Two specimens in the Indian Museum bear perfect resemblance to specimens in my collection from different parts of Europe. Kirby gives the range of habitat as: Europe; North Africa, and North and West Africa.

Acrydium variegatum, Bolivar.

Paratettix variegatus, Bol., Ann. Soc. Ent. Belg., xxxi, p. 280, 1887; *Tettix atypicalis*, Hanc., Spol. Zeylan., ii,

p. 142, 1904; Hanc., Mem. Dept. Agric. India, iv, p. 149, 1912.

Habitat.—Moulmein, Lower Burma, Nov. 16, 1911 (*F. H. Gravely*); Peradeniya, Ceylon, Oct. 1905; Ratnaputa, Ceylon, Apr. 1905 (*E. E. Green*); Singla, Darjiling Dist., 1500 ft.

***Acrydium ceylonicum*, Hancock.**

This is the short-wing form of *variegatum*, *l. c.*, 1904.

Habitat.—Peradeniya, Ceylon. Indian Mus. coll.

***Acrydium indicum*, Bolivar.**

Paratettix indicum, Bol., Ann. Soc. Ent. Belg., xxxi, p. 281, 1887; Hanc., Mem. Dept. Agric. India, iv, p. 150, 1912.

Habitat.—Bihar, Chapra; Gorakhpur; Pupri, Muzaffarpur. Author's coll. "Indes Orientalis" (*Bolivar*).

***Acrydium mundum*, Walker.**

Tettix mundum, Walk., Cat. Derm. Salt. Brit. Mus., p. 827, 1871.

Tettix umbriferum, Walk., *l. c.*, p. 824; *T lineiferum*, Walk., *l. c.*; *T vittiferum*, Walk.; *T dorsiferum*, Walk.; *T oliviferum*, Walk.; *T nigricolle*, Walk.; *T balteatum*, Walk.; *T lineosum*, Walk., *l. c.* 1871.

Habitat.—N. India (*Walker*).

The above species appear to be mere colour varieties of one or two species which I find it impossible to place.¹

***Acrydium tectitergum*, sp. nov.**

Near *subulatum*, Linn. Fuscous or obscure fusco-ferrugineous, granulose; vertex wider than one of the eyes, distinctly produced, carinulae laterally subangularly reflexed, and little compressed, the front border convex, middle carinate, on each side elongate fossulate; eyes moderately small; head in profile obtuse angulate, the face strongly produced, convex, advanced equal to the width of one of the eyes; indistinctly sinuate at the median ocellus; antennae very slender filiform, inserted between the lower border of the eyes and partly below. Pronotum anteriorly very obtuse angulate, posteriorly acute subulate produced beyond the hind femoral apices; dorsum tectiform, median carina of the pronotum forward distinctly compressed elevated cristate, above substraight from the sulci to the shoulders, then gently concavely sloping backward, substraight on the hind process; humeral angles obtuse; lateral carinae little compressed; prozonal carinae behind the anterior border shortened; posterior angles of the lateral lobes

¹ See Kirby's Cat. Orth., III, 1910.

narrowed, apices hebitate; elytra elongate, widest at the middle, the apices narrowly rounded; wings caudate; anterior and middle femora elongate, compressed, margins below undulate, the middle femora below lobate; pulvilli of the first joint of the hind tarsi spinose, the third longer than the second.

Entire length of male and female 10.8–11.5 mm.; pronotum 8.5 mm.; hind femora 3.8 4 mm.

Habitat.—Hoshangabad, Sept. 14, 1911 (*T. B. Fletcher*); Surat, Bombay, July 8, 1904 (*T. B. Fletcher*). Author's collection.

One example from the former locality is distinctly larger in stature; entire length 13 mm.; pronotum 10.5 mm.; post. fem. 5.3 mm.; the colour obscure ferrugineous, with an elongate black spot on each side of the disc. In structure this example is near typical *tegitertum*. Until a larger series are obtained for study I hesitate to designate this form as new.

This species differs from *subulatum*, Linn., in the cristate median carina of the pronotum, in the slender antennae, in the lobate inferior carina of the middle femora, and somewhat shorter third pulvillus of the hind tarsi.

Genus *Coptotettix*, Bolivar.

Table for separating the Indian species.

1. Elytra very minute; stature very small.
2. Hind process of pronotum acute; median carina of pronotum anteriorly largely elevated, posteriorly pluri-interrupted; dorsum rugose tuberculate, pronotum of male 7 mm. *fossulatus*, Bolivar.
2. 2. Hind process in 3 and 3. 3. rounded-truncate at the apex.
3. Median carina of pronotum percurrent, anteriorly lightly elevated, rounded; posterior femora crassate, bearing a strong triangular antegenicular spine, the superior carina also serrulate; pronotum 3.8 mm. *parvulus*, Hancock.
3. 3. Median carina of pronotum percurrent, little elevated, subsinuate before the shoulders; posterior femora with the apical half slender; pronotum of female 8 mm. *capitatus*, Bolivar.
1. 1. Elytra larger; wings explicate, caudate, or abbreviated.
4. Pronotum with the dorsum deplanate, subsmooth, minutely granose.
5. Frontal costa distinctly sinuate at the median ocellus, arcuate or roundly produced before the eyes.

6. Posterior angles of the lateral lobes with the apices rounded; median carina of pronotum straight, not at all interrupted; wings long surpassing the pronotal apex; pronotum of male 11 mm. *interruptus*, Bolivar.
6. 6. Posterior angles of the lateral lobes little expanded, behind obliquely truncate, apices obtuse; hind process and wings either abbreviated or extended beyond the hind femoral knees, the wings then as long as the pronotum; pronotum between the shoulders bearing two short granulose lines; pronotum of male and female 8-9 mm.; male long-winged form 11 mm. *annandalei*, sp. nov.
4. 4. Pronotum with the dorsum deplanate, but with more or less distinct rugulae, or tubercles.
5. 5. Frontal costa not at all or indistinctly sinuate at the median ocellus; roundly or arcuate produced.
7. Dorsum barely subtectiform forward when viewed from behind, elevated forward; median carina percurrent, subdepressed in front of the shoulders, very low subundulate backward; elytra rather large, ovate; pronotum of male and female 11-13 mm. *indicus*, Hancock.
7. 7. Dorsum distinctly convex between the shoulders, lightly granulose-tuberculose, and provided with two short indistinct lineate carinae; backward on the process bearing minute irregular lineate tubercles; pronotum lengthily subulate; posterior angles of the lateral lobes with the apices barely prominent, subtruncate; male and female pronotum 12-14 mm. *conspersus*, sp. nov.
8. Posterior angles of the lateral lobes of pronotum obtuse, rounded; pronotum above little rugose; median carina low, little elevated arcuate behind the anterior border, backward irregularly undulate; body coloured grey palpi white; middle femora of male crassate; pronotum of male 10.5 mm. *retractus*, sp. nov.
8. 8. Posterior angles of the lateral lobes triangular, the apices narrowly subtruncate.

9. Dorsum of pronotum little rugose, bearing lineate tubercles; two short carinae between the shoulders distinctly expressed; colour yellowish-ferruginous; pronotum of male and female 13-14.8 mm. *artolobus*, sp. nov.
9. 9. Dorsum of pronotum distinctly rugose-tuberculose; median carina of pronotum low, pluri-interrupted; hind femora testaceous, four anterior femora fusco-fasciate; the lateral carinae of pronotum maculate with yellow and testaceous; pronotum of female 12.5 mm. *testaceous*, Bolivar.

***Coptotettix fossulatus*, Bolivar.**

Bol., Ann. Soc. Ent. Belg., xxxi, p. 288, 1887; Hanc., Spol. Zeyl., ii, p. 153, 1904.

Habitat.—Balugaon, Puri Dist., Orissa, July 21, 1913 “on lichen-covered rocks” (*N. Annandale*). Ind. Mus. coll.

The type came from Ceylon, and this was the first species described in the genus *Coptotettix* by Bolivar, but the type for this genus was later fixed by Kirby in the selection of *C. asperatus*, Bol., which was figured in Bolivar’s “Essai.” In some respects it resembles in miniature, representatives of the genus *Hyboella*, but for the present I have included it here.

***Coptotettix parvulus*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, pp. 145, 146, 1912.

Habitat.—Singla, Darjiling Dist., 1500 ft., June 1913 (*Lord Carmichael’s coll.*); Kushtea, Bengal, Oct. 7, 1909 (*J T Jenkins*); Sikkim, Darjiling Dist. (*L Mandelli*); Calcutta. Indian Mus. coll. Also: Kobo, “On rotten wood” (*Kemp*); Janakmukh, “Under bark”; Chapra, Bengal (*Mackenzie*). Author’s coll.

***Coptotettix capitatus*, Bolivar.**

Bol., Ann. Soc. Ent. Belg., xxxi, p. 289, 1887; Brunn., Ann. Mus. Genova, xxxiii, p. 111, 1893.

Habitat.—Burma (*Brunner*).

***Coptotettix interruptus*, Bolivar.**

Bol., Ann. Soc. Ent. Belg., xxxi, pp. 291, 292, 1887; Brunn., Ann. Mus. Genova, xxxiii, p. 113, 1893.

Habitat.—Burma.

***Coptotettix annandalei*, sp. nov.**

Colour dark grey, or paler grey sometimes marked with light yellow on the pronotum and hind femora. Head not at all exerted; vertex subequal in width to one of the eyes, slightly narrowed forward, fossulate on each side, not produced; antennae inserted between the lower part of the eyes; paired ocelli placed between the middle of the eyes; frontal costa arcuate produced, distinctly sinuate at the median ocellus. Pronotum anteriorly truncate, posteriorly shortened and acute produced, not at all reaching the knees of the hind femora, or longer subulate, surpassing the hind femoral apices; dorsum deplanate subsmooth, coarsely granulose, with scattered small tubercles, between the shoulders convex; median carina low, forward between the sulci little elevate and rounded crassate, posteriorly little irregularly compressed-elevated; humeral angles strongly obtuse and rounded-depressed; prozonal carinae behind the anterior margin very little expressed and convergent backward; two short carinulae between the shoulders merely granulate lines; posterior angles of the lateral lobes of the pronotum little dilated, obliquely truncate, apices little prominent; elytra elongate, rounded truncate at the apices; wings extended little beyond the pronotal apex; middle and anterior femora elongate, margins of the middle femora subundulate; posterior femora moderately stout, superior carina minutely serrulate, the antegenicular denticle acute; first joints of the hind tarsi longer than the third, the first and second pulvilli acute spinose, the third longer than the second and flat below.

Entire length of male and female 9-10 (to end of pronotum); pronotum 8-9 mm.; posterior femora 5-6 mm.; male long-wing form 12.5 mm.

Habitat.—Singla, Darjiling Dist., 1500 ft., Apr. 1913 (*Lord Carmichael's coll.*); Northern Shan Hills, Upper Burma (*J. C. Brown*); Calcutta, India. Ind Mus coll.

Some examples from Calcutta are somewhat smaller in stature than the type from Singla. This species resembles *interruptus*, Bol., in the frontal costa being sinuate at the median ocellus, but differs in the posterior angles of lateral lobes; in *annandalei* they are obliquely truncate, the apices of the angles little prominent, whereas in *interruptus* they are rounded, and the median carina of the pronotum is straighter.

***Coptotettix conspersus*, sp. nov.**

Colour yellowish-ferrugineous, subinfusate; vertex narrower than one of the eyes, narrowed forward, not produced, fossulate on each side; frontal costa strongly roundly produced, barely sinuate at the median ocellus. Pronotum truncate anteriorly, lengthily subulate posteriorly, long surpassing the hind femoral apices; dorsum above granose-rugose, and tuberculose backward, between the shoulders convex; median carina of the pronotum

very low forward, but between the sulci barely elevated, posteriorly irregularly undulate; posterior angles of the lateral lobes narrowed, barely prominent, subtruncate; elytra somewhat widely rounded at the apices, subovate; wings surpassing the pronotal apex; anterior femora elongate, margins entire; middle femora in the male little crassate toward the base, the lower carina with the basal two-thirds little dilated, in the female both margins subparallel; hind femoral margins minutely serrulate; first joint of the hind tarsi longer than the third, the third pulvillus longer than the second and straighter below.

Entire length of male and female 13-16 mm.; pronotum 12-14.5 mm.; posterior femora 6-7 mm.

Habitat.—Sibsagar, N. E. Assam (*S. E. Peal*); Bhim Tal, 4500 ft., Kumaon; Siliguri, base of E. Himalayas, Bengal, June, 1906.

This species is somewhat stouter in stature than *retractus*, and the posterior angles of the pronotum more narrowed, subtruncate; on the dorsum of pronotum between the shoulders there are vestiges of two short carinulae, or they are entirely wanting; on the base of process rugose tuberculose, but forward granose.

***Coptotettix indicus*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, pp. 144, 145, 1912.

Habitat.—Vela, Koyna Valley, Satara Dist., 2100 ft., Apr. 26, 1912 (*F. H. Gravely*). Ind. Mus. coll.

This species has the general appearance of *Hedotettix gracilis*, but with the vertex characters and rugose pronotum of *Coptotettix*.

***Coptotettix retractus*, sp. nov.**

Colour grey; body above granose, sparingly tuberculose; head not at all exserted; vertex subnarrower than one of the eyes, narrowed forward, not advanced quite as far as the eyes, carinula on either side subcurvate, little compressed, open in front, with minute fossa on each side; frontal costa strongly arcuate produced, not sinuate at the median ocellus; antennae inserted between the lower part of the eyes; palpi white. Pronotum anteriorly truncate, posteriorly lengthily subulate surpassing the apices of the hind femora; dorsum granose and scattered with small tubercles; median carina low, behind the anterior margin little compressed-elevated, between the humeral angles depressed, posteriorly pluri-undulate; prozonal carinae behind the front border very lightly expressed, convergent backward; posterior angles of the lateral lobes of the pronotum with the apices rounded, very slightly prominent; elytra widened at the middle, narrowed and rounded at the apices; wings caudate and pale; anterior femora elongate, margins entire; middle femora toward the base crassate in the male, lower margin undulate; hind femora moderately stout, margins entire, granose; hind tibiae pale yellow; first joint

of the hind tarsi longer than the third, the first and second pulvilli acute, the third longer than the second and straighter below.

Entire length of male 12.5 mm.; pronotum 10.5 mm.; posterior femora 5.2 mm.

Habitat.—Pusa, Bihar, Aug. 28 (*T. B. Fletcher*). Author's coll.

***Coptotettix artolobus*, sp. nov.**

Near *conspersus*, but differing in the narrower pronotum, the hind process being very slender subulate; the hind femora not so stout; the dorsum between the shoulders bearing two distinctly expressed carinulae, and backward many minute rugulae; the posterior angles of the lateral lobes of the pronotum distinctly narrowed, minutely obliquely truncate, and as viewed from above the apices little prominent; middle femora in the male very slightly or not at all crassate, the inferior carina very little elevated toward the base; wings caudate; colour yellowish-rufescent or ferrugineous.

Entire length of male and female 13–14.8 mm.; pronotum 11.5–13.5 mm.; hind femora 5.2–6.5 mm.

Habitat.—Ceylon. Indian Mus. coll.

***Coptotettix testaceus*, Bolívar.**

Bol., Ann. Soc. Ent. Belg., xxxi, p. 291, 1887; Hanc., Spol. Zeylan., ii, p. 153, 1904.

Habitat.—Chota Nagpur, Pass between Chaibassa and Chakardharpur, Mar. 2, 1913 (*F. H. Gravely*), Ind. Mus. coll. Ceylon (*Bolívar*).

Genus *Hedotettix*, Bolívar.

Table for separating the Indian species.

1. Median carina of pronotum anteriorly between the shoulders strongly arcuate-cristate, very thin and translucent.
2. Pronotum at the front border distinctly angulate produced over the head *cristitergus*, sp. nov.
2. 2. Pronotum anteriorly not produced over the head, subangulate or truncate.
1. 1. Median carina of pronotum more or less compressed-arcuate forward before the shoulders, higher at the sulci; vertex and front margin of pronotum viewed from above subobtuse angulate, in profile rounded *gracilis*, de Haan.
3. Median carina of pronotum very low, not at all or little compressed; frontal costa strongly produced before the eyes; vertex in profile and viewed from above angulate; front of head oblique *costatus*, Hancock.

3. 3. Median carina of pronotum little compressed, longitudinally low arcuate forward.
4. Dorsum of pronotum between the shoulders subtectiform; frontal costa joined with the vertex in profile strongly arcuate produced; vertex viewed from above subwidened between the frontal carinulae; stature moderate; colour often obscure ferrugineous or infusate, sometimes with a median light fascia on the dorsum *attenuatus*, Hancock.
4. 4. Dorsum between the shoulders distinctly tectiform; frontal costa strongly arcuate produced; blades of the female ovipositor long; the first and third pulvilli of the first joint of hind tarsi subequal in length; stature moderately large; colour grey . *grossus*, sp. nov.

***Hedotettix cristitergus*, sp. nov.**

Near *punctatus*, Hancock. Obscure yellowish-ferrugineous or somewhat infusate; body above granulose. Vertex subequal or barely wider than one of the eyes, frontal carinulae formed in obtuse angle, roundly reflexed at the sides, middle carinate; frontal costa strongly advanced before the eyes and arcuate, barely subsinuate at the median ocellus; antennae inserted distinctly between the lower fourth of the eyes. Pronotum anteriorly distinctly angulate produced over the head; median carina strongly compressed, very thin punctate, arcuate forward, the crest highest above or barely behind the shoulders; hind process acute subulate extended beyond the hind femoral apices; prozonal carinae behind the anterior border abbreviated and parallel; dorsum between the shoulders on either side of the crest somewhat smooth; humeral angles obtuse, rounded, carinae little compressed; posterior angles of the lateral lobes narrowed, apices hebitate; elytra oblong, apices widely rounded; wings strongly caudate; anterior femora elongate, entire; middle femora elongate, margins little compressed in the female but subparallel. in the male arcuate dilated towards the base; hind femora elongate, margins entire, minutely serrulate; first joints of the posterior tarsi longer than the third, the first two pulvilli spinose, the third longer, substraight below.

Entire length of male and female 14.5–16.5 mm.; pronotum 10.8–13 mm.; hind femora 6–6.7 mm.

Habitat.—Hoshangabad, Nov. 14, 1911 (*T. B. Fletcher*). Several examples in author's collection.

This species resembles *punctatus*, Hanc. The habitat of the latter is unknown, the type being in the University Mus., Oxford.

Hedotettix gracilis, de Haan.

Acridium (Tettix) gracile, de Haan, Temminck, Verhandel. Orth., p. 167, 1842; *Hedotettix gracilis*, Bol., Ann. Soc. Ent. Belg., xxxi, p. 283, 1887; Hanc., Spol. Zeylan., ii, p. 156, pl. 3, fig. 19, 1904; *Hedotettix abortus*, Hanc., l. c., p. 151, 1904, short-wing form; *Hedotettix festivus*, Bol., l. c., p. 286, pl. 5, fig. 24, 1887; *Hedotettix diminutus*, Hanc., Mem. Dept. Agric. India, iv, pp. 149, 150, 1912.

Habitat.—Calcutta (*N. Annandale*; *C. A. Paiva*; *F. H. Gravely*; *Brunetti*); Madhupur, Bengal, Oct. 14, 1909 (*C. Paiva*) "at light"; Kharagpur, Bengal, June 17, 1911 (*R. Hodgart*); Wellawaya, Ceylon, Nov. 1905; Peradeniya, Ceylon, Nov. 1910; Goalbathan, E. Bengal, July 9, 1909 (*R. Hodgart*); Berhampur, Murshidabad Dist., Bengal, Jan. 1, 1908 (*R. Lloyd*); Basanti F. S. Sunderbuns (*J. T. Jenkins*); Rangoon, Burma, Feb. 26, 1908 (*N. Annandale*); Balugaon, Lake Chilka, Orissa, Sept. 20, 1913 (*N. Annandale*); Marikuppam, S. India, 2500 ft., Oct. 1, 1911 (*F. H. Gravely*). Indian Museum coll. Also: Pusa, Bihar, Oct. 12, 1911 (*T. B. Fletcher*); Hoshangabad, Sept. 14, 1911 (*T. B. Fletcher*); Chapra, Bengal (*Mackenzie*). Author's coll.

This species has been reported from Java and Sumatra.

The stature of *Hedotettix diminutus*, Hanc., l. c., p. 149, 1912, is smaller, yet from a study of the large series of specimens of *Hedotettix gracilis* from India, this species shows a wide range of variation that intergrade into *diminutus*. The latter I reported as found at Surat, Bombay.

Hedotettix costatus, Hancock.

Hanc., Mem. Dept. Agric. India, iv, pp. 147, 148, 1912.

Habitat.—Madhupur, Bengal, Oct. 16, 1910 (*C. Paiva*) "at light"; Nepal, Nov. 21, 1908; Allahabad, U. Prov., Oct. 25, 1910 (*Kemp*); Tirvani, Nepal Terai, Dec. 27, 1909 (*B. Warren*); Monghyr, Bengal, Sept. 23, 1909 (*J. T. Jenkins*). Indian Mus. coll. Also: Bengal, July 26, 1910 (*T. B. Fletcher*); Narainganj, Assam, Oct. 29, 1906 (*C. S. M.—Fletcher*); Chapra, Bengal (*Mackenzie*); Munshiganj, Assam, Oct. 22, 1906 (*C. S. M.—Fletcher*); Durbhanga, Bengal, Jan. 5, 1903 (*T. V. R. A.—Fletcher*) "on grass" and at light. Author's collection.

Hedotettix attenuatus, Hancock.

Hanc., Spol. Zeylan., ii, p. 151, pl. 3, fig. 18, 1904; Hanc., Gen. Ins. Orth. Acrid. Tetr., p. 60, fig. 23, 1906.

Habitat.—Sur Lake, near Puri, Orissa coast, Aug. 19, 1911 (*N. Annandale*; *F. H. Gravely*); Balighai, near Puri, Orissa, Oct. 24, 1908 (*N. Annandale*); Victoria Gardens, Colombo: (*C. Paiva*); Kesbawa, Ceylon, Apr. 1903; Trincomalee, Ceylon, Nov. 1906; Sibsagar, N. E. Assam; Assam-Bhutan Frontier, Mangaldai Dist., N.-E., Dec. 30, 1910 (*Kemp*).

Hedotettix grossus, sp. nov.

Greyish-cinereous; granulose; vertex equal or subnarrower in width to one of the eyes, narrowed forward, frontal carinula convex and subrounded reflexed at the sides; middle carinate; frontal costa strongly arcuate produced. Pronotum anteriorly truncate, dorsum tectiform; median carina low, little compressed, not at all cristate, low arcuate forward, substraight backward; hind process long acute subulate; between the shoulders on the dorsum presenting two abbreviated carinulae; prozonal carinae behind the anterior margin parallel and rather widely separated; posterior angles of the lateral lobes of the pronotum strongly narrowed; elytra rather large, elongate, apices widely rounded; wings caudate; femoral margins entire; first joint of the posterior tarsi longer than the third; the second and third pulvilli equal in length; valves of the female ovipositor long, acuminate, terminating in curvate spines, the margins above and below serrulate.

Entire length of female 16.5 mm.; pronotum 13.5 mm.; hind femora 6.8 mm.

Habitat.—Singla, Darjiling Dist., 1500 ft., May, 1913 (*Lord Carmichael's coll.*). Indian Mus. coll.

Somewhat larger in stature than *gracilis*; the frontal costa more narrowly sulcate; the pronotum anteriorly truncate; the median carina not at all compresso-elevated forward, though little compressed and forming a low longitudinal arc; the ovipositor much longer than in *gracilis*, and the colour grey, with very obscure dark oblique bands on the outer face of the hind femora.

Genus Euparatettix, Hancock.

In this genus the representatives have the antennae inserted partly between the lower margin of the eyes; the paired ocelli placed between the middle of the eyes; the vertex narrower than one of the eyes and truncate; the frontal costa rounded or arcuate produced; the head exserted; the body graceful, more or less slender, the pronotum posteriorly lengthily subulate and the wings caudate; the intermediate femora elongate, not at all crassate.

Table for separating the Indian species.

- i. Hind tibiae dense black, white annulate just behind the knees; head distinctly exserted; pronotum of male and female 7.5–9.5 mm. *personatus*, Bolivar.
Slightly smaller in stature, with additional white marking at the apical third of hind tibiae.
var. A. E. p. birmanicus, nov.

1. 1. Hind tibiae subunicoloured, or obscurely marked, but not dense black.
2. Head exserted; pronotum narrow between the shoulders; stature very slender; median carina of pronotum substraight, percurrent; pronotum of male and female 11.5-13.5 mm. *tenuis*, Hancock.
2. 2. Head very little exserted; pronotum moderately dilated between the shoulders; stature more robust; median carina of pronotum arcuate forward, often little undulate before the shoulders, subobliterated just behind the front border; pronotum of male and female 9-11 mm. *variabilis*, Bolivar.
 Stature larger; pronotum of male and female 10-13 mm. *corpulentus*, Hancock.

***Euparatettix personatus*, Bolivar.**

Paratettix personatus, Bol., Ann. Soc. Ent. Belg., xxxi, p. 278, 1887; *Euparatettix personatus*, Hanc., Spol. Zeylan., ii. pp. 155, 156, pl. 2, fig. 10 and pl. 3, fig. 20, 1904; Hanc., Gen. Ins. Tetr., p. 55, pl. 3, fig. 32, 1906; Hanc., Mem. Dept. Agric. India, iv, p. 152, 1912; Brunn., Ann. Mus. Genova, xxxiii, p. 109, 1893.

Habitat.—Peradeniya, Ceylon, May 30, 1910; Kandy, Ceylon, July 1909; Calcutta, Oct. 27, 1911 (*F. H. Gravely*); Balugaon, Puri Dist., Orissa, July 21, 1913 (*N. Annandale*); Sigiriya, Ceylon, Aug. 8, 1901; Anuradhapura, Ceylon, "low country," Oct. 18, 1911 (*N. Annandale*); Sibsagar, N. E. Assam (*S. E. Peal*); Berhampur, Murshidabad Dist., Bengal, Jan. 1, 1908 (*R. Lloyd*); Waikam, Travancore, Coastal Region, Nov. 5, 1908 (*N. Annandale*). Indian Museum collection.

The colour pattern in this species varies greatly, and among these examples from Ceylon and India, there are some specimens that agree with the description of the colour as described by Bolivar, namely: "body fuscous, head in front and sides of pronotum cinereous or black." All the specimens have black hind tibiae with a white circular fascia behind the knees, and the antennae are rather long, and the four apical articles are little compressed and black.

***Euparatettix personatus* var. *birmanicus*, nov.**

Besides the above mentioned specimens under *personatus*, there are a number of representatives which are distinguished by the slightly smaller stature, and the hind tibiae has, besides the usual white annulation behind the knees, a little white on the apical third of the black shaft.

Habitat.—Rangoon, Burma, Feb. 26, 1908 (*N. Annandale*); Assam-Bhutan Frontier, Mangaldai Dist., N.-E., Jan. 1, 1911 (*Kemp*).

***Euparatettix tenuis*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, pp. 151, 152, 1912.

Habitat.—Calcutta, Oct. 1912 (*F. H. Gravely*); Thingannyin-aung to Sukli, Dawna Hills, 900-2100 ft., Nov. 23, 1911 (*F. H. Gravely*); Pusa, Bihar, June 15, 1911 (*T. B. Fletcher*; *Hancock coll.*); Monghyr, Bengal, Sept. 22, 1909 (*J. T. Jenkins*). Indian Mus. coll.

This species can be recognized by the slender and graceful stature, the narrow pronotum, and strongly caudate wings.

***Euparatettix variabilis*, Bolivar.**

Paratettix variabilis, Bol., Ann. Soc. Ent. Belg., xxxi, pp. 276, 277, 1887; *Euparatettix variabilis*, Hanc., Mem. Dept. Agric. India, iv, p. 150, 1912.

Habitat.—Rajshai, E. Bengal, Feb. 6, 1907 (*N. Annandale*); Asansol, Bengal, Nov. 13, 1910 (*Paiva* and *Caunter*); Mandalay, U. Burma, Mar. 12, 1908 (*N. Annandale*); Chotajalla, Rajmahal, Bengal, Feb. 14, 1910 (*B. L. Chaudhuri*); Berhampur, Murshidabad Dist., Bengal, Jan. 2, 1908 (*R. Lloyd*); Puri, Orissa, Jan. 20, 1908; Anuradhapura, Ceylon, "low country", Oct. 1911 (*N. Annandale*). Ind. Mus. coll.

This species is smaller in stature than *corpulentus*, Hanc., and nearly allied, and it appears from some of the specimens that they cross, producing hybrids.

***Euparatettix corpulentus*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, p. 158, 1912.

Habitat.—Balugaon, Puri Dist., Orissa, July 21, 1913 (*N. Annandale*); Sur Lake, Puri, Orissa coast. July 19, 1911 (*N. Annandale* and *F. H. Gravely*); Bosondhur, Khulna Dist., Ganges Delta, Aug. 21, 1909, "On launch, at light" (*J. T. Jenkins*); Kalandhungi, Naini Tal Dist., U. P. Agra and Oudh, May 4, 1913 (*R. Hodgart*); Kasara, W. base of W. Ghats, Bombay, Nov. 23, 1901; Balighai, near Puri, Orissa, Oct. 24, 1909 (*N. Annandale*); S. India "On board ship four miles off Tuticorin, May 25, 1908 (*C. Paiva*); Berhampur, Murshidabad Dist., Bengal, Jan. 1, 1908 (*R. Lloyd*); Calcutta; Madhupur, Bengal, Oct. 18, 1909 (*C. Paiva*); Dhappa, nr. Calcutta (*N. Annandale*); Bangalore, S. India (*Cameron*); Purulia, Manbhum Dist., Chota Nagpur, Feb. 10, 1912; Chotajalla, Rajmahal, Bengal, Nov. 14, 1910 (*B. L. Chaudhuri*); Northern Shan Hills, Upper Burma (*J. C. Brown*); Neapalganj, Nepal Frontier, Nov. 22, 1911. Indian Mus. coll.

Genus *Indatettix*, nov. (*Euparatettix* in part)

Resembling *Euparatettix*, Hancock. Head exserted; vertex strongly narrower than one of the eyes; paired ocelli placed nearly between the lower third of the eyes; antennae inserted just below the eyes; frontal costa little arcuate produced between the antennae, but not above between the eyes as in *Euparatettix*; median carina of the pronotum often undulate, or sinuate, or interrupted; the hind process of pronotum with the lateral carinae toward the apex not at all, or more often, minutely crenulate, or with small dilated lobes. the apex then often minutely subdilated-truncate; middle femora crassate, or the margins undulate; body bearing elytra and fully developed wings. The type is *Euparatettix nodulosus*, Hancock.

Table for separating the Indian species.

1. Hind tibiae white and black biannulate, or bifasciate, more or less intensely pigmented, or white annulate behind the knees, the shaft black or fuscous interrupted with white marking; head distinctly exserted.
2. Stature small; pronotum of female not over 9.5 mm.; body above more or less rugose.
3. Middle femora compressed, margins above and below distinctly undulate lobate; pronotum above rugose; hind femora with the outer face bearing compressed prominent tubercles as viewed from above; median carina of pronotum little cristulate forward between the sulci, depressed between the shoulders and backward strongly sinuate, with small elevated nodes; hind process toward the apex bearing minute dilated-serrulate lobes, the apex often minutely expanded-truncate.
nodulosus, Hancock.
3. 3. Middle femora compressed, margins above and below undulate; median carina of pronotum undulate, the median nodes backwards suppressed or not evident; hind process with the lateral carinae very indistinctly lobate toward the apex
parvus, Hancock.
2. 2. Stature somewhat larger; pronotum of female 9.5-11 mm.; above plain or little rugose; hind process of pronotum

- tum with the lateral carinae toward the apex bearing small more or less dilated lobes, or entire; pronotum light testaceous toward the apex, and often maculate.
4. Wings towards the apex dark, often pale maculate.
 5. Median carina of pronotum behind the shoulders undulate, bearing obtuse crenules; hind process of pronotum with the lateral carinae toward the apex subentire; anterior and middle femora narrow; pronotum of female 10.6-11 mm. *interruptus*, Brunner.
 5. 5. Median carina of pronotum backward behind the humeral angles more or less distinctly nodulose and sinuate; the minute lobes of the lateral carinae towards the apex more or less evident *var. A. aff.*
 6. Pronotum above behind the shoulders backward subsmooth; small lobes of the lateral carinae toward the apex more or less distinct; median carina of pronotum backward very low, thin and substraight, barely undulate *var. B. lobulosus*, nov.
 6. 6. Pronotum above behind the shoulders little rugose; the small lobes of lateral carinae evident *var. C.*
 4. 4. Wings plain, not at all maculate; stature little larger; hind process of pronotum above little rugose, light and fusco-maculate; lateral carinae toward the apex with small serrulate lobes; median carina of pronotum backward subnodulose-sinuate; body pale, variegated with fuscous, legs pale, fusco-fasciate; frontal costa depressed, barely arcuate between the antennae; pronotum of female 11.6 mm. *callosus*, sp. nov.
 - 1.1. Hind tibiae subinornate, or sometimes bearing obscure fumate markings, but not distinctly annulate or fasciate with black.
 7. Dorsum of pronotum above subsmooth.
 8. Head distinctly exserted.
 9. Median carina of pronotum percurrent, little compressed-elevated before the shoulders, little sinuate near the anterior border, between the shoulders and backward gently undulate or sub-

straight; highest between the shoulders; middle femora lightly hirsute below; in the male crassate-compressed, the margins dilated, in the female margins subparallel; stature slender

crassipes, Hancock.

9. 9. Median carina of pronotum behind the shoulders backward not at all undulate, little compressed; dorsum often bearing a pale longitudinal fascia; stature slender.

var. A. aff. nov.

7. 7. Dorsum of pronotum above minutely rugose; body pale grey; median carina of pronotum marked with minute black spots; wings hyaline at the base, but toward the apex black or fumate, interrupted with white vertical venations; stature small

var. B. hybridus, nov.

8. 8. Head little exserted; median carina of pronotum undulate; dorsum little rugose; colour brownish-rufescent; hind tibiae little infusate toward the apices.

var. C. bengalensis, Hancock.

***Indatettix nodulosus*, Hancock.**

Euparatettix nodulosus, Hanc., Mem. Dept. Agric. India, pp. 155, 156, 1912.

Habitat.—Calcutta, India, Feb. 22, 1907; Puri, Orissa, Jan. 20, 1908; Purulia, Manbhum Dist., Chota Nagpur, Nov. 10, 1912 (*N. Annandale*); Kaladhugi, Naini Tal Dist., May 4, 1913 (*R. Hodgart*); Kiari, Naini Tal Dist., W. Himalayas, Dec. 24, 1910; Vela, Koyna Valley, Satara Dist., 2100 ft. Apr. 26, 1912 (*F. H. Gravely*); Jalaban, Naini Tal Dist., base of W. Himalayas, Mar. 22, 1910; Motisal, Gharwal Dist., W. Himalayas, Mar. 5, 1910; Amangarh, Bijnor Dist., U.P., Feb. 24, 1910; Raxaul, Nepal Frontier, Nov. 10, 1911. Indian Mus. coll.

***Indatettix parvus*, Hancock.**

Euparatettix parvus, Hanc., Spol. Zeylan., ii, p. 145, 1904;
Euparatettix pilosus, Hanc., Trans. Ent. Soc. London, p. 410, 1909.

Habitat.—Bhim Tal, 4450 ft., Kumaon, W. Himalayas, May 9, 1911 (*Kemp*); Calcutta; Puri, Orissa, Jan. 20, 1908; Amangarh, Bijnor Dist.; Dhampur, Bijnor Dist., U.P., Nov. 11, 1907; Igatpuri, W. Ghats, Bombay Pres., Nov. 20, 1901 (*N. Annandale*). Indian Mus. coll.

Indatettix interruptus, Brunner.

Paratettix interruptus, Brunn., Ann. Mus. Genova, xxxiii, p. 109, 1893.

Habitat.—Marikuppam, S. India, 2500 ft., Oct. 19, 1910, Batticaloa, Ceylon, July 1907; Calcutta, Nov. 2, 1907; Siripur, Saran, N. Bengal, Sept. 25, 1910; Madhupur, Bengal Oct. 16, 1909 (*C. Paiva*); Sur Lake, near Puri, Orissa coast, Aug. 19, 1911 (*N. Annandale*); Ayaramtengu, S. end of L. Kayangulam, Travancore, Nov. 6, 1908 (*N. Annandale*); Damukdia, E. Bengal, June 7, 1908. Indian Mus. coll.

Indatettix interruptus, *var. A aff.*

Habitat.—Satara Dist., 2050 ft., May 3, 1913. Ind. Mus. coll.

Indatettix interruptus, *var. B. lobulatus*, nov. and *var. C.*

Habitat.—Hoshangabad, Sept. 14, 1911 (*T. B. Fletcher*). Ind. Mus. coll. Also in author's coll.

Indatettix callosus, sp. nov.

Body above very little rugose, pale, disc ornate with two black spots, and variegated with fuscous, legs pale, fasciate with fuscous. Head distinctly exserted; vertex and upper part of the eyes elevated higher than the dorsum; vertex not produced, strongly narrower than one of the eyes, narrowed forward; antennae inserted below the eyes; paired ocelli placed between the lower third of the eyes; frontal costa slightly prominent, little arcuate between the antennae, and depressed above between the eyes. Pronotum somewhat wide between the shoulders; posteriorly subulate much surpassing the hind femoral apices; dorsum little rugose and callose; median carina little cristulate forward between the sulci, between the shoulders and backward strongly undulate, and nodulose on base of process; lateral carinae toward the apex bearing small serrulate lobes; hind process white and black maculate; middle femoral margins undulate-sublobate; tibial margins subdilated toward the base; posterior angles of the lateral lobes of pronotum little expanded, apices obtusely-rounded; the three pulvilli of the first joint of the hind tarsi spinose, the third barely longer than the second.

Entire length of female 13.4 mm.; pronotum 11.6 mm.; hind femora 5 mm.

Habitat.—Darjiling Dist., Singla, 1500 ft., May 1913 (*Lord Carmichael's coll.*).

Indatettix crassipes, Hancock.

Euparatettix crassipes, Hanc., Mem. Dept. Agric. India, pp. 153, 157, 1912.

Habitat.—Siripur, N. Bengal, Sept. 27, 1910; Madhupur, Bengal, Oct. 14, 1913 (*C. Paiva*); Kaladhungi, Naini Tal Dist., Unit Prov. Agra and Oudh, May 4, 1913 (*R. Hodgart*); Bhim Tal, 4500 ft., Kumaon, Sept. 27, 1907; Damukdia, Bengal, June 7, 1908; Rajmahal, Bengal, July 6, 1909 (*N. Annandale*); Sicktan, Nepal, Nov. 13, 1908; Ghumti, Darjiling Dist. (*F. H. Gravely*); Pusa, Bihar (*T. B. Fletcher*). Indian Mus. coll. Also: Bankipur and Muzafferpur. Author's coll.

Indatettix crassipes*, var. *A. aff.

Habitat.—Chapra, Bihar (*Mackenzie*); Pusa, Bihar, July 6, 1911 (*T. B. Fletcher*). From Hanc. coll. in the Ind. Mus. coll.

This variety often bears a longitudinal fascia on the pronotum.

***Indatettix crassipes* var. *B. hybridus*, nov.**

Habitat.—Dibrugarh, N.-E. Assam, Abor Exp., Nov. 11, 1911; Madhupur, Bengal, Oct. 16, 1909 (*C. Paiva*); Sukhwani, Nepal, Nov. 15, 1908. Ind. Mus. coll.

***Indatettix crassipes* var. *C. bengalensis*, Hanc.**

Hanc., Mem. Dept. Agric. India, pp. 155, 156, 1912.

Habitat.—Bengal.

BA'TRACHIDINAE.

Genus *Saussurella*, Bolivar.

***Saussurella indica*, Hancock.**

Mem. Dept. Agric. India, iv, pp. 156, 157, 1912.

Habitat.—Lebong, India. Author's coll.

***Saussurella curticornu*, Hancock.**

Mem. Dept. Agric. India, iv, pp. 158, 159, 1912.

Habitat.—?. Ind. Mus. coll. Bihar, Pusa. Author's coll.

***Saussurella decurva*, Brunner.**

Habitat.—Dejoo, North Lakhimpur, base of hills, Upper Assam, June 29, 1910 (*H. Stevens*); Kawkareik to third camp, Amherst Dist., Lower Burma, Nov.—Jan. 21, 1911 (*F. H. Gravely*). Ind. Mus. coll.

Length of pronotum of male 19 mm.; female 19.6 mm.

***Saussurella brunneri*, Hancock.**

Hanc., Mem. Dept. Agric. India, iv, p. 156, 1912; *Saussurella cornuta*, Brunner, Ann. Mus. Genova, xxxiii, p. 113, pl. 5, fig. 45, 1893.

This species was referred by Brunner to *S. cornuta*, de Haan, but as I have previously pointed out, *l. c.*, p. 156, foot note, that it is distinct.

The pronotum of male 13 mm.; female 16 mm.

Habitat.—Sibsagar, N. E. Assam. Indian Mus. coll.

Identifications of Indian Specimens in the Museum.

Kirby's identification.	Hancock's identification.
<i>Coptotettix latifrons</i> , Brunner.	<i>Mazarredia ghuntiana</i> , Hanc. (Type).
" " "	<i>Hyboella obesa</i> , Hanc.
<i>Ergatettix tarsalis</i> , Kirby.	<i>Indatettix interruptus</i> , Brunn.
" " "	<i>Indatettix parvus</i> , Hanc.
" " "	<i>Indatettix nodulosus</i> , Hanc.
<i>Systolederus cinereus</i> , Brunn.	<i>Indatettix interruptus</i> , Brunn.
" " "	<i>Bolotettix lobatus</i> , Hanc.
<i>Euparatettix interruptus</i> , Brunn.	<i>Indatettix interruptus</i> , Brunn.
" " "	<i>Indatettix parvus</i> , Hanc.
<i>Hedotettix gracilis</i> , de Haan.	<i>Hedotettix costatus</i> , Hanc.
" " "	<i>Euparatettix corpulentus</i> , Hanc.
" " "	<i>Euparatettix variabilis</i> , Bol.
<i>Hybotettix</i> , sp.	<i>Xistrella dromadaria</i> , Bol.
<i>Apterotettix obtusus</i> , Hanc.	<i>Scelimena harpago</i> , Serv.
<i>Acantholabus cunecatus</i> , Hanc.	<i>Thoradonta spiculoba</i> , Hanc.
<i>Euparatettix personatus</i> , Bol.	} <i>Criotettix rugosus</i> , Bol.
var. <i>longicornis</i> , Krby.	
" " "	<i>Acrydium polypictum</i> , Hanc.
<i>Coptotettix acuteterminatus</i> , Brunn.	<i>Mazarredia ghuntiana</i> , Hanc. (? larva).
<i>Mazarredia lugubris</i> , sp. n.	<i>Bolotettix lobatus</i> , Hanc.
<i>Criotettix obscurus</i> , Krby. (Type).	<i>Criotettix spinolobus</i> , Hanc.
(on label) <i>Eugavialidium hastatum</i> , Kb.	<i>Tettitulum hastatum</i> , Hanc. (Type).
(Type) (in F.B.I. <i>E. hastulatum</i> , Kb.).	
<i>Scelimena producta</i> (Serv.)	<i>Eugavialidium multidentatum</i> , Hanc. (Type).
<i>Scelimena gavialis</i> , Ssr.	<i>Scelimena spinata</i> , Hanc. (Type).
<i>Criotettix exsertus</i> , Bol.	<i>Criotettix annandalei</i> , Hanc. (Type).
<i>Ergatettix tarsalis</i> , Kby. (n. g. & sp.)	<i>Indatettix parvus</i> , Hanc.
" " "	<i>Indatettix nodulosus</i> , Hanc.
" " "	<i>Indatettix crassipes hybridus</i> , Hanc.
" " "	<i>Eupartettix personatus</i> , Bol.
" " "	<i>Indatettix interruptus</i> , Brunn.
<i>Euparatettix personatus</i> , Bol.	<i>Euparatettix corpulentus</i> , Hanc.
" " "	<i>Indatettix interruptus</i> , Brunn.
" " "	<i>Euparatettix tenuis</i> , Hanc.
" " "	<i>Euparatettix variabilis</i> , Bol.
" " "	<i>Euparatettix personatus</i> , Bol.
" " "	" " burmanicus, Hanc.
" " "	<i>Indatettix crassipes</i> , Hanc.
" " "	<i>Hedotettix attenuatus</i> , Hanc.
" " "	<i>Indatettix crassipes hybridus</i> , Hanc.
" " "	<i>Indatettix nodulosus</i> , Hanc.
" " "	<i>Indatettix parvus</i> , Hanc.
" " "	<i>Acrydium variegatum</i> , Bol.
<i>Hedotettix gracilis</i> , de Haan.	<i>Euparatettix variabilis</i> , Bol.
" " "	<i>Euparatettix corpulentus</i> , Hanc.
" " "	<i>Indatettix crassipes</i> , Hanc.
" " "	<i>Hedotettix costatus</i> , Hanc.
" " "	<i>Hedotettix attenuatus</i> , Hanc.
" " "	<i>Coptotettix artolobus</i> , Hanc. (Type).

SPECIES FROM OUTSIDE THE INDIAN EMPIRE IN
THE INDIAN MUSEUM.***Discotettix belzebuth*, Serville.**

Habitat.—Kuching, Sarawak, Borneo, June 27 1910 (*Beebe*).

***Tripetalocera ferruginea*, Westwood.**

Habitat.—Kuching, Sarawak, Borneo, June 27, 1910 (*Beebe*).

***Dasyleurotettix curriei*, Rehn.**

S. Africa.

Genus *Hexocera*, nov.

Allied to *Eugavialidium*, Hancock. Pronotum ornate with spines and gibbose. Face slightly oblique; frontal costa obsolete or nearly so above the paired ocelli, protuberant between the antennae and sulcate; antennae long slender filiform, inserted far below the eyes; eyes globose, slightly sessile; vertex wider than one of the eyes, on either side little elevated or subacute terminated, not higher than the eyes. Pronotum anteriorly truncate, dorsum concave between the shoulders, the humeral angles produced in a spine on each side; median carina of pronotum often bigibbose or obtuse spined behind the shoulders; posterior angles of the lateral lobes of the pronotum laminate outwards, and produced in a sharp spine, at the lateral margin in front produced on each side in a spiniform tubercle; hind process lengthily produced backward beyond the hind femoral apices. Elytra acuminate backward toward the apices, wings perfectly explicate, and extended backward nearly to the apex of the pronotal process. Anterior and middle femora narrow, and strongly elongate, margins not compressed, but often subtuberculate; posterior femora elongate, inferior margin obtuse dentate; hind tibiae and first article of the posterior tarsi marginate, entire. Type *Acridium (Tetrix) hexodon*, de Haan.

***Hexocera sexspicata*, sp. nov.**

Near *H. hexodon*, de Haan. Body minutely punctate, coloured ferrugineous-fuscous, hind femora obscurely marked with alternating light and fuscous bars. Vertex wider than one of the eyes, concave forward, frontal carinulae rounded, abruptly terminated at the sides, and slightly elevated nearly as high as the eyes; eyes prominent, strongly globose, subsessile; paired ocelli placed on a line with the lower margin of the eyes; antennae long and very thin, articles strongly elongate, inserted far below the eyes; frontal costa strongly protuberant between the antennae, sulcate, depressed and thin near the vertex above the paired ocelli. Pronotum truncate anteriorly, dorsum inequal, concave between the shoulders; median carina obliterated near the front border, unigib-

bulate forward before the shoulders, and behind the shoulders elevated in the form of a dull conical spine or gibbosity black at the apex; dorsum depressed just behind the spine; humeral angles broadly elevated, crenulate, and strongly produced on each side in an acute spine, directed obliquely upwards; before the shoulders appears a small tubercle on each side on the lateral carinae; dorsum above the elytral apices on each side bearing an obtuse rounded node, and farther backward the base of the process provided with two elongate nodes nearly joining in front, and fossulate between them; hind process lengthily produced and smooth above; lateral lobes of pronotum on each side in front below the eyes outwardly produced in a subspine, longer than a tubercle; posterior angles of the lateral lobes outwardly laminate and produced in a single transverse strong spine on each side, little curvate forward toward the apex; elytra externally impresso-punctate, elongate, widest near the middle, rounded below or acuminate toward the apices; wings extended backward nearly to the apex of the hind process; anterior femora strongly elongate, margins entire or subundulate above; middle femoral margins above subtrilobate, below nearly bituberculate; posterior femoral carinae above thinly compressed bearing two minute tubercles, below dentate; hind tibiae mutilated in the type.

Entire length of male 20.7 mm.; pronotum 19.8 mm.; post. femora 6 mm.; antennae 7.5 mm.

Habitat.—Sandakan, N. Borneo (*Pryer*). Ind. Mus. coll.

The type of de Haan's species *hexodon* is from Sakoembang, Sumatra, and this species is closely allied to *hexodon*. The spined shoulders are more pronounced than in *dentifer*, Bolivar.

The type specimen bears a label on which is written "*Scelimena hexodon*, De Haan," and appears to be in Saussure's handwriting.

Genus *Eugavialidium*, Hancock.

Eugavialidium chinensis, sp. nov.

Body greyish, light and fusco-maculate. Vertex wider than one of the eyes, on either side dentate, but not elevated above the eyes; dorsum of the pronotum strongly rugose, reticulate, deplanate, depressed and fossulate behind the shoulders; median carina multi interrupted, gibbulate forward between the sulci and just back of the shoulders, at the front margin produced over the occiput in a tubercle; humeral angles armed with an obtuse, slightly produced tubercle on each side; front margin of pronotum on each side of the lateral lobes bearing a small subacute denticle; posterior angles of the lateral lobes produced in an uncinat spine on each side, which is rather slender; hind process more or less maculate above, very strongly produced, much longer than the apices of the outstretched hind tibiae, subulate, and toward the apex cylindrical, and rugose; wings fully explicate, pellucid, reaching nearly to the pronotal apex; anterior femora compressed,

elongate, margins above distinctly lobate, toward the base acute lobate, below bidentate; middle femoral margins above trilobate, below strongly bidentate; hind femora elongate bearing a large very obtuse lobe at the middle, and two acute denticles backward before the antegenicular lobe; below armed with very small tubercles; hind tibiae marked with black and white, black at the base and with two black annulations on the shaft, the margins very moderately expanded and armed with small spines; first joint of the posterior tarsi very slightly expanded.

Entire length of male and female 26-29 mm.; pronotum 25-28 mm.; posterior femora 7.5-8.5 mm.

Habitat.—Phuc Son, Annam (*R. Rolle*). Author's coll.

***Acrydium hancocki*, Morse.**

Habitat.—United States. Ind. Mus. coll.

***Acrydium subulatum*, Linn.**

Habitat.—Europe; Siberia. Ind. Mus. coll.

***Acrydium depressum*, Bris.**

Habitat.—Europe (*de Saussure*). Ind. Mus. coll.

Acrydium variegatum*, Bolivar, *aff.

Habitat.—Kuching, Sarawak, Borneo (*Beebe*); Tiberias, Palestine (*N. Annandale*).

***Acrydium polypictum*, Hanc.**

Habitat.—10 miles south of Kuching, Borneo. Ind. Mus. coll.

***Nomotettix tartarus*, Saussure.**

Habitat.—Turkestan (*Saussure*). Ind. Mus. coll.

This is the species described as *Tettix tartarus* by Bolivar, in *Ann. Soc. Ent. Belg.*, xxxi, pp. 262, 263, 1887.

***Nomotettix compressus*, Morse.**

Habitat.—Georgia, U.S. America. Ind. Mus. coll.

***Paratettix singularis*, Shiraki.**

Habitat.—Japan. Ind. Mus. coll.

***Paratettix meridionalis*, Ramb.**

Habitat.—Greece; Teneriffe; Europe. Ind. Mus. coll.

Paratettix texanus, Hancock.

Habitat.—Texas, U.S.A. Ind. Mus. coll.

Paratettix similis, Bol.

Habitat.—10 miles south of Kuching, Sarawak, Borneo. Ind. Mus. coll.

Paratettix toltecus, Saussure.

Habitat.—Mexico (*Saussure*). Ind. Mus. coll.

Euparatettix personatus, Bolivar, *aff.*

Habitat.—Borneo. Ind. Mus. coll.

Telmatettix aztecus, Saussure.

Habitat.—Mexico (*Saussure*). Ind. Mus. coll.

Tettigidea prorsa, Scudder.

Habitat.—Georgia, U.S.A. Ind. Mus. coll.

Tettigidea lateralis, Say.

Habitat.—Texas, United States (*Saussure*). Ind. Mus. coll.

Tettigidea parvipennis, form **pennata**, Morse.

Habitat.—Chicago, Illinois, U.S.A., Sept. 29, 1892 (*Hancock*) Ind. Mus. coll.

Tettigidea medialis, Hancock.

Habitat.—Georgia, U.S.A. (*Saussure*). Ind. Mus. coll.

Tettigidea mexicana, sp. nov.

Near *nigra*, Morse. Vertex wider than one of the eyes, not advanced beyond the eyes, median carina small, the crown sub-horizontal, or barely convex in profile, and with the vertex obtuse angulate; frontal costa advanced beyond the eyes nearly one-half their breadth, and convex, little sinuate at median ocellus, viewed in front widely sulcate, and forked above the paired ocelli, and little divergent forward. Pronotum tectiform, plain granulose above, posteriorly cuneate reaching to the knees of the hind femora; median carina of the pronotum compressed, elevated, little arcuate before the shoulders, and little depressed between the shoulders, the hind process little depressed toward the apex; posterior angles of the lateral lobes of the pronotum angulate, the inferior margins little outwardly deflexed; the superior elytral sinus right angulate and very shallow; elytra very small, elliptical,

bearing a subapical white mark; wings wanting; colour reddish brown, hind femora ferrugineous.

Entire length of female 12 mm.; pronotum 10 mm.; posterior femora 7 mm.

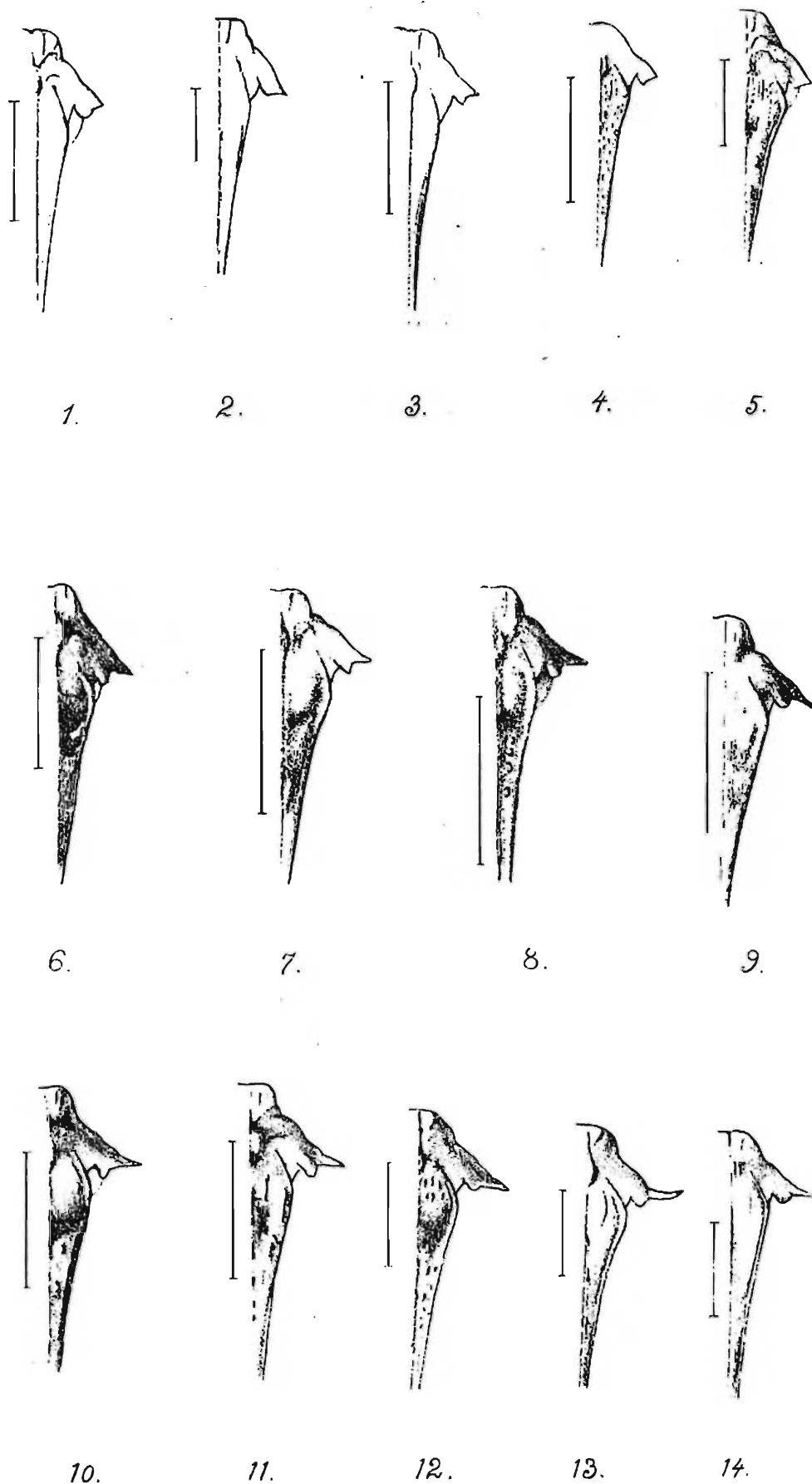
Habitat.—Orizaba, Sumuhran, Mexico (*Saussure*). Ind. Mus. coll.

The printed name "*Tettigidea polymorpha*, Burm." is on the label attached to this specimen, probably placed by *Saussure*.

EXPLANATION OF PLATE XIV.

Lateral lobes of the pronotum in *Criotettix*. Line indicates length of pronotum.

- FIG. 1. *Criotettix montanus*, Hanc.
,, 2. *Criotettix rugosus*, Bol.
,, 3. *Criotettix aequalis*, Hanc.
,, 4. *Criotettix dohertyi*, sp. nov.
,, 5. *Criotettix pallidus*, sp. nov.
,, 6. *Criotettix annandalei*, sp. nov.
,, 7. *Criotettix maximus*, Hanc.
,, 8. *Criotettix grandis*, Hanc.
,, 9. *Criotettix graveleyi*, sp. nov.
,, 10. *Criotettix flavopictus*, Bol.
,, 11. *Criotettix extremus*, Hanc.
,, 12. *Criotettix orientalis*, Hanc.
,, 13. *Criotettix spinilobus*, Hanc.
,, 14. *Criotettix tricarinatus*, Bol.



J. L. Hancock, del.

A. Chowdhary, lith.

PRONOTUM OF *CRIOETTIX*.

MISCELLANEA

INSECTS.

Additional Mallophaga from the Indian Museum (Calcutta).

In addition to a large collection of Mallophaga from birds of India and S. Asia generally, received from the Indian Museum, and recently reported on by Kellogg and Paine (*Rec. Ind. Mus.* Vol. X, pp. 217-243, 1914), we have received a small sending composed of the species noted in this paper. Although no new species are included in this collection, the new host and locality records are worth recording.

Docophorus rostratus, Nitzsch. Juvenile specimens from *Scops* sp. (taken at sea, off Aden).

Docophorus gonorhynchus, Nitzsch. Specimens taken from *Milvus melanotis* (Kurseong, E. Himalayas).

Nirmus rufus, Nitzsch. Specimens from the Brahmini Kite *Haliaster indicus* (Calcutta).

Lipeurus longus, Piaget. Specimens from the pheasant *Tragopan satyra* (Zool. Gardens, Calcutta).

Lipeurus antilogus, Nitzsch. Males and females of this well-marked and interesting parasite of the bustards from *Houbara* (*Otis*) *macqueeni* (in captivity, Lahore, Punjab, and also wild, Bhawalnagar, Punjab).

Goniodes bicuspidatus, Piaget. Males and females from the pheasant *Tragopan satyra* (Zool. Gardens, Calcutta).

Colpocephalum flavescens, Nitzsch. Specimens from the Brahmini Kite *Haliaster indicus* (Calcutta).

Colpocephalum subpachygaster, Piaget. Specimens from *Scops* sp. (at sea, off Aden).

Colpocephalum miandrium, Kellogg. Specimens from the African Brown Crane *Balearica pavonina* (in captivity, Calcutta). This species was originally described from specimens taken from a crane of the same genus collected by Sjöstedt's Kilimanjaro Meru Expedition in E. Africa in 1907.

Menopon gonophaeum, Nitzsch. Specimens from the Raven *Corvus corax* (Zool. Gardens, Calcutta, recently received from Nepal).

Menopon nigrum, Kellogg and Paine. Specimens from *Corvus splendens* (Calcutta). This species was described in 1911 from specimens taken from the White-Necked Raven *Corvultur albicollis*, shot at Oshogbo, Southern Nigeria, by J. J. Simpson. The species,

though closely related to others of the genus found on crows and ravens, is a well-marked one.

Nitzschia minor, Kellogg and Paine. Specimens taken from the Swift *Cypselus affinis* (Calcutta). The species was described in 1914 from specimens from the same host taken in the same locality and included in the earlier sending from the Indian Museum.

Laemobothrium tilan, Piaget. Male, female and young specimens from a Baza, *Baza jerdoni* (Kurseong, E. Himalayas)

V L. KELLOGG and S. NAKAYAMA,
Stanford University, California.

REPTILES.

An abnormal specimen of *Naja bungarus*, Schleg.

Dr. Boulenger in the "Fauna" volume on "Reptilia and Batrachia" shows a rhomboidal shield, in between the *occipitals* anteriorly in fig. 114. on page 390, but in the description he says that the *parietals* are followed by a pair of large shields (*occipitals*), no mention being made of this shield.

Major Wall has also in his book on the "Poisonous Snakes of India and how to recognize them" (1913) shown the *parietals* followed by a pair of large *occipitals*; and he says that these (*occipitals*) are in contact with one another throughout.

Sir J. Fayrer, K.C.S.I., in the "Thanatophidia of India" does not show any shield in between the *occipitals* which are shown in contact throughout. In some specimens examined the condition is exactly as shown by Wall or Fayrer, but in the singular specimen about which this note has been written the condition is exactly as shown in fig. 114, on page 390 of the "Fauna" volume.

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BATRACHIA.

A South Indian Flying Frog: RHACOPHORUS MALABARICUS (Jerdon).

(Extract from a letter). I have the honour to state that I have collected a specimen of a flying tree-frog near Sagar, a place in the Malnad forest regions, or the Western Ghats portion, of Mysore Province, some twenty miles from the famous Gersoppa Falls. I happened to catch it in this way. I was collecting and photographing natural science specimens in the locality for my College. As I approached a big tree with my camera, my attention was suddenly drawn by a rustling noise in the leaves above and, as I looked up, I found a beautifully coloured little animal having all the appearance of a small bird, falling from the top of the tree in a slanting direction. Its flight was curious, inasmuch as it did not flap its "wings" All

the same, a sort of a whir was audible as it flew slantingly. It alighted on the ground a good distance from the tree it darted from. It is a pity I failed to measure the distance travelled by the animal. It may, I think, be somewhere between thirty to forty yards. My attendant happening to be close to where the creature alighted ran and caught it by throwing his cloth over it. When I went to see what it was, I found to my intense surprise and delight that it was not a bird, but a gaily coloured flying tree-frog.

Its upper side was coloured a beautiful grass-green, the webs bright red, and its underside a bright yellow. It possessed well-developed adhesive discs at the ends of its fingers and toes with which it could attach itself to any surface easily. It could with ease attach itself to the wet slippery sides of the glass bottle in which I carried it home. It was crouching in the bottle in such a way that it looked a lump of dull green. When among the green leaves, it could, I think, escape detection most efficiently. The brilliancy of its colour was to be seen only during its flight and might serve for purposes of recognition by others of its kind. I already mentioned that a kind of whir was audible during its flight. This whir and the sudden flash of colour as it darted from the tree brings to my mind certain grasshoppers with criptic colouring which make a sort of sound as they leap and take short-flights and at the same time display their brilliantly coloured nether garments of inner wings—a sort of warning to the effect that “danger is near; follow my lead.”

I filled the bottle three-fourths with water, but the frog did not much tolerate the water. It climbed as high as it could up the sides of the bottle and avoided the water. Evidently it did not live in water. Its home and even nesting place probably were always the tree-tops, like those of some of its relatives.

Colouration.

Upper portion of the body, bright grass-green (dull steel-blue in spirit), obscurely dark dotted all over. Finely tuberculated, almost smooth, except at the sides of the upper jaw which are a bit coarser in granulation.

Underside golden yellow; granular a little from the arm pits downwards. Underside of the thighs interspersed with bigger granules. Two streaks of dull yellow at the sides speckled all over with dark brown spots and tinged with red. Upper portion of the arms, the legs, and the last digits of the limbs coloured green like the upper portion of the body. The underside of the legs yellow. The upper arms are coloured yellow, but bear a red streak on the side towards the body. The undersides of the thighs are coloured yellow and bear a reddish blotch which increases in redness towards the knee joint, the redness continuing lightly on the inner unexposed side of the leg towards the calf which is mainly yellow in colour. Web between 1st and 2nd finger, yellow; between 2nd and 3rd finger, yellow towards the distal end only, but the rest bright red; between 3rd and 4th finger, red

throughout, except a little at the two corners near the discs. The web extends only a little beyond half way between the 1st and 2nd finger in each hand, but right up to the discs between the other fingers.

Measurement of the specimen (in spirit).

Length of the body	3 $\frac{1}{4}$ inches.
„ „ hand	2 „
„ „ leg	5 „
Area of expanded fore web about $\frac{1}{2}$ sq. inch.	
„ „ hind „ $1\frac{1}{8}$ sq. inch.	
Total area of the four webs about 3 $\frac{1}{4}$ sq. inches.	

I wish to express my thanks to my student, Mr. H. Channapayya for the help he gave me, and to Mr. N. P. Muniswami Naidu, Drawing-master, Teachers' College, Saidapet, for the excellent coloured sketch of the frog he has made.

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