

# ON A COLLECTION OF TRICHOPTERA FROM THE INDIAN MUSEUM.

## PART II.—INTEGRIPALPIA.<sup>1</sup>

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This second part of the paper deals with the collection of the suborder Integripalpia in the Indian Museum. Of this suborder only about 45 species have been described so far from Continental India. The material of the Indian Museum increases the number of species of Integripalpia known from Continental India to 79; of these 31 species proved to be new. A few forms from Ceylon are also recorded in this paper.

At the end of this paper I give the description of a new species of the suborder Annulipalpia and some corrigenda and addenda to the first part. The Indian fauna appears to be rich and composite, and further new species will be found as the various areas are more intensively explored. The southern and western parts of India particularly are not sufficiently explored so far and new records from these regions will be valuable.

### Family CALAMOCERATIDAE.

#### **Ganonema** McLach.

#### **Ganonema salsum** Betten.

(Text-figs. 1, 2).

1909. *Ganonema salsum*, Betten, *Rec. Ind. Mus.* III, p. 238, pl. xvi, figs. 14-17 (Assam).  
2 ♂, 2 ♀. Darjeeling Distr., Pashok, 3,500 ft., 1-12.x.17; F. H. Gravely (in spirit). Also 2 larvae and pupae.  
2 ♂, ♀. Kumaon Hills, Bhowali, bushes and trees on the sides of the stream below Sanitarium, 12.v.30; H. S. Pruthi (dry).  
♂. Kumaon Hills, sides of the Deo-Gad stream and the forests S.W. of Pinath, 7 miles from Kausani, Almora distr., 1.vi.30; H. S. Pruthi.  
♂. Kumaon Hills. Forests round Mahasekhan Forest House, ca. 6,500 ft., 5 miles from Bhowali, 13.v.30; H. S. Pruthi.  
♀. Kumaon Hills, Dalmati, Almora distr., sides of the Kali Nala, below the Forest Bungalow, 21-22.v.30; H. S. Pruthi.  
♀. Assam-Bhutan Frontier, Boirakund, Darrang distr., 18-22.x.12; S. W. Kemp.  
♂. Garhwal distr., Gular, the mouth of a spring, 15.v.15.

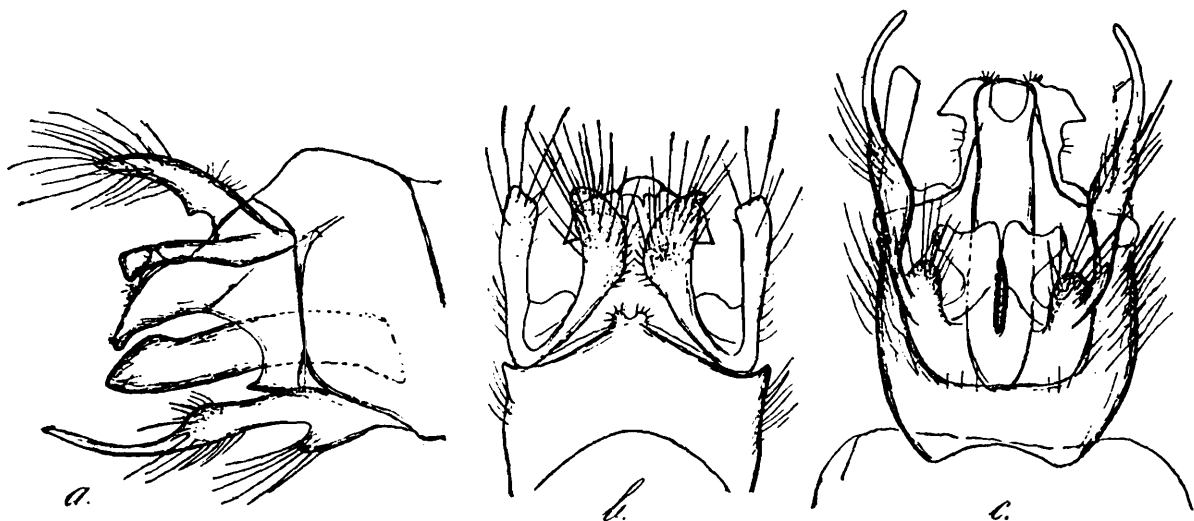
Head and thorax rufous brownish, with yellowish rufous hairs; antennae yellow, with narrow brown annulations; palpi clothed with yellowish rufous pubescence. Legs brownish-yellow clothed with yellow hairs. Posterior tibiae in ♂ bearing a brush of long yellowish hairs behind. Anterior wings pale brownish, broad, with obliquely truncated apical edge, clothed with yellowish rufous hairs; venation, as in Betten's figure 14, pl. xvi. In the posterior wings fork 1 begins

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<sup>1</sup> The first part of this series was published in this journal, vol. XXXVII, pt. ii, pp. 93-209 (1935).

somewhat earlier than in Betten's fig. 14, but after the 3rd fork; colouring somewhat paler than that of the forewings.

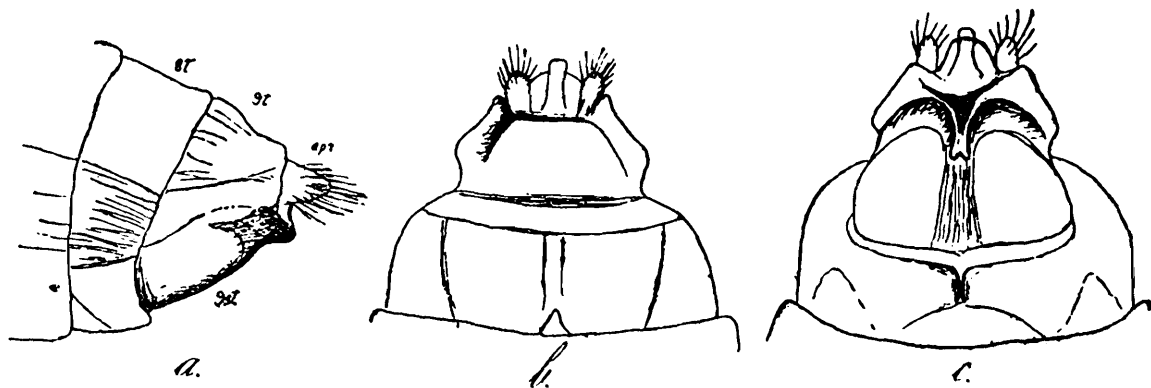
♂. 9th segment broad, somewhat narrowed beneath; tergite with a shallow triangular projection, ending in two minute median tubercles above; sternite narrower than tergite. Preanal appendages divided up to their bases into two thick stick-shaped processes, united at their bases; the upper process, if seen from above, directed upwards and inwards; distal portion of the upper branch somewhat plate-like, narrow from side, dilated from above, hairy.



TEXT-FIG. 1, a-c.—*Ganonema salsum* Betten, ♂; genital appendages from side (a), from above (b) and from beneath (c).

10th segment: distal portion triangular from side, separated from the basal by an excision above; end somewhat extended downwards. Seen from above, 10th segment is broad in its basal part, then suddenly narrowed; apical portion with a deep rounded excision divided into two lobes, at sides dilated into two triangular projections. Penis straight, cylindrical, under it are situated two broad pale plates, separated from each other by a narrow median fissure.

Pedes genitales long and rather slender, directed backwards; proximal half, which may be considered as representing the basal joint, is provided internally and ventrally with a rounded hairy thickening at its base; distal portion of the basal joint is also somewhat thickened



TEXT-FIG. 2, a-c.—*Ganonema salsum* Betten, ♀; last segments of abdomen from side (a), from above (b) and from beneath (c).

(if seen from beneath) and is beset with long hairs. Second joint slender, pale, somewhat arcuate, not separated from the basal one.

♀. 9th tergite truncated and behind it there is a narrow elongated lobe, belonging to the 10th segment ; 9th sternite broad, with a median impression subdivided into two side portions. Preanal appendages short, rounded, hairy ; ventrally between them is a broad, rounded plate belonging to the 10th segment ; genital orifice situated behind the 9th sternite.

*Remarks.*—*Ganonema salsum* is, apparently, not uncommon in North India ; it differs from all other species of the genus in the two-branched preanal appendages of the males.

From Assam are known also *G. brunneum* Ulm. and *G. longipenne* Mart., but these species are not represented in the present collection.

### **Asotocerus** McLach.

#### **Asotocerus fuscipennis** Albarda.

1887. *Asotocerus fuscipennis*, Albarda, *Veth's Midden-Sumatra*, IV, pt. 5, p. 17, pl. v, fig. 1.

1909. *Asotocerus fuscipennis*, Betten, *Rec. Ind. Mus.* III, p. 239, pl. xvii, figs. 1-3.

♂. Kumaon Hills, sides of the Deo-Gad stream and the forests S.W. of Pinath, 7 miles from Kausani, Almora distr., 1.vi.30 ; H. S. Pruthi.

♂. S. Shan States, swamp at head of Inle Lake, Yawngnwe State, 20.ii.17 ; F. H. Gravely.

♂. S. India, Kodaikanal, 6,900 ft., Palni Hills, viii.22, at light ; S. W. Kemp.

♀. S. Shan States, Inle Lake, Yawngnwe State, 3,000 ft., 18-23. ii. 17 ; F. H. Gravely.

The wing venation and the shape of the ♂ genitalia in the first and in the second specimens being very similar to Betten's figures 1-3, pl. xvii, I believe that they belong to this species.

Length of body in the second specimen is 9 mm. The third specimen from Kodaikanal, S. India is larger (length of body 10.2 mm.), and its venation is somewhat different. In the anterior wings  $RS_1$  derives from the discoidal cell somewhat later, fork 2 is angulate at base ; in the posterior wings the pedicel of the first apical fork is longer, and the bases of forks 1, 2 and 3 are situated nearer to each other than in the other two specimens or in Betten's figure 1. However, the structure of the ♂ genitalia, and in particular the shape of the 10th segment are similar to those in *A. fuscipennis*. I, therefore, refer this specimen also to *A. fuscipennis* ; it perhaps represents a distinct variety.

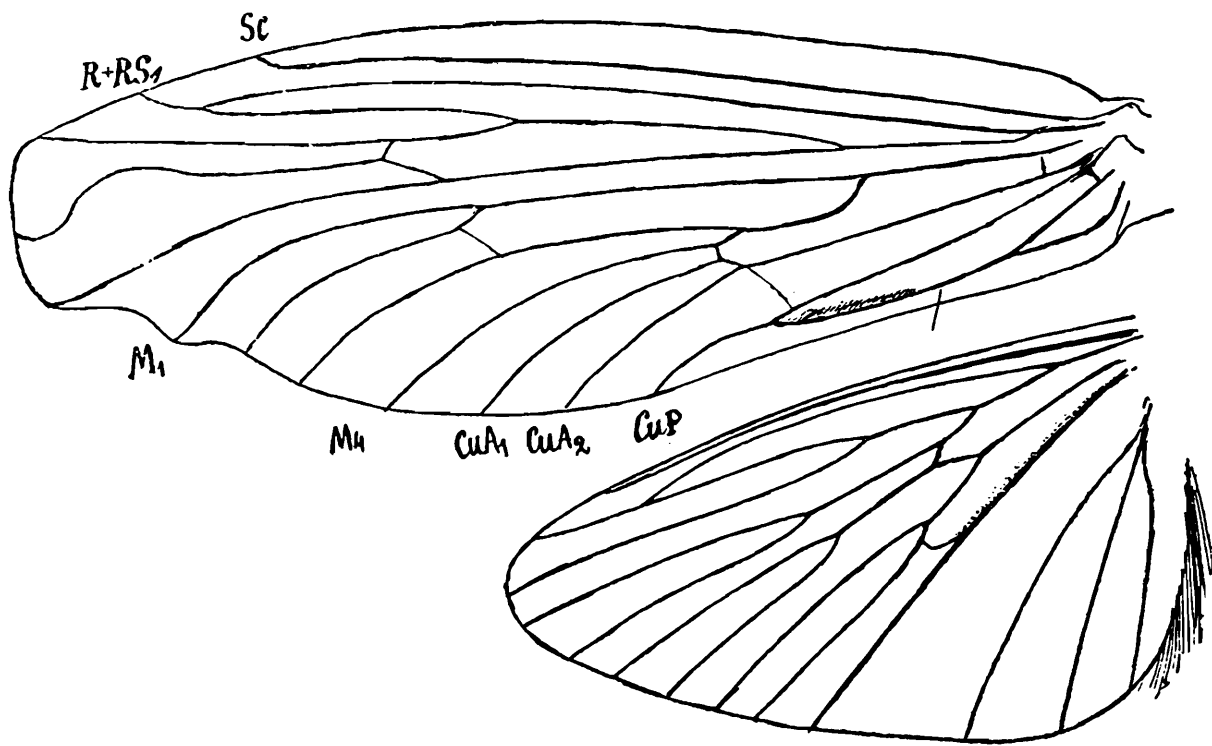
#### **Asotocerus flexuosus**, sp. nov.

(Text-figs. 3, 4.)

♂. Peninsular India, Castle Rock, N. Kanara distr., x.16 ; S. W. Kemp (in spirit).

Head and thorax yellow, antennae pale yellow, with black annulations ; palpi pale. Anterior wings brownish in the anterior parts, paler in the middle, clothed with rufous hairs ; apex truncated, hind-apical

margin somewhat sinuate, forming a convexity at the end of  $M_1$ , separated by two concavities; R united in its end portion with  $RS_1$ ; DC long, narrow;  $RS_1$  arising from it at the base of three-fourths of its length; area between  $RS_2$  and  $RS_4$  rather broad, and  $RS_3$  distinctly curved in this region. MC beginning at same level with DC and nearly as long; CuP pale, feeble,  $A_1$  distinct,  $A_3$  present,  $A_2$  apparently lacking or



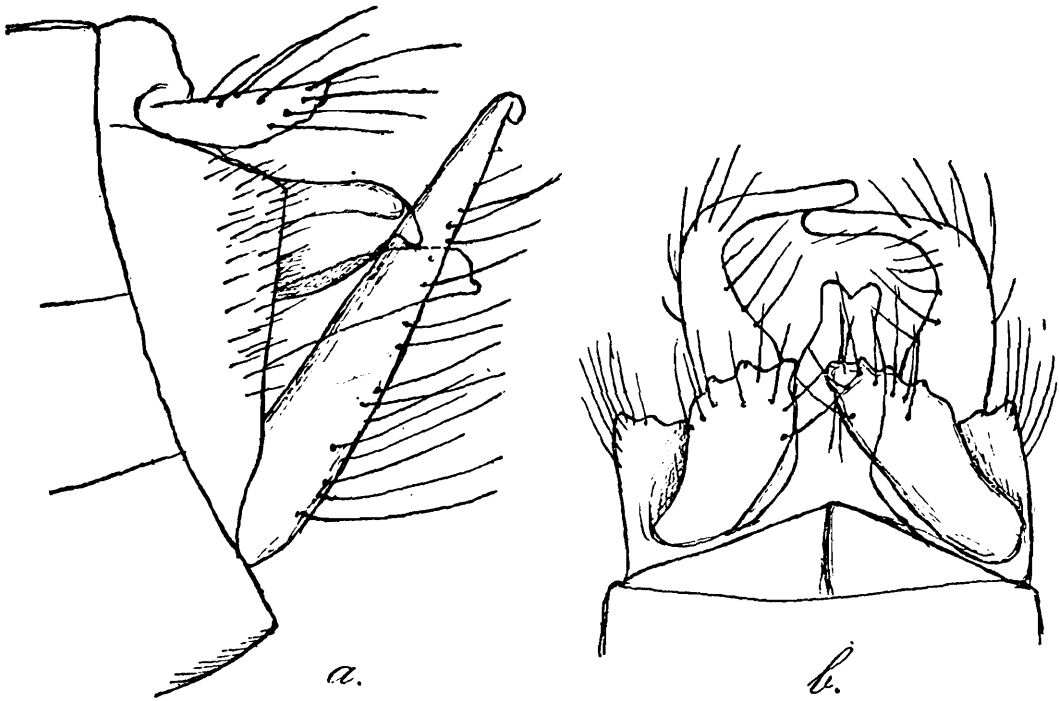
TEXT-FIG. 3.—*Asotocerus flexuosus*, sp. nov., ♂; venation of fore- and hind-wings.

united with  $A_1$ . Posterior wings as broad as the anterior, clothed with yellowish rufous hairs;  $RS_1+2$  dividing early, fork 1 much longer than the 2nd, cross vein rs-m oblique, 3rd fork beginning at same level as the 2nd; the so-called— $CuA_1$  represents here the hind branch of the long fork 4;  $CuA$  strong, practically simple, accompanied anteriorly by a brownish chitinated streak<sup>1</sup>; cross vein m-cu curved. Jugal region very narrow, and I can detect no arcuate vein here; on its inner margin a set of long thin brownish hairs. Abdomen brownish above, pale beneath.

♂. Genital appendages resembling those of *Asotocerus ochraceellus* McLach. and of *Asotocerus sinuatus*, sp. nov. 9th segment forming two broad low triangular side pieces; tergite narrow, but forming a convexity above. Appendices preanales rather short but broad if seen from above; they are directed somewhat inwards and arched above, with several bristles; their hind margin is sinuate. 10th segment short; seen from above it is somewhat dilated in the middle, then constricted and at its end subdivided into two lobes; median portion raised upwards; seen from side it is broader; apex attenuated and curved somewhat downwards. Pedes genitales long, ascending; distal portions,

<sup>1</sup> I believe this streak to be a remnant of MP, which existed in the ancestral types of Trichoptera; it is preserved mainly in the genus *Setodes* and in some other genera.

representing second joints, united with the basal ones, slender and curved inwards. Penis straight.



TEXT-FIG. 4, a, b.—*Asotocerus flexuosus*, sp. nov., ♂; genital appendages from side (a) and from above (b).

Length of body 7.5 mm., length of anterior wings 13 mm.

*Remarks.*—This species is allied to *A. sinuatus*, sp. nov., but is easily distinguished by its arcuate  $RS_3$ .

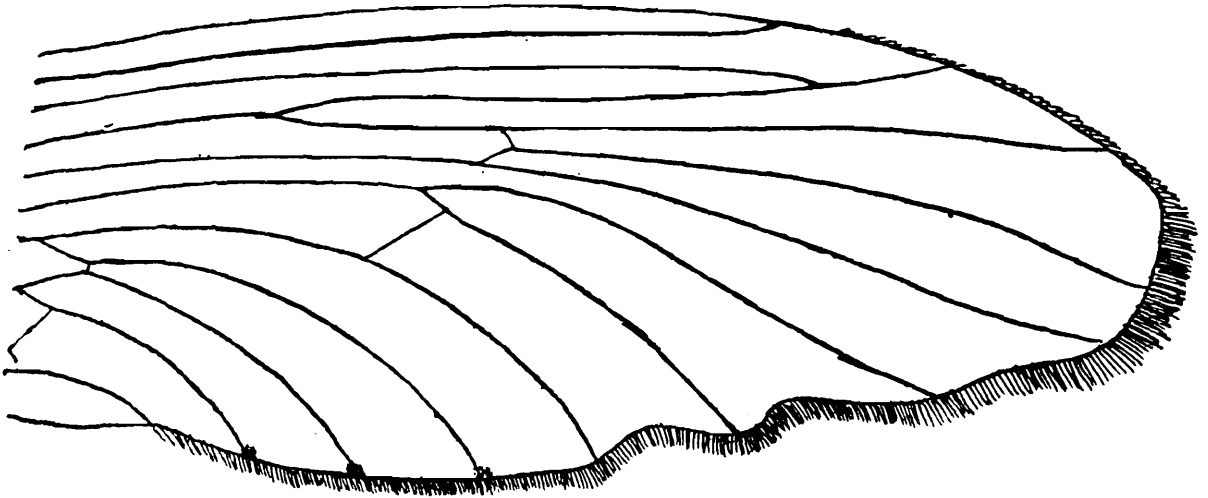
***Asotocerus sinuatus*, sp. nov.**

(Text-figs. 5, 6.)

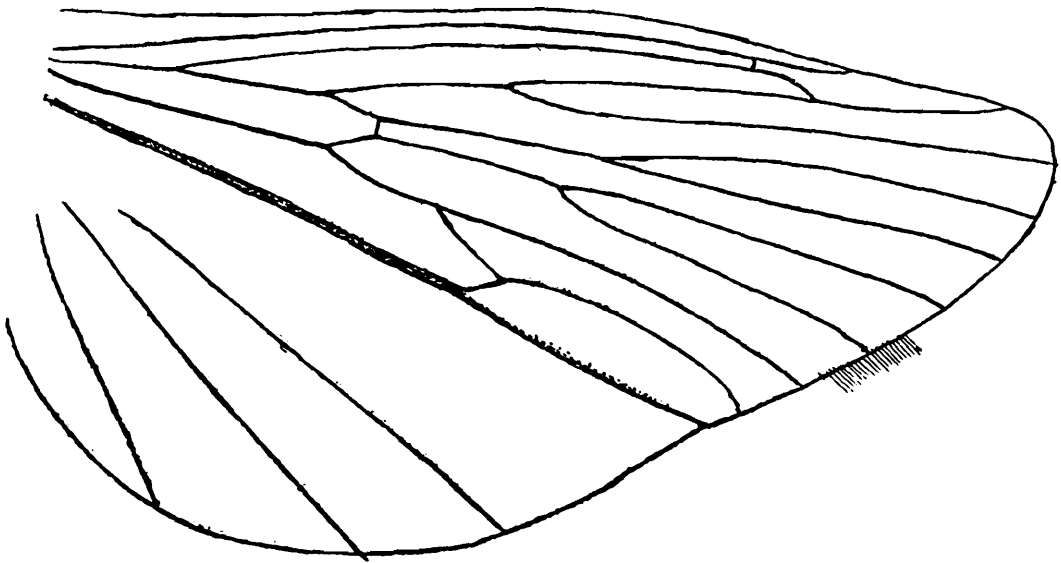
♂. Nilgiri Hills, 3,000 ft., ix.10; H. L. Andrews (dry specimens).

Head and the basal joint of antennae yellowish rufous, clothed with concolorous hairs; antennae yellow, narrowly annulated with black; palpi yellowish. Thorax brownish, pronotum and tegulae yellow, bearing long yellowish hairs; metanotum paler, yellowish; coxae in the pro- and mesothorax dark brownish, with long pale hairs; posterior coxae yellowish; legs yellow or yellowish, anterior femora brownish; posterior tibiae bearing long pale hairs, outstanding posteriorly. Anterior wings elongated, not curved backwards, with apex truncated, densely clothed with yellow rufous hairs; fringe brownish, but at the ends of veins there are also yellow hairs. At the ends of  $CuP$ ,  $CuA_1$ ,  $CuA_2$ ,  $M_4$  and  $M_3$  blackish spots; hind apical margin sinuate, forming concavities between  $M_3$  and  $M_2$ ,  $M_2$  and  $M_1$ ,  $M_1$  and  $RS_4$ ; areas between  $RS_2$  and  $RS_3$ ,  $RS_3$  and  $RS_4$ ,  $RS_4$  and  $M_1$ ,  $CuA$  and  $CuP$  forming longitudinal pale greyish streaks, which are almost nude, clothed with few sparsely arranged hairs; similar, but short streak may be seen between  $M_1$  and  $M_2$ ; discoidal cell extraordinarily long and narrow,

RS deriving at  $\frac{2}{3}$  from its base ; 3rd fork triangular at its base, the 4th long, curved ; MC but a little shorter than DC,  $M_4$  arising at  $\frac{2}{5}$  from



TEXT-FIG. 5.—*Asotocerus sinuatus*, sp. nov., ♂ ; distal part of fore-wing.



TEXT-FIG. 6.—*Asotocerus sinuatus*, sp. nov., ♂ ; posterior wing.

its base. Venation of posterior wings resembling that of *A. flexuosus*, sp. nov. ; fork 1 beginning earlier than fork 2, basal portions of  $RS_3+4$  and  $M_1+2$  connected by a transverse cross vein ;  $CuA_1$  shorter than in *A. flexuosus*, sp. nov., arcuate<sup>1</sup>, connected by an elongated oblique vein<sup>2</sup> with  $M_3+4$  ;  $CuA$  strong, with a narrow brownish streak before it ; membrane of the posterior wings brownish, clothed with sparse brownish hairs. Abdomen brownish.

♂. Structure of male genital appendages resembling that of *A. flexuosus*, sp. nov. ; 10th segment also somewhat dilated in its middle, above, and at its end divided into two small oval lobes.

Length of body 10 mm., that of anterior wings 17 mm.

*Remarks.*—This species is allied to *A. flexuosus*, sp. nov., differing mainly in the wing venation and in its larger size.

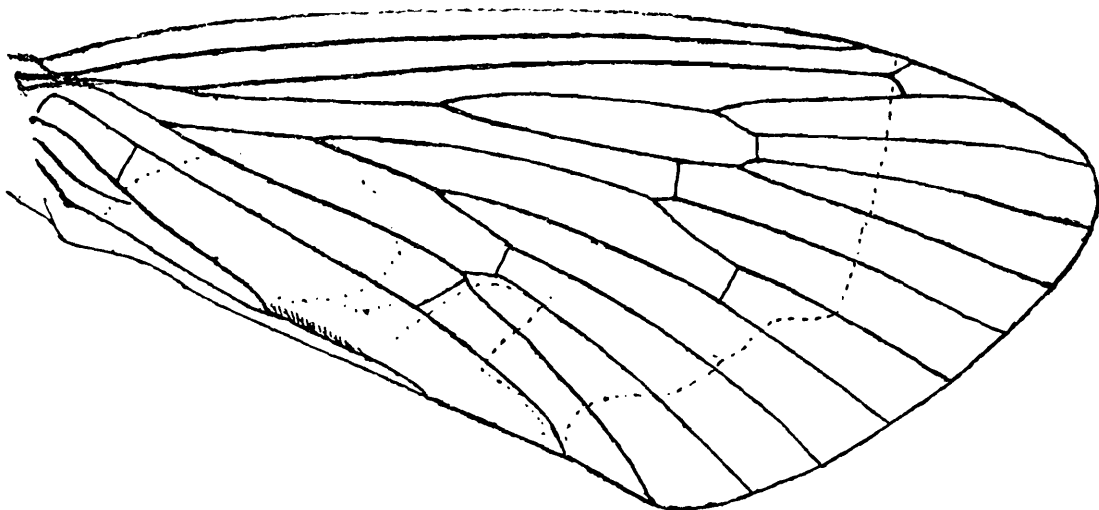
<sup>1</sup> This vein is morphologically  $M_4$ , as in *Asotocerus flexuosus*, sp. nov.

<sup>2</sup> This oblique vein certainly represents the basal part of  $M_4$ .

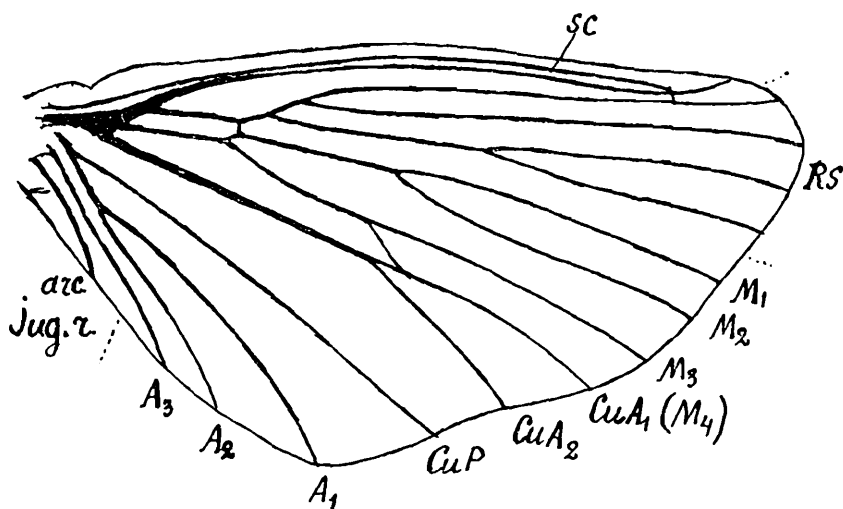
**Anisocentropus** McLach.**Anisocentropus kemp**i, sp. nov. (figs. 7-9).

♂, ♀. Peninsular India, Castle Rock, N. Kanara distr., x.16; S. W. Kemp (in spirit).

Head and thorax yellow. Antennae yellow, with somewhat brownish articulations; palpi maxillares 6-jointed, yellow, clothed with pale hairs; basal joint thick, oval, 3rd joint the longest, 4th and 5th ones shorter, subequal; 2nd joint a little longer than the 4th, basal joint shorter. Eyes large, in female somewhat smaller. Legs pale yellow, spurs 2.4.3. Anterior wings pale, clothed with yellowish rufous hairs, apical portion almost nude; hind portions of wings also but sparsely clothed with hairs; membrane considerably dilated in its distal half, apical margin obliquely truncated; costal margin convex. R at its end suddenly curve to  $RS_1$ , and prolonged with a feeble nervule to apical margin; discoidal cell only slightly longer than RS; MC at least  $1\frac{1}{2}$  times as long as DC, somewhat curved; fork 4 very long.



TEXT-FIG. 7.—*Anisocentropus kemp*i, sp. nov., ♂; anterior wing.



TEXT-FIG. 8.—*Anisocentropus kemp*i, sp. nov., ♂; posterior wing.

Posterior wings pale, irregularly triangular, clothed with pale yellow hairs; apical margin somewhat projecting or convex at the ends of  $M_3$  and  $CuA_1$ ; SC united at its end with R, which is connected here by

a short cross vein with  $RS_1$ ; RS in its basal part connected by a short cross vein with  $M_1+2$ , then almost immediately divided into very short  $RS_1+2$  and long  $RS_3+4$ ; 2nd fork a little longer than its pedicel, but much shorter than 1st; 3rd fork beginning somewhat earlier than 2nd;  $M_3$  connected with  $CuA_1$  by an oblique vein, representing probably the basal part of  $M_4$ ;  $CuA_1$  may be considered as  $M_4$ , as in the foregoing species. CuP straight,  $A_2$  united in its proximal part with  $A_1$ ; jugal region short, narrow, but containing distinct vena arcuata (arc.). Abdomen pale yellow.

♂. Side pieces of the 9th segment not greatly projecting above the base of the pedes genitales; 9th tergite with a short tongue-shaped projection above. Preanal appendages short, broad, oval, bearing many



TEXT-FIG. 9, a, b.—*Anisocentropus kempī*, sp. nov., ♂; genital appendages from side (a) and from above (b).

long hairs. 10th segment high from side, seen from above its end portion is in the form of a transverse thickening, excised in the middle and also bearing hairs; pedes genitales long, very slender and curved; second joint not separated from the first; basal part bearing very long hairs; second joint clothed with shorter hairs. Penis invisible in our specimen.

Length of body 8 mm.

#### *Notes on wing venation in the family Calamoceratidae.*

Among the Integripalpia the family Calamoceratidae is the most archaic; the wing venation and the structure of the male genitalia reveal very primitive characters in many representatives of the family. Only in this family there is, in the anterior wings, a closed median cell (MC), usually large and bearing two forks, 3rd and 4th. Venation of the posterior wings is also very primitive; the discoidal and the median cells are here open, but it is interesting that the so-called upper branch of CuA ( $CuA_1$ ) originates in some species, for instance, in *Asotocerus flexuosus* and *Asotocerus sinuatus*, not from CuA but from  $M_3+4$ , demonstrating, morphologically, that it represents the 4th branch of M, as in

the anterior wings. Therefore M in the posterior wings in Calamoceratidae is, indeed, four-branched, and the arrangement of its branches is similar to that in the anterior wings. CuA is simple in this family or perhaps CuA<sub>1</sub> is reduced.

In *Asotocerus* and, apparently, in other genera of Calamoceratidae CuA is a strong vein, and before it there is usually a brownish chitinized streak. I am of opinion that this streak represents the remains of the vein, which is preserved before CuA in the hind wings of many species of *Setodes*. This vein is generally designated as supplemental or "false", but morphologically it represents the greatly reduced MP (mediana posterior). The vein is preserved sporadically also in some representatives of the extinct order Paratrachoptera Till., for instance, in the genus *Ferganopsyche* Mart.<sup>1</sup>, and here its significance as mediana posterior is more evident. Tillyard named this vein M<sub>5</sub> (1919), but I believe it is more convenient to name it MP, i.e. mediana posterior. We observe some remains of this vein also in some other genera of Leptoceridae and even in some few Phryganeidae and Limnophilidae. Therefore we may suggest that this vein existed formerly in the ancestors of all Integripalpia and perhaps in the ancestors of Annulipalpia, although in this suborder any remains of it are quite unknown. If this vein existed in the ancestors of Integripalpia, we may presume that it existed formerly in the ancestors of some groups of Lepidoptera, as this order (suborder Frenata) appears to me to be indubitably allied to Integripalpia and to the family Calamoceratidae, in particular.

In consideration of these facts attention may be directed to some peculiar features of the wing venation in the family Simuliidae (Diptera). It is well known that before CuA there is a thin vein, ending in a fork—"submedian fork". Some authors consider this vein as "additional" or "false", or as only a fold, but others (Vignon, Seguy, Enderlein, Edwards) take it for a true vein, belonging to M. This vein in *Simulium* appears to me to be evidently homologous with that vein in Leptoceridae, Calamoceratidae, etc., which is named MP above. Traces of this vein are apparently not completely lacking in some other families (Chironomidae). If this hypothesis is correct, this vein ("submedian fork") cannot represent M<sub>1</sub> or M<sub>2</sub>, but only MP, which existed sporadically also in the order Paratrachoptera, related to the order Diptera. Whether CuA in the posterior wings of Trichoptera was formerly simple, like Mecoptera, as was suggested by R. Tillyard, or two-branched, it is not easy to decide at present. If in *Asotocerus* the so-called CuA<sub>1</sub> probably represents M<sub>4</sub>, the arrangement of the veins in *Leptocerus distinguendus*, sp. nov. (text-fig. 13) rather supports the view of the two-branched condition of CuA, since MP is here prolonged before CuA<sub>1</sub>. Probably, in various families of Trichoptera (that is, in their ancestors) there existed formerly a somewhat diverse condition of venation. As to the forewings, it appears to me to be more probable that CuA is here truly two-branched.

The structure of the male genitalia in the family Calamoceratidae is also very primitive, but this complex problem cannot be discussed here.

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<sup>1</sup> In the press.

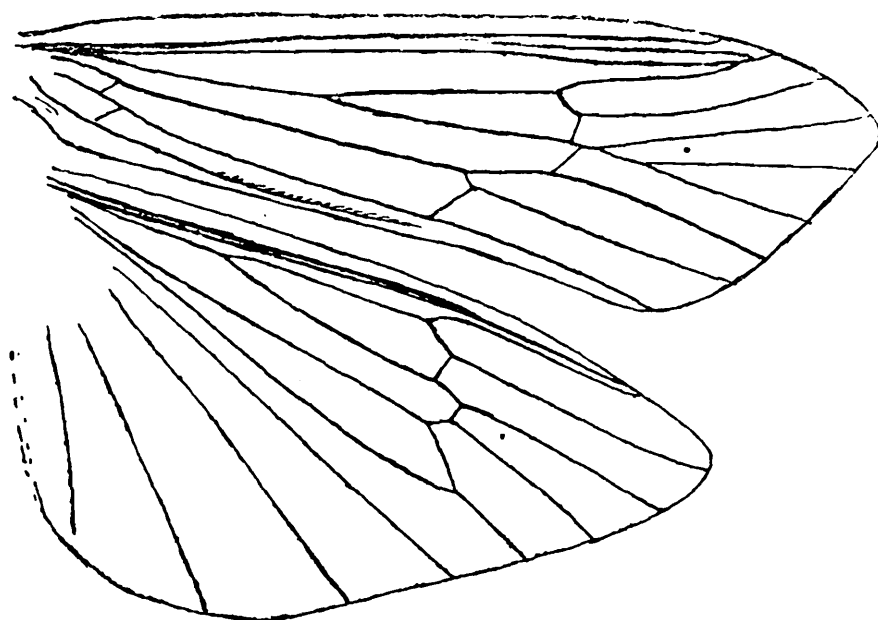
## Family ODONTOCERIDAE.

**Marilia** Fr. Müll.**Marilia ceylanica**, sp. nov.

(Text-figs. 10, 11.)

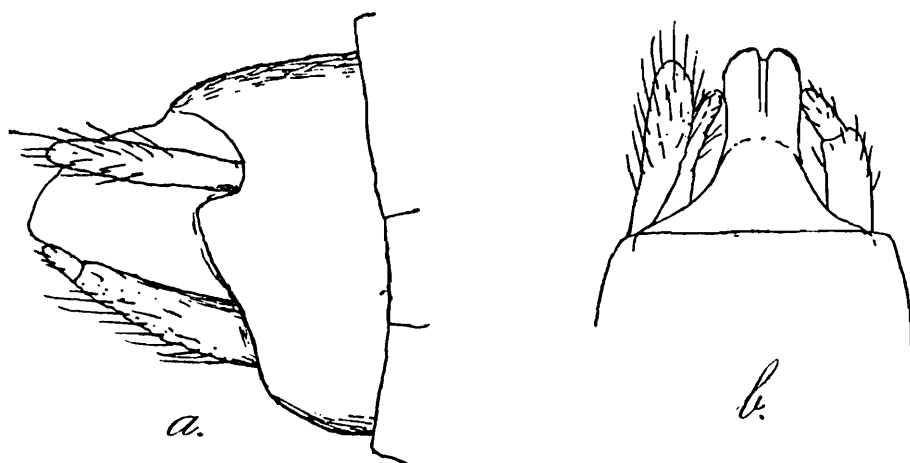
♂. Ceylon, Peradeniya, 8.vi.10 (in spirit).

Head and thorax brownish; eyes large, vertex with an excision behind; basal part of antennae brownish (the remaining portion set off). Legs greyish yellowish, spurs 2.4.4. Anterior wings yellowish,



TEXT-FIG. 10.—*Marilia ceylanica*, sp. nov., ♂; venation of anterior and posterior wings.

only  $M+CuA$  is brownish; venation as in other *Marilia* species; discoidal cell of moderate length, first apical sector originating from its



TEXT-FIG. 11, a, b.—*Marilia ceylanica*, sp. nov., ♂; genital appendages from side (a) and from above (b).

apex and near its end uniting with  $R$ ;  $M_1+2$  derived from  $RS_4$ . Posterior wings pale;  $RS_1$  originating near the end of  $DC$ ;  $M_3+4$  does not

reach the edge of wing and is united with CuA, which is simple, as in males of *M. minor* Ulmer and *M. elongata* Mart. Abdomen pale.

♂. 9th segment very broad, pale yellowish, with two side excisions for the preanal appendages; 9th tergite somewhat projected, but indistinctly separated from 10th tergite. Preanal appendages digitiform from side, a little broader above, clothed with not very long hairs. 10th dorsal segment pale, very broad from side, but seen from above it is much narrower and provided at its end with a small median excision. Basal joint of pedes genitales elongated and clothed with not long but strong hairs; 2nd joint short, bearing but short setulae. Penis invisible.

*Remarks.*—Judging by the shape of DC, it is possible that *Marilia* sp. described by Betten from the Kumaon Hills (*Rec. Ind. Mus.* III, 1909, p. 239) is this species. In this species fork 4 in anterior wings of female is present, which is a feature in which it apparently differs from the known American species. However, since the species *ceylanica* sp. nov. is very similar to *Marilia flexuosa* Ulm. from N. America, I refer it to the genus *Marilia*.

#### Family MOLANNIDAE.

##### **Molanna** Curt.

##### **Molanna** sp.

♀. Bombay Presidency, hill stream on Jog-Sagar Road, N. Kanara distr., 30.xi.28; H. S. Rao.

Head and body brown; coxae brown; anterior legs brown, median legs brownish yellow, posterior legs yellow.

Anterior wings brownish, darker anteriorly, clothed with yellowish hairs; posterior wings yellowish, clothed with rufous hairs; venation in both wings much resembling that of *M. falcata* Ulm.

*Remarks.*—Although the wing venation of this species is very similar to that of *M. falcata*, I am not certain about its identity with this species. It is probable, however, that it may represent a new species.

#### Family LEPTOCERIDAE.

This family contains two unequal subfamilies, Triplectidinae and Leptocerinae. Leptocerinae is a large subfamily, rather abundantly represented in India, and in non-palaeartic Africa. It is now evident that this Indian Leptocerine fauna is closely related to the African one; it is composed mostly of the same genera and several of the species are closely allied to the African ones. The subfamily Triplectidinae is much poorer, containing but three closely related genera—*Triplectides* McLach., *Notanatolica* McLach. and *Symphitoneura* Ulm. Its representatives are not uncommon in Australia and the adjacent islands, New Zealand, the Philippines, Nippon Islands and India; and also occur in Brazil, but none are found in Africa.

## Subfamily TRIPLECTIDINAE Ulm.

**Notanatolica**<sup>1</sup> McLach.**Notanatolica magna** Walker.(Text-fig. 12, *a-c.*)1909. *Notanatolica magna* (Walker) Betten, *Rec. Ind. Mus.* III, p. 239.

3 ♂, 2 ♀. Chota Nagpur, Chakradharpur, Singhbhum distr., 8-10.ii.18, at light; N. Annandale and F. H. Gravely (in spirit).

♀, ♀. Calcutta, 28.ii.11 and 11.iii.15, at light; F. H. Gravely.

♀. Calcutta, 17.ii.26; R. B. S. Sewell.

♀. Bihar, Katihar, Purneah distr., 1-24.x.10; C. Paiva.

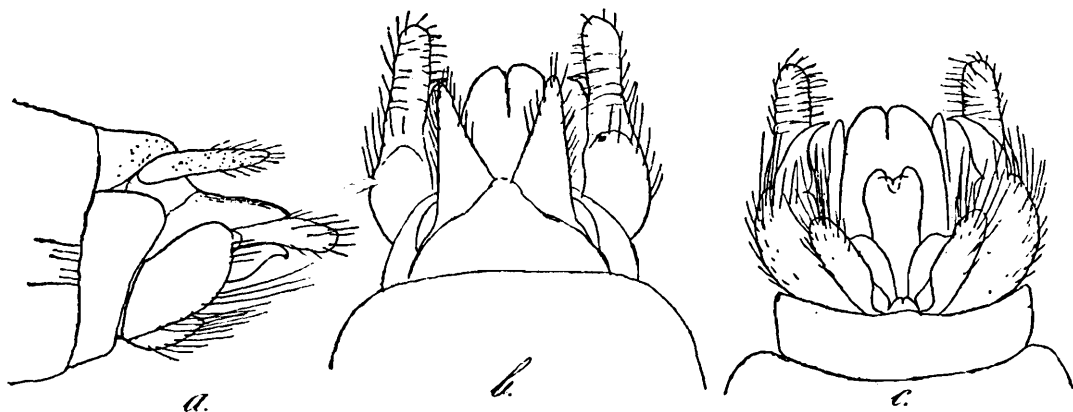
4 ♂. Bihar, Forbesganj, Purneah distr., 10.ix.10; C. Paiva.

2 ♂. Orissa, Balighai, near Puri, 16-20.viii.11; N. Annandale &amp; F. H. Gravely.

I refer all these specimens to *N. magna* Walker, although they differ somewhat from each other in size, colour and even in some details of wing venation. However, this widely distributed species is variable enough, and the difference between our specimens does not, apparently, exceed the limits of the variability of this species. Considering the size of the specimens I distinguish among them two forms, a larger and a smaller. To the large form belong three females from Calcutta and one from Katihar, and the males and females from Chakradharpur. The length of the bodies in this form is 8-13 mm., the males are smaller than the females. To the second form belong specimens from Forbesganj and from Balighai,—all males, with the length of the body 6.5-7.5 mm. Colouring similar, but the smaller form appears to be a little paler. Antennae brownish yellow, with blackish annulations, clothed with white hairs; spurs 2.2.2. Anterior wings variable, being clothed with pale and brownish hairs; posterior wings clothed with rufous yellowish hairs. Venation of anterior wings similar to that in *N. magna* and to Betten's figure 5, pl. xvii, but somewhat variable. 1st fork a little variable in its length; 4th apical cell sometimes has a short pedicel; vein, closing DC, is sometimes rightly transverse, sometimes concave outwards. In the posterior wings in two females from Calcutta and in the specimen from Katihar fork 1 is present, but in the third female (17.ii.26) from Calcutta it is lacking, although all these specimens are quite similar in other features. In the specimens from Chakradharpur (3 ♂, 2 ♀) only one male and one female have the 1st fork in their hind wings, whereas three specimens are without this fork. In the collection from Forbesganj (4 ♂) one specimen is without the 1st fork, but  $RS_1$  is a little bent at the point, while in other specimens it starts from  $RS_2$ . Two specimens from Balighai possess the 1st fork, but in one specimen there is an irregular 3rd fork. 1st fork of posterior wings, when present, is never very short. Taking into consideration the condition in the above mentioned male from Forbesganj and in one specimen from Calcutta I come to the conclusion that this fork 1 is very inconstant in the Indian form of *N. magna*; it may be present or absent. In the specimen from Forbesganj

<sup>1</sup> Dr. M. Mosely (*Trans. Ent. Soc. London*, LXXXV, p. 3, 1936) has now united the genus *Notanatolica* with the genus *Triplectides* Kol., but as my paper was already in press I could not make the necessary changes without considerable alterations.

it is  $RS_2$ , which vanishes; in the specimen from Calcutta (28.ii.11; Gravely), on the contrary,  $RS_1$  is reduced, shortened and very weak, scarcely appreciable. Since the venation of the wings in our specimens is quite similar to that of *N. opposita* (?) Betten, except the condition in fork 1 of the posterior wings, I come to the conclusion that Betten's *N. opposita* is perhaps *N. magna*; among specimens from near Calcutta occur forms with and without 1st fork in the posterior wings. I give three figures of the male genitalia prepared from a specimen collected at Chakradharpur.



TEXT-FIG. 12, a-c.—*Notanatolica magna* Walk., ♂; genital appendages from side (a), from above (b) and from beneath (c).

#### Subfamily LEPTOCERINAE.

#### **Leptocerus** Leach

#### **Leptocerus distinguendus**, sp. nov.

(Text-figs. 13, 14.)

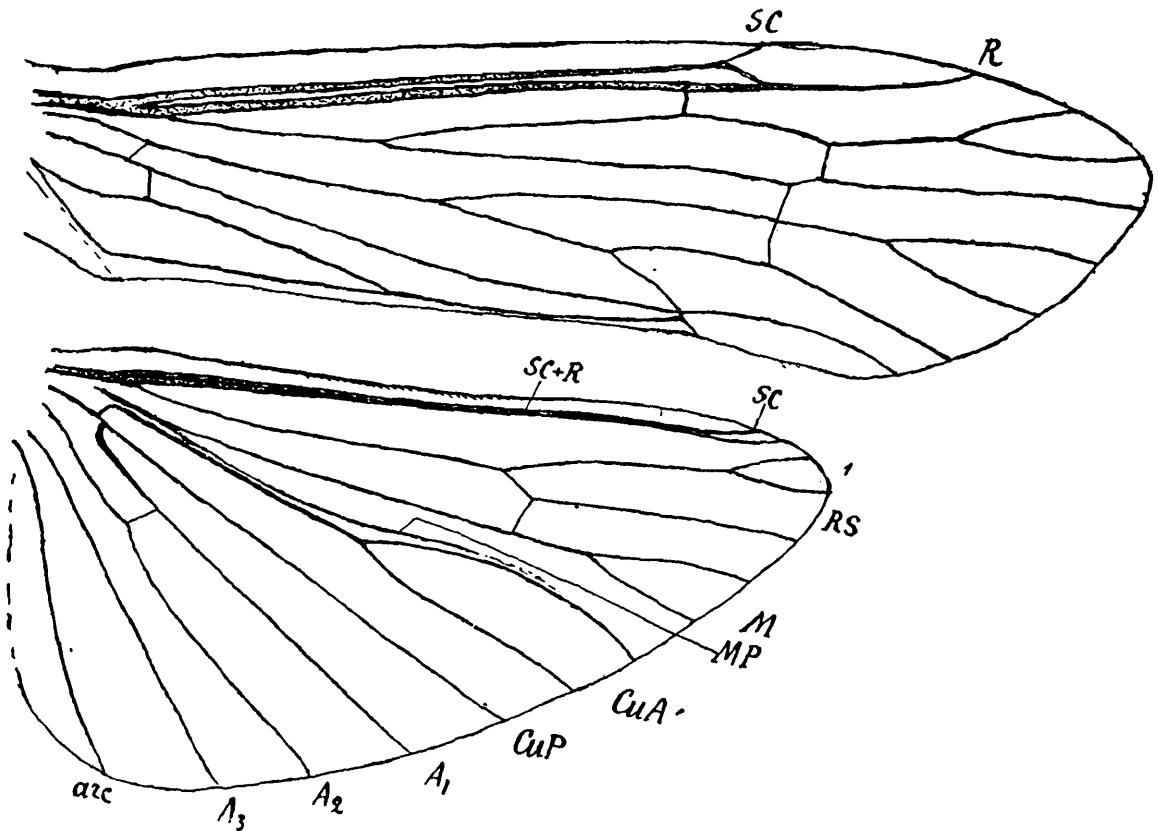
♂. Rewa State, opposite the camp at Harra, 2,625 ft., iii.27; H. S. Pruthi (in spirit).

Head yellow with yellow antennae (incomplete). Meso- and meta-thorax brownish above, paler at sides; legs yellowish, spurs 2.2.2. Membrane of the anterior wings (in spirit!) pale; R and SC strong; discoidal cell very long; fork 1 only a little longer than its pedicel, fork of M longer than its pedicel. In posterior wings fork 1 short, fork of M somewhat longer than its pedicel; cubital fork long; before CuA there is a rudiment of MP, well seen at the end of CuA and at the basal portion of CuA<sub>1</sub>. Abdomen pale.

♂. Structure of ♂ genitalia similar to that of *L. annulicornis*, *L. aterrimus* and allied species. 9th segment forms two side projections above the base of pedes genitales; 9th tergite forms a short dorsal plate, narrowed and truncated at its end; preanal appendages broad, triangular from side, but not long; these processes are united together in the middle.

Pedes genitales at first ascending, then curved backwards; inner branches stick-shaped, slender, but somewhat shorter than the distal parts of the pedes genitales; basal portions thickened and pale, if seen from beneath. 10th segment forming a broad plate (above), sides of

which are curved downwards and form two ridges at their ends separated by two short excisions from the middle portion ; this is also provided



TEXT-FIG. 13.—*Leptocerus distinguendus*, sp. nov., ♂ ; venation of wings ; *MP*—remains of “ false ” vein (mediana posterior).

with a small median excision. Penis short, curved downwards. Length of body 7.2 mm.



TEXT-FIG. 14, a-c.—*Leptocerus distinguendus*, sp. nov., ♂ ; genital appendages from side (a), from beneath (b) and from above (c).

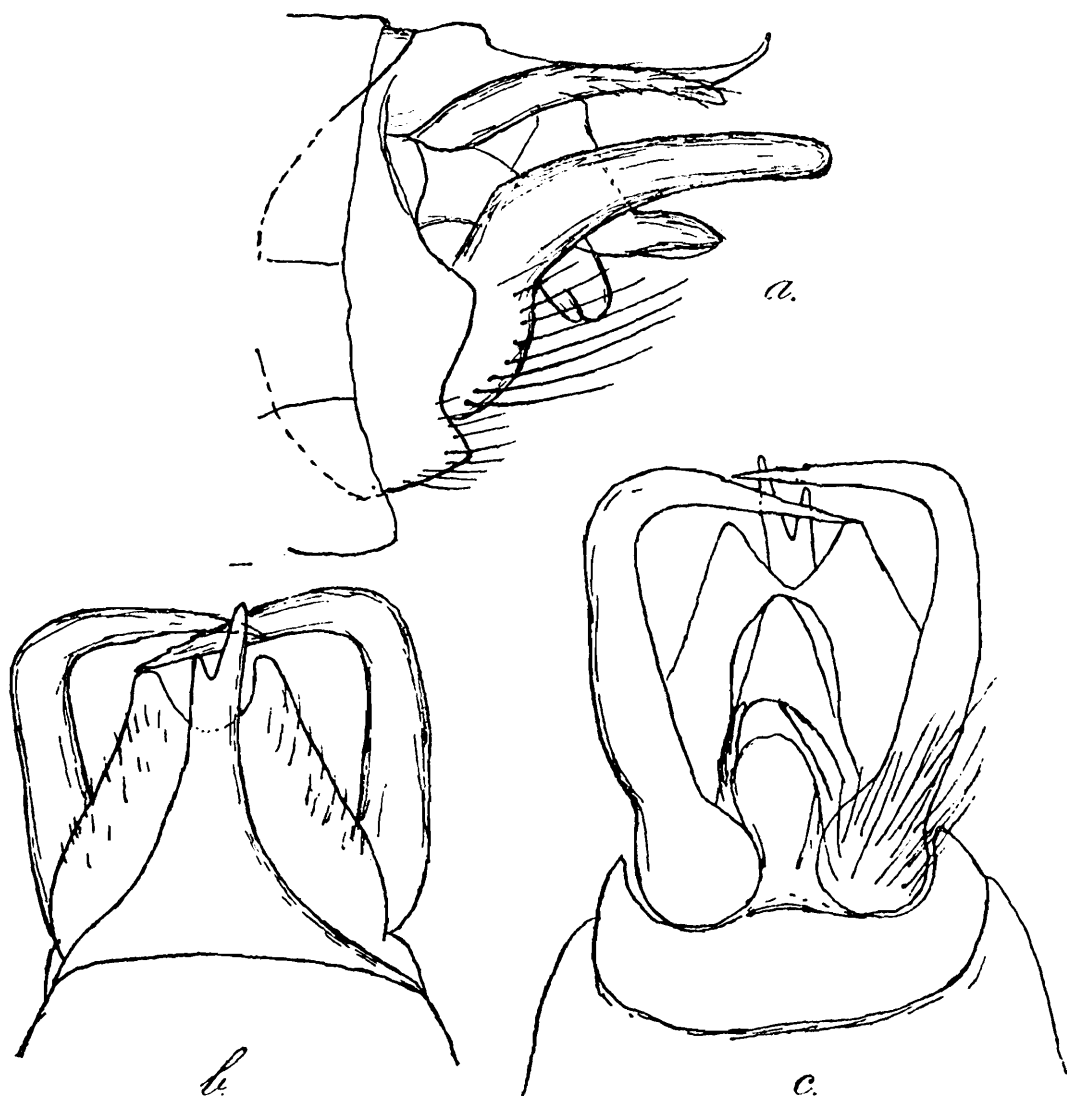
*Remarks.*—This species appears to be allied to *L. annulicornis* and related species. From a morphological point of view it is interesting in the presence of a distinct rudiment of what I consider to be *MP*<sup>1</sup>, before *CuA*.

<sup>1</sup> As stated already rudiments of this vein are preserved in some fossil Paratrichoptera and among recent Trichoptera, especially in *Setodes*.

***Leptocerus forcipatus*, sp. nov.**(Text-fig. 15, *a-c.*)

♂. Rewa State, opposite the camp at Harra, 2,625 ft., iii.27; H. S. Pruthi (in spirit).

Head brownish above; antennae brownish yellow, narrowly annulated with black; palpi pale. Thorax brownish, legs yellow. Membrane of anterior wings pale (in spirit!) with dusky pterostigma; R thick; fork 1 twice longer than its pedicel, discoidal cell at least  $\frac{1}{3}$  longer than thyridial cell; anastomosis gradate. In posterior wings fork 1 somewhat shorter than its pedicel. Abdomen pale, 9th segment yellow.



TEXT-FIG. 15, *a-c.*—*Leptocerus forcipatus*, sp. nov., ♂; genital appendages from side (*a*), from beneath (*b*) and from above (*c*).

♂. 9th segment with two moderate projections above the bases of the pedes genitales, narrowing above; median portion of the 9th tergite extended into a narrow, pale, weak plate, which is more or less united above with the dorsal plate. The latter is formed by two coalesced preanal appendages and represents a broad yellowish plate, narrowed behind, with the median rounded triangular excision at its end. Median process of the 9th tergite is somewhat longer than this plate, and its end portion is divided into two unequal lobes or processes

by a narrow excision. 10th segment in its basal part directed rather downwards, then extended backwards into a moderate projection, side portions of which are as usual curved downwards; penis is situated under the 10th tergite but, almost invisible in this specimen.

Pedes genitales yellow or dark yellow; their basal portions very short, ascending, then suddenly turned backwards and produced into two long processes; distal portions of the latter are curved inwards, crossing each other and acute at ends; apical portions somewhat serrate.

Length of ♂ body 6 mm.

*Remarks.*—The structure of the male genital appendages in this species is peculiar.

### **Leptocerus** sp.

♀. Rewa State, opposite the camp at Harra, iii.27; H. S. Pruthi (in spirit).

It is impossible to determine the species from the single female specimen.

### **Parasetodes** McLach.

#### **Parasetodes bakeri** Bks.

1913. *Leptocella bakeri*, Banks, *Proc. Ent. Soc. Washington*, XV, p. 177, pl. ix, fig. 15.

1915. *Leptocella bakeri*, Ulmer, *Deutsch. Ent. Zeitsch.* p. 56, figs. 28, 29 (Ceylon).

9 ♂♂. West Bengal, on board steamer in the River Ganges between Sakri Gali and Manihari Ghat, 7.viii.10, at light; C. Paiva (in spirit).

4 ♂♂. Upper Burma, Yenangyaung, Magwe, 300 ft., viii-ix.11; J. C. Brown.

♂. Bihar, Pusa. 26-30.viii.25; H. S. Pruthi.

♂. Bihar, Siripur, Saran. 25.ix.10; Mus. Collector (dry specimen).

*Parasetodes (Leptocella) bakeri* was described by Banks from the Philippine Islands and was referred by him to the genus *Leptocella* Bks. It was described under the same name by Ulmer from Ceylon. Since in the wing venation and in the structure of the male genitalia this species is very similar to *P. respersella* McL. and to other species of the genus *Parasetodes* McL., I refer it to this genus. Dorsal plate (10th segment) is well seen from side (in Ulmer's drawing it is not figured, probably by accident).

The colouration of the forewings is somewhat variable.

### **Setodes** Ramb.

#### **Setodes inlensis**, sp. nov.

(Text-figs. 16-18.)

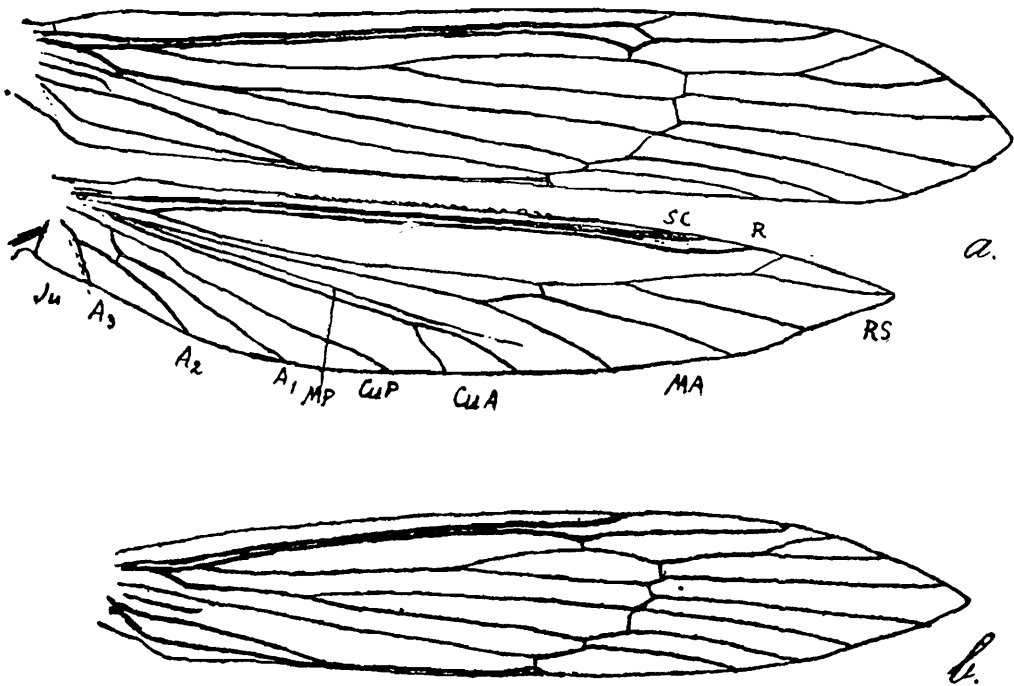
Many specimens. S. Shan States, Inlé Lake, Yawnghwe State, 3,000 ft., 1.iii.17; F. H. Gravely (in spirit).

♂, 2 ♀. The same locality. 18-28.ii.17; F. H. Gravely (dry specimens).

♀. Orissa, Balighai, near Puri. 16-20.viii. 11; N. Annandale and F. H. Gravely.

Head and thorax yellowish testaceous above, sides yellowish, abdomen pale. Joints of antennae brownish, but the basal portion of each

joint pale; palpi and legs pale, spurs 0.2.2. In dry specimens the head and thorax are rather brown, median portion of mesonotum being covered with pale hairs. Anterior wings narrow, subacute, clothed with yellowish hairs (somewhat thickened), mixed with brownish, in the apical portions in particular; apical parts provided with a few whitish spots or dots; along R brownish hairs interrupted by several whitish dots, and similar white spots are situated along CuA, separat-



TEXT-FIG. 16, a, b.—*Setodes intensis*, sp. nov., (a) venation of wings in ♂; (b) venation of anterior wing in ♀.

ing brown spots; fringe brownish yellowish. SC strong, R appears connected by short cross-vein r-rs to  $RS_{1+2}$ ; discoidal cell long in males, connected with R by cross-vein r-rs, near its end; in the female it is much shorter, cross-vein r-rs reaching  $RS_{1+2}$  near the middle of the discoidal cell; 1st apical fork a little shorter than its pedicel; base of M bent towards R. Posterior wings narrow, acute, pale, covered with rufous hairs; fringe long, rufous; SC strong, R running near it; cross-vein rs-m situated near the base of  $M_{1+2}$ ; additional vein before CuA distinct, long, cubital fork rather short; CuP and analia, as usual.

♂. Side pieces of 9th segment triangular, dorsal part pale, indistinctly separated from the dorsal plate (=10th tergite); this plate is broad above, elongated, with a shallow excision at end; before the end it is provided with 3-4 bristles at each side; its outer angles prolonged into two short slender processes. Seen from the side the dorsal plate is broad at base, then narrows and ends in the two just named slender processes. Pedes genitales large, divided into two portions, lower and upper; lower branch broad from side, with its end curved upwards and inwards; upper branch digitiform, but thick, bearing prominent hairs. Seen from beneath pedes genitales (lower branches) are elongated, tapering gradually; end portions curved inwards, triangular, acute at ends. Penis short, but much thickened in its apical portion, divided here into two projections, upper and lower; the lower curved downwards,

the upper plate-like, with a median fissure subdivided into two elongated side portions.



TEXT-FIG. 17, a-c.—*Setodes inlensis*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

♀. Dorsal plate broad above, with a shallow median excision at end; seen from the side it is obliquely truncated at end; lateral lobes of 9th segment very long and broad from side, narrow and truncated at ends if seen from beneath; between them 9th sternite provided with a triangular projection.

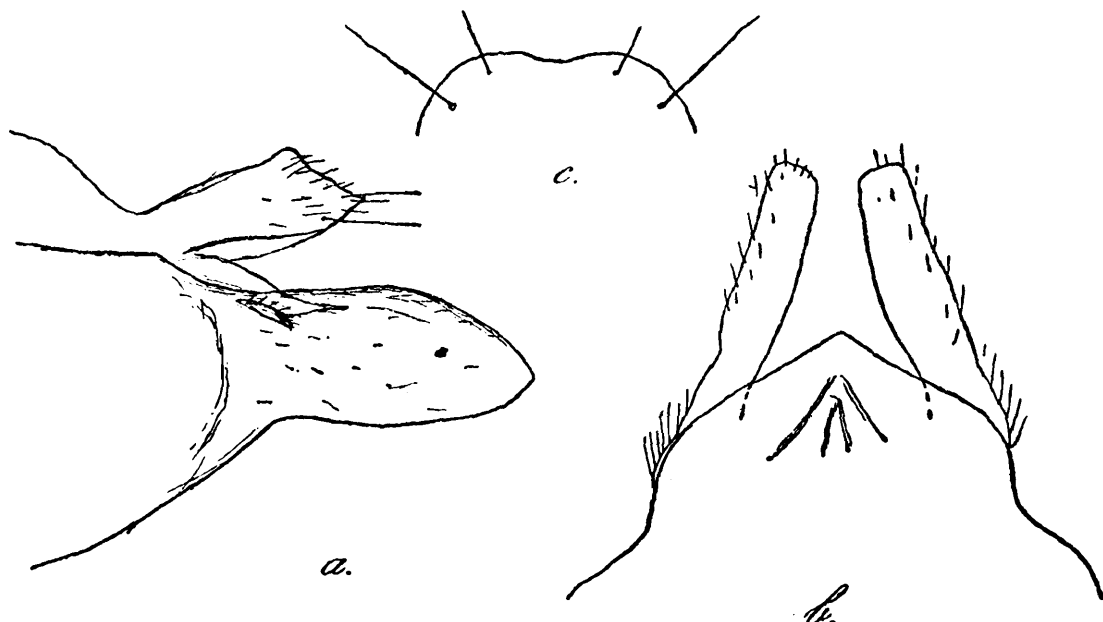
Length of body 4.5 mm.

Var. ? ♀. Sind, Bubak, from pools 13.xi.27; B. Prashad & B. N. Chopra.

Anterior wings clothed with yellow and pale scale-like hairs between M and Cu; whitish dots present, although not as distinct. Posterior wings rufous. Length of body 6 mm.

*Remarks.*—*Setodes inlensis*, sp. nov. is a distinct species differing in the structure of the ♂ genitalia, as also in wing-venation. The so-called false or additional nervure before CuA in the hind wings is here

distinct enough and at its base is connected with M. This vein is evidently homologous with that vein in some fossil Paratrachoptera



TEXT-FIG. 18, *a-c.*—*Setodes inlensis*, sp. nov., ♀; genital appendages from side (*a*) and from beneath (*b*); (*c*) end of 10th segment from above.

described in another paper, which I take for MP (median posterior). It is subject to reduction in Paratrachoptera and Trichoptera, but rudiments of it are preserved in several genera of Trichoptera.

***Setodes unispina*, sp. nov.**

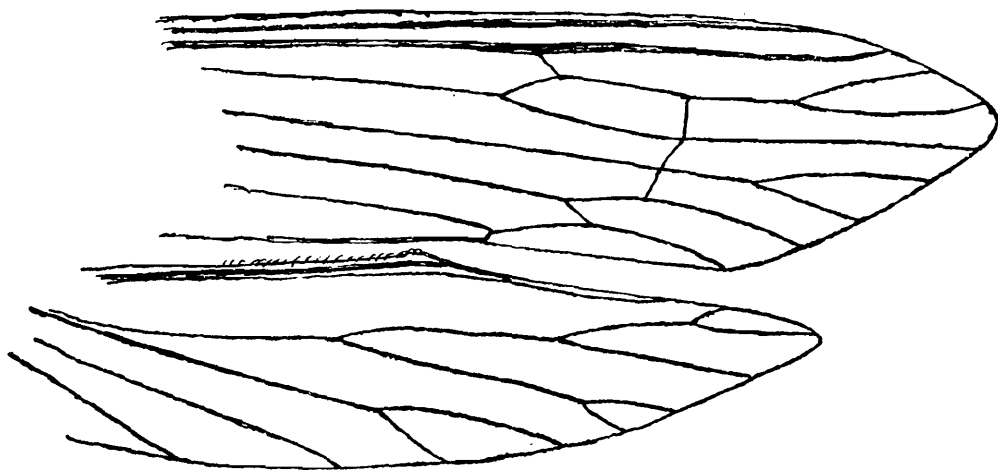
(Text-figs. 19-21.)

♂. Chota Nagpur, Purulia, Manbhum distr., 10.ii.12; F. H. Gravely.

♂. Chota Nagpur, Chakradharpur, Singhbhum distr., 8-10.ii.18; N. Annandale & F. H. Gravely.

Several specimens. Chota Nagpur, Sanjai River, Chakradharpur, 8-10.ii.18; N. Annandale and F. H. Gravely (in spirit).

Head and thorax yellow, antennae pale yellow, legs and abdomen pale. Wings pale, translucent (in spirit). In the anterior wings the

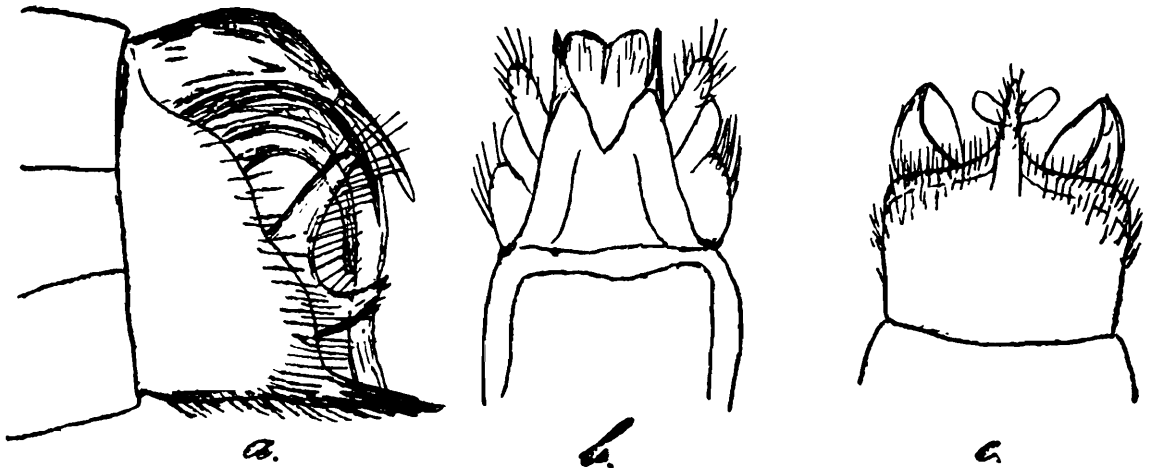


TEXT-FIG. 19.—*Setodes unispina*, sp. nov., ♂; wing venation.

discoidal cell is short, near its base it is connected by a cross-vein with R, which is thick; cross-veins of the anastomosis forming a fractured

line. In the posterior wings fork 1 distinct, not very short; fork 3 very short, fork 5 longer; additional vein before Cu (MP) lacking.

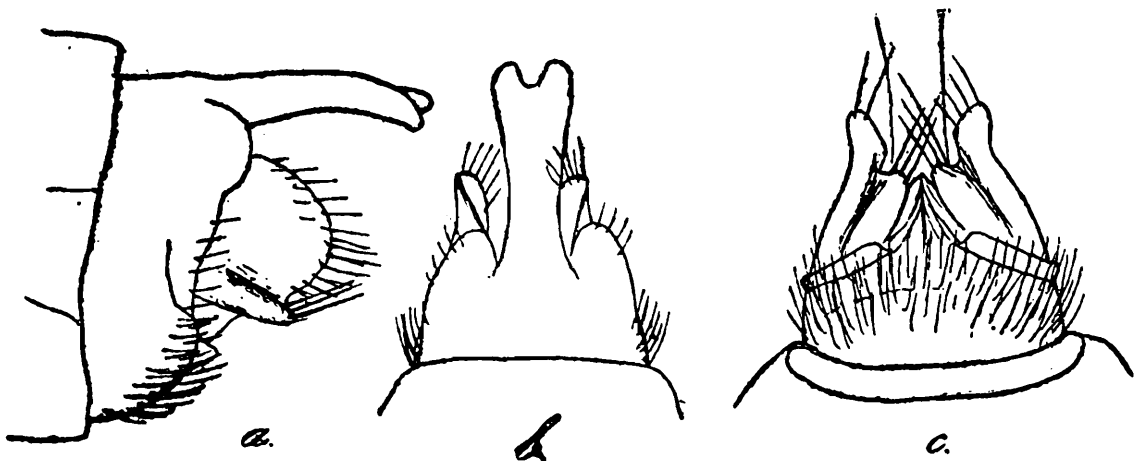
♂. 9th segment much dilated at sides and underneath; narrow, indistinct above; 9th sternite very broad and provided with a median spine-like process. Dorsal plate (10th segment?) rather large, pale; seen from above it is broad, somewhat narrowed behind and triangularly excised at end; its end-lobes are prolonged into two slender processes, directed downwards and backwards. Seen from the side the dorsal plate is thick and convex above, bearing the two above named slender processes. Under these are seen two more slender processes near the penis; the latter is very long and turned downwards. Pedes genitales



TEXT-FIG. 20, a-c.—*Setodes unispina*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

are seen only in their distal parts, basal parts being concealed by the side pieces of 9th segment; seen from the side they are very broad at base, but almost immediately divided into two branches; upper branch digitiform and directed somewhat upwards; lower branch shorter, subacute at end and separated from the first by a broad, rounded excision. Seen from beneath (text-fig. 20c) the lower branches are broad, concave internally. Penis very long, directed downwards.

Length of body 4.8 mm.



TEXT-FIG. 21, a-c.—*Setodes unispina*, sp. nov., ♀; genital segments with appendages from side (a), from above (b) and from beneath (c).

♀. 9th segment broad from side, dilated upwards, but narrowing above and uniting here with a long plate-like process, which belongs

probably to the 10th segment; this plate is pale, its apex divided into two lobes by a short median excision. Lateral appendages of 9th segment broad, rounded at ends and hairy; their lower parts are somewhat bent inwards and bear few long bristles. Between these appendages is situated a triangular projection of the 9th sternite seen from beneath.

*Remarks.*—*Setodes unispina* sp. nov. resembles *Setodes argentoaurea* Ulm. from the Celebes in the structure of the male genitalia.

***Setodes argentifera* McLach.**

(Text-fig. 22.)

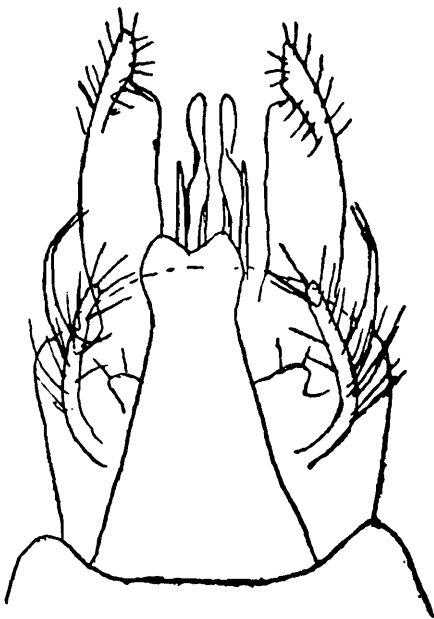
1873. *Setodes argentifera*, McLachlan, *Journ. Linn. Soc. London (Zoology)*, XI, p. 129, pl. iii, fig. 13.

1909. *Setodes argentifera*, Betten, *Rec. Ind. Mus.* III, p. 240, pl. xvii, figs. 9-11.

4 ♂♂. Bihar, Mokameh Ghat, at light (in spirit).

2 ♂. Bihar, Pusa, 5-10.ii.15; F. H. Gravely.

This species was described from North India without any precise locality. Betten gave two figures of the male genitalia; I add here a figure of the end of the ♂ abdomen as seen from above. Dorsal plate



TEXT-FIG. 22.—*Setodes argentifera* McLach., ♂; genital appendages from above.

(10th segment) long, narrowing backwards, with a bilobed apical portion. Below from it are seen two pairs of spine-like appendages, and the penis, which is bilobed. Pedes genitales, seen from the side, moderately broad, but their apical portion is slender. With the base of pedes genitales are connected two long slender appendages curved upwards, then backwards and inwards.

***Setodes tenuifalcata*, sp. nov.**

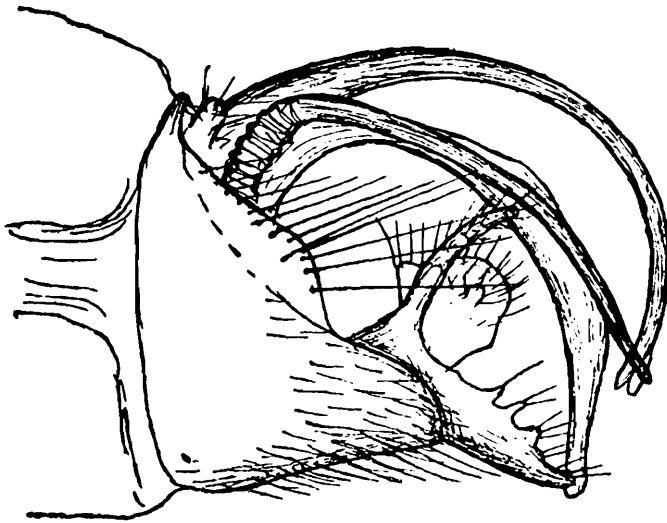
(Text-figs. 23, 24.)

2 ♂. Chota Nagpur, Sanjai River, Chakradharpur, 8-10.ii.18; N. Annandale and F. H. Gravely (in spirit).

Head and the whole body pale yellowish; antennae pale yellowish, palpi and legs pale. Anterior wings (membrane) pale yellowish, narrow;

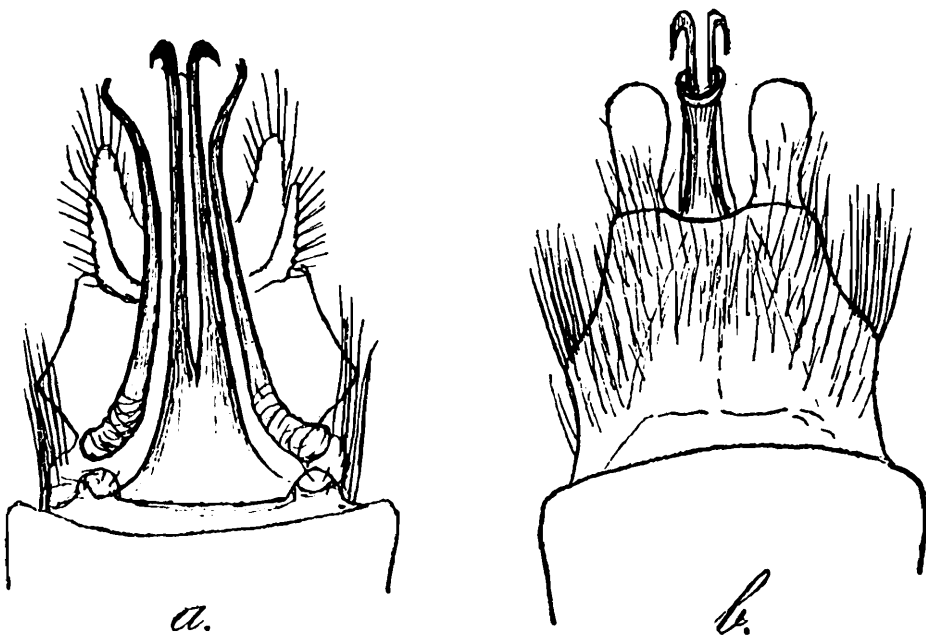
DC moderately long, 1st apical fork longer than its pedicel and nearly equal to the fork of mediana; second and third cross-veins of anastomosis oblique and placed almost in one line, cross-vein closing discoidal cell placed somewhat further. Posterior wings a little broader than the anterior; fork 1 small, narrow, main fork of RS equal to fork 5; fork of mediana shorter; RS short and lacking in its greatest proximal part.

♂. Structure of ♂ genital appendages similar to that in *S. uncinata* Ulm., *S. falcata* Ulm. and allied species. 9th segment strongly dilated in its ventral portion, very narrow in its dorsal part; side pieces forming two low plate-like projections, bearing long hairs. 10th seg-



TEXT-FIG. 23.—*Setodes tenuifalcata*, sp. nov., ♂; genital segments and appendages from side.

ment in its basal portion entire, broad, but narrowed behind and soon dividing into two long, slender, falciform processes, with their ends



TEXT-FIG. 24, a, b.—*Setodes tenuifalcata*, sp. nov., ♂; genital appendages from above (a) and from beneath (b).

curved downwards. Pedes genitales already in their basal portions divided into two branches, the lower branch is directed backwards and

downwards, and the upper upwards; lower branches, if seen from beneath, not long but broad, with rounded apices; seen from the side they are also broad, above with 3 or 4 minute processes, bearing few bristles; upper branch directed nearly upwards, stick-shaped, a little curved, hairy; internally from the bases of the pedes genitales arise two broad plates, apparently united together; their upper edge irregular, rounded, with short outstanding bristles. Penis very long, arcuate, curved downwards; it is accompanied at the sides by two long slender titillators, subdivided at their ends into two minute portions; they are somewhat shorter than the penis; their basal portions are very pale, irregularly annulated and apparently, flexible; their bases are united with the basal part of the penis.

Length of body 5 mm.

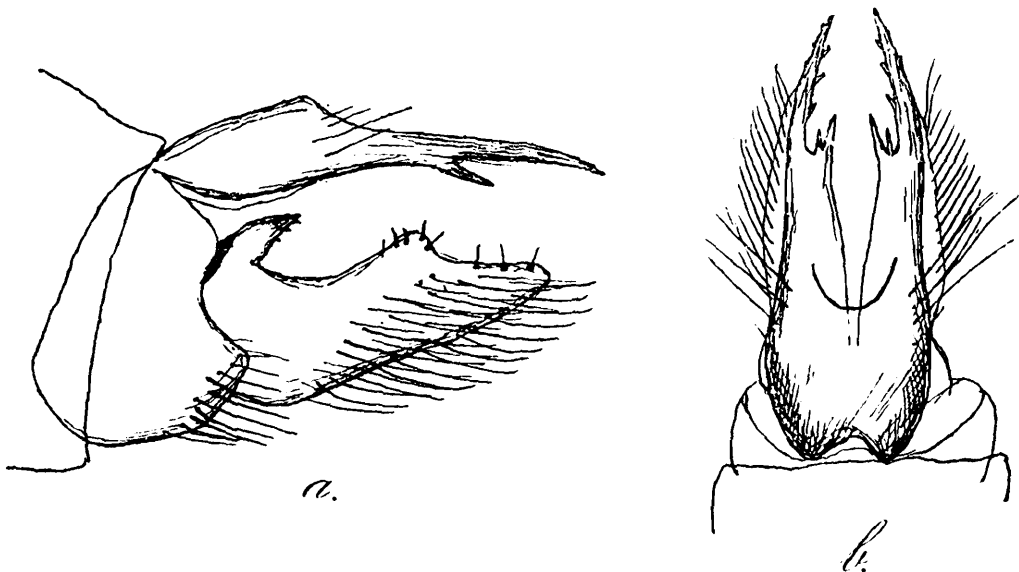
*Remarks.*—This species belongs to the group of *viridis* and is apparently more allied to *S. uncinata* Ulm. from Java and *S. falcata* Ulm. from the Philippine Islands.

***Setodes bimaculata*, sp. nov.**

(Text-fig. 25, *a-b*.)

♂. Bihar, Katihar, Purneah distr., 7-31.viii.10; C. Paiva.

Head and thorax brown, clothed with brown hairs, becoming blackish between the antennae. Joints of antennae brownish yellowish, but the basal portion of each joint white; basal joint brown, clothed with whitish hairs; palpi pale, legs pale. Anterior wings narrow, brownish,



TEXT-FIG. 25 *a, b.*—*Setodes bimaculata*, sp. nov., ♂; genital appendages from side (*a*) and from beneath (*b*).

densely clothed with brown hairs; in the hind portion of wings the hairs are yellow and whitish, with brown interruptions; there are two distinct white spots, one spot in the base of the 2nd and the second at the base of the 3rd vein of the wing; behind these white spots are two greyish hyaline markings; in the apical portion there are three or four

small white spots; apical fringe white; discoidal cell short, 1st apical fork equal to its pedicel, 3rd fork almost equal to it. Posterior wings greyish, provided with long rufous-greyish fringe, narrow; 1st apical fork shorter than its pedicel; M forming short narrow fork; 5th apical fork longer. Abdomen brownish.

♂. Structure of male genitalia resembling that of *Setodes tineiformis* Curt. and of *Setodes similis* McLach. 9th segment broad at sides, with triangular projections at the base of pedes genitales. 10th segment in its basal part entire, moderately broad, then dividing into two long and more slender portions, each of which is provided internally with an acute tooth in the middle; distal portions slender and provided internally with four small denticles (proximal denticle is situated at the base of the inner, larger tooth). Pedes genitales large from side, narrower beneath, straight. Seen from the side they each form a small triangular process at base; then their upper and lower edges become parallel at some distance; end portion subtriangular as in many *Rhyacophila* species, with upper margin concave, separating a low oval basal portion from the elongated distal lobe; both lobes provided above with several spinules. Penis not exerted.

*Remarks.*—In the structure of the male genitalia this species somewhat reminds one of *S. tineiformis* Curt. and *S. similis* McLach. Pedes genitales resemble those in *S. similis*, but the basal process is here much longer. In the wing venation *S. bimaculata* sp. nov. greatly resembles *S. bifasciipennis* Ulm. from the Philippines.

### **Setodes sternalis**, sp. nov.

(Text-fig. 26, a-b.)

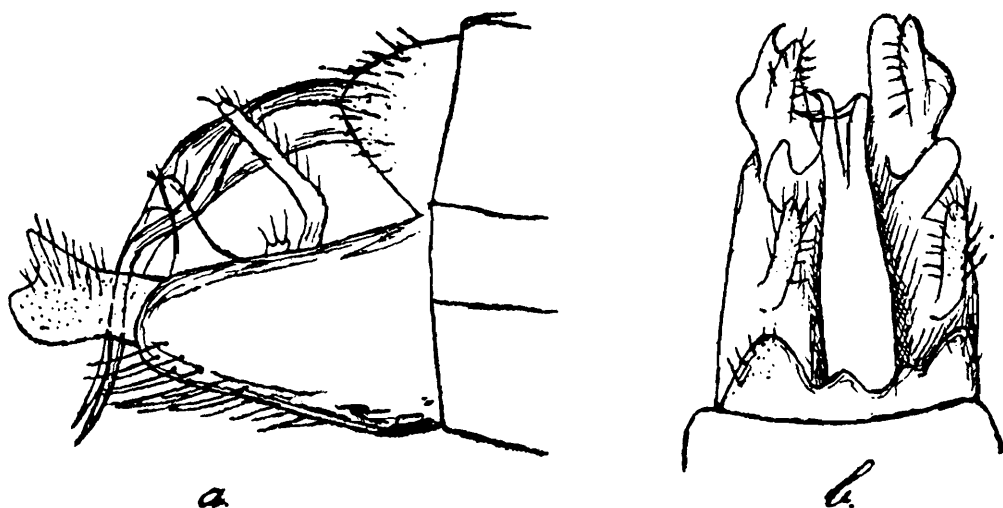
♂, ♀. Rewa State, opposite the camp at Harra, iii.27; H. S. Pruthi.

Head pale, with yellowish antennae; thorax yellowish, legs yellow; anterior wings pale; DC short, cross-vein r-rs reaching it near its base; apical fork 1 longer than its pedicel, median fork with a pedicel; cross-veins rs-m and m-cu placed near each other, cross-vein closing the discoidal cell situated far beyond them.

In the posterior wings main fork of RS only a little longer than the forks of mediana and of CuA (fork 5), which are nearly equal; 1st apical fork very small. Abdomen pale.

♂. 9th segment large, broad, subdivided into dorsal and ventral parts by two triangular lateral excisions; dorsal part is triangular from side and morphologically represents preanal appendages, coalesced with the true dorsal part of the segment. Ventral half of 9th segment very large, produced far backwards; seen from above the 9th tergite is subdivided by three excisions into four lobes. Pedes genitales short, pale; seen from the side, they are excised at the ends, with the upper lobe narrow and the lower broad; seen from above, they are convex externally and somewhat asymmetrical, the right appendage being excised at the end and thus forming a short claw-shaped slender process on its outer angle. Internally and more basad with the basal portions of pedes genitales are connected two more appendages directed upwards; the basal one is stick-shaped and curved somewhat backwards, the distal

one plate-like, pale, shorter, but broader than the first; between them is a small projection with three bristles.



TEXT-FIG. 26, a, b.—*Setodes sternalis*, sp. nov., ♂; genital segments and appendages from side (a) and from above (b).

10th segment in the shape of a narrow, but very long plate, the median portion of which is thin, whereas side portions are thickened forming two long appendages curved downwards; the left thickening is somewhat higher than the right, which is sinuous; end portion of the left thickening curved to the right; penis concealed under the 10th segment.

Length of ♂ body 5.4 mm.; female 4 mm.

*Remarks.*—This species is evidently rather closely allied to *Setodes amurensis* Mart. from Amur, resembling it in the structure of the ♂ genitalia in particular, in the structure of the 9th segment with its preanal appendages, and of the pedes genitales.

### **Trichosetodes** Ulmer.

#### **Trichosetodes composita**, sp. nov.

(Text-figs. 27, 28.)

5 ♂♂. Chota Nagpur, Sanjai River, Chakradharpur, 8-10.ii.18; N. Annandale and F. H. Gravely (in spirit).

Head pale; basal joint of antennae thick, longer than the head, at its end bearing a tuft of long thin hairs; thread of antennae slender, pale, with brownish annulations; joints rather long. Thorax pale yellow, legs yellow, spurs 0.2.2. Anterior wings pale (in spirit!), narrow, acute at their ends; costal (marginal) vein thick, bearing series of numerous (about 90) minute internal dot-like thickenings; R and SC strong, uniting together before the middle of the discoidal cell; this cell is long, somewhat longer than its pedicel, near its base connected with R and near its middle by a cross-vein with M; fork 1 a little longer than its pedicel; M and CuA uniting before the middle of RS. Posterior wings shorter, acute at ends; region of costal hooks short; SC + R strong; RS without

basal continuation; fork of M short, as short as fork 1; fork 5 a little larger; before CuA feeble remains of MP.



TEXT-FIG. 27.—*Trichosetodes composita*, sp. nov., ♂; venation of anterior and posterior wings.

Abdomen pale, 9th segment yellow, pedes genitales and 10th segment brownish.

♂. 9th segment very broad, in particular in its lower portion; dorsally there is a short subtriangular yellowish dorsal plate, apparently belonging



TEXT-FIG. 28, a-c.—*Trichosetodes composita*, sp. nov., ♂; genital segments and appendages from side (a), from beneath (b) and from above (c).

to the 9th dorsal segment. Preanal appendages short, pale. 10th segment appears to be narrow at its base when seen from above, then it

dilates into a subquadrangular plate above, with processes at its hind angles; on the left angle it has two short processes, on the right side one long process, curved abruptly inwards, then downwards and backwards (from side). Pedes genitales in the form of two long unequal processes; the left process shorter than the right, in its distal half curved somewhat inwards and acute at end; the right process longer and thicker, arcuately curved inwards, basal portions of these processes bearing tufts of long thin hairs; similar hairs are present also on the distal parts of processes. With the 9th sternite are connected two more processes; they are much shorter than the processes described above, pale, bearing dense hairs on their hind edge; these processes also probably belong to the pedes genitales. Penis thick, curved downwards; with asymmetrically formed apex. With the base of the penis are connected (apparently) two stick-shaped processes, directed backwards and somewhat upwards and acute at their ends; seen from the side they are situated above the pedes genitales, but are more than twice as short as these appendages.

Length of body 3.7 mm.

*Remarks.*—This species is quite distinct from *Tr. argentolineatus* Ulmer described from Ceylon in the structure of the ♂ genitalia as well as in its wing venation.

### **Episetodes**, gen. nov.

Spurs 0.2.2; palpi long, as in *Setodes* Ramb. Anterior wings narrow, acute; venation as in *Setodes*, but CuP is lacking and the cross vein between M and CuA is also absent. Posterior wings also narrow and acute at ends; fork of M very short, CuA simple, without fork; feeble remains of MP may be seen before CuA.

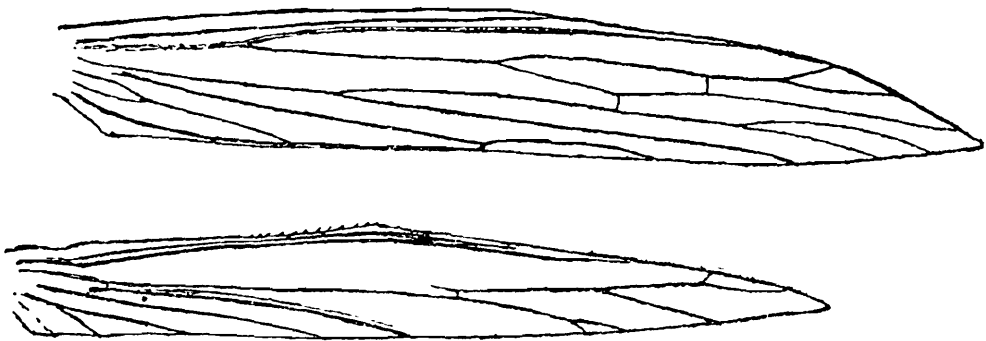
*Genotype.*—*Episetodes angustipennis*, sp. nov. from Rewa State, Central India.

### **Episetodes angustipennis**, sp. nov.

(Text-figs. 29, 30.)

♀. Rewa State, junction of two streams about a mile below Pharisemar, 18.ii.27; S. L. Hora (in spirit).

Head and thorax brownish yellowish; basal joint thick and somewhat longer than the head, 2nd joint very short (the remaining part is



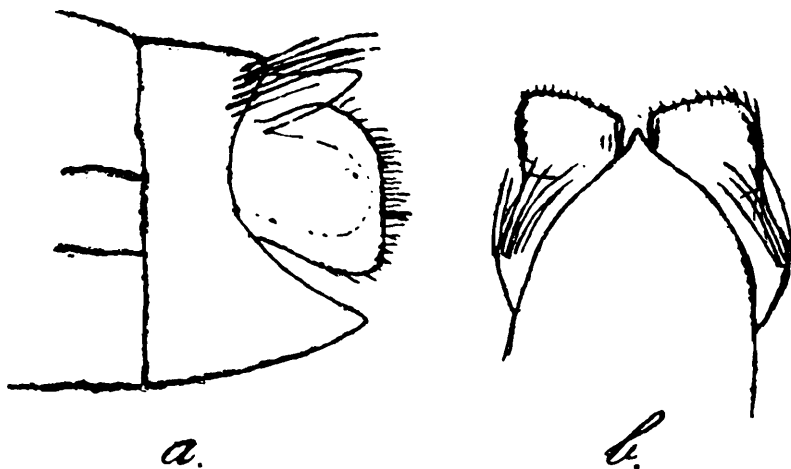
TEXT-FIG. 29.—*Episetodes angustipennis*, gen. et sp. nov., ♀; wing venation.

set off). Legs pale yellow, spurs 0.2.2. Anterior wings yellowish, long, narrow, acute at their ends; R rather strong, but vanishing in its basal

part ; discoidal cell moderately long, at its middle connected by a cross-vein with M ; cross-vein m-cu invisible or lacking, CuP also absent.

Posterior wings very narrow, acute ; RS connected with a cross-vein with M ; its basal part lacking ; fork of M very short, CuA simple ; remains of MP before CuA present. Abdomen brownish yellowish.

♀. 9th segment dilated below and forming beneath a small median process ; side lobes of the 9th segment very broad, dilated backwards and truncated at their ends ; on the hind edge is situated a series of short



TEXT-FIG. 30, a, b.—*Episetodes angustipennis*, gen. et sp. nov., ♀ ; genital segments and appendages from side (a) and from beneath (b).

hairs ; seen from beneath the side lobes are approximated and nearly touch each other. 9th tergite with two groups of bristles ; dorsal plate weakly rounded at end. Male unknown.

*Remarks.*—The genus *Episetodes* is, perhaps, allied to *Trichosetodes* Ulm., but the tuft of hairs on the basal joint of antennae and fork 5 in the hind wings are absent in the genus *Episetodes*.

### **Oecetis McLach.**

#### **Oecetis bengalica, sp. nov.**

(Text-figs. 31, 32.)

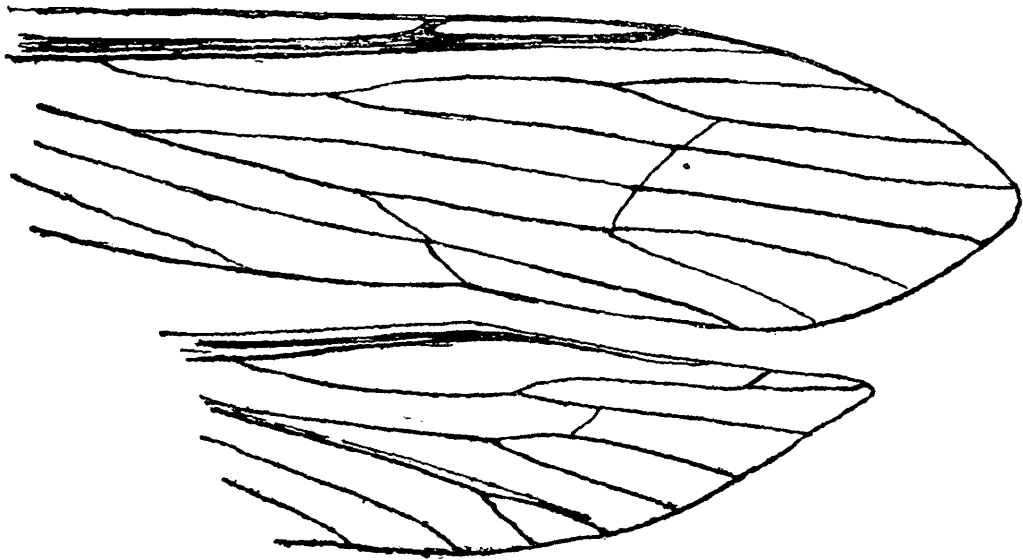
♂. Bihar, Katihar, Purneah district, 15.viii.10 ; C. Paiva (in spirit).

♂. Bihar, Katihar, Purneah district, 7-31.viii.10 ; C. Paiva (dry specimen).

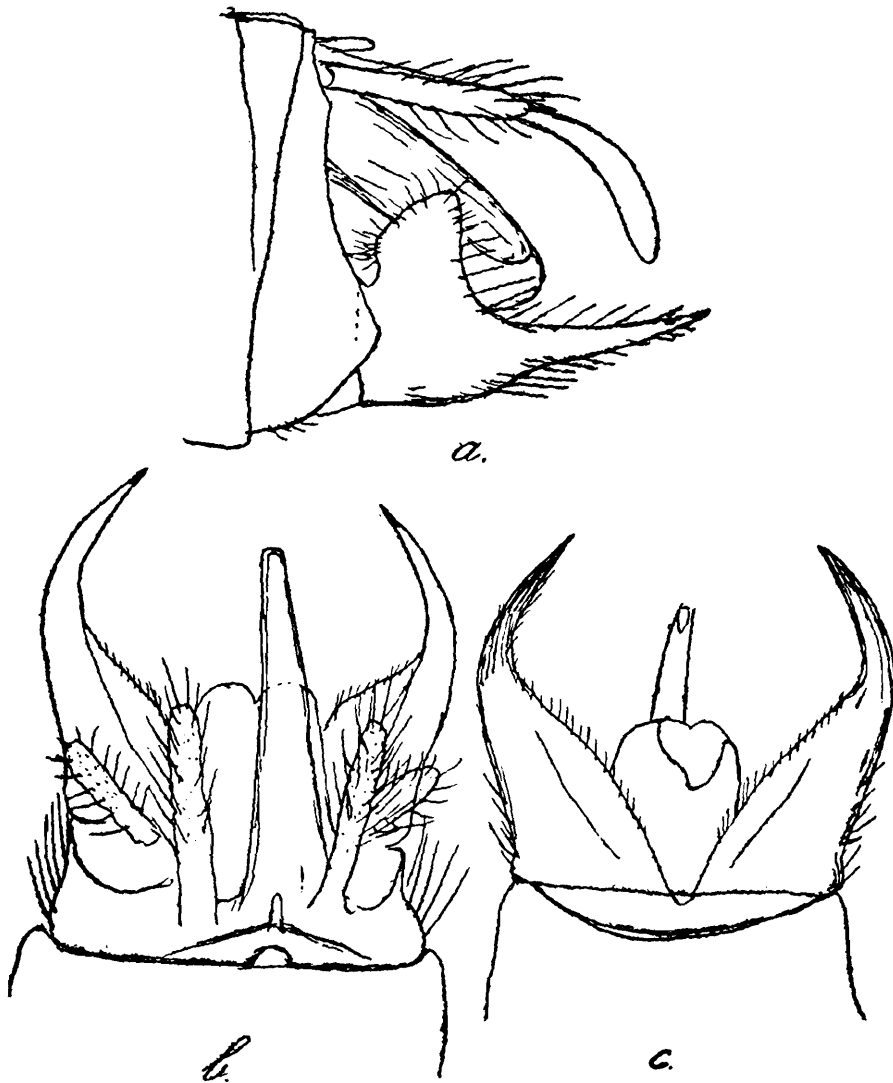
Head pale yellow ; antennae yellow with thin brown annulations, basal joint bulbous, pale. Thorax brownish yellow ; legs yellow, ends of tibiae and of tarsal joints white. Anterior wings brownish, densely clothed with yellow hairs ; in the middle of wing, however, there are two almost transverse brownish bands, formed by brown hairs, with admixture of white ones ; in the distal half are situated four small blackish spots, in the basal half only one or two such spots are perceptible ; at the ends of apical sectors brownish dots with concolorous fringe ; hair-clothing usually long. Venation similar to that in *Oecetis scutata* Ulm. but  $RS_{1+2}$  dividing earlier, before the end of the elongated discoidal cell ; SC thick, strong, connected with the fore margin by a short cross-vein far before its end ; three cross-veins forming one oblique vein (anastomosis).

Posterior wings greyish, iridescent, fringe brownish yellowish ; 1st fork small, M dividing at the same level with RS ; cross-vein rs-m oblique,

connecting  $RS_{3+4}$  with  $M_{1+2}$ ; before CuA may be seen feeble remains of MP.



TEXT-FIG. 31.—*Oecetis bengalica*, sp. nov., ♂; wing venation.



TEXT-FIG. 32, a-c.—*Oecetis bengalica*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

♂. Abdomen pale. Side pieces of the 9th segment forming obtuse angles at the bases of the pedes genitales; tergite very narrow, with

a minute pale process in the middle. Preanal appendages digitiform, more slender than in *Oe. scutata* Ulm. 10th segment forming a very long, narrow, pale process in its apical portion curved downwards; seen from above, it is gradually narrowed behind. Penis thick directed somewhat downwards. Pedes genitales, seen from beneath, are broad at base, then gradually narrowing; end portions slender, acute at ends and somewhat curved inwards; seen from the side, they form at base a broad plate-like projection above; distal portion narrow, directed backwards.

Length of body 4.7 mm.

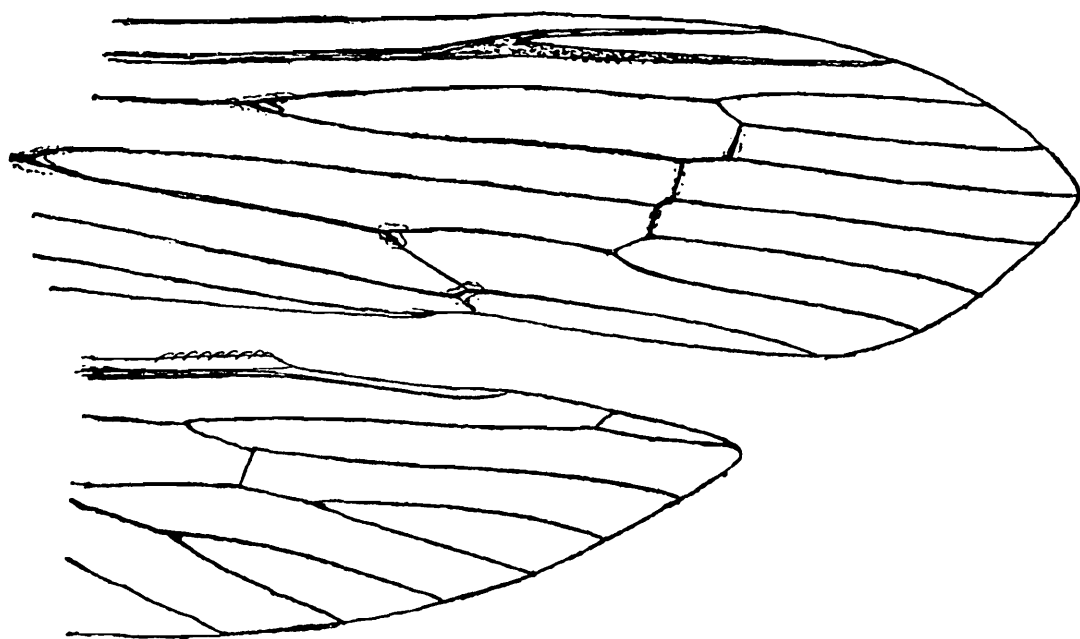
*Remarks.*—This species is very similar to *Oe. scutata* Ulm. from South Sumatra in the structure of the ♂ genitalia, but differs in some details. The preanal appendages are more slender, the penis is without appendages, and the pedes genitales are also somewhat different.

### ***Oecetis scutulata*, sp. nov.**

(Text-figs. 33, 34.)

4 ♂♂. Rewa State, opposite the camp at Harra, 2,625 ft., iii.27; H. S. Pruthi.

Very similar and closely allied to *Oe. scutata* Ulm. from Sumatra. Anterior wings as in that species, with similar brown spots at the angles of the forkings and along the veins of anastomosis; venation similar.

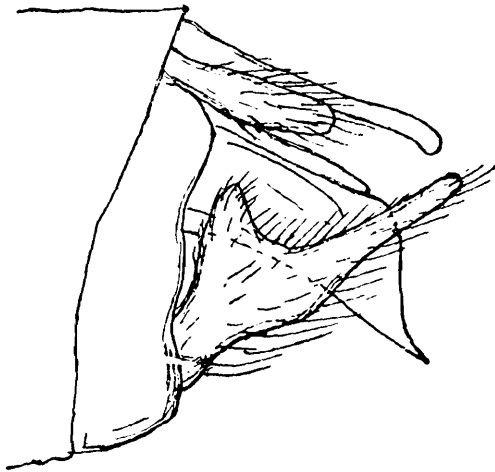


TEXT-FIG. 33.—*Oecetis scutulata*, sp. nov., ♂; wing venation.

Posterior wings also as in *Oe. scutata*, but the 5th fork is a little longer (text-fig. 33).

♂. Preanal appendages and 10th segment as in *Oe. scutata*; basal projection or process of the pedes genitales more distinct, more separated than in *Oe. scutata*; distal portion straight from side, curved inwards; penis acute at end as in *Oe. scutata*.

*Remarks.*—Although closely allied to *Oe. scutata*, *Oe. scutulata*, sp. nov. differs to some extent in the wing venation and in some details of the structure of the male genitalia.



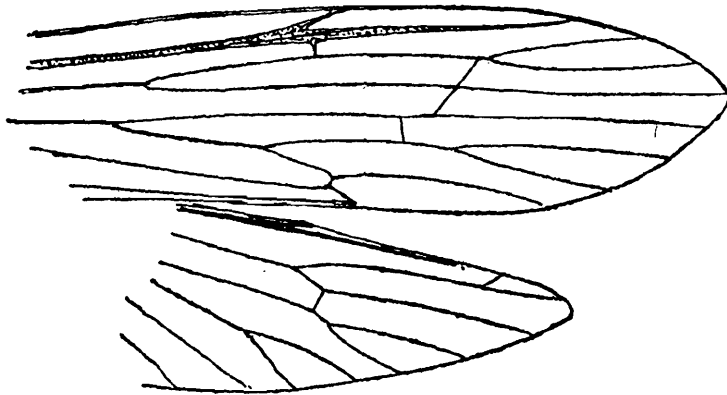
TEXT-FIG. 34.—*Oecetis scutulata*, sp. nov., ♂; genital appendages from side.

***Oecetis biramosa*, sp. nov.**

(Text-figs. 35, 36.)

♂. Orissa, Balighai, near Puri, 16-20.viii.11; N. Annandale and F. H. Gravely (in spirit).

Head yellow, antennae yellow, with narrow black annulations, thorax brownish yellowish, legs pale yellow. Anterior wings pale greyish yellowish; venation resembling that of *Oe. bengalensis*, sp. nov., but DC is longer and fork 1 is shortly pedicellate; 1st and 2nd cross-veins

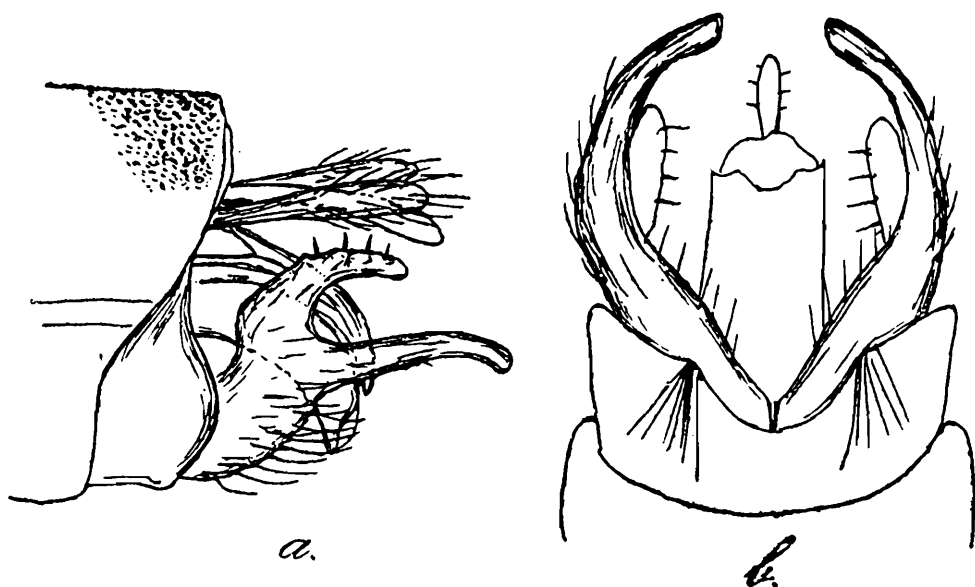


TEXT-FIG. 35.—*Oecetis biramosa*, sp. nov., ♂; wing venation.

of anastomosis forming an oblique line, as in *Oe. bengalensis*, but the 3rd cross-vein transverse, not oblique, and is situated before the 2nd vein. In the posterior wings fork 1 short, forks of M and CuA shorter than in the preceding species. Abdomen pale.

♂. Tergites of the 8th, 7th and parts of the 6th segments rough, covered with minute pits, as in *Oe. scutata* and *Oe. scutulata*. Median upper appendage of 10th segment straight, only a little longer than preanal appendages, which are somewhat narrowed in the basal portion,

pale, hairy. In the pedes genitales upper basal projection extended into a long and thick digitiform process, directed backwards and bearing



TEXT-FIG. 36, a, b.—*Oecetis biramosa*, sp. nov., ♂; genital appendages from side (a) and from beneath (b).

few spinules above; distal portions of pedes genitales also digitiform, but longer, directed backwards; seen from beneath they are rather slender, arcuate before ends, each adorned with a blackish line on its inner side. 10th segment covering penis from above, resembling apparently that in *Oe. scutata*, but details of its shape are not very clear. Penis arcuately curved downwards, not acute from side.

Length of body about 5 mm.

*Remarks.*—This species also belongs to the group *scutata-bengalensis*.

### ***Oecetis* sp. 1 (*jacobsoni* Ulm. ?).**

♀. U. Burma, Lonton, western shore of Indawgyi Lake, Myitkyina district, 18-31.x.26, at light; B. N. Chopra.

♀. Bihar, Katihar, Purneah district, 7-31.viii.10; C. Paiva.

Venation of wings, their colour-pattern and colouring of the body are absolutely similar to those in *Oecetis jacobsoni* Ulmer (*Treubia* XI, Livr. 4, 1930, p. 465, fig. 132) and I therefore consider these specimens as probably belonging to this species. It is, however, impossible to insist on this opinion, as in the genus *Oecetis* similar colour-pattern and venation of wings may exist in closely allied, but distinct species. It is not improbable that these specimens represent a new species closely allied to *Oe. jacobsoni* Ulm. from Sumatra.

### ***Oecetis* sp. 2.**

♀. Bihar, Kierpur, Purneah district, 8-11.ix.15; C. Paiva.

♀. Bihar, Kierpur, Purneah district, 12.ix.15; C. Paiva (in spirit).

Thorax brownish, with yellowish hairs; legs yellow. Anterior wings clothed with rather long, yellow rufescent hairs; on the ends of  $RS_{1+2}$ ,  $RS_{3+4}$ , M CuA and at anastomosis are seen four brushes of longer hairs,

the end portions of which are white; brownish spots may also be seen at the ends of apical sectors, at the base of DC, at the commencement of CuA (near its union with M); brown spot before the end of SC. In the hind wings, which are broad enough, the hairs are also rather long; fork of M rather long, but with a short pedicel; fork 5 shorter than it.

Length of body 4.6 mm.

*Remarks.*—This is probably a new species, but I consider it useless to name it from a single female, without giving a description of the genitalia.

### **Oecetis** sp. 3.

♀. Calcutta, 1912; F. H. Gravely.

Anterior wings long, narrow, with dusky pterostigma; fork 1 sessile, impinging a little on DC, which is long; cross-vein rs-m situated before irs and scarcely visible, cross-vein m-cu quite lacking. In the posterior wings the fork of M very short; before CuA a trace of MP.

Body yellow, antennae pale yellow, with thin annulations; wings yellowish.

Length of body 4.2 mm.

*Remarks.*—This is a distinct form, differing in the reduction of two cross-veins of anastomosis. It is probably a new species.

### **Setodellina** Lestage, 1919 (s. emend.).

1919. *Setodellina*, Lestage, *Rev. Zool. Afric.* VI, fasc. 2, p. 209, fig. 5 (*S. albopunctata* Lest.).

Closely allied to *Oecetis* McLach. In the anterior wings SC and R in their greater part united into one thick vein; SC with a branch anteriorly; discoidal cell elongated, but the thyridial cell usually longer than it; 1st apical fork sessile or shortly pedicellate; anastomosis usually gradate. In the posterior wings 1st and 5th apical forks and the fork of M very short, fork 1 sometimes entirely absent.

♂. Preanal appendages broad and united into one thick plate, usually bilobed at end; pedes genitales elongated, rather narrow, with a prominence or short process above near the middle of the upper margin, penis thick, curved downwards.

♀. In the female also preanal appendages united into one transverse thick plate; lateral lobes of 9th segment large, composite, with inner portions curved upwards and very broad, and having from the side the shape of two high plates; lower parts hairy, concave upwards, spoon-shaped; median portion of 9th sternite sometimes separated and ending in a small median process (*S. mahadeva* Bks.).

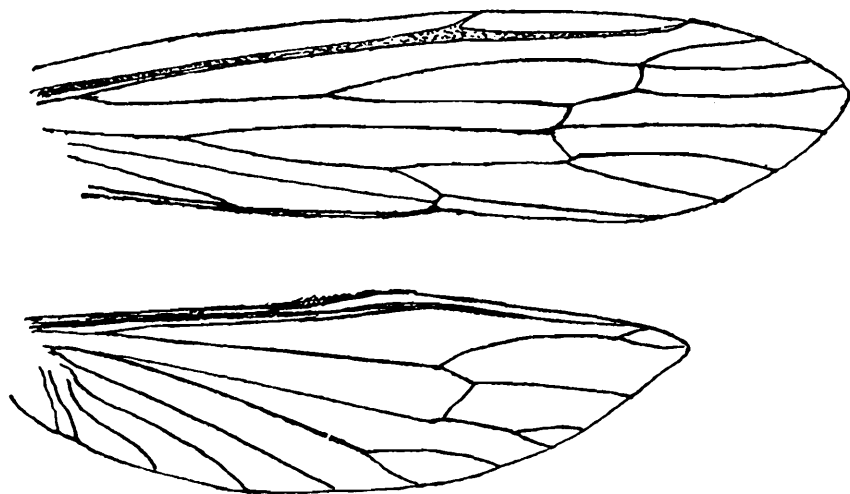
*Remarks.*—This Indo-African genus is related to *Oecetis*. I refer to it *Setodellina albopunctata* Lestage, *Setodellina brunnescens* Ulm., *Setodellina* (*Oecetis*) *gradata* Ulm., *Setodellina* (*Oecetis*) *maculipennis* Ulm., *Setodellina indivisa*, sp. nov., *Setodellina tenuis*, sp. nov., *Setodellina angustipennis*, sp. nov. and *Setodellina* (*Oecetina*) *mahadeva* (Bks.). The first four species occur in Africa, the remaining four in India.

**Setodellina indivisa**, sp. nov.

(Text-figs. 37, 38.)

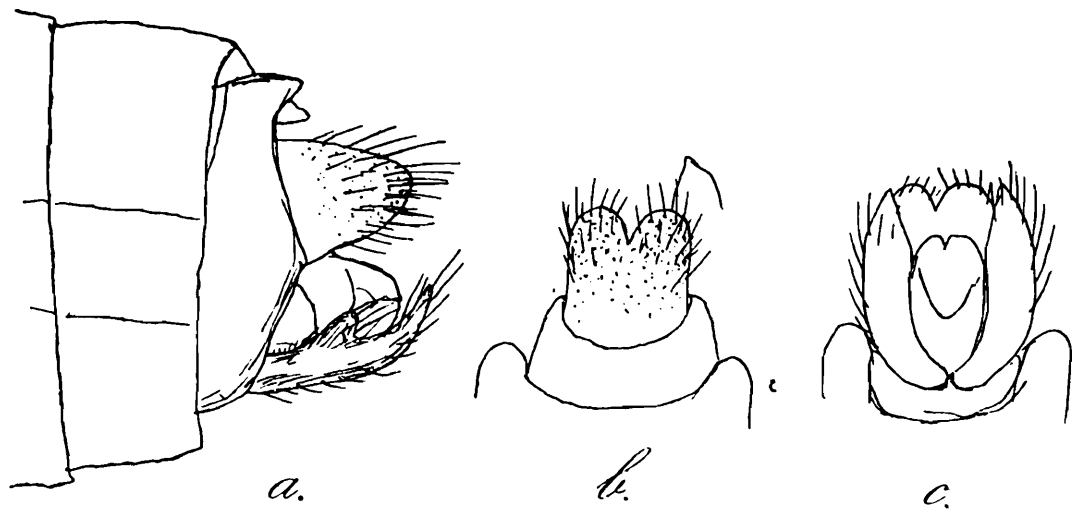
♂♂♀ (about 20 specimens in spirit, 1 sp. dry). U. Burma, Lonton, western shore of Indawgyi Lake, Myitkyina district, 18-31.x.26; B. N. Chopra.

Head brownish yellowish, antennae yellow, with black annulations; thorax brownish above, median portion of mesonotum paler, sides of thorax and coxae brownish yellowish; legs yellow. Anterior wings pale greyish yellowish, venation dark yellowish; SC thick, R slender in its basal part, then uniting with SC; far before the end of R, Sc is connected with C by an oblique vein; DC elongated, fork 1 sessile;

TEXT-FIG. 37.—*Setodellina indivisa*, sp. nov., ♂; wing venation.

rs-m situated at the base of 3rd discoidal cell; cross-vein oblique and situated between cross-vein m-cu and the base of  $M_{3+4}$ . In posterior wings SC strong, its end portion uniting with R; fork of M very small, cubital fork somewhat larger; 1st fork very small and not infrequently completely lacking. Abdomen yellowish.

♂. 9th segment as usual, broad at sides; preanal appendages large, triangular, oval from side, coalesced into a plate, which at its end is divided by a median excision into two oval lobes; the plate is clothed

TEXT-FIG. 38, a-c.—*Setodellina indivisa*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

with hairs. Inferior appendages resembling in their shape those in *Oecetis paula* McLach. and in *Oecetis tripunctata* McLach., with a short

oval process above near the middle ; seen from beneath they are rather broad, with triangular apical portions. Penis strongly dilated at its end.

♀. At the end of abdomen there are two large and broad oval lobes, curved upwards.

Length of body 4.5 mm.

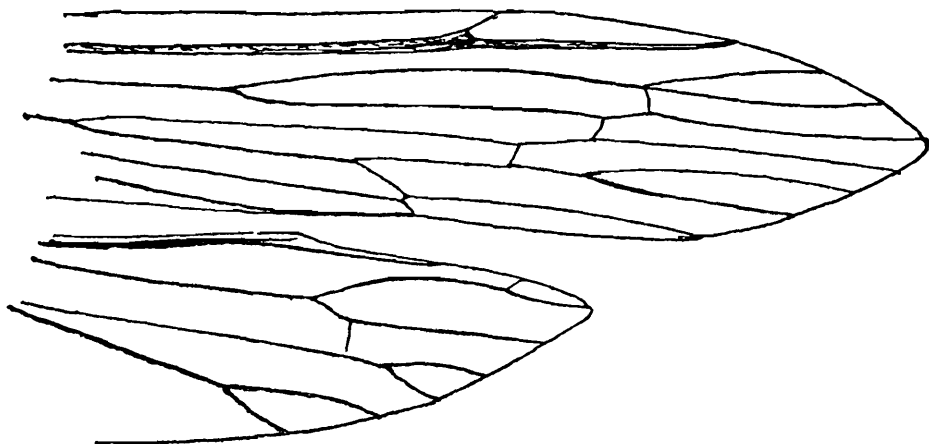
*Remarks.*—*S. indivisa* is evidently allied to *S. maculipennis* Ulm., *S. gradata* Ulm. and *S. brunnescens* Ulm. and all these species may be referred with *S. albopunctata* Lest. to the genus *Setodellina*. According to Lestage *Setodellina* differs from the allied genera mainly in the absence of fork 1 in the posterior wings. However, this fork is very small in *S. maculipennis*, *S. gradata* and in *S. indivisa*, sp. nov., and in the last named species it is rather inconstant, present only in a few specimens, being absent in others. Thus, this fork appears to be variable and in a condition of reduction, and its presence or absence cannot be considered as a generic feature. In other features, in the wing venation and in the structure of the genitalia all these species are similar to each other and therefore should be considered as belonging to the same genus for which the name *Setodellina* may be used.

***Setodellina tenuis*, sp. nov.**

(Text-figs. 39, 40.)

5 ♂♂, 3 ♀♀. Rewa State, opposite the camp at Harra, iii.27 ; H. S. Pruthi (in spirit).

Head and thorax brownish ; antennae yellow with brown annulations ; coxae brownish, legs yellow. Anterior wings narrow, greyish yellowish (in spirit) ; SC+R yellowish brownish, as also CuA and M in their basal parts ; DC long, narrow, thyridial cell a little longer ; fork 1 acute, but sessile ; anastomosis gradate ; fork of M with a short pedicel.

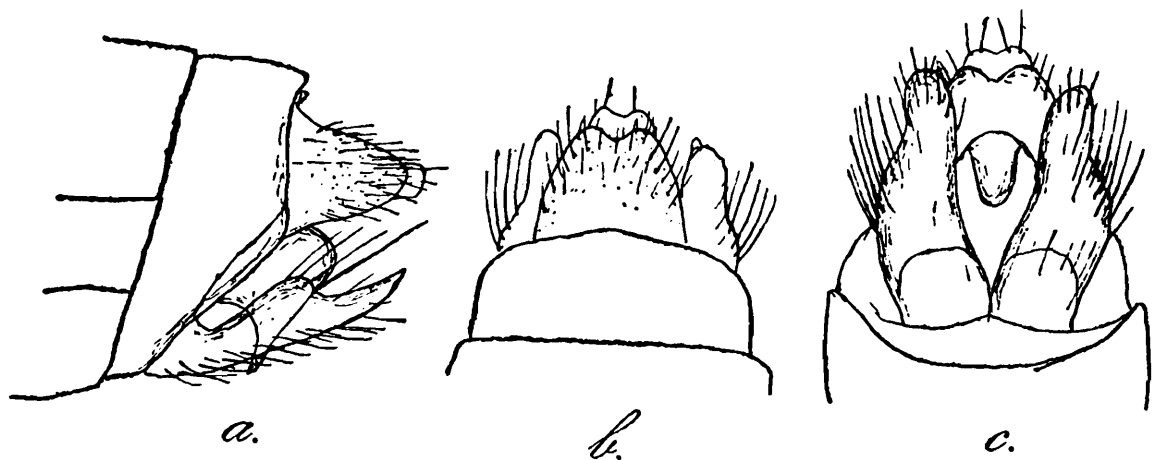


TEXT-FIG. 39.—*Setodellina tenuis*, sp. nov., ♂ ; wing venation.

Posterior wings not very narrowed ; fork 1 small ; fork of M also short, but broader ; fork 5 a little longer than the 3rd ; fringe on the anterior margin yellowish-brownish. Abdomen pale yellowish.

♂. Preanal appendages large, subtriangular and rounded at the end when seen from the side ; they are completely coalesced into a plate, which is narrowed at its end when seen from above ; apex shallowly

excised in the middle. Behind this plate the end portion of 10th segment may be seen, which is pale, transparent and also excised at



TEXT-FIG. 40, a-c.—*Setodellina tenuis*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

its end. Pedes genitales broad from beneath, apical portion a little narrower; seen from the side they are narrower and directed backwards; they form above, near the middle, a broad low projection, bearing behind 3-4 bristles. Penis very broad, its end portion turned downwards and attenuated when seen from the side; seen from beneath the end portion is tongue-shaped, rounded at its end.

In the female the genital appendages have the same structure as in the preceding species, but their shape cannot be properly judged as the preservation of the specimens is very poor.

Length of ♂ body 5.4 mm., that of ♀ 4 mm.

*Remarks.*—Judging by the structure of the ♂ genitalia *Setodellina tenuis* sp. nov. is closely allied to *S. brunnescens* Ulmer from Sudan. Wing venation is also similar, but DC in forewings is longer in *S. tenuis*; posterior wings in our species are very similar to those in *S. brunnescens* and differ only in  $RS_{1+2}$  being forked, whereas in *S. brunnescens* this fork is completely reduced. This is a good demonstration of the opinion that the presence or absence of the small fork 1 cannot be of any great systematic importance.

### ***Setodellina angustipennis*, sp. nov.**

(Text-figs. 41-43.)

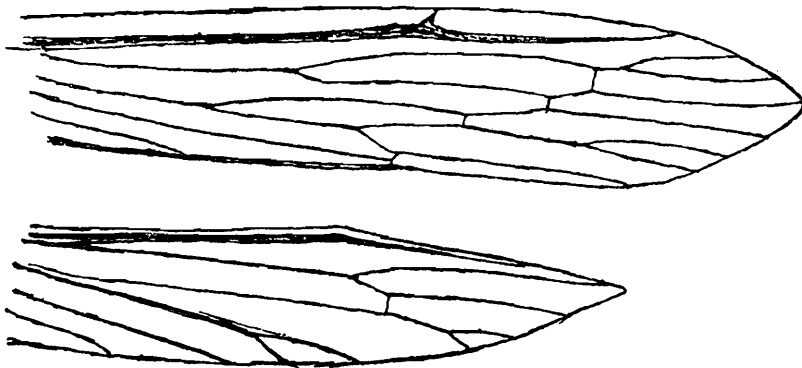
2 ♂, ♀. Mokameh Ghat, at light (in spirit).

Head and thorax yellow; antennae yellow with narrow brownish annulations; legs yellow, spurs 0.2.2, inner ones longer than the outer.

Anterior wings narrow, pale, membrane nearly iridescent; SC thick, R approximated to it and united with it at the end; discoidal cell very long, thyridial cell a little shorter, 1st fork with a short pedicel, 5th apical cell also pedicellate. In the posterior wings 1st fork is absent, fork of mediana very short, that of CuA also short.

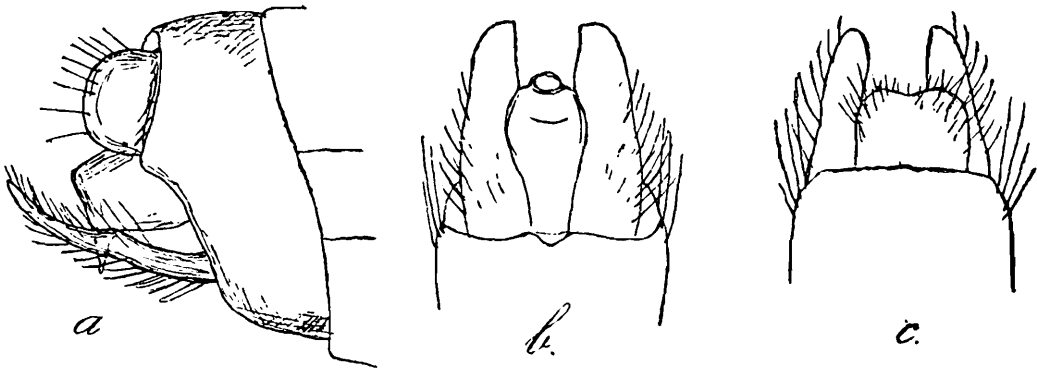
Abdomen pale,

♂. 9th segment broad; preanal appendages rounded from side, united into a parallel-sided plate, shallowly excised at end; pedes genitales



TEXT-FIG. 41.—*Setodellina angustipennis*, sp. nov., ♂; wing venation.

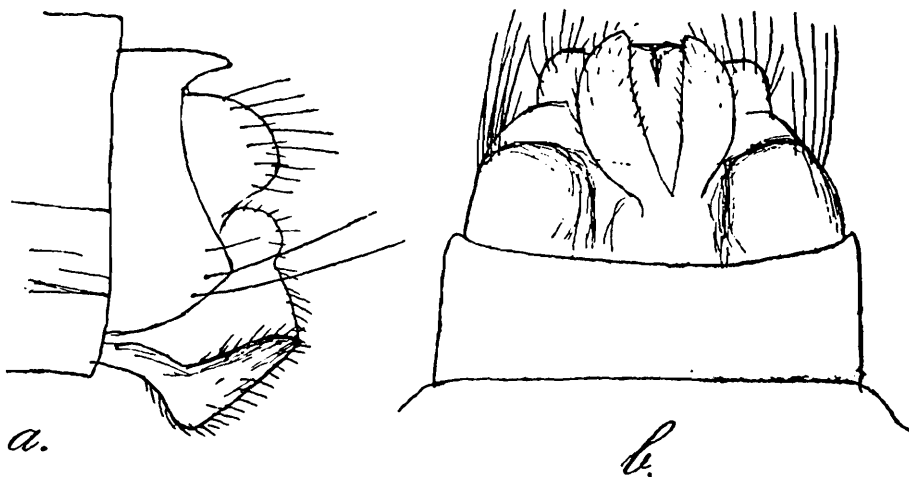
somewhat resembling, from side, those in *S. gradata* Ulm., but more slender; seen from beneath they are rather broad, band-shaped, with



TEXT-FIG. 42, a-c.—*Setodellina angustipennis*, sp. nov., ♂; genital appendages from side (a), from beneath (b) and from above (c).

somewhat excised inner margin; penis broad, with an acute process at its end below (seen from side).

♀. Preanal appendages united together in a plate, like *S. mahadeva* (Bks.); lateral lobes of the 9th segment large, resembling those in *S.*



TEXT-FIG. 43, a, b.—*Setodellina angustipennis*, sp. nov., ♀; genital segments and appendages from side (a) and from beneath (b).

*mahadeva*, but their hind edge is not concave, only slightly incised, separating a rounded upper lobe; seen from beneath they are elongated,

rounded externally and originating together from the pale, not separated, median portion of the 9th segment.

Length of body 4.4-5 mm.

*Remarks*.—This species appears to be more allied to *S. gradata* Ulm. from Egypt and Sudan.

***Setodellina mahadeva* (Bks.).**

(Text-figs. 44, 45.)

1913. *Oecetina mahadeva*, Banks, *Trans. Amer. Ent. Soc.* XXXIX, p. 236 (Chapra, Bihar).

2 ♀. Bihar, Siripur, Saran, 25.ix.10; Museum Collector.

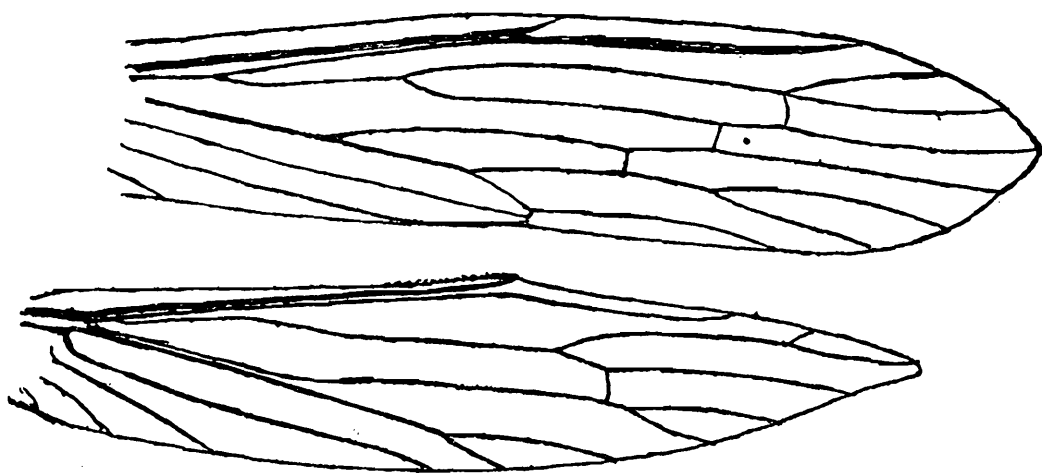
♀. Bihar, Kierpur, Purneah district, 8-14.ix.15; C. Paiva.

3 ♀. U. Burma, Lonton, western shore of Indawgyi Lake, Myitkyina district, 18-31.x.25, at light; B. N. Chopra (one specimen without abdomen).

♀. Bihar, Katihar, Purneah district, 7-31.viii.10; C. Paiva.

Head brownish, clothed with pale yellow hairs; palpi with a whitish pubescence; antennae brownish yellowish, bases of joints paler, ends blackish; distal half of antennae brownish, basal joint yellow.

Thorax brown, somewhat paler at sides; legs yellow. Anterior wings: membrane greyish, clothed with yellowish hairs; there are several dark brown short streaks or spots as follows: (1) a streak along M, between two cross-veins; (2) a less distinct streak at the base of  $RS_{3+4}$ ; (3) a streak along the basal part of M, up to the level of the base of the discoidal cell; (4) a small brown spot on the end of CuA; moreover, brown spots are sometimes found at the end of SC, at the base of RS and at the end of R. Venation brownish, SC brown, thick, giving a branch forward, then uniting with R into a very thick vein; discoidal cell long, 1st fork sessile, anastomosis gradate; thyridial cell beginning earlier than DC, but shorter than it.

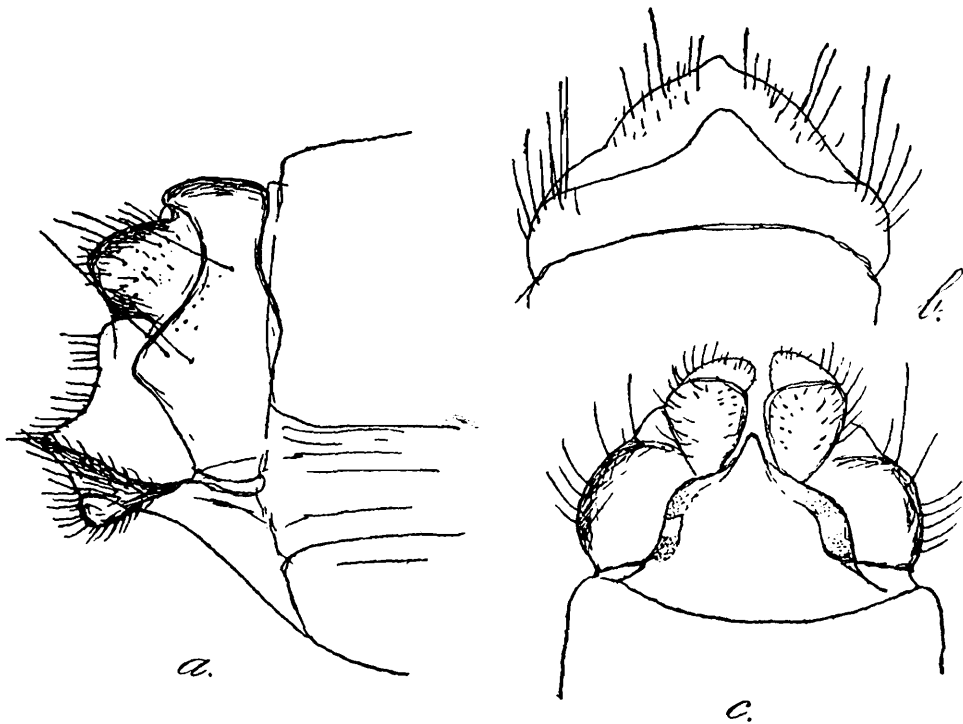


TEXT-FIG. 44.—*Setodellina mahadeva* (Bks.), ♀; wing venation.

Posterior wings greyish rufous, iridescent, with brownish fringe; venation pale brownish; SC ending on the projection of the fore margin; RS in its basal portion running near to R, then deviating from it; M in its basal half also running near to CuA, then deviating; fork 1 small, forks 3 and 5 small and nearly equal. Abdomen brown.

♀. 9th segment of usual shape, forming two triangular projections at sides and one rounded triangular above; preanal appendages coalesced

into a thick transverse hairy plate, situated behind 9th tergite; lateral lobes (of 9th segment) large, irregular from side, but with concave hind



TEXT-FIG. 45, a-c.—*Setodellina mahadeva* (Bks.), ♀; genital segments and appendages from side (a), from above (b) and from beneath (c).

edge of the upper portion; seen from beneath they represent two broad, subtriangular rounded lobes with narrow bases; their inner portions are curved upwards and form two high pale plates, seen from side; outer edges are also a little curved upwards, and thus a spoon-shaped structure is formed, hairy and triangular from the side. 9th sternite sub-divided into two side pieces and a median broad portion<sup>1</sup> ending in a small triangular projection between the bases of the lateral lobes of 9th segment.

Length of body 3.4-4 mm.

Males not known.

*Remarks.*—The specimens described above are probably to be referred to *Oecetina mahadeva* Bks., but since the original description of Prof. Banks is unfortunately not accompanied by any figure of wing venation or of genitalia, I cannot be certain. Our specimens resemble Banks' description in the presence of brown streaks on M and on the base of  $RS_{3+4}$ . In the specimens before me some other brown markings are also present, but they are rather variable and sometimes even absent. Specimens from Siripur and Katihar are small, with the length of body 3.4-3.7 mm. and 4 mm. respectively. In the specimen from Katihar brown markings on wings are distinct, and this specimen is, therefore, more closely allied to the specimen described by Prof. N. Banks.

*Remarks.*—The structure of the ♀ genital segments and appendages is peculiar; however, other species of *Setodellina* possess similar structures, differing only in some details.

<sup>1</sup> This is not a true sternite but its appendages which are coalesced with it.

**Trienodes** McLach.**Trienodes indica**, sp. nov.

(Text-figs. 46a-c.)

2 ♂. S. India, Kodaikanal, 6,900 ft., Palni Hills, viii. 22, at light; S. W. Kemp (in spirit).

Head brownish-yellow, paler at sides near eyes; antennae yellow, with brown annulations. Thorax brownish yellowish above, pleural regions and coxae brownish; legs yellow, femora somewhat darker. Anterior wings pale, yellowish, with usual venation. Abdomen pale yellow; 9th segment and pedes genitales darker, brownish yellowish.

♂. Preanal appendages not very long, more than twice shorter than the median appendage of 10th tergite. 9th segment broad in its ventral portion, very narrow in its dorsal portion; side pieces broadly excised above the base of the pedes genitales. 10th segment covering only the basal half of the penis, moderately broad at base, then narrow, acute at end; median basal process of 10th tergite long, slender, arcuate from



TEXT-FIG. 46, a-c.—*Trienodes indica*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

side, somewhat thickened in its end portion. Pedes genitales elongated and broad from side, with upper and lower edges subparallel; their hind upper portions each prolonged into a process, which at its end is curved downwards. Seen from beneath the inferior appendages are cone-shaped, truncated at their ends, but at their outer upper angles each extended into a narrow process, which has been described above in the side view; near the base of the upper edge of each appendage is a small and very slender process visible from the side. Penis very long, curved downwards, accompanied at sides with two slender sickle-shaped appendages, representing, probably, its titillators.

Length of body 3.6 mm.

*Remarks.*—This is a distinct species apparently allied to *Tr. hastata* Ulm.

**Trienodes ornata** Ulm.

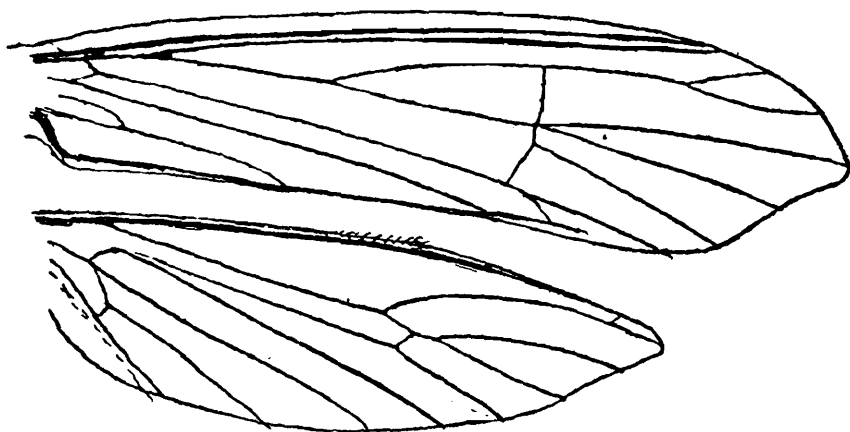
(Text-fig. 47.)

1915. *Trienodes ornata*, Ulmer, *Deutsch. Ent. Zeitsch.* p. 57, figs. 30-31.

2 ♀. Ceylon, Peradeniya, 8.vi.10 (in spirit).

Head, thorax and abdomen pale yellowish; antennae and palpi pale, legs pale, spurs 2.2.2.

Anterior wings as in Ulmer's figure 30, but the hind apical margin is a little excised, concave; venation similar to that in the figure 30,



TEXT-FIG. 47.—*Triaenodes ornata*, Ulm., ♀; wings.

but the apparent fork 2 is sessile, although acute; in the posterior wings apparent fork 2 with a short pedicel; hairs set off.

Length of body 6-6.2 mm.

*Remarks.*—I believe that these specimens belong to *Tr. ornata* Ulm. which was described from Peradeniya.

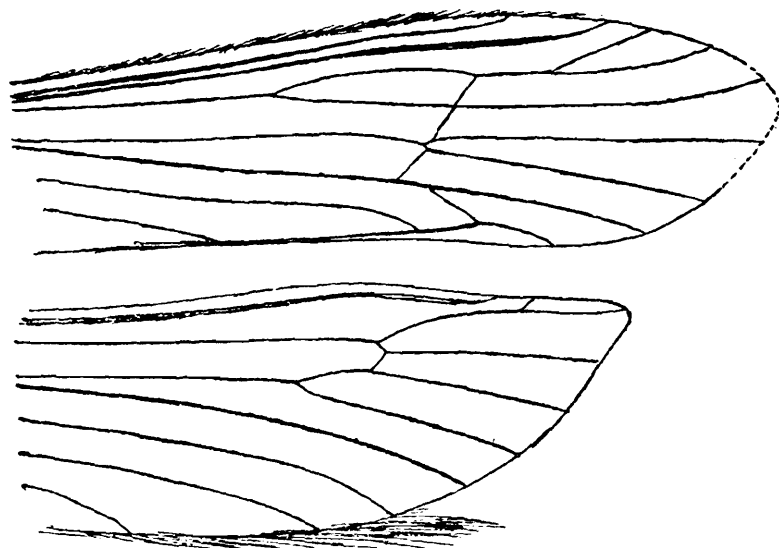
### **Adicella** McLach.

#### **Adicella biramosa**, sp. nov.

(Text-figs. 48, 49.)

♂, Assam, the Peak, Shillong, 8,400 ft., 12.x.14; S. W. Kemp (in spirit).

Head and thorax pale brownish yellow; antennae yellow, with narrow black annulations; on the vertex near the eyes two brushes of long pale hairs; legs pale yellow, spurs 1.2.2. Anterior wings pale, clothed with yellowish hairs; venation dark yellowish; R thickened in its apical

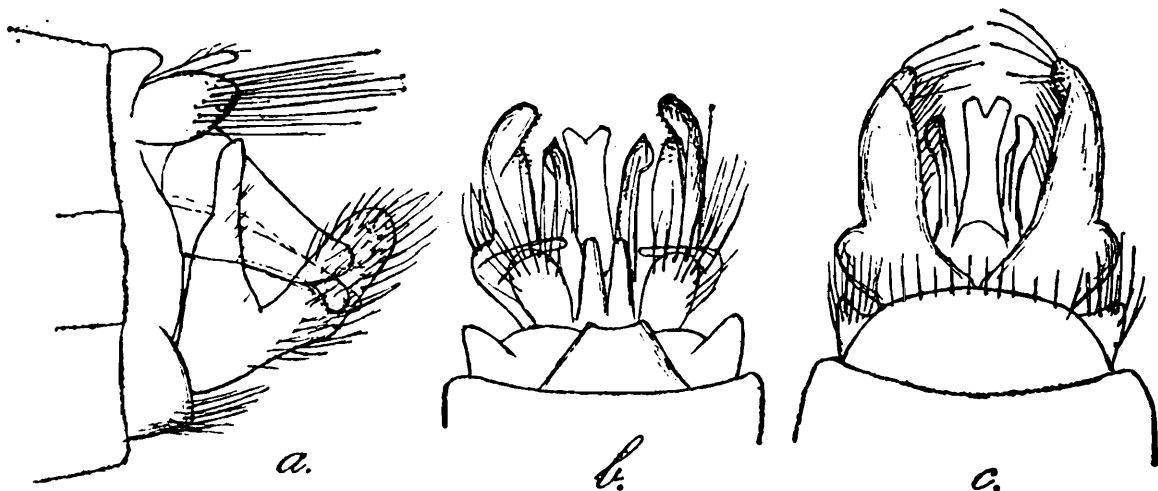


TEXT-FIG. 48.—*Adicella biramosa*, sp. nov., ♂; wing venation.

portion; DC short, fork 1 longer than its pedicel; three veins of anastomosis forming one oblique line; in the posterior wings M divides earlier

than RS, cross-vein rs-m situated not very near to this bifurcation. Abdomen pale yellowish.

♂. Preanal appendages broad, almost truncated behind, adorned with long hairs; at the base of 10th tergite are two digitiform short processes, equal in their length to the preanal appendages. Median portion of 9th tergite is more or less separated in the shape of a plate,



TEXT-FIG. 49, a-c.—*Adicella biramosa*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

narrowed behind and with a concave hind edge. 10th segment descendent, near its base divided into two long side plates, which are broad in their basal part, but somewhat narrowed behind if seen from side; penis slender, concealed between these plates; at its end it appears to be sub-divided into two small side lobes, when seen from above. Pedes genitales divided near their bases into a main portion, directed backwards and somewhat upwards, and a basal process directed upwards; basal part of appendages thickened; main portions broad from side, hairy; internally they are covered with spinules, in the distal portions in particular; apical portions somewhat curved inwards; basal processes broad in the proximal and slender in the distal portions, latter curved inwards. 9th sternite rounded on its hind edge.

Females unknown.

Length of body 5.8 mm.

*Remarks.*—This is a distinct species which is more similar to the European *A. reducta* McLach. than *A. pulcherrima* Ulm. from Java, and *A. nigropunctata* Ulm. from Sumatra.

### **Mystacides** Latr.

#### **Mystacides indica**, sp. nov.

(Text-figs. 50 a-c.)

♂. Western Himalayas, Kumaon Hills, Malwa Tal, 3,600 ft., 7.v.11; S. W. Kemp (in spirit).

Head brownish above, pale yellowish in front; antennae pale yellowish, with somewhat brownish annulations. Thorax brownish, legs brownish yellow. Anterior wings yellowish brownish with a little darker venation; venation similar to that in *M. longicornis* L. and in

other species; CuA darker than other veins; posterior wings somewhat paler. Abdomen pale.

♂. The structure of ♂ genital appendages resembles rather closely that in *M. dentata* Mart. from the Altai Mountains. 9th sternite forming a broad bifid process, representing a triangular hairy plate with concave hind margin. Preanal appendages as usual, long, straight, slender. 10th segment, seen from above, long and broad, thick and brown at sides, paler and slender in the middle; thickened lateral borders extending backwards in the shape of two processes, the right one long, curved at first to the left and upwards, then backwards and somewhat downwards, with the apices directed backwards; the left process is short, also acute



TEXT-FIG. 50, a-c.—*Mystacides indica*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

at end. Seen from the side, 10th segment is broad at base, attenuated backwards and extending into the two above mentioned processes, of which the short left process is situated above the right. Pedes genitales broad from side, ascending, with an acute triangular projection from its upper portion, directed backwards; seen from above they are concave internally with slender and acute apical portions; at their bases, internally, are two broad plate-like projections, rounded at the ends. Penis thick in its proximal half, somewhat more slender in the distal half which is turned downwards; seen from above it is much broader than from the side.

*Remarks.*—This species is evidently rather closely allied to *M. dentata* from the Altai Mountains, differing from it in some details of the structure of the male genitalia.

### Family SERICOSTOMATIDAE.

#### Sub-family LEPIDOSTOMATINAE.

#### **Dinarthrum** McLach.

#### Sub-genus **Indodinarthrum**, nov.

Closely allied to *Paradinarthrum* Mart. and partly to *Metadinarthrum* and *Hypodinarthrum* McLach, but somewhat different. Basal joint in the ♂ antennae long, with the usual processes in the basal part. Anterior wings (♂) resembling those in *Paradinarthrum*, but the median groove is better developed; hind branch of M scarcely connected or

completely disconnected from M, and united with CuA; anal stripe well developed, but not extremely long, the cell between CuA<sub>2</sub> and M<sub>3</sub>+CuA<sub>1</sub> is triangular, not very extensive. Median portion of the 10th segment (♂) divided by a fissure into two plates; side portions not projecting, small, second joint of the pedes genitales longer.

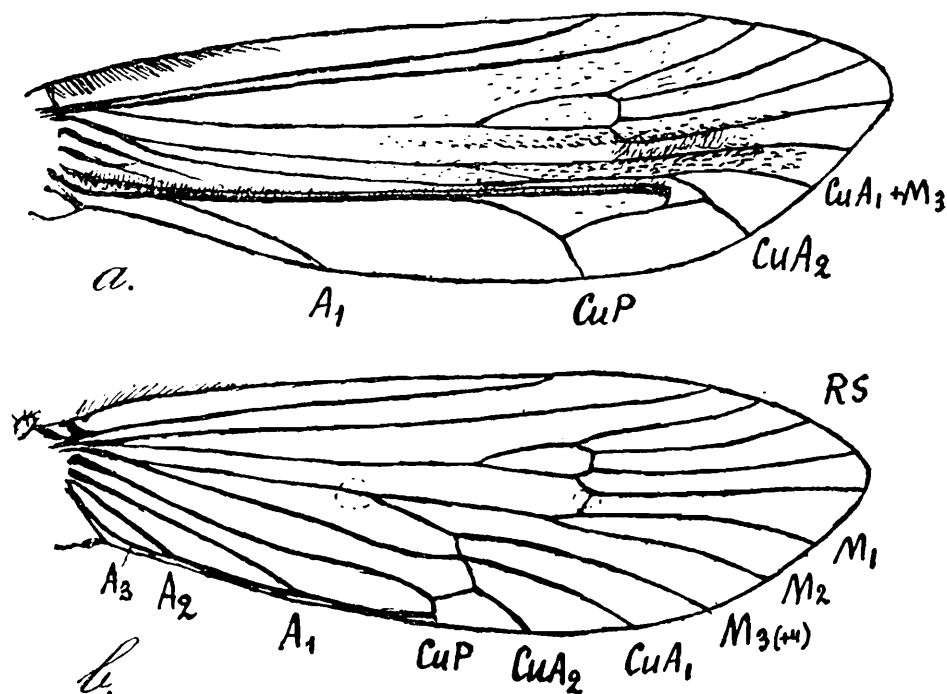
*Remarks.*—I refer to this sub-genus two species—*D. punjabicum*, sp. nov. and *D. latum*, sp. nov. both from the Punjab; the second species is also represented by a specimen from Darjeeling, Eastern Himalayas.

***Dinarthrum (Indodinarthrum) punjabicum*, sp. nov.**

(Text-figs. 51, 52.)

11 ♂, 6 ♀. Punjab, Punj-pul Nullah, about a couple of miles from Dalhousie on Dalhousie-Bakloh Road, 6,500 ft., v.27; S. L. Hora.

♂. Head and thorax brown above, head transverse. Basal joint of ♂ antennae brown, nearly as long as the thorax and abdomen, curved, directed forwards and clothed with rufescent hairs and outstanding thickened hairs; it bears at its inner side two processes, the basal long and curved and the second shorter, thread-like, yellowish, annulated with brown. 1st joint of ♂ maxillary palpi long, second shorter, slender. Coxae brownish, legs yellow, or somewhat brownish; tarsal joints darker at their ends. Anterior wings greyish-brown, clothed with yellowish rufous hairs and with black scales before and behind the longitudinal subdiscoidal groove; whitish spots of hairs at the end of SC, somewhat nearer to the base and at the end of M. Venation somewhat resembling that in *D. ferox* McLach.; discoidal cell rather short, but somewhat variable. M weak, dividing at the base of discoidal cell into the fore branch, reaching the end of wing, and the weak hind branch soon uniting with CuA to form a common vein, then separating and forming



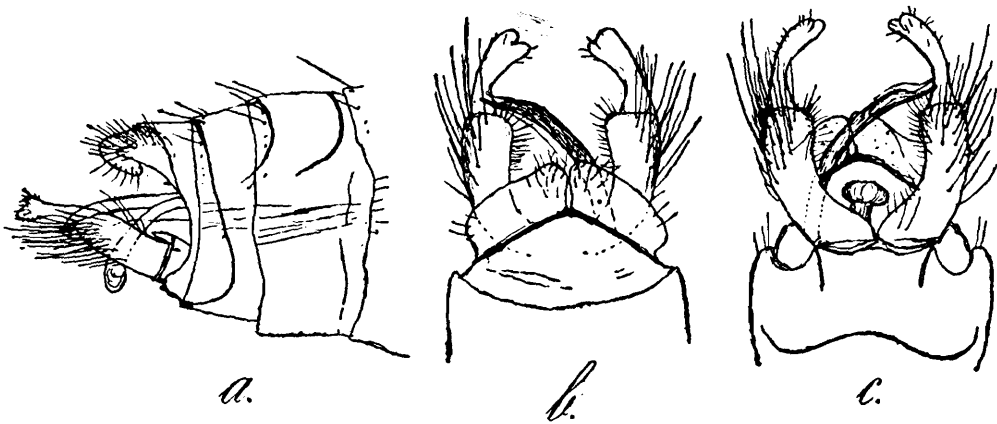
TEXT-FIG. 51, a, b.—*Dinarthrum (Indodinarthrum) punjabicum*, sp. nov., (a) fore-wing of ♂; (b) fore-wing of ♀.

probably M<sub>3</sub>+CuA<sub>1</sub>. Anal groove or stripe straight, distinct and extending a little beyond the end of DC; basal portions of CuP and of A<sub>1</sub>

present; fork 5 (between  $M_3 + CuA_1$  and  $Cu_2$ ) somewhat variable, but usually rather short (text-fig. 51); apical cell between the ends of  $CuA_2$  and  $CuP$  extended, elongated; in the posterior wings discoidal cell sometimes closed by a cross-vein; sparse blackish scales present. In females DC in the anterior wings is also short,  $CuP$ ,  $A_1$ ,  $A_2$  and  $A_3$  connected behind by a postcostal vein, running near the hind edge of the wing; forks 1, 2, 3 and 5 present; basal joint of ♀ antennae twice shorter than in ♂, without processes.

Abdomen dark brownish.

♂. Side pieces of 9th segment with concave hind margins; 9th tergite almost triangular, with dark hind edge; 10th dorsal segment not entire, but divided by a median fissure into two portions, which, from above, are band-shaped, with hind margins nearly parallel to the hind edge of



TEXT-FIG. 52, a-c.—*Dinarthrum* (*Indodinarthrum*) *punjabicum*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

9th tergite; side portions not projecting above. Second joint of pedes genitales elongated, slightly thickened in its distal portion; end part sub-divided by a small incision above into two small lobes (text-fig. 52b).

Penis curved downwards; titillators originating from the left side of the penis; they are rather thick and curved to the right.

In ♀ anterior wings DC is also short, forks 1, 2 and 3 beginning at the same level.

Length of body 4 mm.

*Remarks.*—This species resembles *D. (Paradinarthrum) longiplocatum* Mart. and *D. (P.) mesoplicatum* Mart., but differs somewhat in the structure of ♂ genitalia, as also in the venation of anterior wings in ♂.

### ***Dinarthrum* (*Indodinarthrum*) *latum*, sp. nov.**

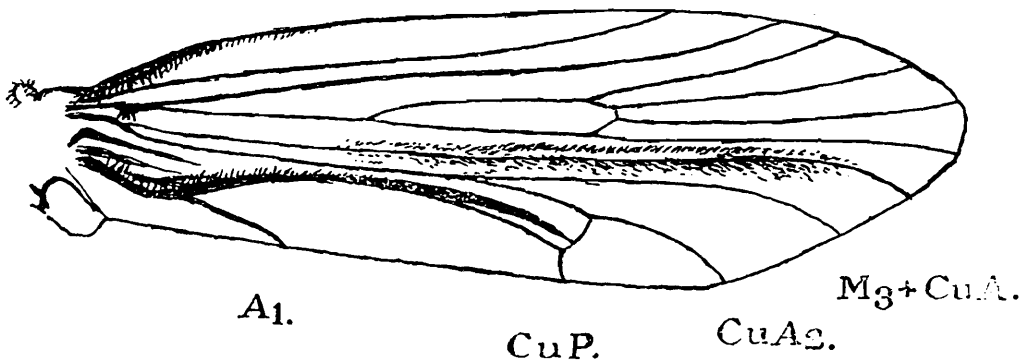
(Text-figs. 53, 54.)

♂. Punjab, Punj-pul Nullah, about a couple of miles from Dalhousie on Dalhousie-Bakloh Road, 6,500 ft., v.27; S. L. Hora.

♂. Eastern Himalayas, Darjeeling, 11.vi.14; F. H. Gravely (defective specimen).

Similar and related to the foregoing species. Basal joint of antennae nearly as long as the whole body, armed with two processes in the basal

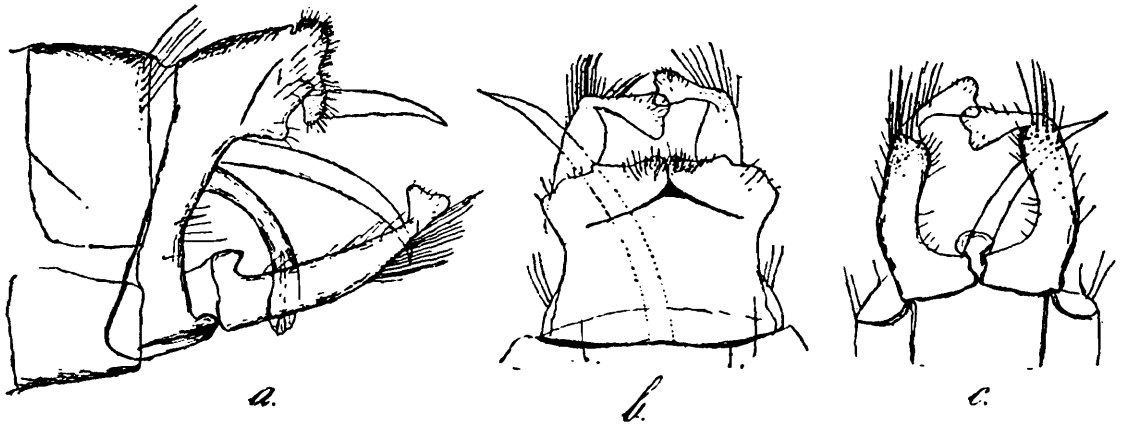
part. Anterior wings, as in *D. (I.) punjabicum*, sp. nov., but discoidal cell is longer, the cell between  $M_3 + CuA_1$  and  $CuA_2$  much longer, cell



TEXT-FIG. 53.—*Dinarthrum (Indodinarthrum) latum*, sp. nov., fore-wing of ♀.

$CuA_2$ — $CuP$ , on the contrary, not as extended; anal stripe with spinules and scales, a little shorter and somewhat arcuate.

♂. Dorsal plate of the 10th segment short, with irregular hind margin; from the side the 10th segment is higher than in *D. punjabicum*.



TEXT-FIG. 54, a-c.—*Dinarthrum (Indodinarthrum) latum*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

Basal joint of the pedes genitales more elongated, second joint more dilated at its end; titillators also curved to the right.

Length of body 5.5-5.3 mm.

### **Dinarthrodes Ulm.**

#### **Dinarthrodes inequalis**, sp. nov.

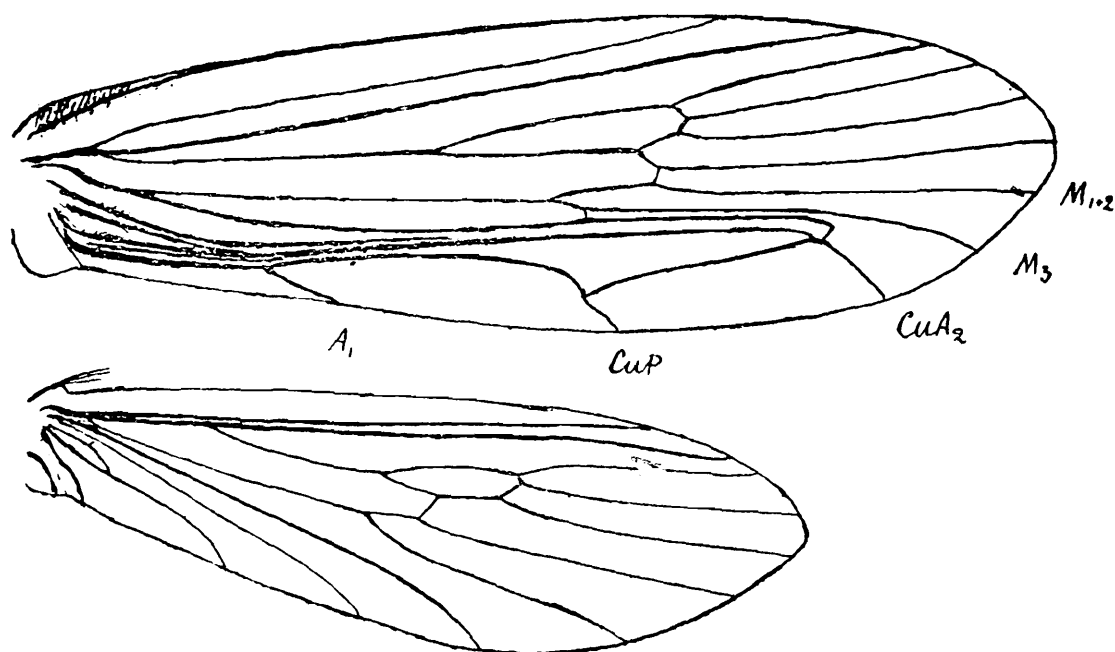
(Text-figs. 55-56.)

2 ♂, ♀. Western Himalayas, Kumaon Hills, Bhowali, bushes and trees, 12.v.30; H. S. Pruthi.

Head and thorax brown; head transverse; basal joint in ♂ antennae long, but shorter than the body, curved inwards, without any spines. Maxillary palpi densely clothed with greyish and black elongated scales, apparent basal joint probably represents an outgrowth of the palpiger; second (first) joint slender and directed upwards, third (second) joint slender, shorter than the foregoing. Labial palpi pale, fairly long, as usual three-jointed.

♂. Anterior wings greyish-yellow; DC elongated, but shorter than its pedicel; M dividing into two branches at the middle of DC,  $M_{3+4}$  near its base connected with a short cross-vein with  $CuA$ ; this

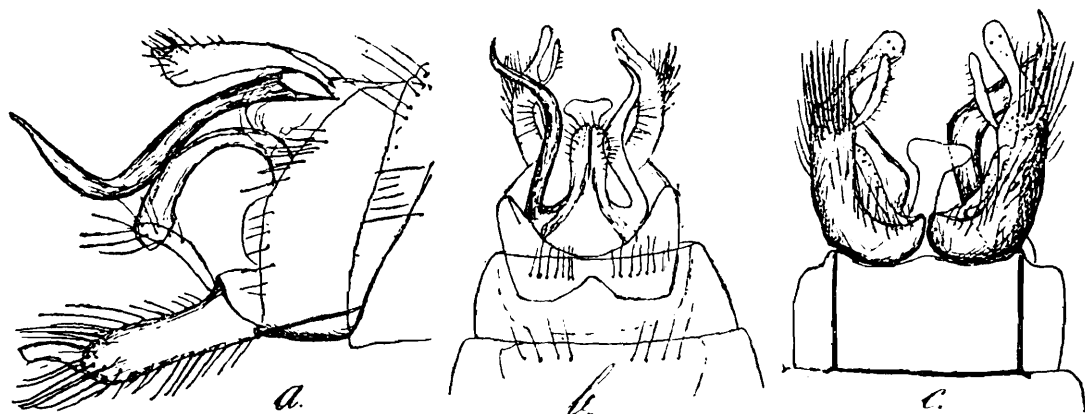
vein is long and curved at its end backwards and then prolonged with  $CuA_2$ ;  $CuA_1$  absent; cross-vein between  $CuA_2$  and  $CuP$  long; before  $CuP$



TEXT-FIG. 55.—*Dinarthodes inequalis*, sp. nov., ♂; wing venation.

and the basal part of  $A_1$  is the anal groove with hairs, concealing the venation in the basal part. Posterior wings greyish, DC subelliptical; cross-vein  $rs-m$  connecting basal parts of  $RS_{3+4}$  and  $M_{1+2}$  (text-fig. 55).

♂. 9th segment broad, narrowed above; side pieces with convex hind margins; sternite provided with two brownish lateral, straight, chitinous thickenings. Median portion of 10th segment elongated, with a narrow cleft divided into two portions, bearing short erect hairs; seen from the side this portion of the 10th segment is narrow at base, gradually thickening to its end. Side portions of 10th segment (morphologically they probably represent preanal appendages) extended as two long sinuate processes of unequal length, the left being considerably shorter



TEXT-FIG. 56, a-c.—*Dinarthodes inequalis*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

than the right. The right process is directed backwards, then curved upwards and outwards; acute end portion is turned backwards; the left process is curved in a similar manner, but its end portion is directed somewhat inwards.

Basal joint of the pedes genitales brown, thick, straight, bearing on its end portion a tuft of long bristles; second joint pale, almost twice shorter, slender in its middle, at base uniting with first joint; internally from it originates the inner slender branch, and from the base of the first joint arises on each side another pale slender process, directed rather upwards. Penis slender, arcuately curved downwards (titillators invisible, probably shortened or absent).

♀. Anterior wings brownish, venation as usual in females; forks 1, 2 and 5 present. Basal joint of antennae somewhat longer than the head with eyes.

Length of body about 5.5 mm.

*Remarks.*—Allied to *D. albardana* Ulm. but distinct, differing mainly in the structure of the 10th segment.

### **Dinarthrella** Ulm.

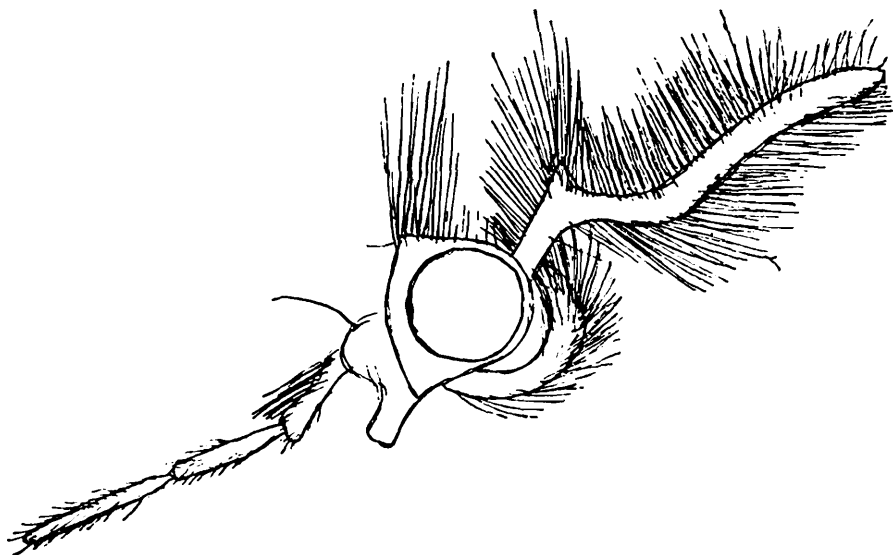
#### **Dinarthrella betteni**, sp. nov.

(Text-figs. 57-59.)

1 ♂. Eastern Himalayas, Pashok, Darjeeling district, 3,500 ft., 1-12.x.17; F. H. Gravely (in spirit).

The specimen is young and pale; colouring in fully adult specimens would be darker.

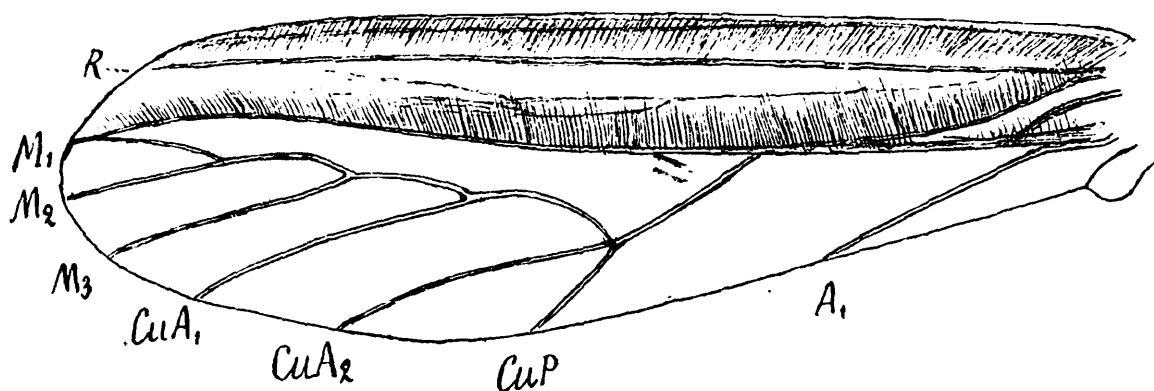
Head pale, clothed with dense pale, greyish-yellow hairs, with some admixture of brownish ones near the eyes. Basal joint of antennae as long as the thorax, slender, sinuate from side, pale, densely clothed above and beneath with dense, slender, erect, rufous brownish hairs; on the distal portion the hairs become paler, yellowish-grey; basal portion of the joint ending in a short triangular process or projection; thread pale yellow.



TEXT-FIG. 57.—*Dinarthrella betteni*, sp. nov., ♂; head with palpi and basal joint of antennae.

Maxillary palpi long, pale, adjacent to the head, curved upwards, their ends are situated between the bases of antennae and bear here a dense tuft of brownish-yellow hairs. Labial palpi long; 3rd joint longer than 2nd, which in its turn is longer than first.

Thorax yellow, mesonotum elongated, twice longer than the metanotum, brownish, with two rounded pale marks, bearing tufts of pale erect hairs; behind them two more small whitish spots. Metanotum brownish. Legs pale yellowish. Anterior wings pale, narrow; costa thick; subcosta running near to it, in its basal part apparently uniting with it with dense series of yellowish hairs turned backwards; this series is continuous with the hairs, arising from costa. R straight, thick; RS originating early from it and forming a narrow and short discoidal cell, concealed by hairs, starting from M and therefore not easily dis-

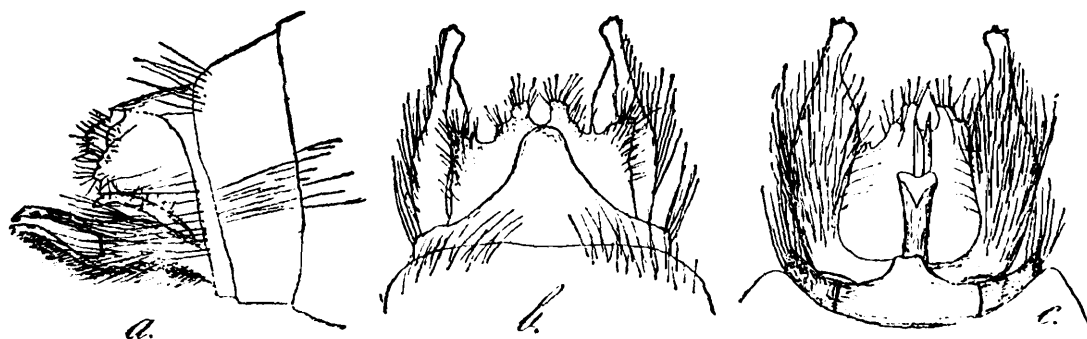


TEXT-FIG. 58.—*Dinarthrella betteni*, sp. nov., ♂; wing venation.

tinguished. Only the basal part of M may be discerned, since its further part is concealed by a long and distinct anal fold, extending from the base up to the end of  $M_1$ ; from the base of M and from the fold arise forwards dense series of brownish-grey hairs, as in *Dinarthrella destructa* Ulm. Venation behind this fold is much disturbed, as in *D. destructa*; three branches of M,  $CuA_1$ ,  $CuA_2$  and CuP connected basally and forming series of parallel (except CuP) veins; in the proximal part of wing there is only  $A_1$ , which is oblique, straight; jugal lobe rounded. Venation in posterior wings similar to that in *Dinarthrella* sp. Betten, 1909.

Abdomen pale brownish, tergites provided with dark transverse (slender) thickenings at their anterior edges; 1st tergite broad, brownish.

♂. Side pieces of 9th segment with straight hind edges; sternite narrow with a small median projection; tergite forming a broad projec-



TEXT-FIG. 59, a-c.—*Dinarthrella betteni*, sp. nov., ♂; genital appendages from side (a) from above (b) and from beneath (c).

tion narrowed behind and reaching the base of the median excision of 10th segment, broad both from above and from the side; one may distinguish here, as in *Dinarthrum*, one median and two lateral portions;

side portions short, irregular, hairy, separated from the median by two broad excisions, in which two more minute processes may be seen. Median portion also short, but with a rounded excision divided into two irregular projections, broad from side, narrower from above.

Pedes genitales broad from the side, hairy, divided near the middle into two branches, upper and lower, the lower being more slender and bearing beneath dense greyish brown hairs; seen from beneath the pedes genitales are dilated in the middle, then attenuated (lower branch); apices ending in two or three tubercles. From the bases of the pedes genitales arise two pale sabre-shaped processes, reaching the base of the upper branch. Penis short; above it two titillators, acute at ends.

Length of body 6 mm.

*Remarks.*—*Dinarthrella* sp. briefly described and figured by C. Betten (*Rec. Ind. Mus.* III, p. 241, pl. xviii, figs. 10-12, 1909) belongs probably to this species, although there is some difference in the shape of the basal joint of antennae and in the venation of the fore wings. DC and its branches are almost invisible in our specimen, but it is young, RS and M are here very pale and weak and therefore indistinct; Betten's figure of the basal joint of antennae is perhaps not quite correct (Betten's specimen was in bad condition). *Dinarthrella betteni*, sp. nov. is evidently allied to *D. destructa* Ulm. from Darjeeling, but distinct.

### **Maniconeura** McLach. (s. emend).

1815. *Maniconeura*, McLachlan, Fedtschenko's *Reise in Turkestan*, Zoology, Pt. 6. Neuroptera, p. 31.  
 1880. *Maniconeura*, McLachlan, *Monogr. Revisn. Synops. Trichopt. European Faun.* p. 280, pl. xxix, figs. 1, 2.  
 1913. *Crunoeciella* (Ulm.), Martynov, *Horae Soc. Entom. Ross.* XL, p. 27 (*C. batumica* Mart.).  
 1927. *Dinogoerodes*, Martynov, *Ann. Mus. Zoolog. Acad. Sci. U. R. S. S.* p. 469.  
 1927. *Crunoeciella*, Martynov, *ibid.*, p. 471.

Basal joint in male antennae rather short, approximately equal to the width of head with eyes, sometimes with a process at its base; basal joint of ♂ maxillary palpi elongated, bearing usually long hairs, second joint short, pale, directed backwards; labial palpi elongated as usual.

In ♂ anterior wings forks 1 and 2 present; discoidal cell elongated, thyridial one sometimes shortened; anal groove with hairs and scales situated near the posterior margin of wings, behind it no remains of any anal veins; at its end anal groove is continued with  $CuA_2$ , and when the groove is very long and distinct, transverse basal portion of  $CuA_2$  vanishes; two branches of M and  $CuA$  sometimes compressed before the groove.

♂. 10th segment divided into four or two processes; with the basal portion of the pedes genitales are connected two processes, one directed backwards, the other upwards; second joint diverse; near its base usually there is internally a slender furcate process.

*Genotype.*—*Maniconeura penicillata* McLach. (1875).

*Maniconeura penicillata* McLach. was insufficiently described from a single specimen which is not available in the Zoological Museum in

Leningrad. In 1935 I received a male specimen from Turkestan<sup>1</sup> which proved to be this species. An examination of this specimen showed that *Dinogoerodes relictæ* Mart. which I described in 1927 from Turkestan, is indeed very near to *M. penicillata*. I, therefore, propose to drop the name *Dinogoerodes* and unite it with *Maniconeura* McLach.

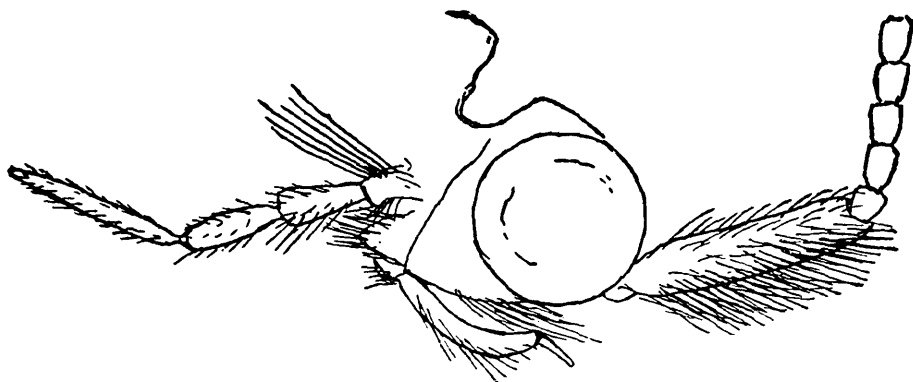
*Maniconeura indica*, sp. nov. described below proves to be evidently allied to both *Crunobiella* (*Crunoeciella*) *batumica* Mart. and *Maniconeura relictæ* Mart., thus uniting these two genera. As a result I have come to the conclusion that the genus *Crunoeciella* Mart. which is also monotypic, should be united with *Maniconeura* McLach. Four species of this genus are known, two from Russian Turkestan (*penicillata* McL. and *relictæ* Mart.), one from Transcaucasia (*batumica* Mart.) and one from India (*indica*, sp. nov.).

### ***Maniconeura indica*, sp. nov.**

(Text-figs. 60-62.)

2 ♂, 2 ♀. Peninsular India, Castle Rock, N. Kanara district, x.16; S. W. Kemp, (in spirit).

♂. Head transverse, pale brownish, with two rather large oval dark warts behind; basal joint of antennae yellowish, as long as the diameter of head, brownish, clothed with long dark hairs anteriorly; in female basal joint similar, a little more slender. Maxillary palpi directed up-



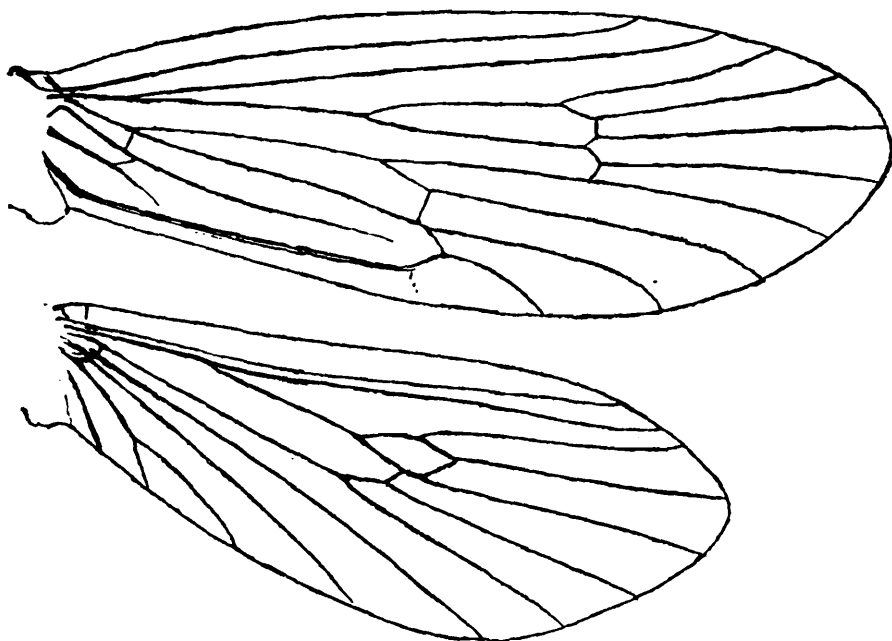
TEXT-FIG. 60.—*Maniconeura indica*, sp. nov., ♂; head with maxillary and labial palpi and with basal joint of antennae.

wards, but short, composed of elongated basal joint, and very short and slender second joint; labial palpi long, pale, 3rd joint nearly equal to 1st and 2nd combined. In female maxillary palpi long, 5th joint the longest, then follow 3rd, 2nd, 4th and 1st joints; labial palpi somewhat shorter than in males.

Thorax brownish, darker above, except median parts which are paler; legs pale. Membrane of anterior wings pale brownish, elliptic; venation brownish; DC elongated, but shorter than its pedicel, M divided into two branches almost at the level of the base of DC; thyridial cell elongated; CuA ending with a fork, CuP not reaching it; A<sub>1</sub>

<sup>1</sup> The specimen of *Maniconeura penicillata* shall be described in another paper.

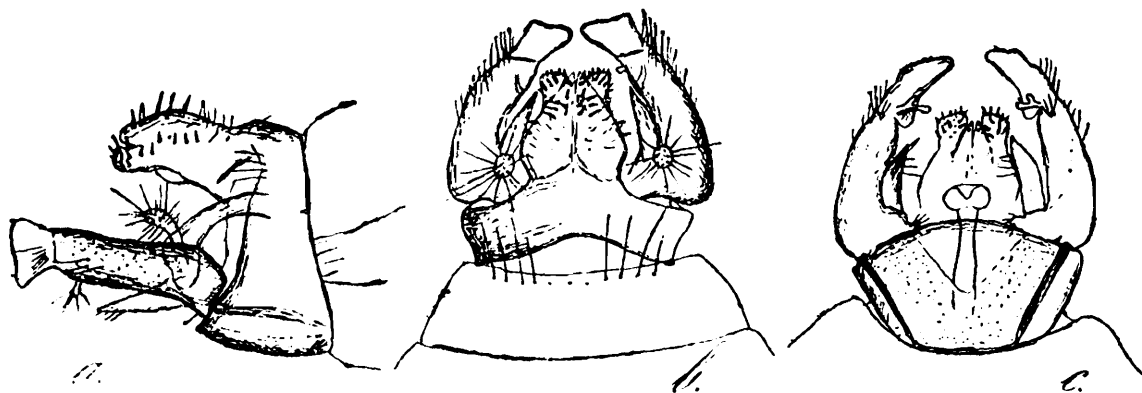
represented by its basal portion; anal groove with hairs and spinules situated near the hind margin, at its end continued with  $CuA_2$ , shorter



TEXT-FIG. 61.—*Maniconeura indica*, sp. nov., ♂; wing venation.

than in the remaining species. In posterior wings  $RS_1$  deeply impinging on the discoidal cell. Wing venation in females resembling that in *M. batumica* Mart.

♂. 9th segment gradually dilating to its ventral part, which is very broad, with convex hind margin; tergite produced backwards in the form of a short triangle, but pale; 10th segment thick from side, broad above, separated from 9th tergite by a constriction; its hind portion is composed of a median triangular portion, at its end with a short incision subdivided into two small acute lobules, and two side lobes, situated somewhat beneath the median; both triangular portions armed, each with 6-7 erect thick yellow spinules; side lobes also each bearing several similar but smaller spinules.



TEXT-FIG. 62, a-c.—*Maniconeura indica*, sp. nov., ♂; genital appendages from side (a), from above (b) and from beneath (c).

Basal joint of the pedes genitales fairly thick, somewhat curved inwards; from its basal portion arise two processes: the upper is slender, directed upwards, at its end bearing erect hairs; lower process is directed backwards, cuneiform, pale. 2nd joint short, plate-like

from side, dilated to its truncated hind margin (from side); it is more or less fused with the 1st joint, and from the point of fusion arises internally a small slender furcate process. Penis curved downwards, thickened at its end.

Length of ♂ body 4.5 mm., that of ♀ 5—5.5 mm.

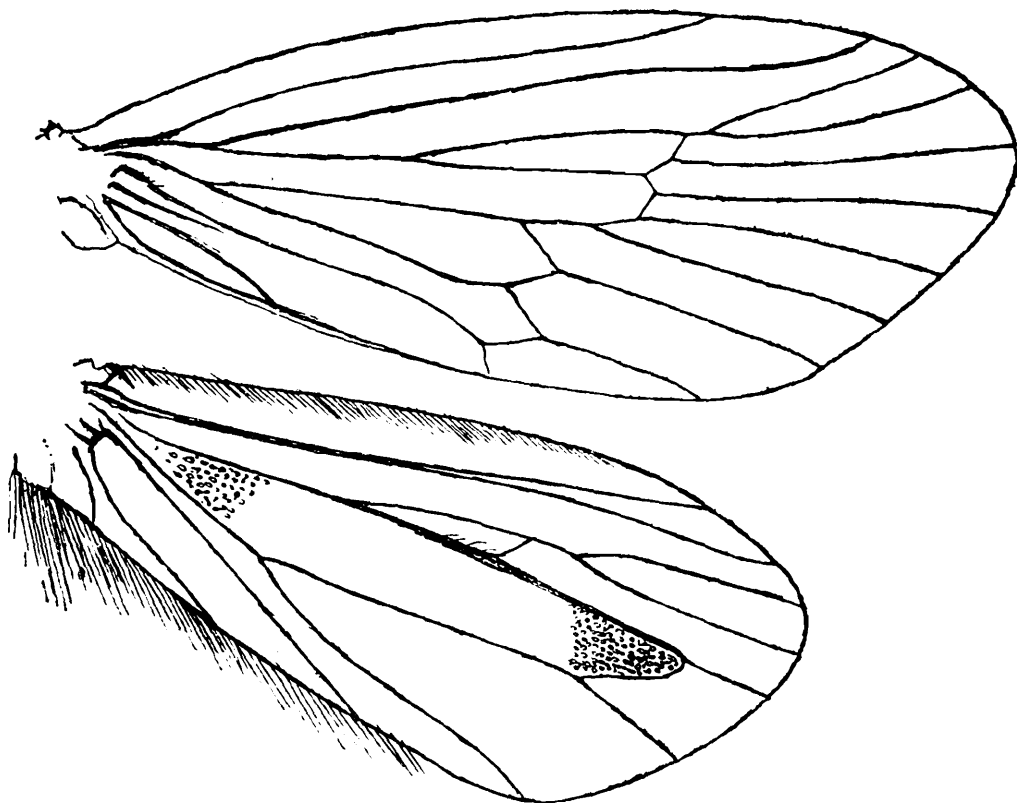
*Remarks.*—This species is distinct, but apparently allied more to *M. batumica* Mart. The thyridial cell in this species is much shorter, but M divides also at the base of DC; anal groove is longer in *M. batumica*, but is in the same situation and has the same structure as in *M. indica* sp. nov.; branches of M and CuA are not compressed as in *M. indica*. Male maxillary palpi are shortened and weakened in *M. indica*, their structure is similar to that in *M. batumica*. Second joint of the pedes genitales in *M. indica* shows a somewhat archaic condition as in *Dinarthrum*, but at its base there is a small forked process resembling a similar process in *M. relictata*. 10th segment is rather peculiar, but resembles the 10th segment of *M. batumica*.

***Paraphlegopteryx compositus*, sp. nov.**

(Text-figs. 63-65.)

♂. Eastern Himalayas, Darjeeling district, C. Lynch.

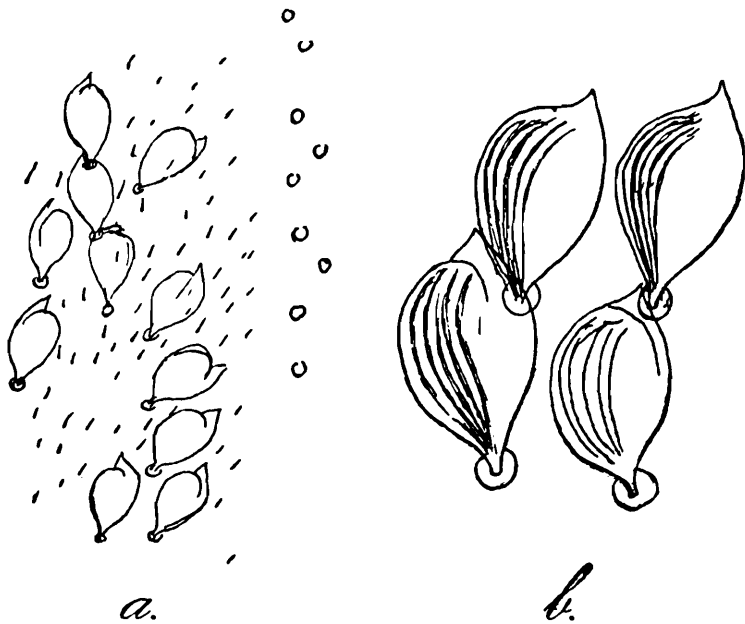
Head transverse, brown, mainly clothed with brown hairs mixed with a few yellowish hairs; basal joint of antennae short, in length



TEXT-FIG. 63.—*Paraphlegopteryx compositus*, sp. nov., ♂; wing venation.

equal to about three joints of the thread, the latter is brown, with pale annulations. Maxillary palpi very short, curved upwards, composed of a single joint, which is short, rounded at the end and armed with long hairs; labial palpi long, 3rd joint equal to 1st and 2nd combined.

Thorax brown, paler at sides; legs yellow, spurs 2.4.4. Anterior wings broad, egg-shaped, greyish yellowish, clothed with short yellowish hairs; in the region of pterostigma hairs darker. Venation pale brownish; DC elongated, narrow, closed by an oblique cross-vein; 1st fork with a short pedicel, 2nd sessile, triangular at base; 5th fork elongated, similar to that in *P. tonkinensis* Ulm., but its upper branch probably represents the united  $CuA_1 + M_{3+4}$ , fork 3 acute at base, mediana dividing near the middle of DC as in *P. tonkinensis*;  $A_1$  reduced,  $A_2 + A_3$  running close to the hind margin of wing. The membrane bears whitish scales. Posterior wings also broad, narrowing to the base, pale, almost hyaline; venation pale brownish; C bearing dense series of elongated hairs, directed backwards; SC and R approximated and apparently even fused in their middle portion; RS arising very early from the base of wing and forming a narrow discoidal cell, closed with an oblique vein; 1st fork also pedicellate. M fused with RS and  $RS_{3+4}$ , separating from it only at the discoidal cell; CuA forming a very long and broad fork, but the apical portion of its upper branch is composed of  $M_{3+4}$  and  $CuA_1$  fused together. Long area behind

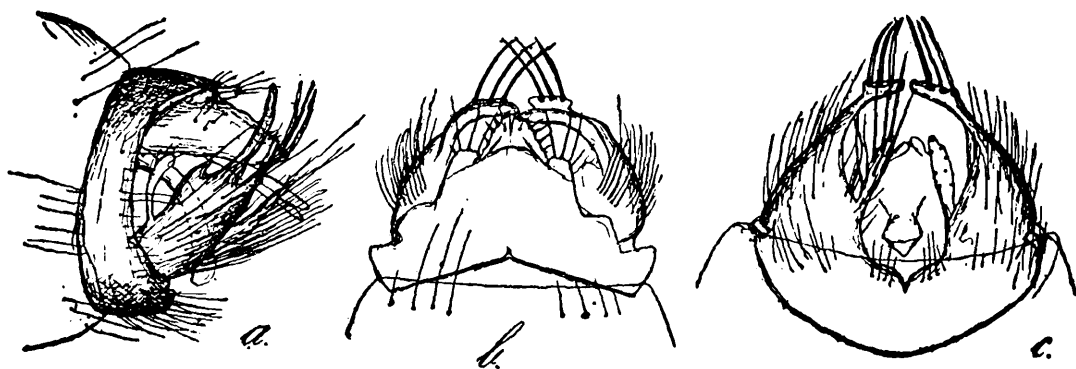


TEXT-FIG. 64, *a*, *b*.—*Paraphlegopteryx compositus*, sp. nov., ♂; (*a*) arrangement of scale in the hind wings; (*b*) four scales, more enlarged.

RS+M uniformly covered with numerous oval swollen scales, on its upper side bearing 5-6 costae, running parallel to one margin (fig. 64); at the base of wing there is anteriorly a short frenular spine.

♂. 9th segment with concave hind margins at sides; dorsal portion dilated, with somewhat gradate hind-lateral edges. 10th segment broad at base, if seen from side triangularly narrowing backwards; in its apical portion it is divided by a short cleft into two subtriangular lobes (above), bearing at sides a few acute spinules. At the base of 10th segment are seen two obtuse projections, bearing four long hairs; they probably represent preanal appendages. From under 10th tergite arise two long, pale, band-shaped appendages, probably belonging also to 10th segment. Pedes genitales composite, very thick at bases and almost

completely fused with 9th sternite. Seen from the side they are broad in the basal half, then divided into three processes of which the proximal



TEXT-FIG. 65, *a-c.*—*Paraphlegopteryx compositus*, sp. nov., ♂; genital appendages from side (*a*), from above (*b*) and from beneath (*c*).

one is short, the median long, digitiform and curved inwards; the distal process is a little shorter, slender, also curved inwards; it is thickened in its apical portion and bears behind three thick spines. From the basal part of pedes genitales arise two more processes, upper and lower; the upper is slender, directed upwards, covered with short thin hairs; inner lower process longer, thicker, and directed upwards and backwards; it bears long thick hairs. Penis slender, curved downwards.

Length of body 5 mm.

*Remarks.*—In this species the structure of the wing venation is evidently similar to that in *Paraphlegopteryx tonkinensis* Ulm. from Tonkin. I, therefore, refer it to this genus. *P. compositus*, sp. nov. differs from *P. tonkinensis* mainly in the more specialised venation of posterior wings; one-jointed maxillary palpi of ♂ are probably characteristic of the genus.

### **Indocrunoecia, gen. nov.**

Basal joint of antennae of ♂ not very long; basal joint of maxillary palpi long, directed upwards, bearing a tuft of long hairs; second joint very small or absent. Anterior wings broad, clothed with hairs and spinules (or elongated scales); DC elongated; forks 1, 2 and 3 present, CuA<sub>2</sub> lacking; CuP<sub>1</sub>, A<sub>1</sub> and A<sub>2</sub> approximated in the basal half. Posterior wings also bear black spinules, but the area between CuP and A<sub>1</sub> is densely clothed with minute scales; only fork 1 is present.

*Remarks.*—Allied to *Paraphlegopteryx* Ulm. but distinct.

*Genotype.*—*Indocrunoecia heterolepidia*, sp. nov.

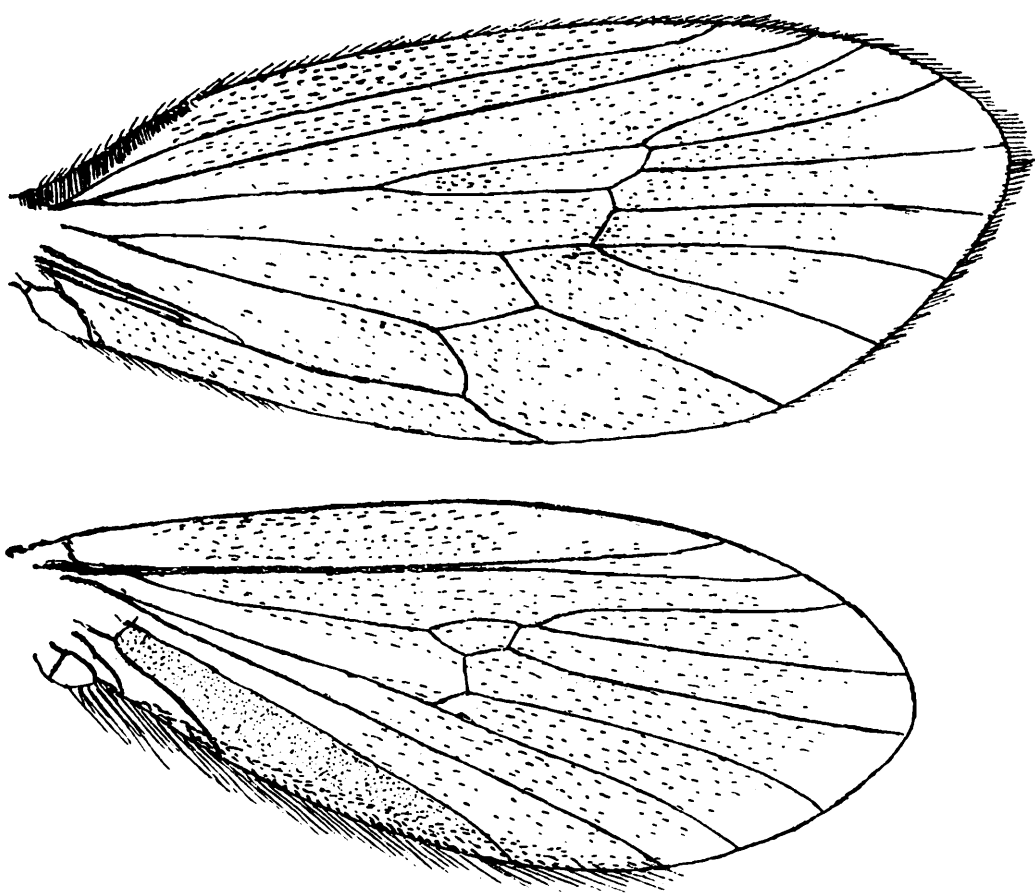
### **Indocrunoecia heterolepidia, sp. nov.**

(Text-figs. 66, 67.)

2 ♂, 2 ♀. Eastern Himalayas, Darjeeling district, C. Lynch (dry and in spirit).

Head and thorax brown; basal joint of ♂ antennae straight, as long as the diameter of the head with eyes, on the inner side and anteriorly

bearing dense brush of black hairs; thread paler, brownish. Basal joint of ♂ antennae long, ascendent, bearing on its inner side long black hairs; apical portion bears a long tuft of black hairs, directed backwards; 2nd joint imperceptible (probably very small); labial palpi somewhat shorter than the maxillary palpi, slender. Thorax brown, legs brownish. Anterior wings broad, egg-shaped, greyish yellow, with yellowish brown venation; membrane clothed with thin short yellowish pubescence and with small elongated black scales; costal vein in its basal part bearing brush of black hairs, turned backwards; venation somewhat resembling that of *Paraphlegopteryx* Ulm. but  $CuA_2$  absent, RS beginning at the very base of wing; 1st apical fork acute, but sessile; 3rd fork acute, beginning at the cross vein  $rs-m$ ;  $CuP$  not approximated to  $CuA$ , and close to it are situated a short groove (with  $A_1$ ?) and  $A_2$ , which is united at end with  $CuP$ .

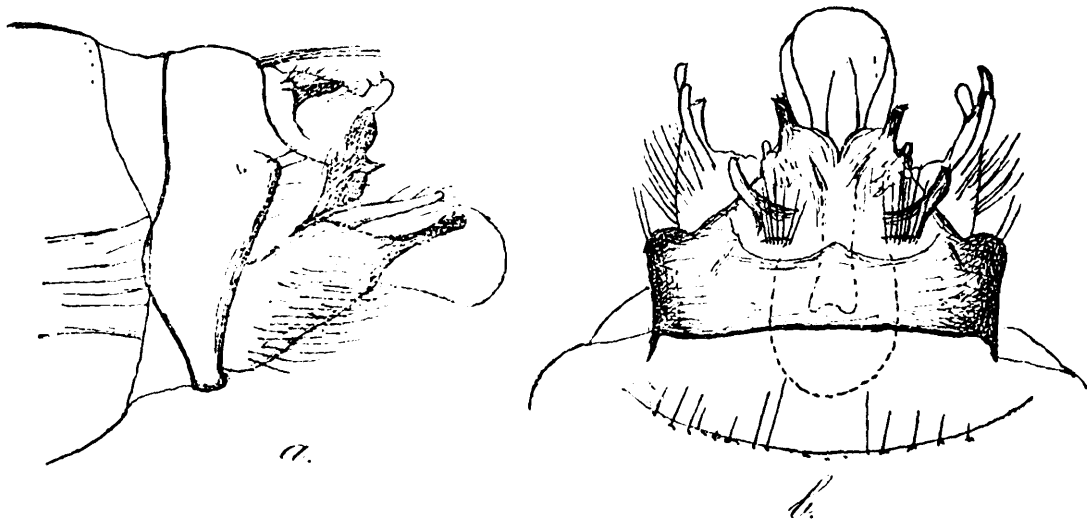


TEXT-FIG. 66.—*Indocrunoecia heterolepidia*, gen. et sp. nov., ♂; venation of wings.

Posterior wings broad, elliptic;  $SC+R$  partly united together, DC short, cross vein  $rs-m$  derived nearly from its middle;  $CuA$  simple, straight; area between  $CuP$  and  $A_1$  densely clothed with smaller, minute scales; the remaining part of wing clothed with elongated spinule-like scales, similar to those in the forewings. Abdomen brownish.

♂. 9th segment narrow in its ventral part, broader at sides. 10th segment short, but very broad, pale; seen from above it is very broad at base, narrowed behind; its apical portion with a median excision subdivided into two short lobes, bearing externally two short brown processes, which if seen from the side are rounded at their ends; at the

base of the segment there are, above, two dark stick-shaped processes, above the base of which are situated two short transverse ribs, bearing several bristles (preanal appendages?). Seen from the side 10th segment is broad, almost truncated at end and provided here with two



TEXT-FIG. 67, a, b.—*Indocrunoecia heterolepidia*, gen. et sp. nov., ♂; genital appendages from side (a) and from above (b).

more short conical processes. Pedes genitales broad from side, each ending in a dark process; above which is another similar pale stick-shaped process; internally there is a third small process; seen from beneath basal parts of the pedes genitales are very broad, bulbous. Penis very thick in its distal part, rounded at its end, pale.

♀. Basal joint of antennae shaped as in the male; maxillary palpi brownish; legs yellow. Venation of anterior wings resembling that of the male, but  $CuA_2$  present;  $CuP$ ,  $A_1$ ,  $A_2$ ,  $A_3$  present, of usual form; in posterior wings forks 1, 2 and 3 are present; discoidal cell short.

Length of body 5—5.6 mm.

*Remarks.*—*Indocrunoecia*, gen. nov. appears to be allied to the genus *Paraphlegopteryx* Ulm. and has some resemblance to it not only in the venation of forewings but also in the structure of the male genitalia. Pedes genitales are also very broad, with three processes at the end, as in *I. heterolepidia*, sp. nov., but the shape of the processes is different; 10th segment and penis are also different. I consider *I. heterolepidia* as belonging to a distinct genus.

### Goerodes Ulm.

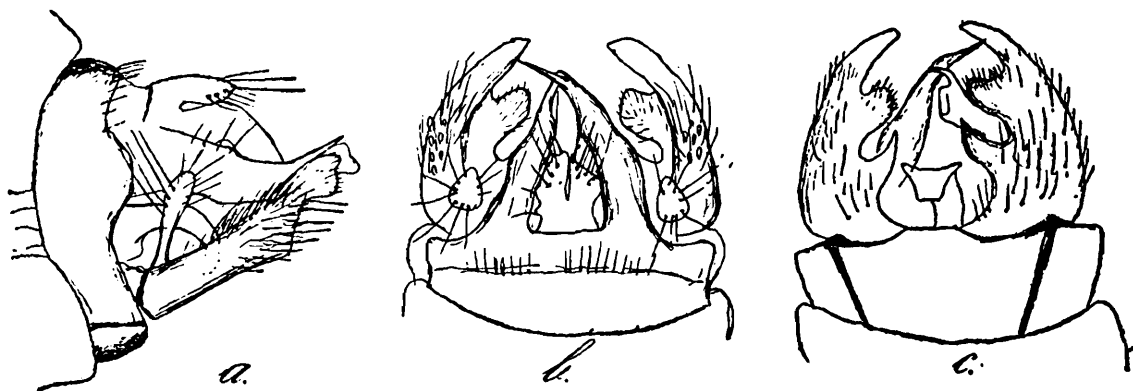
#### Goerodes piscina Hag.

(Text-fig. 68, a-c.)

♂. Ceylon, Pattipola (hill country), 6,000 ft. 13.x.11; N. Annandale (defective specimen, in spirit).

This species was described by Ulmer (*Deutsch. Ent. Zeitsch.* p. 68, figs. 45-47, 1915) from Pattipola, Ceylon. I have prepared three new

figures from this male specimen (text-fig. 68a-c). As can be seen from fig. 68b, the median plate of the 10th segment has in our specimen a



TEXT-FIG. 68, a-c.—*Goerodes piscina*, Hag., ♂; genital appendages from side (a), from above (b) and from beneath (c).

different shape. Nevertheless I do not think that it belongs to a distinct species.

#### Sub-family THREMMINAE.

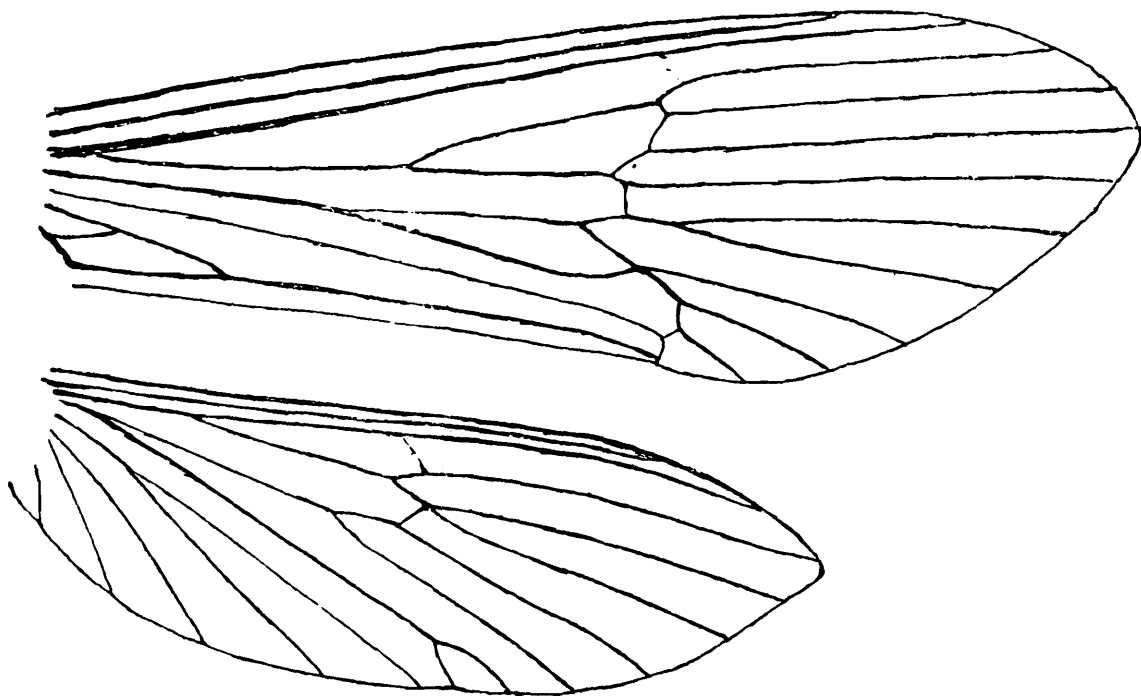
#### *Eothremma* Mart.

#### *Eothremma hindustana* sp. nov.

(Text-fig. 69.)

♀. Punjab, Punj-pul Nullah, about a couple of miles from Dalhousie, on Dalhousie-Bakloh Road, 6,500 ft., v.27; S. L. Hora.

Head blackish-brown, with distinct ocelli, behind which and the eyes are seen pale yellow stripes. Basal joint of antennae brownish, second very short, next two joints elongated, yellow.



TEXT-FIG. 69.—*Eothremma hindustana*, sp. nov., ♀; venation of wings.

Thorax dark-brown, portions of membrane uniting separate sclerites, pale; coxae brown, legs brownish yellow. Anterior wings

pale brownish, with brownish venation; venation resembling that of *Eothremma japonica* Mart., but discoidal and thyridial cells (text-fig. 69) are longer, fork 3 pedicellate, and CuA in its end portion is drawn towards  $M_3$ . In posterior wings M divides a little earlier than the division of RS, cross-vein rs-m longer, fork 5 is very short in *E. hindustana*, sp. nov.

Abdomen brown, but three posterior segments yellow above.

Length of body 5.5 mm.

*Remarks.*—Judging by the wing venation, *E. hindustana*, sp. nov. is evidently similar and allied to *E. japonica* Mart. from Japan. Thremminae is a relict subfamily with few genera and species; its representatives are very rare; therefore the discovery in N. India of the second species of *Eothremma* is very interesting; similar geographical distribution is met with in the genus *Limnacentropus* Ulm. (Phryganeidae).

## Family LIMNOPHILIDAE.

### **Phylostenax himalus** Mosely.

1935. *Phylostenax himalus*, Mosely, *Entomologist* LXVIII, p. 184 (Kumaon, Muktesar, 7,000 ft.).

2 ♂. Eastern Himalayas, Darjeeling district, C. Lynch.

These specimens were sent to Dr. Mosely who refers them to his new genus and species—*Phylostenax himalus* Mos. although he finds in them a slight variation.

I have before me also two females from Kalatope Hill, Dalhousie, Punjab (2.vi.27; S. L. Hora), which in wing venation and colouring closely resemble the above named males. I am inclined now to refer them also to *Ph. himalus* Mos. The formula of spurs in these females is 1.2.2. Although in his paper Dr. Mosely says (*l. c.* p. 184) that he is “unable to make out the spurs, as the legs . . . are much broken”, nevertheless in another letter he gives the formula of spurs as 1.2.2. If so, this coincides with the formula of spurs in two females from the Punjab, and I have, therefore, little doubt that these females belong to Mosely's species.

The structure of the male genital appendages in *Phylostenax himalus* is very similar to that of *Pseudostenophylax fumosus* Mart. Therefore, *Ph. himalus* may be considered as a species allied to the latter, although it differs in the formula of the spurs. As to the absence of scales in the posterior wings, I would add that the condition in the jugal and in inner portions of anal regions is rather different; in some species (*Ps. fumosus*) there is an area with scales, in others instead of scales there is a pouch (in jugal portion) with long thin hairs, and there exist species (*Ps. secretus* Mart.) in which such a pouch is lacking. In *Ph. himalus* there is a shallow pouch or concavity on the jugal portion, and it bears elongated hairs. Thus, as regards this character, there is no distinct difference between the genus *Phylostenax* Mos. and the genus *Pseudostenophylax*, and the only difference is in the formula of spurs.

**Pseudostenophylax** sp.

♀ Sikkim. Captain Dracott ; 1915.

This is a large, dark specimen. Anterior wings dark brownish, sprinkled with numerous pale rounded irrorations ; formula of spurs 1. 3. 4.

**Stenophylina** Mosely (1935, in litt.).

As the result of my examination of the specimen under description I came to the conclusion that it is representative of a new genus and species, allied to *Pseudostenophylax* Mart. and to *Drusus* Steph. I sent my figures to Dr. Mosely, who was studying at the time Indian Limnophilidae, and he wrote to me that he has described the same form under the name *Stenophylina mitchelli* Mosely and that his paper is in the press. I retain Mosely's names, but not having seen his description and figures, I give here my own description of the genus and the species :

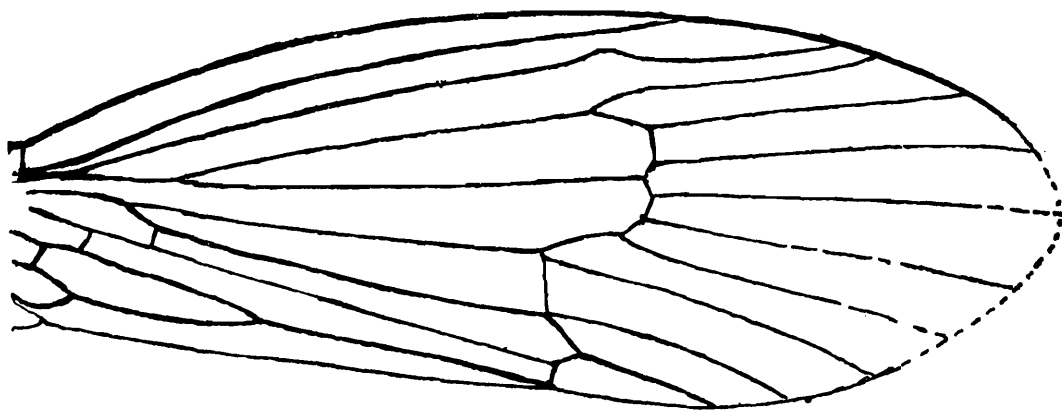
Resembling and allied to *Pseudostenophylax* Mart. and *Pseudohalesus* Mart. General form, as in these genera ; spurs 1.3.4. Anterior wings with strongly convex costal margin, without any basal folds ; in ♂ posterior wings jugal region (between  $A_3$  and inner edge of wing) much dilated and elongated, with inner margin straight and thickened, bearing short, curved hairs. Male genital appendages shaped as in *Drusus* Steph. and *Pseudohalesus* Mart.

**Stenophylina mitchelli** Mosely.

(Text-figs. 70-72.)

♂. North-Western Himalayas, Kashmir Valley, 5,000-6,000 ft., vi.13 ; F. Smith.

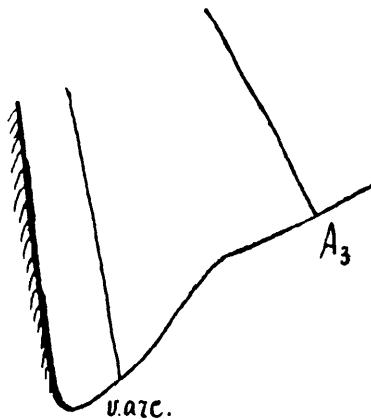
Head reddish yellow, antennae yellow, basal joint somewhat reddish ; thorax dark reddish yellow above, median stripe paler ; sides of the thorax pale brownish yellow ; legs yellow, spines black, spurs reddish, 1.3.4 ; last tarsal joint without spinules. Anterior wings greyish yellow somewhat darker and more ochraceous in the anterior portion, with dusky, greyish pterostigma ; spots lacking ; costal margin strongly



TEXT-FIG. 70.—*Stenophylina mitchelli* Mosely, ♂ ; forewing.

convex, arcuate ; discoidal cell very long, 1st apical cell a little impinging on it. Posterior wings pale greyish, with broad, large ano-jugal

portion; costal vein bearing series of long outstanding but slender hairs; discoidal cell not very long; jugal region broad and elongated,

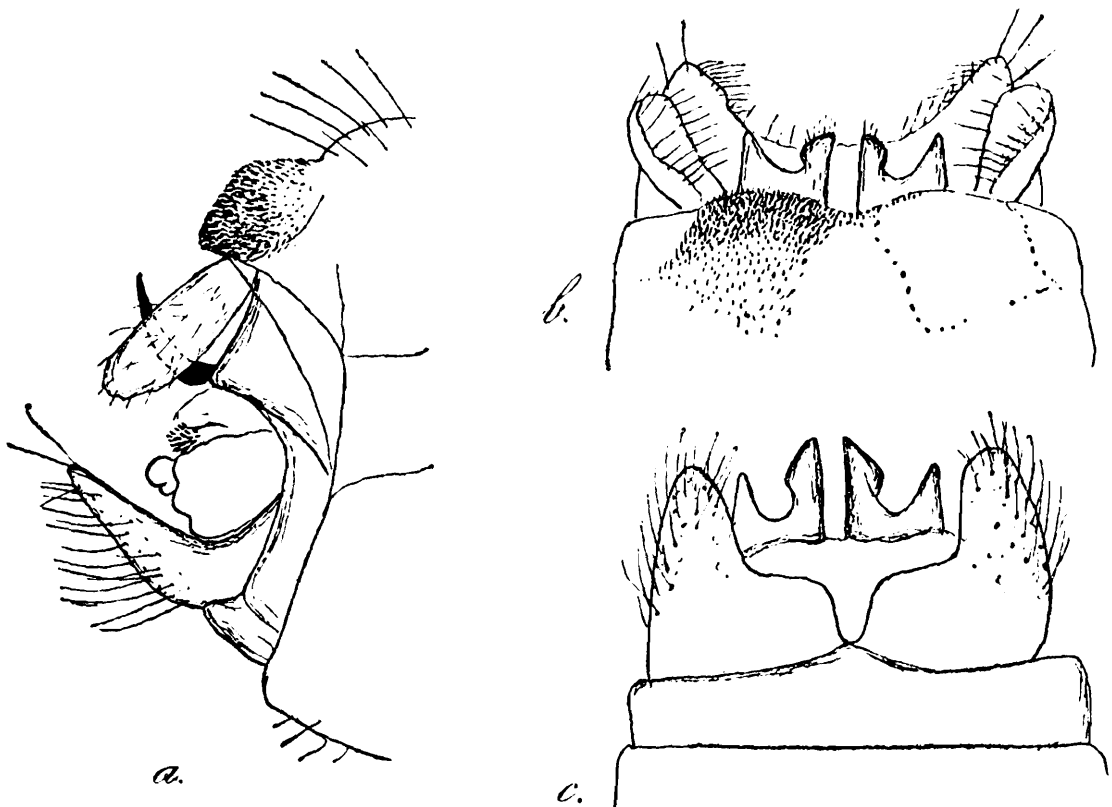


TEXT-FIG. 71.—*Stenophylina mitchelli* Mosely, ♂; inner posterior portion of the hind wing.

forming a distinct projection backwards<sup>1</sup>; its inner margin thickened and armed with series of short curved hairs; scales lacking.

Abdomen yellowish.

♂. 8th tergite covered behind with small black spinules, forming two blackish spots, connected behind with a slender stripe of spinules. 9th segment concave behind if seen from the side, but with a triangular projection above; preanal appendages elongated, pale, directed somewhat



TEXT-FIG. 72, a-c.—*Stenophylina mitchelli* Mosely, ♂; genital appendages from side (a), from above (b) and from beneath (c).

downwards, concave internally if seen from above. 10th segment represented with two short black plates, with rounded excisions each divided

<sup>1</sup> This projection resembles that in *Odontocerum albicorne* Scop.

into two processes, inner of which is longer and curved upwards, sickle-shaped from side; pedes genitales broad in the basal, twice narrower, tongue-shaped in the distal portion, which is separated from the basal by an angular excision of the inner edge; penis and titillators not exerted; end portion of penis thick, with irregular hindmargin.

Length of body 11.5 mm.

*Remarks.*—This species belongs, doubtless, to the group of *Pseudostenophylax-Drusus*, but differs mainly in the shape of posterior wings, in the somewhat coriaceous condition of anterior wings and in the absence of any spots on them.

### **Apatelina** gen. nov.

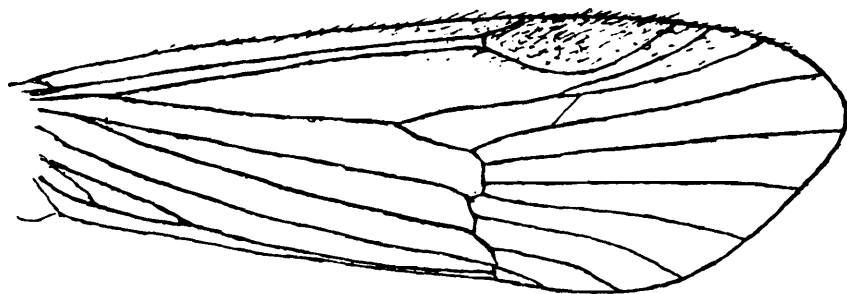
Allied to *Apatelia* Wall and *Apatania* Kol., but differing in the venation of anterior wings; pterostigma large, distinct, but subcosta ending on costa as in *Chilostigma* McLach., *Glyphopsyche* Bks. and allied forms; discoidal cell elongated, but shorter than its pedicel, closed with very oblique cross-vein; 2nd apical fork deeply impinging on DC, beyond its middle; 3rd apical fork broad at its base, sessile; 5th apical fork short.

### **Apatelina incerta** sp. nov.

(Text-fig. 73.)

♂. Defective specimen (without abdomen and hind wings; legs broken); India (exact locality not known).

Head brown, with brown hairs; antennae brown, with yellow annulations; maxillary palpi brown, third joint equal to the second, first joint very short; labial palpi short. Thorax brown above, somewhat paler at sides, anterior and median legs brownish; spurs 1.2 (posterior legs set off). Anterior wings greyish brown, clothed with brown pubescence; pterostigma darker; 1st apical fork acute at base, slightly



TEXT-FIG. 73.—*Apatelina incerta*, gen. et sp. nov., ♂; anterior wing.

impinging on DC;  $RS_4$  originating from  $RS_{3+4}$  at the base of 2nd third of the length of DC, nearly transverse at base; cross-vein  $rs-m$  and base of 3rd fork forming almost a transverse line; cubital fork short.

*Remarks.*—Judged by the venation of fore wings this species appears to be allied to and probably belongs to the subfamily Apataniinae, but it differs from the other genera, mainly in the shape of the discoidal cell. Posterior wings unfortunately not preserved.

*List of Trichoptera-Integripalpia from Continental India.*

Family CALAMOCERATIDAE.

- Ganonema brunneum* (Ulmer) Betten, *Rec. Ind. Mus.* III, p. 238 (1909)—Assam; other localities: Sumatra; Malay Peninsula.
- Ganonema salsum*, Betten, *Rec. Ind. Mus.* III, p. 238 (1909)—Upper Assam; also *antea*, p. 239—Darjeeling; Kumaon Hills; Assam-Bhutan Frontier; Gular.
- Ganonema longipenne*, Martynov, *Proc. Zool. Soc. London*, 1930, p. 85—Assam.
- Asotocerus fuscipennis* (Albarda) Betten, *Rec. Ind. Mus.* III, p. 239 (1909)—Kulu, W Himalayas; also *antea*, p. 241—Kumaon Hills; near Inlé Lake, Yawngnwe State; Palni Hills; other localities: Sumatra; Java; Annam; Malay Peninsula.
- Asotocerus flexuosus*, sp. nov., *antea*, p. 241—N. Kanara district.
- Asotocerus sinuatus*, sp. nov., *antea*, p. 243—Nilgiri Hills.
- Anisocentropus longulus*, Navas, *Ins. Orient. Mem. Pont. Accad. Rome*, (2) XVII, p. 105 (1933)—Burma.
- Anisocentropus kempi*, sp. nov., *antea*, p. 245—Castle Rock, N. Kanara district.

Family ODONTOCERIDAE.

- Marilia* sp., Betten, *Rec. Ind. Mus.* III, p. 239 (1909)—Bhim Tal, Kumaon.

Family MOLANNIDAE.

- Molanna* sp., *antea*, p. 249—Kanara district, Bombay Presidency.

Family LEPTOCERIDAE.

- Notanatolica magna* (Walker) Betten, *Rec. Ind. Mus.* III, p. 239 (1909)—Calcutta; also *antea*, p. 250—Calcutta; Chota Nagpur; Purneah district; Balighai, near Puri.
- Leptocerus marginatus*, Banks, *Proc. Ent. Soc. Washington* XIII, p. 105 (1911)—Pusa, Bihar.
- Leptocerus* (?) *indicus*, Walker, *Catal. Neuropt. Brit. Mus.* p. 72 (1852)—Bengal.
- Leptocerus distinguendus*, sp. nov., *antea*, p. 251—Rewa State (opposite the camp at Harra).
- Leptocerus forcipatus*, sp. nov., *antea*, p. 253—Rewa State (*ibid*).
- Parasetodes bakeri*, Banks, *antea*, p. 254—River Ganges, between Sakrigali and Manihari; Upper Burma; Pusa and Siripur, Bihar.
- Setodes postica*, Banks, *Proc. Ent. Soc. Washington* XIV, p. 104 (1911)—Bombay; Chapra, Bihar.
- Setodes lineata*, Banks, *Trans. Amer. Ent. Soc.* XXXIX, p. 237—Chapra, Bihar.

- Setodes argentifera*, McLachlan, *Journ. Linn. Soc. London* (Zoology), XI, 2nd Pt., p. 129 (1873)—India Septentrionalis; Betten, *Rec. Ind. Mus.* III, p. 240 (1909); also *antea*, p. 259—Pusa and Mokameh, Bihar.
- Setodes furcata*, Navas, *Rev. Acad. Cien. Zarag.* p. 37 (1932)—Khandala, Bombay.
- Setodes viridella*, Navas, *ibid.*, p. 38—Khandala, Bombay.
- Setodes inlensis*, sp. nov., *antea*, p. 254—Inlé Lake, Yawngghwe State; Balighai, near Puri; Bubak, Sind.
- Setodes unispina*, sp. nov., *antea*, p. 257—Purulia and Chakradharpur, Chota Nagpur.
- Setodes bimaculata*, sp. nov., *antea*, p. 261—Katihar, Purneah district, Bihar.
- Setodes tenuifalcata*, sp. nov., *antea*, p. 259—Sanjai River, Chota Nagpur.
- Setodes sternalis*, sp. nov., *antea*, p. 262—Rewa State (opposite the camp at Harra).
- Episetodes angustipennis*, gen. et sp. nov., *antea*, p. 265—Below Pharisemar, Rewa State.
- Trichosetodes composita*, sp. nov., *antea*, p. 263—Sanjai River, Chota Nagpur.
- Leptocella maculata*, Banks, *Proc. Ent. Soc. Washington* XIII, p. 104 (1911)—Pusa, Bihar.
- Oecetis bengalica*, sp. nov., *antea*, p. 266—Katihar, Purneah district, Bihar.
- Oecetis scutulata*, sp. nov., *antea*, p. 268—Rewa State (opposite the camp at Harra).
- Oecetis biramosa*, sp. nov., *antea*, p. 269—Balighai, near Puri, Orissa.
- Oecetis* sp. 1 (*jacobsoni* Ulm. ?), *antea*, p. 270—Lonton, W. shore of Indawgyi Lake, U. Burma.
- Oecetis* sp. 2, *antea*, p. 270—Kierpur, Purneah district.
- Oecetis* sp. 3, *antea*, p. 271—Calcutta.
- Oecetis* (*Oecetina*) *insignis*, Banks, *Proc. Ent. Soc. Washington* XIII, p. 104 (1911)—Bombay.
- Oecetis* (*Oecetina*) *pretiosa*, Banks, *Trans. Amer. Ent. Soc.* XXXIX, p. 237 (1913)—Chapra, Bihar.
- Oecetis punctulata*, Navas, *Rev. Acad. Cien. Zarag.* 4 ser., 14, p. 35 (1932)—Khandala, Bombay.
- Oecetis rufescens*, Navas, *ibid.*, p. 36—Khandala, Bombay.
- Setodellina indivisa*, sp. nov., *antea*, p. 272—Indawgyi Lake, U. Burma.
- Setodellina tenuis*, sp. nov., *antea*, p. 273—Rewa State (opposite the camp at Harra).
- Setodellina angustipennis*, sp. nov., *antea*, p. 274—Mokameh, Bihar.
- Setodellina mahadeva*, (Banks).—Chapra, Bihar; also *antea*, p. 276—Siripur and Purneah district, Bihar; near Indawgyi Lake, U. Burma.
- Triaenodes indica*, sp. nov., *antea*, p. 278—Kodaikanal, Palni Hills.

*Adicella biramosa*, sp. nov., *antea*, p. 279—Shillong, Assam.

*Mystacides indica*, sp. nov., *antea*, p. 280—Malwa Tal, Kumaon, W. Himalayas.

#### Family SERICOSTOMATIDAE.

*Goera relictata*, Betten, *Rec. Ind. Mus.* III, p. 240 (1909)—India (exact locality not known).

*Goera nigricornis*, Navas, *Rev. Acad. Cien. Zarag.* p. 39 (1932)—Khandala, Bombay.

*Goerodes* sp., Betten, *Rec. Ind. Mus.* III, p. 241 (1909)—Upper Assam.

*Dinarthrum ferox*, McLachlan, *Journ. Linn. Soc. London* (Zoology), XI, p. 118 (1873)—N. India.

*Dinarthrum* (*Indodinarthrum*) *punjabicum*, sp. nov., *antea*, p. 282—Punj-pul Nullah, Punjab.

*Dinarthrum* (*Indodinarthrum*) *latum*, sp. nov., *antea*, p. 283—Punj-pul Nullah, Punjab.

*Dinarthrodes inequalis*, sp. nov., *antea*, p. 284—Kumaon Hills.

*Dinarthrodes armata*, Ulmer, *Ann. Naturhist. Mus. Wien*, p. 69 (1905)—Assam.

*Dinarthrella betteni*, sp. nov., *antea*, p. 286—Darjeeling and Kurseong, E. Himalayas.

*Dinarthrella* (*Maniconeura*) *destructa*, Ulmer, *Notes Leyden Mus.* XXVIII, p. 28 (1906)—Darjeeling.

*Maniconeura indica*, sp. nov., *antea*, p. 289—Castle Rock, N. Kanara district.

*Paraphlegopteryx compositus*, sp. nov., *antea*, p. 291—Darjeeling district.

*Indocrunoecia heterolepidia*, gen. et. sp. nov., *antea*, p. 293—Darjeeling district.

*Ignasala fuscata*, Navas, *Rev. Acad. Cien. Zarag.* p. 40 (1932)—Khandala, Bombay.

*Eothremma hindustana*, sp. nov., *antea*, p. 296—Punj-pul Nullah, Punjab.

#### Family PHRYGANEIDAE.

*Eubasilissa* (Syn. *Neuronia*, *Holostomis*, *Regina*) *mclachlani* White, *Proc. Ent. Soc. London*, p. 26 (1861); McLachlan, *Trans. Ent. Soc. London* (3) V, p. 249 (1865-67)—India orientalis; Betten, *Rec. Ind. Mus.* III, p. 242 (1909)—Kulu; Darjeeling; Shillong, Assam; Martynov, *Proc. Zool. Soc. London*, p. 87 (1930)—Shillong, Assam; Darjeeling; Mosely, *Journ. Bombay Nat. Hist. Soc.* XXXVIII, p. 126 (1935)—same localities.

*Eubasilissa* (Syn. *Neuronia*, *Holostomis*, *Regina*) *regina* McLach. *Journ. Linn. Soc. London* (Zoology) XI, p. 103 (1873) (*Holostomus mclachlani*, var. *regina* McLach.); Ulmer, *Deutsch. Ent. Zeitsch.* III, pp. 339-340 (1908)—Kulu;

- Martynov, *Proc. Zool. Soc. London*, pp. 88, 111 (1930);  
 Mosely, *Journ. Bombay Nat. Hist. Soc.* XXXVIII, p. 125  
 (1935)—Kulu.
- Eubasilissa tibetana*, Martynov, *Proc. Zool. Soc. London*, p. 88  
 (1930)—Sikkim; Yatung; Mosely, *Journ. Bombay Nat.  
 Hist. Soc.* XXXVIII, p. 127 (1935)—Sikkim; Tibet.
- Oopterygia brunnea*, Martynov, *Proc. Zool. Soc. London*, p. 89  
 (1930)—Yatung; Mosely, *op. cit.*, p. 128—Yatung.
- Oopterygia asiatica*, Betten, *Rec. Ind. Mus.* III, p. 242 (1909)—  
 Sibsagar, Assam; Mosely, *op. cit.*, p. 128—same locality.
- Oopterygia minor*, Mosely, *Journ. Bombay Nat. Hist. Soc.*  
 XXXVIII, p. 128 (1935)—N. E. Burma, Kambaiti.
- Neurocyta arenata*, Navas, *Mem. Acad. Cienc. Art. Barc.* XII,  
 N. 13, pp. 240, 241 (1916); Mosely, *op. cit.*, p. 129—Dar-  
 jeeling.
- Agrypnia picta* (Kol.) *tibetana*, Martynov, *Proc. Zool. Soc. London*,  
 p. 91 (1930)—Tibet; Mosely, *op. cit.*, p. 130—Tibet  
 (probably occurs in N. Himalayas).
- Limnocentropus insolitus* (Ulmer) *himalayanus*, Martynov, *Proc.*  
*Zool. Soc. London*, p. 91 (1930)—Sikkim; Tsung-tang;  
 Mosely, *op. cit.*, p. 132—same locality.
- Limnocentropus fletcheri*, Mosely, *Journ. Bombay Nat. Hist. Soc.*  
 XXXVIII, p. 132 (1935)—Sikkim.

#### Family LIMNOPHILIDAE.

- Pseudostenophylax himalayanus*, Martynov, *Proc. Zool. Soc.*  
*London*, p. 92 (1930)—Tibet, Yatung; Sikkim, Khamba  
 Jong.
- Pseudostenophylax griseolus*, Martynov, *Proc. Zool. Soc. London*,  
 p. 97 (1930)—Sikkim, Khamba Jong.
- Phylostenax himalus*, Mosely, *Entomologist*, LXVIII, p. 184 (1935)  
 —Kumaon, Muktesar; also *antea*, p. 297—Darjeeling.
- Pseudostenophylax* sp., *antea*, p. 298—Sikkim.
- Stenophylina mitchelli*, Mosely, *antea*, p. 298—Kashmir.
- Halesinus albipunctatus*, Martynov, *Proc. Zool. Soc. London*, p. 98  
 (1930)—Tibet, Yatung.
- Platyphylax rufescens*, Martynov, *ibid.*, p. 105—Tibet, Yatung.
- Apatelina incerta*, gen. et. sp. nov., *antea*, p. 300—India.

Dr. M. Mosely has kindly informed me that he is describing several new Limnophilidae from India and that his paper is now in the press (12.xi.35).

#### SUPPLEMENT.

Addenda and Corrigenda to the 1st part.

#### 1. DESCRIPTION OF A NEW SPECIES OF RHYACOPHILIDAE.

##### **Allagapetus**, gen. nov.

In the anterior wings discoidal cell long, with but a short pedicel.

♂. 10th segment short, subdivided into paired lobes in its distal part; pedes genitales very long, with distal portions suddenly curved inwards (2nd joint); longer proximal parts bearing internally series of short spines.

Closely allied to *Agapetus* Court., but distinct. To it I refer two species—*Allagapetus* (*Agapetus*) *cocandicus* McLach. and *Allagapetus punjabicus*, sp. nov.

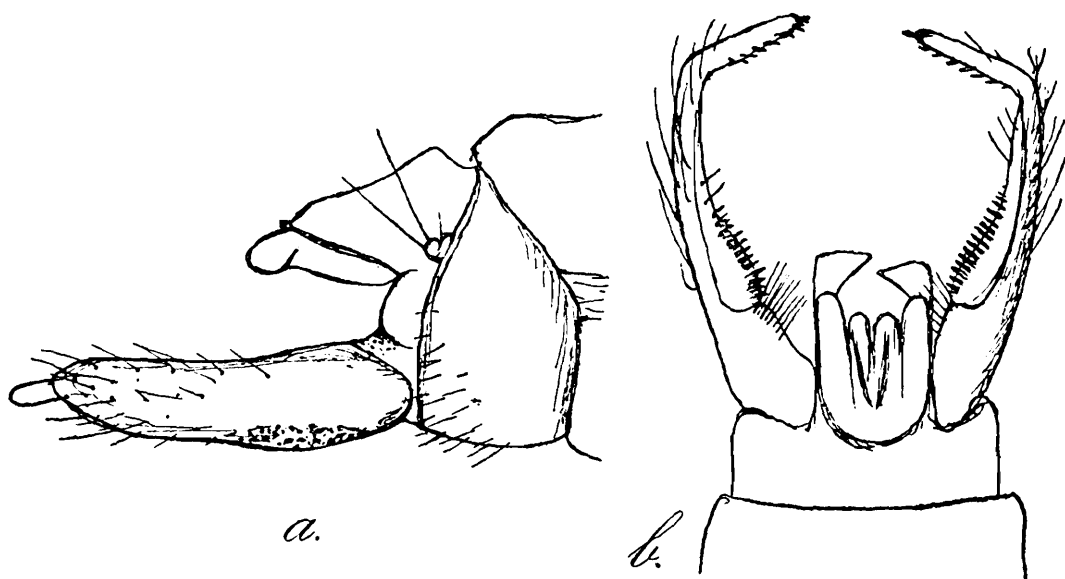
***Allagapetus punjabicus*, sp. nov.**

(Text-fig. 74, a-b.)

♂. Punjab, Punj-pul Nullah, about a couple of miles from Dalhousie, on Dalhousie-Bakloh Road, 6,500 ft., v. 27; S. L. Hora.

Head and thorax brown; side of thorax brownish, legs yellowish. Anterior wings pale greyish yellow; venation much resembling that in *Allagapetus cocandicus* McLach.; venation of posterior wings also resembling that in this species.

♂. 10th segment broad from side, narrowing backwards, short; seen from above it is subdivided into four lobes; behind and beneath from the outer lobes are situated two short pale projections, rounded from side, triangular from above. Preanal appendages very small, bearing but 2-3 long hairs. Pedes genitales long, band-shaped from side, each ending in a short slender appendage; seen from above they are more slender but dilated in their basal portion, which is armed internally with dense series of minute spinules; distal portion curved inwards and



TEXT-FIG. 74, a, b.—*Allagapetus punjabicus*, sp. nov., ♂; genital appendages from side (a) and from above (b).

also armed internally with several spinules; seen from the side it is more slender than the basal part; it represents the second joint, coalesced with the first; penis not exerted.

*Remarks.*—This species is evidently allied to *A. cocandicus* McLach. from Turkestan. Since these two species differ from *Agapetus* Curt. in

the venation of the fore wings and in the structure of the pedes genitales, they may be considered as representing a separate genus allied to *Agapetus*.

2. Some specific names in Part I proved to be *nomina praeoccupata* and have to be changed ; I propose to change *Rhyacophila pallida* (p. 100) into *Rh. horai*, nom. nov., *Oxyethira angustella* (p. 112) into *Ox. ramosa*, nom. nov., *Hydropsyche obscura* (p. 171) into *H. lobulata*, nom. nov. and *Hydropsyche tenuicornis* (p. 173) into *H. sagittata*, nom. nov. Moreover, it should be noted that *Cheumatopsyche processuata* Mart. is incorrectly referred to *Hydropsyche* (p. 175) ; it is indeed a species of *Cheumatopsyche*.

3. To my list of Trichoptera-Annulipalpia from Continental India have to be added 6 species, as follows :—

- i. *Stenopsyche pallidipennis*, Martynov, *Eos*, II, p. 297, figs. 22-24 (1926)—N. E. Assam.
- ii. *Stenopsyche himalayana*, Martynov, *Eos*, II, p. 298, figs. 25-27—N. E. Assam ; Baltistan.
- iii. *Dipseudopsis buddha*, Banks, *Trans. Amer. Ent. Soc.* XXXIX, p. 239 (1913)—Chapra and Pusa, Bihar.
- iv. *Nyctiophylax abrupta*, Banks, *Ibid.* p. 240—Chapra, Bihar.
- v. *Arctopsyche composita*, Martynov, *Proc. Zool. Soc. London*, p. 75, figs. 17-19 (1930)—Sikkim.
- vi. *Allagapetus punjabicus*, gen. et. sp. nov., *antea*, p. 305—Punj-pul Nullah, Punjab.

PHYLLACANTHUS FORCIPULATUS, SP.NOV., A NEW CIDARID  
FROM THE INDIAN OCEAN.

By TH. MORTENSEN, *Copenhagen.*

(Plates X-XII.)

Some years ago I received from the Zoological Survey of India, Indian Museum, Calcutta, a number of unidentified Echinoids, which had, evidently, not been in the hands of Koehler, when he was writing his famous reports on the Echinoderms of the "Investigator." Most of these unidentified specimens proved to be common, well known forms of no special interest. But among them was a Cidarid of the genus *Phyllacanthus* which looked rather peculiar and appeared to represent a new species. As it was apparently not fully adult, I put it aside in the hope that more material would turn up some day,—particularly I hoped that the "Murray" Expedition would succeed in collecting specimens of this form during its investigations in the Indian Ocean.

Although the said Expedition brought home several new forms of Cidarids, the above mentioned species is not represented in its collections. Fortunately, however, a collection of Echinoids sent me by Dr. B. Sundara Raj, Director of the Madras Fisheries, contained a couple of adult specimens of the said new Cidarid, so that it can now be duly described.

Dr. B. Prashad, Director, Zoological Survey of India, has suggested that the specimen from the Indian Museum, as the first one found, should be regarded as the type of the new species. Although, as remarked above, it is not fully adult, it is a very fine specimen (Pl. X, fig. 1), and I, therefore, accept Dr. Prashad's suggestion in designating this specimen as the type of the new species, which I describe below under the name *Phyllacanthus forcipulatus*, sp. nov.

Together with the as yet unpublished new Cidarids from the "Murray" Expedition, this new *Phyllacanthus* represents a very noteworthy addition to the rich Cidarid fauna of the Indian Ocean—a fauna so rich, indeed, that it can almost match with that of the richest region in the world, the Malay Archipelago. Moreover, the fact that such a notable new form could be found in the comparatively well known Bay of Bengal makes it rather safe to prophesy that further investigations, particularly in the little known Eastern and Southern regions of the Indian Ocean, will bring still more new forms to light.

| Serial No. | Horizontal diameter. | Vertical diameter. | Apical system.     | Peristome.          | Number of plates. |               | Longest spines. |
|------------|----------------------|--------------------|--------------------|---------------------|-------------------|---------------|-----------------|
|            |                      |                    |                    |                     | I. A.             | A. pro. I. A. |                 |
| 1.         | 58 mm.               | 36 mm.             | 23 mm. (38% h.d.). | 24 mm. (41% h.d.).  | 7—8               | 17—18         | 80 mm.          |
| 2.         | 27.5 mm.             | 16 mm.             | 11 mm. (40% h.d.). | 13 mm. (47% h.d.).  | (5)—6             | 12—14         | 55 mm.          |
| 3.         | 13 mm.               | 7 mm.              | 6 mm. (46% h.d.).  | 6.5 mm. (50% h.d.). | (4)—5             | 10—12         | 22 mm.          |

Specimen 2 of the above table is the type-specimen, which belongs to the collection of the Indian Museum, Calcutta ; the two other specimens are deposited in the Zoological Museum, Copenhagen.

*Test.*—Flattened above, but not below ; sides beautifully arched, circumference round.

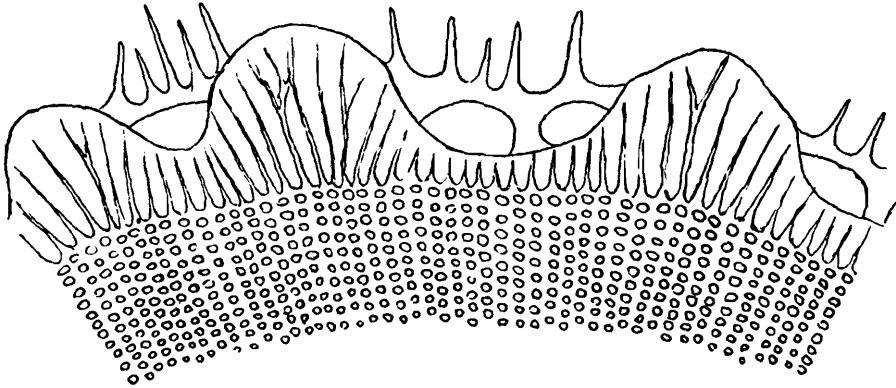
*Ambulacra.*—Rather conspicuously sinuate, only about  $\frac{1}{5}$  the width of the interambulacra. Interporiferous zone slightly broader than a pore-zone. Marginal series of tubercles perfectly regular, the tubercles contiguous ; the mamelon not very distinct, but clearly excentric. Adradially to the marginal tubercle each plate carries one somewhat smaller, not distinctly mamelonate tubercle, placed about in the middle of the plate, these inner tubercles forming regular series ; in the largest specimen there may also be some smaller tubercles on some of the plates at the ambitus. In any case the interporiferous zone is completely filled up by the secondary tubercles, there being no naked or sunken line. The pores, as is usual in *Phyllacanthus*, conjugate, but have the upper part of the wall is raised ; and the ridge is low and rounded (Pl. XII, fig. 1).

*Interambulacra.*—Areoles large, not deepened, all well separated, at most the two lowermost ones may be confluent ; they are all, except the two or three upper ones, markedly transverse-oval. The scrobicular tubercles are of the form typical of *Phyllacanthus*, with a raised inner part (cf. fig. 160, p. 501 of my *Monograph of the Echinoidea*, I). The median space is narrow, ca  $\frac{1}{2}$  the width of an areole, wholly covered by the secondary tubercles, which decrease rather abruptly in size from the scrobicular circle towards the sunken, but not naked, median line. Also on the adradial side of the scrobicular circle there is room for a few secondary tubercles.

*Apical system.*—About 40 per cent of the horizontal diameter in the adult, somewhat more in the younger specimens. The ocular plates are all exserted ; the madreporite scarcely enlarged, not elevated. The whole apical system closely covered by a uniform tuberculation (Pl. XII, fig. 2). *Peristome*, as usual in the genus *Phyllacanthus*, larger than the apical system, slightly rising towards the mouth. The pores distinctly biseriate, ca. 21-22 in each ambulacral half. Interradial plates, in the adult, ca. 8 in a regular series, not reaching the mouth edge.

*Primary spines.*—Rather long, up to twice the horizontal diameter. They are slender, cylindrical, scarcely at all tapering, only slightly thicker in the basal part in the adult, in the young rather a little club-shaped. There are ca. 12 low, rounded-serrate ridges, which become slightly more prominent towards the end of the spine, forming a small, inconspicuous terminal crown. The space between the ridges covered by a coat of low, coarse, anastomosing hairs (cf. text-fig. on p. 309). The characteristic arrangement in bundles of the radiating septa (cf. fig. 162, p. 502, of my *Monograph of the Echinoidea*, I) is seen very distinctly in sections. The neck is very short and inconspicuous, the collar ca. 3 mm. long, increasing somewhat in thickness towards the very inconspicuous milled ring. The oral primaries are rather slender, not club-shaped, distinctly longi-tudinally ridged. The 2nd and 3rd form a very gradual transition to the ambital spines.

*Secondary spines.*—The scrobicular spines are *ca.* 6-7 mm. long, rather tightly appressed, flat, smooth, slightly narrowing towards the end,



Part of transverse section of primary spine of *Phyllacanthus forcipulatus*, sp. nov.  
×45.

which is somewhat rounded. Marginal ambulacral spines slender, flattened, *ca.* 3 mm. long in the large specimen, not narrowing towards the rounded point. The smaller secondary spines scale-like, appressed; those around the anal opening slightly larger.

*Pedicellariae.*—The large globiferous form found only in the young specimen; they are small, but of the typical form, without end tooth; the stalk is slender, with a few small thorns at the upper end (Pl. XII, figs. 3, 4). The small globiferous pedicellariae of the type usual in *Phyllacanthus*; they are most of them very small, but larger samples occur, which form a transition to the tridentate pedicellariae (Pl. XII, figs. 6-8). A form with shorter but broader valves occurs on the peristome (Pl. XII, fig. 5). The tridentate pedicellariae are rather extraordinarily developed, the length of head up to *ca.* 5 mm.; the valves are very slender (Pl. XII, figs. 9, 10), with the blade filled up by longitudinal, finely serrate low crests. Tridentate pedicellariae, though not of the largest size, also occur on the peristome, which is very unusual.

*Spicules.*—Of the usual form, irregular, thorny rods.

*Colour.*—The test, as covered with its spines, is a light brownish, in specimen 2 with a tinge of pink on the scrobicular spines. The primary spines are brown, with a whitish band near the tip. The ridges of the shaft are somewhat darker, which makes them the more conspicuous. The denuded test is white.

*Remarks.*—That this is a very distinct species is beyond doubt. From *Ph. imperialis*, the only other species known to occur in the Indian Ocean, as well as from all the other known species, it is distinguished at a glance by its primary spines, which are much more slender, not nearly as smooth, and have much fewer ridges. Also the tridentate pedicellariae distinguish it markedly from the other species.

EXPLANATION OF PLATE X.

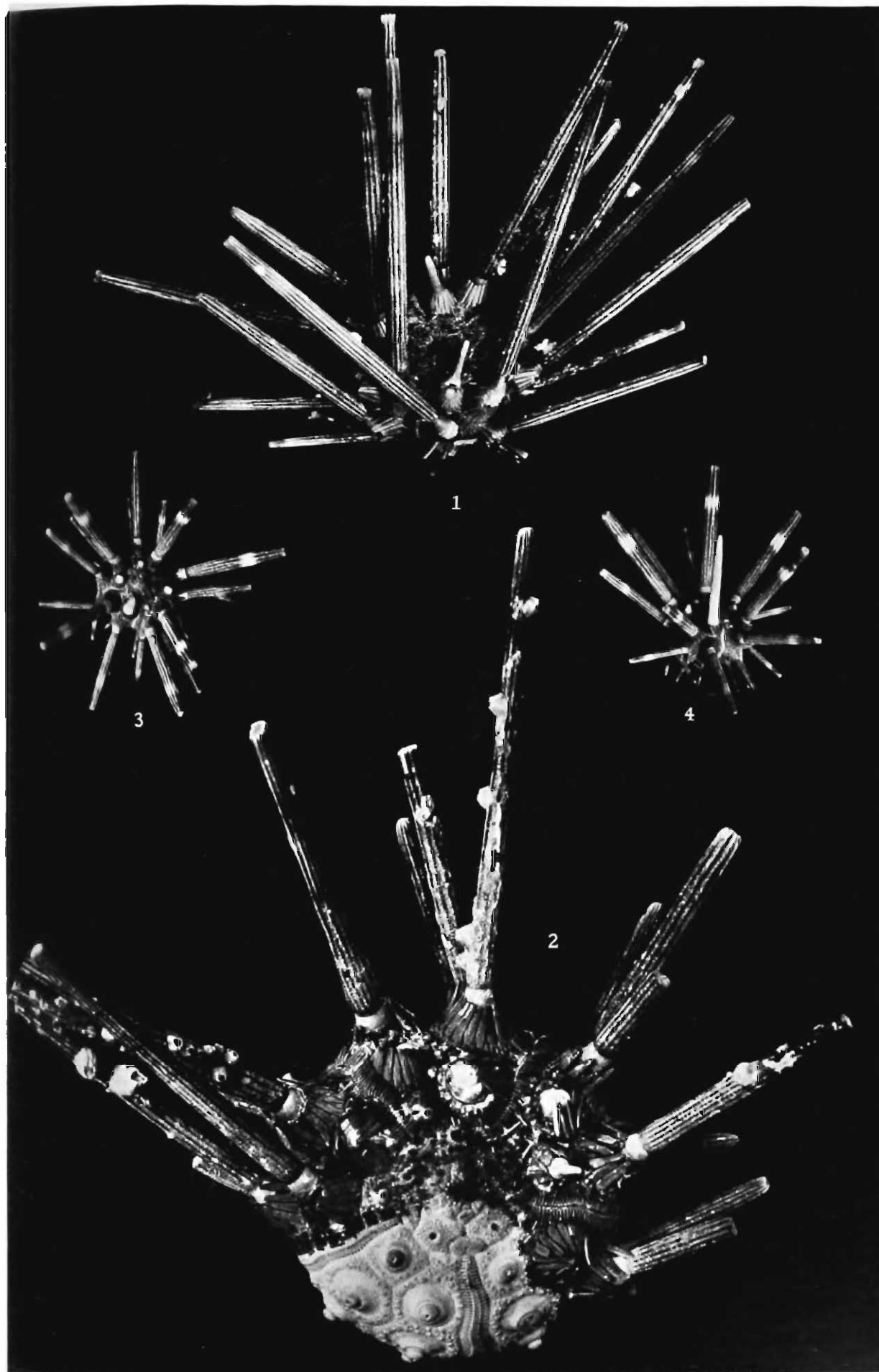
*Phyllacanthus forcipulatus*, sp. nov.

FIG. 1.—The type specimen seen from the aboral side.

FIG. 2.—An adult specimen partly denuded ; seen from the aboral side.

FIGS. 3, 4.—A young specimen from the aboral side (fig. 3) and inside view (fig. 4).

All figures natural size.



*Phyllacanthus forcipulatus*, sp. nov.

## EXPLANATION OF PLATE XI.

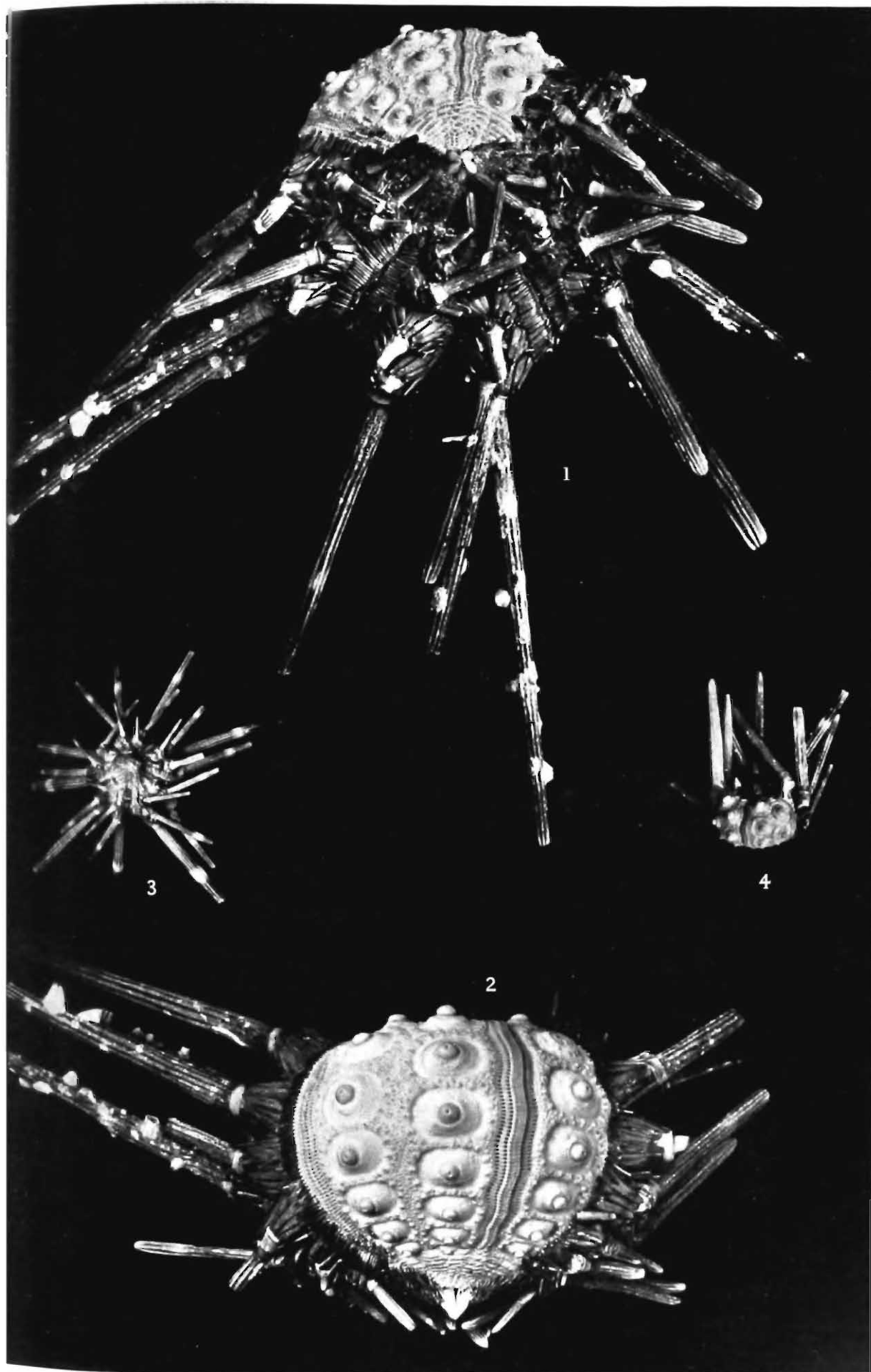
*Phyllacanthus forcipulatus*, sp. nov.

FIGS. 1, 2.—Adult specimen (same as Pl. X, fig. 2), from the oral side (fig. 1) and inside view (fig. 2).

FIGS. 3, 4.—Young specimens from the oral side (fig. 3) and inside view (fig. 4), the latter half denuded.

Fig. 3 is of the same specimen as Pl. X, figs. 3, 4.

All figures natural size.

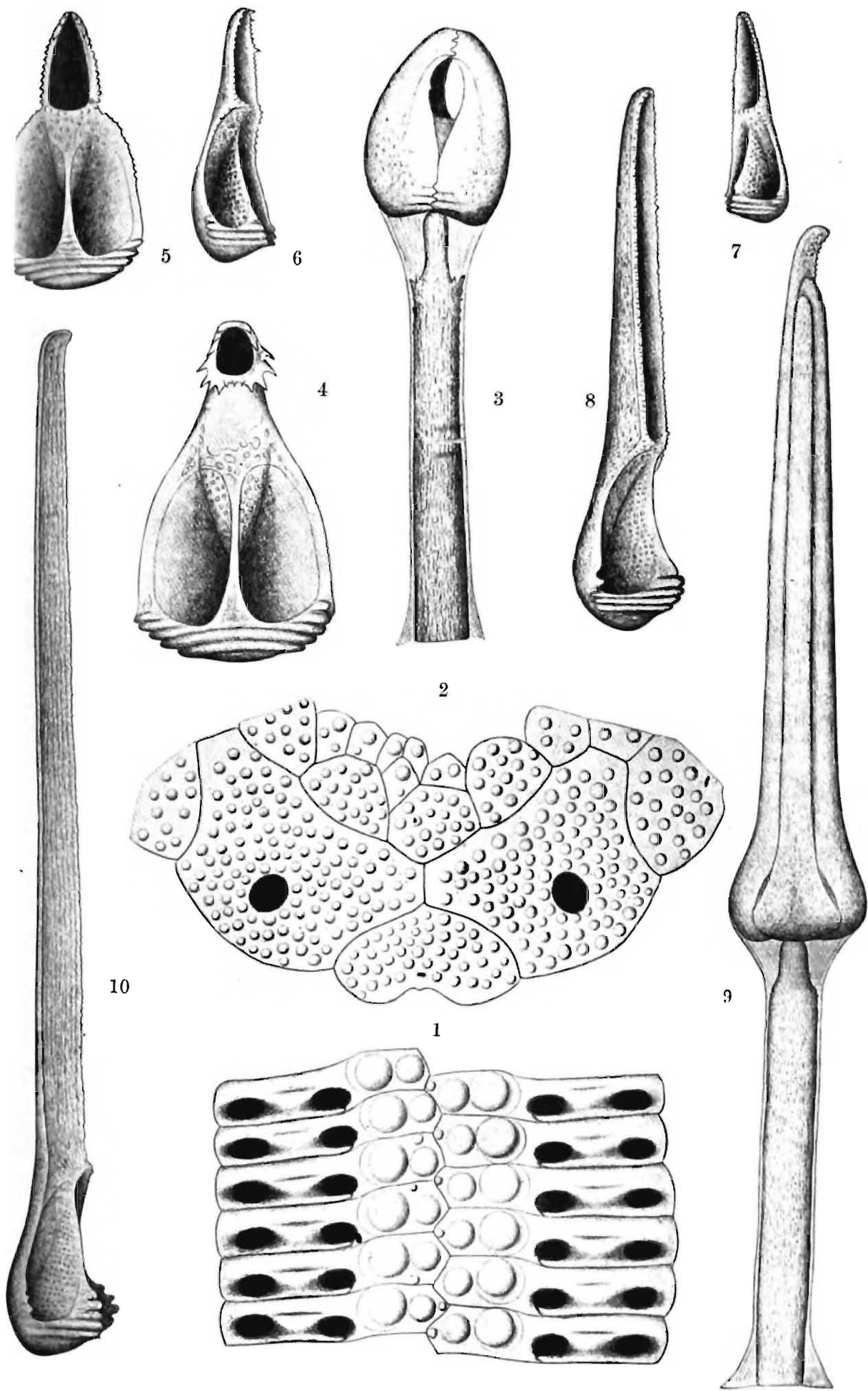


*Phyllocanthus forcipulatus*, sp. nov.

## EXPLANATION OF PLATE XII.

### *Phyllacanthus forcipulatus*, sp. nov.

- FIG. 1.—Part of ambulacrum.  $\times 12$ .  
FIG. 2.—Part of apical system of adult specimen.  $\times 6$ .  
FIG. 3.—Large globiferous pedicellaria.  $\times 85$ .  
FIG. 4.—Valve of large globiferous pedicellaria, from the inside.  $\times 165$ .  
FIG. 5.—Valve of small globiferous pedicellaria, from the peristome ; from the inside.  $\times 165$ .  
FIGS. 6, 7.—Valves of small globiferous pedicellaria ; side view.  $6 \times 85$  ;  $7 \times 65$ .  
FIG. 8.—Valve of pedicellaria intermediate between the small globiferous and the tridentate forms. Side view.  $\times 85$ .  
FIG. 9.—Tridentate pedicellaria.  $\times 30$ .  
FIG. 10.—Valve of tridentate pedicellaria. Side view.  $\times 45$ .



*Phyllacanthus forcipulatus*, sp. nov.

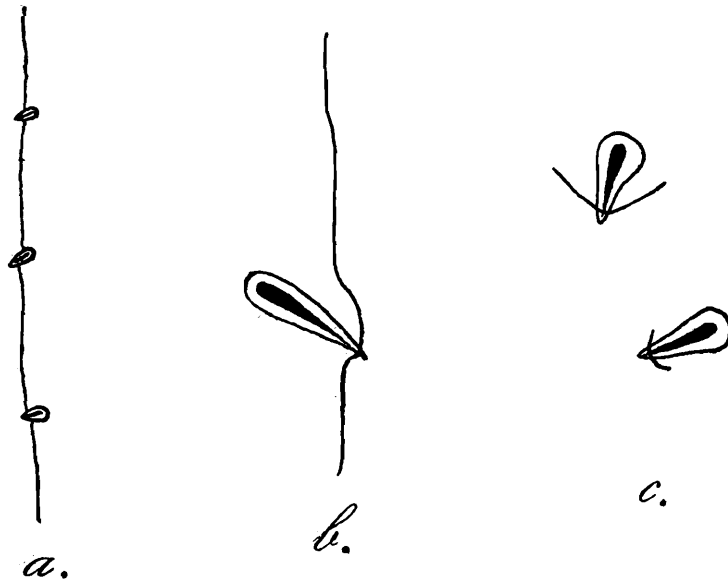
## STUDIES ON THE ACANTHOCEPHALAN FAUNA OF BURMA.

By K. SUBRAHMANYAN, M.A., D.T.

(From the Biological Department of the University College, Rangoon.)

Acanthocephalan worms *Pallisentis naggpurensis* Bhalerao (1931) were collected from half-a-dozen food-fish (*Ophicephalus striatus* Bloch ?) which were brought to the present writer, while on a short visit to Gyo-bingauk, a town 120 miles from Rangoon, Lower Burma. When fresh they were white and not "pinkish brown" in colour (Datta & Poddar 1935, p. 234). Of the thirty specimens collected, all except a few were females in different stages of development. The females were more numerous than the males, which is contrary to the observations of Bhalerao (1931, p. 570) and Datta & Poddar (1935, p. 234) for Nagpur and Calcutta respectively.

*Female* : Largest specimen in the collection  $19^1 \times 0.144$  at the posterior extremity, to  $0.504$  behind mantle spines. Anteriorly a region  $0.396$  in length, armed with 12—15 close set rows of cuticular spines, the spiny region extending to the posterior end of the proboscis sheath. Posteriorly body armed with 43—53 rows of spines, not as closely set as those of the anterior region. Mantle rows of spines  $0.027$ — $0.031$  long,  $0.031$ — $0.035$  apart, the distance between the spines in the same row



TEXT-FIG. 1.—Body and Mantle Spines of *Pallisentis naggpurensis* (Bhalerao, 1931).

a. Arrangement of Spines on the Body ; b. Single body spine magnified ; c. Mantle Spines magnified.

being  $0.031$ — $0.039$ . Body spines,  $0.020$ — $0.031$  long ( $0.055$ — $0.059$  max.), in consecutive rows, equal distances apart,  $0.090$ — $0.125$  and

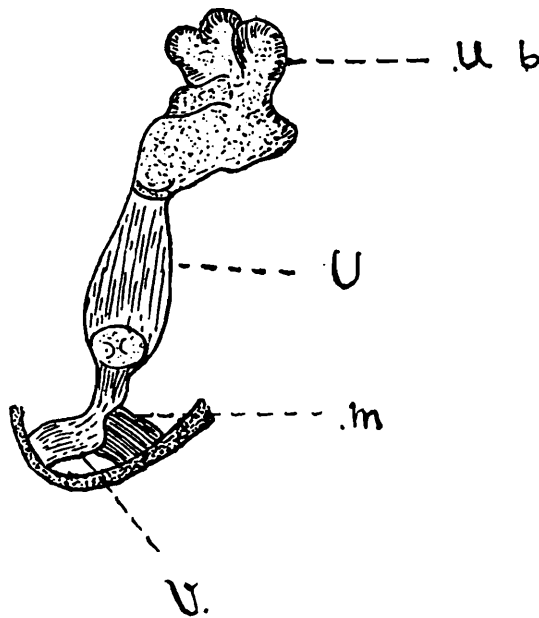
<sup>1</sup> All measurements in millimetres.

not extending to posterior end as in *P. ophioccephali*. In the posterior region of the body the spines thin out and in some of the posterior rows only the lateral spines of the row are clearly seen. Roughly  $\frac{1}{4}$  to  $\frac{1}{5}$  of the total length of the worm at the posterior end is devoid of spines. Mantle and body spines are set in cuticular prominences.

Proboscis short, globular, separated from first row of anterior body spines by a well developed neck. Proboscis sheath single-layered, cylindrical, 0.017—0.024 thick,  $0.447-0.501 \times 0.214-0.286$ . Proboscis retractors emerge posteriorly from the proboscis sheath and are attached to the sides of the body wall a little in front of the lemnisci.

Proboscis when fully extended  $0.215-0.236 \times 0.236-0.250$  apically to  $0.179-0.189$  basally, armed with 4 circular rows of 10 hooks each. This number (10 hooks in each row) seems to be constant. All hooks of one type provided with well developed roots. Free portions of the hooks measure H1-0.079—0.083 ; H2-0.063—0.070 ; H3-0.047—0.059 ; H4-0.032—0.034.

Genital opening sub-terminal. Vagina 0.138—0.142 long. Eggs 0.075—0.079  $\times$  0.039—0.047 ; embryos 0.047—0.059  $\times$  0.024.

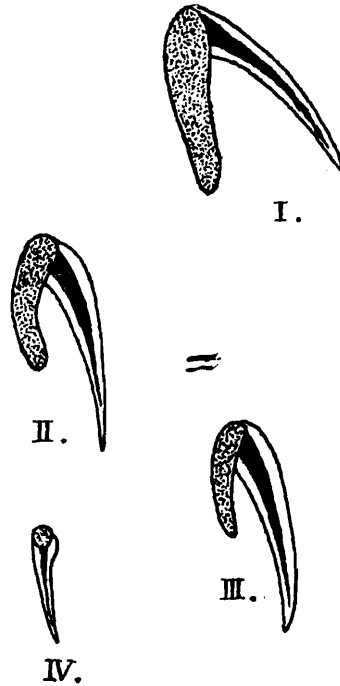


TEXT-FIG. 2.—Female Genitalia of *Pallisentis nagpurensis* (Bhalerao, 1931).

U. b. Uterine Bell ; U. Uterus ; M. Muscles attaching vagina to body wall ; V. Vagina.

*Male* : Largest 15 long. Body of immature young  $1.98 \times 0.108$  ; neck  $0.108 \times 0.144$  apically to 0.198 basally. Proboscis  $0.197 \times 0.197$  apically to 0.143 basally. Number and size of proboscis hooks similar to those in the female ; H1-0.079 ; H2-0.063 ; H3-0.039—0.043 ; H4-0.032. Roots : H1-0.039 ; H2-0.035 ; H3-0.035 ; H4-0.032 long. Proboscis sheath  $0.537 \times 0.179$ . Armature of body similar to that of female but less developed. Body spines 0.035—0.039, ceasing anterior to anterior testis, in 24—25 rows of spines. Lemnisci cylindrical, a little coiled, 3.2 and 2.52 long by 0.076—0.095 broad, extending to posterior attachment of proboscis retractors. In immature male, of the two elliptical testes the posterior slightly overlaps the posterior end of

the anterior, but in the fully developed male the two testes are contiguous, the anterior  $0.895 \times 0.251$ , the posterior  $0.896 \times 0.268$ . Ductus ejaculatoris  $0.322 \times 0.286$ .



TEXT-FIG. 3.—Proboscis Hooks of *Pallisentis nagpurensis* (Bhalerao, 1931) (♂).  
I,  $H_1$ ; II,  $H_2$ ; III,  $H_3$ ; IV,  $H_4$ .

*Remarks.*—In *P. ophioccephali* the body spines extend to the posterior end of the body. In *P. nagpurensis* they seem to extend to the posterior end in the female (Bhalerao, 1931, p. 570). None of the present specimens, male or female, showed any trace of the body spines in the posterior region, which disagrees with Bhalerao's statement (1931, p. 570) "There is a tendency for the rings of spines in the post-testicular regions to disappear." In fact in the present specimens, there is a tendency for the spines of the body to disappear even in the pre-testicular region.

The vascular system consists of two longitudinal canals (ventral and dorsal?) which, in the anterior part of the body, give off transverse commissures corresponding in number to the anterior body-spine rings. They are not so simple as indicated by Bhalerao (1931, p. 572). Well developed small longitudinal connections between adjacent transverse canals could be seen. This corroborates the statement of Baylis, "The transverse commissures are not so simply and regularly arranged but anastomose among themselves to form a network" (Baylis, 1933, p. 447, foot-note).

#### Genus *Pallisentis* Van Cleave, 1928.

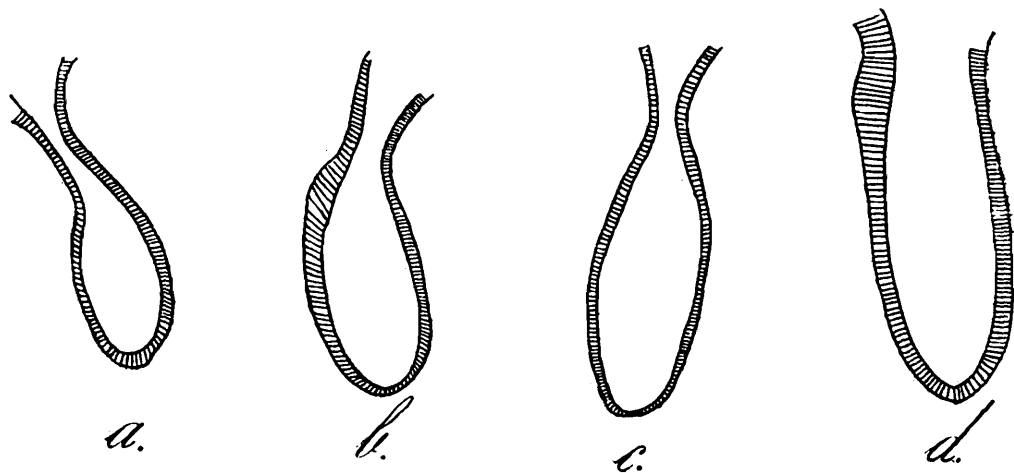
During his study of the specimens just described the writer was struck by resemblance between the genera *Pallisentis* and *Nersentis*. Van Cleave (1928, p. 4) himself says that they are, 'rather closely related'; and his diagnoses do not clearly separate them. Baylis (1933,

p. 448) is of the opinion that the differences separating them are only of specific importance.

The 'significant points of difference' in the generic diagnoses given by Van Cleave are : (1) the differences with regard to the spines, (2) the form of the proboscis and of its hooks and (3) the nature of the receptacle of the proboscis.

The difference in the anterior armature of the body varies considerably in the different species of *Pallisentis*. There are 9 rings in *P. umbellatus* (Van Cleave, 1928, p. 2), 11 according to Thapar (1930, p. 77) in *P. ophioccephali*, 13 in *P. gaboos* (Baylis, 1933, p. 446), 12—14 in *P. nagpurensis* (Bhalerao, 1931, p. 570) and 12—15 in the present specimens. Starting with *Neosentis celatus* the circles of body spines are in an ascending order. This clearly indicates that, in the arrangement of the spines in the anterior part of the body, no sharp distinction exists between the various species. The spines in the mantle of *P. umbellatus* measure 0.012, in *N. celatus* 0.016; the difference between the two being 0.006, a difference of insufficient importance for a generic distinction. Again in the two species *P. umbellatus* and *N. celatus*, the difference in the body spines in the posterior part of the body is not great, being only 0.006. This, in the author's view, is also not of generic importance. The size and arrangement (20—40 circles in *P. umbellatus*, and 10 in *N. celatus*) of the body spines, the writer considers as only of specific value; species of the genus *Pallisentis* show great variation in this respect. The size and arrangement of the body spines have, therefore, no generic value.

The second point of difference between the two genera is the form of the proboscis. In his generic diagnoses Van Cleave (1928, pp. 1, 4) states that in *Pallisentis* the proboscis is "short, cylindrical to globular" while in *Neosentis* it is "short, globular" "Cylindrical to globular" and "globular" are expressions which overlap and therefore automatically exclude this character from any generic diagnosis.



TEXT-FIG. 4.—Shapes of Proboscis Receptacles of *Pallisentis nagpurensis* (Bhalerao, 1931). *a*, *b* & *c*. Probosces partially retracted; *d*. Proboscis fully retracted.

The nature of the proboscis receptacle, in the author's opinion, depends to a great extent on the state of retraction or protrusion of the proboscis. In specimens where the probosces were completely retracted or protruded the receptacles were of the normal cylindrical

shape, but where only partially retracted or protruded were of a shape approaching that figured for *N. celatus* (Van Cleave, 1928, p. 5). Datta & Poddar (1935, p. 235) say that "In some specimens left in water in a tray the protrusion of the proboscis was clearly observed: the protrusion is the result of a sudden springing movement while the withdrawal is much slower and gradual" This the author himself observed four years ago when collecting *Acanthocephala* from Rangoon food fishes. The gradual process of withdrawal might result in the fixation of the proboscis in a partially retracted condition. Van Cleave's figure is probably that of a specimen with partially retracted proboscis and the difference mentioned by him a matter of individual variation, probably dependant upon the nature of the fixation.

In the light of the above considerations the writer is of opinion that the genus *Neosentis* Van Cleave, 1928, is a synonym of *Pallisentis* Van Cleave, 1928.

In conclusion I desire to express my indebtedness to Dr. F. J. Meggitt of the University of Rangoon for his help and guidance.

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## ON A FURTHER COLLECTION OF FISH FROM THE NAGA HILLS.<sup>1</sup>

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Early this year Dr. B. Prashad and Dr. B. Chopra paid another visit to the Naga Hills, and availed themselves of the opportunity to make a further collection of fishes. The greater part of the material, which comprises 129 specimens, was obtained from the streams of the Barail Range over which crosses the road from Imphal to Silchar, a part of the Naga Hills<sup>2</sup> the fauna of which had not been investigated so far.

The following are the streams of the Barail Range from which collections were made : (i) Laimatak River, 32 miles from Imphal, (ii) Irang River, 51 miles from Imphal, (iii) Khathalo stream near Nongba, (iv) Barak River between Nongba and Kalanaga, and (v) Makru River, 87 miles from Imphal. The waters from this part of the Naga Hills drain into the Barak River, which is a tributary of the Brahmaputra. From the collections before me all the streams appear to be large hill-streams with rocky beds and fairly deep waters.

Collections were also made by the Zoological Survey party at two places between Kohima and Imphal : Zekwara in the neighbourhood of Khezobama and at Karong on the ridge separating Naga Hills from the Manipur Valley. The waters from these two places drain ultimately into the Brahmaputra.

Besides, there are a few specimens, belonging to *Garra naganensis*, *Danio naganensis*, *Danio dangila*, *Psilorhynchus homaloptera* and *Nemachilus kangjupkhulensis*, of which the locality labels were torn to bits in transit and, in consequence, the precise habitat cannot now be given. Of these, *D. naganensis* and *N. kangjupkhulensis* are known only from the Chindwin drainage system and it seems likely that the party also made collections from areas whence the waters drain into the Chindwin River. *Psilorhynchus homaloptera* is known from the Brahmaputra system, *Garra naganensis* is found in both the Brahmaputra and the Chindwin systems, while *Danio dangila* is a widely distributed species.

According to the localities enumerated above the collection may be arranged as follows :—

1. Zekwara, Naga Hills. 28.i.36.

- |                                          |                           |
|------------------------------------------|---------------------------|
| i. <i>Barilius bendelisis</i> (Ham.)     | 1 specimen (28 mm.).      |
| ii. <i>Oreinus molesworthi</i> Chaudhuri | 5 specimens (98-120 mm.). |

2. Karong, Naga Hills. 5.ii.36.

- |                                    |                             |
|------------------------------------|-----------------------------|
| i. <i>Barbus clavatus</i> McClell. | 18 specimens (126-192 mm.). |
|------------------------------------|-----------------------------|

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<sup>1</sup> For a comprehensive report on the fish fauna of the Naga Hills see Hora & Mukerji, *Rev. Ind. Mus.*, XXXVII, pp. 381-404, 6 text-figs. 1 pl. (1935).

<sup>2</sup> It may again be pointed out that for the purpose of this paper under the name "Naga Hills" is included all the country inhabited by the Naga tribes and not merely the district to which the name is officially applied. The part of the Barail Range traversed by the party of the Zoological Survey is under the Manipur State and is inhabited by the Kacha Nagas of whom the Kabui is the predominant type.

## 3. Laimatak River, Imphal-Silchar Road. 8.ii.36.

- |                                                    |                             |
|----------------------------------------------------|-----------------------------|
| i. <i>Pseudecheneis sulcatus</i> (McClell.)        | 1 specimen (171 mm.).       |
| ii. <i>Barbus progeneius</i> McClell.              | 1 specimen (137 mm.).       |
| iii. <i>Barilius bendelisis</i> (Ham.)             | 4 specimens (123-147 mm.).  |
| iv. <i>Barilius barila</i> (Ham.)                  | 11 specimens (105-145 mm.). |
| v. <i>Psilorhynchus homaloptera</i> Hora & Mukerji | 1 specimen (106 mm.).       |

## 4. Irang River, Imphal-Silchar Road. 11-13.ii.36.

- |                                        |                            |
|----------------------------------------|----------------------------|
| i. <i>Barbus claratus</i> McClell.     | 5 specimens (107-157 mm.). |
| ii. <i>Barbus progeneius</i> McClell.  | 4 specimens (107-202 mm.). |
| iii. <i>Crossochilus latius</i> (Ham.) | 3 specimens (133-143 mm.). |
| iv. <i>Garra gotyla</i> (Gray)         | 1 specimen (200 mm.).      |
| v. <i>Barilius bendelisis</i> (Ham.)   | 1 specimen (99 mm.).       |
| vi. <i>Barilius barila</i> (Ham.)      | 16 specimens (99-162 mm.). |

## 5. Khathalo stream near Nongba, Imphal-Silchar Road. 13.ii.36.

- |                                               |                             |
|-----------------------------------------------|-----------------------------|
| i. <i>Silurus cochinchinensis</i> Cuv. & Val. | 2 specimens (198-200 mm.).  |
| ii. <i>Barbus hexagonolepis</i> McClell.      | 12 specimens (113-280 mm.). |
| iii. <i>Garra naganensis</i> Hora.            | 2 specimens (124-126 mm.).  |

## 6. Barak River between Nongba and Kalanaga, Imphal-Silchar Road. 13.ii.36.

- |                                         |                                                                        |
|-----------------------------------------|------------------------------------------------------------------------|
| i. <i>Barbus progeneius</i> McClell.    | 1 specimen (710 mm.).                                                  |
| ii. <i>Barbus tor</i> (Ham.)            | 1 specimen (491 mm.).                                                  |
| iii. <i>Labeo dyocheilus</i> (McClell.) | 2 specimens (1 complete 672 mm., one head of a still larger specimen). |

## 7. Makru River, Imphal-Silchar Road. 18.ii.36.

- |                                           |                            |
|-------------------------------------------|----------------------------|
| i. <i>Barbus hexagonolepis</i> (McClell.) | 6 specimens (125-183 mm.). |
| ii. <i>Garra naganensis</i> Hora          | 1 specimen (113 mm.).      |
| iii. <i>Ophicephalus gachua</i> Ham.      | 3 specimens (88-152 mm.).  |

## 8. Locality unknown.

- |                                                               |                                          |
|---------------------------------------------------------------|------------------------------------------|
| i. <i>Garra naganensis</i> Hora                               | 3 specimens (72-91 mm.).                 |
| ii. <i>Danio</i> ( <i>Danio</i> ) <i>naganensis</i> Chaudhuri | 1 specimen (ca. 160 mm.).                |
| iii. <i>Danio</i> ( <i>Danio</i> ) <i>dangila</i> (Ham.)      | 20 specimens (25-46 mm. without caudal). |
| iv. <i>Psilorhynchus homaloptera</i> Hora & Mukerji           | 1 specimen (70 mm.).                     |
| v. <i>Nemachilus kangjupkhulensis</i> Hora                    | 2 specimens (55-73 mm.).                 |

Of the 18 species represented in the recent collection 5—*Silurus cochinchinensis*, *Pseudecheneis sulcatus*, *Labeo dyocheilus*, *Barbus progeneius* and *Garra gotyla*—are recorded from this area for the first time. The last species was, however, obtained by Dr. Murray Stuart (Hora, *Rec. Ind. Mus.*, XXII, p. 743, 1921) from the North-eastern border of Burma and the Naga Hills, but it can now be definitely included in the fauna of the latter district. The range of *S. cochinchinensis* extends from the Eastern Himalayas (below Darjeeling) through Assam hills and Burma to Cochin China, Fukien and Hainan. *Pseudecheneis sulcatus* is found in Assam and Northern Burma and westwards its range extends to the Darjeeling Himalayas. *Labeo dyocheilus* was described from the Brahmaputra in Assam but since then it has been recorded from Hardwar, Simla and the Sind hills. *Barbus progeneius* was described from the Brahmaputra but its identity had been confused with *B. tor*. *Garra gotyla* is found along the Himalayas from the Dehra Dun hills to Assam and Burma.

Including the collection under report, the fish fauna of the Naga Hills comprises 49 species distributed among the following families: 2 to Siluridae, 1 to Bagridae, 1 to Amblycepidae, 4 to Sisoridae, 24 to

Cyprinidae, 2 to Psilorhynchidae, 11 to Cobitidae, 1 to Mastacembelidae, 1 to Nandidae and 2 to Ophicephalidae.

Though most of the species represented in the collection do not call for any comments, it has been possible to elucidate the chief distinguishing features of the large-scaled Barbels of Assam—*B. hexagonolepis*, *B. tor* (= *B. hexastichus*), *B. putitora* and *B. progeneius*. The study of a large specimen of *Labeo dyocheilus* has also enabled me to clear up the specific identity of this species and to distinguish it from the allied *L. dero*. The Burmese and Siamese specimens of *L. dero* are separated into a distinct species *L. devdevi*, sp. nov. Further it is shown that Mukerji's "Assamese and Burmese form" of *Crossochilus latius* is restricted to the Burmese drainage systems and that in the parts of Assam drained by the Brahmaputra only the typical form of the species is found. In view of the structural differences between the two forms and their restricted ranges of distribution the name *burmanicus* is proposed here for the Burmese form. Observations are also offered regarding variation in structure or colouration of *Silurus cochinchinensis* and *Pseudecheneis sulcatus*. The record of *Psilorhynchus homaloptera* from a different part of the Naga Hills is also of special interest, as it shows that the species is not strictly localised in its distribution.

The following vernacular names were noted down by the party :—

1. *Khotavu* Angami : *Oreinus molesworthi* Chaudhuri.
2. *Kha suang* : *Pseudecheneis sulcatus* (McClell.).
3. *Tau pompoi* : *Psilorhynchus homaloptera* Hora & Mukerji.
4. *Them ga* : *Barilius bendelisis* (Ham.) and *B. barila* (Ham.).
5. *Kha goi* : *Barbus clavatus* McClell.

*Kha* means fish corresponding with the Burmese *Nga*. *Tau* means stone and *pompoi* means 'to stick to', *Tau pompoi* is thus a very appropriate name for *Psilorhynchus homaloptera*. *Goi* means 'serrated like a saw', thus *Kha goi* means a fish with the dorsal spine serrated like a saw, a very significant name for *Barbus clavatus*. These fish names indicate the great familiarity of the local people both with the habits and structures of the fishes inhabiting their part of the Naga Hills.

## SILURIDAE.

### *Silurus cochinchinensis* Cuvier & Valenciennes.

1929. *Silurus cochinchinensis*, Prashad & Mukerji, *Rec. Ind. Mus.*, XXXI, p. 171.

Khathala stream near Nongba, Imphal-Silchar Road. 13.ii.36.

*Silurus cochinchinensis* is represented by two adult specimens, about 200 mm. in total length, in the recent collection of fish from the Naga Hills. In this species there are only two mandibular barbels and, in consequence, it is placed in the genus *Parasilurus* Bleeker by certain ichthyologists. Day<sup>1</sup> and Günther<sup>2</sup>, however, did not attach much importance to this character and their contention is now fully borne

<sup>1</sup> Day, *Fish. India*, p. 481 (1877).

<sup>2</sup> Günther, *Cat. Fish. Brit. Mus.*, V, p. 32 (1864).

out by the discovery of 3 pairs of barbels<sup>1</sup> in the young stages of *Silurus asotus* Linn., the genotype of *Parasilurus*. In the course of growth, however, one pair of mandibular barbels is absorbed.

Usually there are 2 to 4 soft rays in the dorsal fin which, in the case of well preserved specimens, are invariably enveloped in thick skin. In both the specimens under report the dorsal fin is totally absent and no vestige of it can be made out externally. It would thus appear that no taxonomic value can be attached to the presence or absence of a vestigial dorsal fin in the case of Silurid fishes.

*S. cochinchinensis* was originally described from Cochin China, but it has since been found in Burma, Assam, and Darjeeling Himalayas towards the west and in Hainan and Fukien towards the east. It is a small species growing to about 8 or 9 inches in length.

### SISORIDAE.

#### ***Pseudecheneis sulcatus* (McClelland).**

1923. *Pseudecheneis sulcatus*, Hora, *Rec. Ind. Mus.*, XXV, p. 44.

Laimatak River, Imphal-Silchar Road. 8.ii.36.

Only one example of *Pseudecheneis sulcatus*, 171 mm. in total length, was collected by Drs. B. Prashad and B. Chopra in their recent visit to the Naga Hills. It corresponds with specimens from other localities, except that it is much darker in colour and the lighter bands across the back are fewer and shorter.

The range of the species extends from the Darjeeling Himalayas and the Assam hills to Upper Burma.

### CYPRINIDAE.

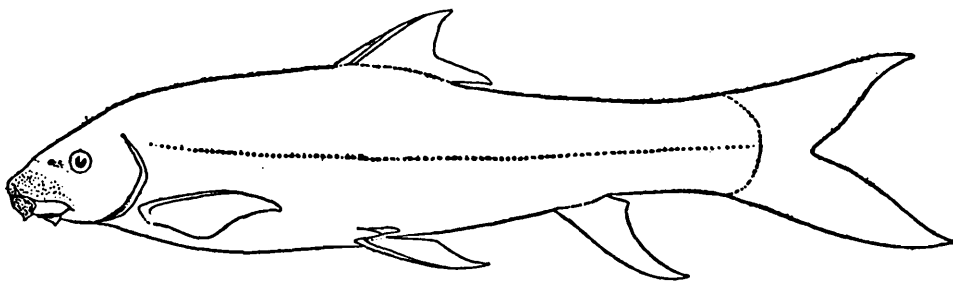
#### ***Labeo dyocheilus* (McClelland).**

1839. *Cyprinus* (*Labeo*) *dyocheilus*, McClelland, *As. Res.*, XIX, pp. 268, 330, pl. xxxvii, fig. 1.

1877. *Labeo dyocheilus*, Day, *Fish. India*, p. 540, pl. cxxx, fig. 1.

Barak River between Nongba and Kalanaga, Imphal-Silchar Road. 13.ii.36.

*Labeo dyocheilus* and *L. dero* (Ham.) are similar in several features and as their respective ranges of distribution more or less coincide they



TEXT-FIG. 1.—Lateral view of a stuffed specimen of *Labeo dyocheilus* (McClelland).  
 $\times \frac{2}{15}$ .

are liable to be confused with each other. Though the original accounts of the species are inadequate for the determination of their precise specific

<sup>1</sup> Atoda, *Doutsugaku Zasshi*, XLVII, p. 228, (1935) [text in Japanese]; Kimura, *Journ. Shanghai Sci. Inst.*, sec. 3 III, p. 105 (1935).

limits, the specimens referred by Day to the two species and now preserved in the collection of the Indian Museum show that he was familiar with the differences between them. According to Day's descriptions, the two species may be differentiated as follows :

"*Labeo diplostomus*"<sup>1</sup> (*L. dero*).

*Labeo dyocheilus*.

- |                                                                                                       |                                                                                                    |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| i. 6-7 rows of scales below lateral line to base of ventral.                                          | 5 rows of scales below lateral line to base of ventral.                                            |
| ii. Length of head $5\frac{1}{2}$ - $6\frac{1}{4}$ , height of body $5-5\frac{1}{2}$ in total length. | Length of head $5-5\frac{1}{2}$ , height of body $3\frac{1}{2}$ to $4\frac{1}{2}$ in total length. |
| iii. Diameter of eye $5-6\frac{1}{2}$ in length of head, $2\frac{1}{2}$ -3 in interorbital width.     | Diameter of eye 6-9 in length of head, $3\frac{1}{2}$ -5 in interorbital width.                    |
| iv. Snout with a groove and without lateral lobes.                                                    | Snout without a groove <sup>2</sup> and with distinct lateral lobes.                               |
| v. Mouth rather narrow                                                                                | Mouth wide.                                                                                        |
| vi. Upper margin of dorsal deeply concave in the adult.                                               | Upper margin of dorsal slightly concave in the adult.                                              |
| vii. Pectoral does not extend to ventral, nor the latter to anal.                                     | Pectoral reaches ventral, and the latter base of anal.                                             |

I have studied these differences in reference to the material in the Indian Museum and find that the proportions of various parts vary considerably with age in both the species, except that the interorbital space is relatively much broader and the eyes smaller in *L. dyocheilus* than in *L. dero*. The number of scales below the lateral line is also a good diagnostic character for distinguishing the two species. The nature of the snout offers a useful character, especially in adults. In *L. dyocheilus* the front part of the snout, dorsally, laterally and ventrally, is studded with pearl organs or spiny tubercles, whereas in *L. dero* they are, when present, fewer in number and totally absent from the ventral surface of the head. Along with the appearance of large pearl organs a deep groove is developed on the snout of *L. dero*, especially in the males. The prolongation of the anterior dorsal rays in *L. dero* is also associated with the development of the pearl organs in the males, while in *L. dyocheilus* there is no such correlation. It is thus seen that marked sexual dimorphism is also a feature of *L. dero*. Reference may here be made to an interesting case of sexual dimorphism found by Mukerji and myself<sup>3</sup> in the case of *Barbus chagunio* (Ham.).

The examination of a large series of specimens has shown that the two species can be readily distinguished by the nature of the dorsal surface of the free portion of the lower lip. In *L. dero*, as indicated already,<sup>4</sup> this surface is studded with large tubercles, whereas in *L. dyocheilus* there are series of ridges instead of tubercles or papillae. This difference in the structure of the lower lip is noticeable both in the young and adult specimens of the two species.

McClelland remarked that his *L. dyocheilus* "is found in the clear active currents of the Brahmaputra from Middle Assam to the rapids at

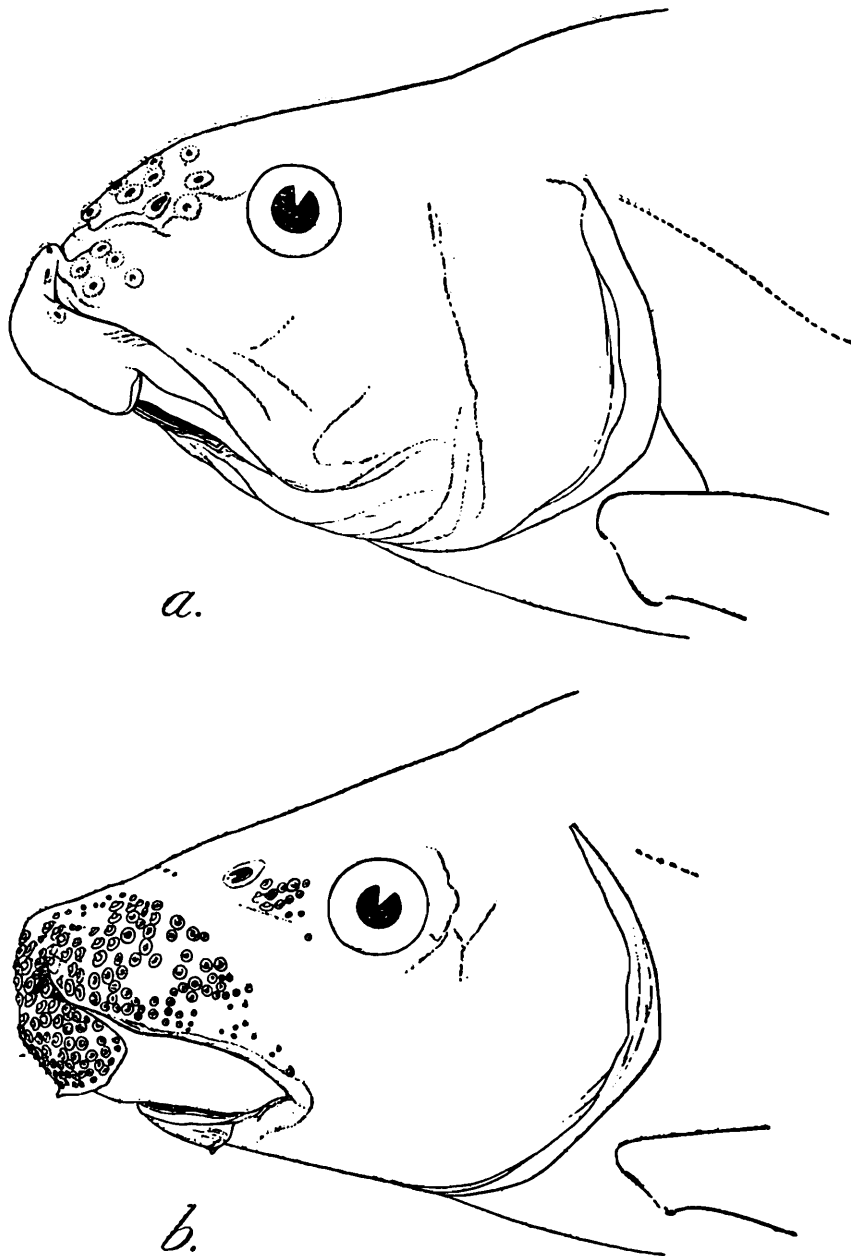
<sup>1</sup> All the specimens determined by Day as *L. diplostomus* and now preserved in the collection of the Indian Museum are referable to *L. dero* (Ham.).

<sup>2</sup> Day noticed a Sind specimen with a depression across the snout.

<sup>3</sup> Hora & Mukerji, *Journ. As. Soc. Bengal* (N. S.) XXVII, pp. 137-139 (1933).

<sup>4</sup> Hora & Mukerji, *Rev. Ind. Mus.*, XXXVIII, p. 142 (1936).

the extremity of the valley, but appears to be equally unknown in mountain torrents, and sluggish rivers and jeels in the plains." This indicates that the species is to be found in deeper parts of swift flowing rivers, like the Brahmaputra. Drs. Prashad and Chopra obtained the

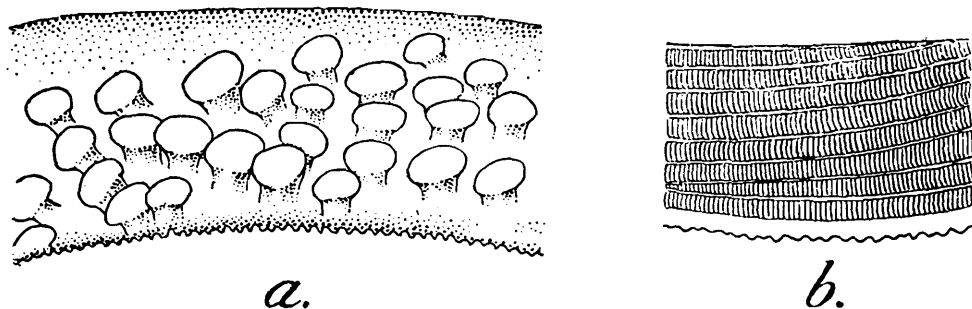


TEXT-FIG. 2.—Lateral view of head and anterior part of body of *Labeo dero* (Ham.) and *Labeo dyocheilus* McClelland, showing general form of head and arrangement of tubercles.

a. *Labeo dero* (Ham.). ca. Nat. size; b. *Labeo dyocheilus* (McClell.).  $\times$  ca.  $\frac{1}{2}$ .

two specimens noted above in similar situations in the Barak River. *L. dero*, on the other hand, is found at the sides of torrential streams in shallow waters and is caught in large numbers with the help of cast nets. Probably on account of these differences in the habitats of the two species, we find that *L. dero* is well represented in Museum collections whereas *L. dyocheilus* is rather rare. Both the species are of great economic importance, *L. dero* growing to a length of about 18 inches and *L. dyocheilus* to 3 feet or more. The largest specimen of the former in the collection of the Indian Museum is 17 inches and of the latter 26 inches.

Mukerji's<sup>1</sup> observations on *L. dyocheilus* were unfortunately based on inadequate material in the collection of the Indian Museum which then consisted of only three specimens, one from Simla, one from Hardwar, and one from the Abor Hills, Assam.<sup>2</sup> As the species was



TEXT-FIG. 3.—A portion of dorsal surface of the free lower lip of *Labeo dero* (Ham.) and *Labeo dyocheilus* (McClell.).  $\times 61$ .

a. *Labeo dero* (Ham.); b. *Labeo dyocheilus* (McClell.).

originally described from Assam, Mukerji regarded the Assamese specimen as *forma typica* and remarked: "These two specimens from the Western Himalayas do not appear to me to represent the true *L. dyocheilus* so far as I am able to judge by comparison with the Abor specimen, which I consider to be the typical form of *L. dyocheilus*. It seems probable that the Western Himalayan form of the species is distinct." In conformity with the conclusions recorded above specimens received from the Darjeeling Himalayas were referred by Mukerji and myself to the typical form of *L. dyocheilus*.

The presence of two large specimens of *L. dyocheilus* in the collection under report made me examine the previous material once again and it was found that the Simla and Hardwar specimens represent *Labeo dyocheilus*, while all the other specimens from the Darjeeling Himalayas, Assam, Burma and Siam are referable to the allied species *L. dero* and its Burmese form. Of the typical *L. dero* Mukerji and I<sup>3</sup> had recently collected a large number of specimens in the Dehra Dun hills. The four specimens of *L. dyocheilus* seem to agree in almost all particulars, but as they greatly differ in size no real comparison can be made between them.

The position with regard to *L. dero* is different. This species is represented by a large number of specimens collected from the Ganges and the Brahmaputra drainage systems and from the Burmese drainage systems. There are two specimens from the Kashmir Valley also. The differences noted by Mukerji in the Eastern Himalayan and Assamese specimens (Brahmaputra drainage) and the Burmese and Siamese specimens show that here again we have a condition similar to that of *Crossochilus latius* (*vide infra*) and it seems advisable to regard the two forms as distinct species. The Burmese and the Siamese form which differs from the typical specimens of *L. dero* in having a somewhat shorter head, bluntly rounded snout with the depression across it less

<sup>1</sup> Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, pp. 55-59 (1934).

<sup>2</sup> Chaudhuri, *Rec. Ind. Mus.*, VIII, p. 249 (1913).

<sup>3</sup> Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, p. 142 (1936).

marked, 40-41 scales along the lateral line and 13 in a transverse series between the bases of the dorsal and ventral fins (*versus* 40-44 along the lateral line and 16-17 rows between the bases of the dorsal and ventral fins) and 19-21 scales round the caudal peduncle (*versus* 22-23) may be called **L. devdevi**, thus associating its name with that of Mr. Dev Dev Mukerji who first noticed these differences.

The Kashmir specimens seem to differ from both *L. dero* and *L. devdevi*, but the material is not sufficient to discuss their true relationships. They had better be kept separate as *L. diplostomus* (Heckel)<sup>1</sup> for the time being.

### **Crossochilus latius** (Ham.).

1934. *Crossochilus latius* (*forma typica*), Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, p. 52.

Irang River, Imphal-Silchar Road. 13.ii.36.

The specimens of *Crossochilus latius* hitherto collected from Assam (Manipur Valley<sup>2</sup>; Tizu River, Naga Hills<sup>3</sup>) have been referred to the Assamese and Burmese form as recognised by Mukerji (*op. cit.*). The three specimens recently collected from the Naga Hills, however, belong to the typical form known from the Brahmaputra<sup>4</sup> and the Gangetic<sup>5</sup> drainage of the Himalayas. It would thus appear that the term "Assamese form" is ambiguous, for within the political limits of Assam both the forms are met with. When, however, the distribution of the two forms is considered with regard to the various drainage systems, it is found that the *forma typica* is restricted to the Brahmaputra and the Gangetic systems, whereas the form **burmanicas** (this new specific name is proposed for the Assamese and Burmese form of Mukerji) is found in the various drainage systems of Burma—the Chindwin, the Irrawadi<sup>6</sup>, the Salween<sup>7</sup>, etc.<sup>8</sup>. The two forms differ mainly in their lepidosis and the relative length of the head. Even superficially they appear to be quite distinct, and it seems desirable to denote them by different names, as has been done already by Mukerji<sup>9</sup> for the Punjab form.

### LARGE-SCALED BARBELS OF ASSAM.

In Bengal and Assam the vernacular names *Mahasaula*, *Mahaseer*, *Tora*, etc., in which reference is made to the large size of the head or scales, are indiscriminately applied to several species of large-scaled Barbels which are usually confined to the rapid and clear currents of the larger rivers at the bases of mountains. The confusion has become worse on account of the sportsmen having either adopted local names

<sup>1</sup> Mukerji, *Mem. Connecticut Acad. Arts. & Sci.*, X, p. 329 (1936).

<sup>2</sup> Hora, *Rec. Ind. Mus.*, XXII, p. 183 (1921).

<sup>3</sup> Hora & Mukerji, *Rec. Ind. Mus.*, XXXVII, p. 389 (1935).

<sup>4</sup> Hamilton, *Fish. Ganges*, p. 345 (1822).

<sup>5</sup> Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, p. 143 (1936).

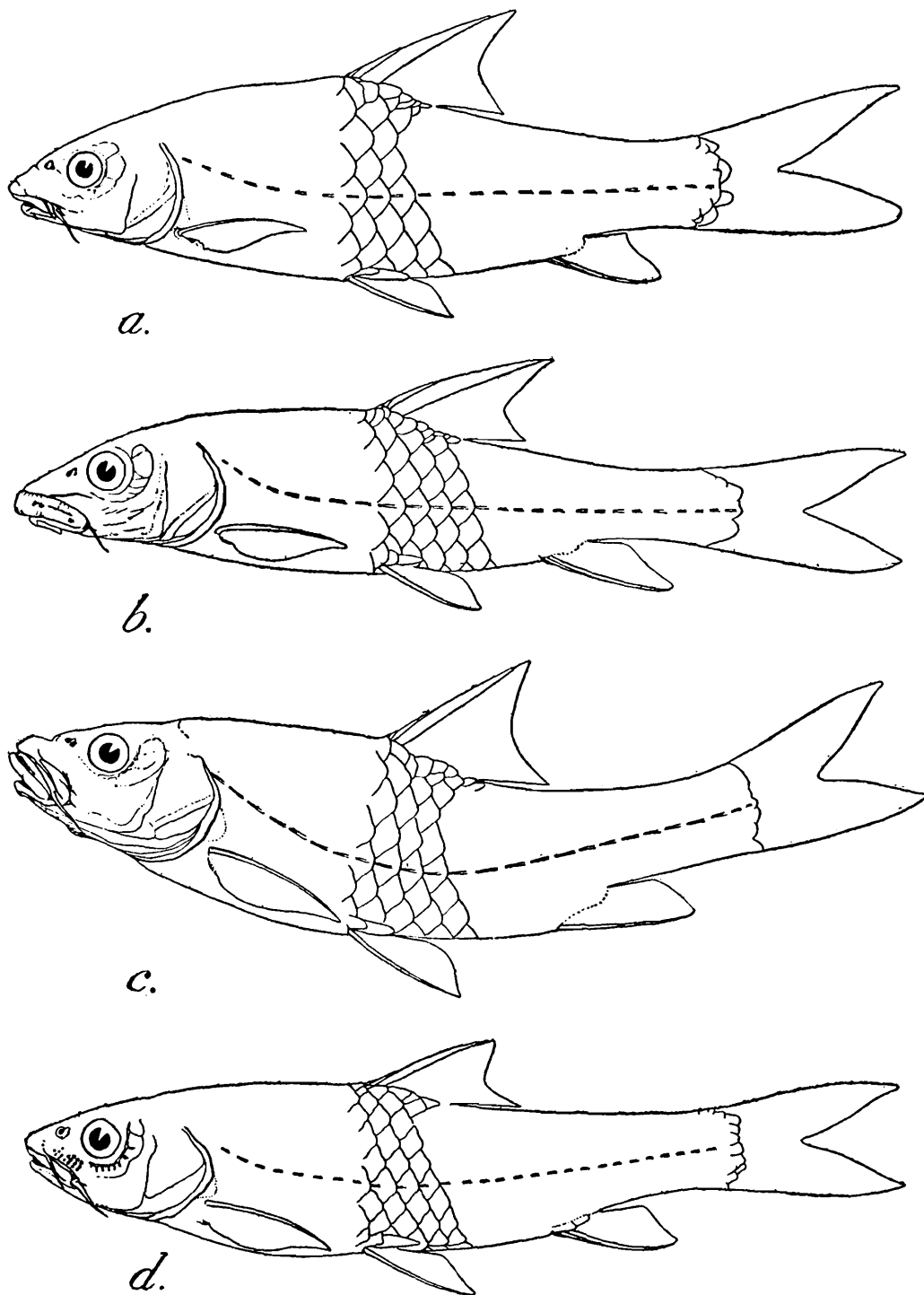
<sup>6</sup> Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, p. 52 (1934).

<sup>7</sup> Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2) IX, p. 280 (1890).

<sup>8</sup> Mukerji, *Rec. Ind. Mus.*, XXXIV, p. 283 (1932).

<sup>9</sup> Mukerji, *Mem. Connecticut Acad. Arts & Sci.*, X, p. 331 (1936).

or called their catches representing various species as *Mahseer*. Unfortunately, the ichthyologists, not having sufficient material of the various forms at one place for examination, have also thought it convenient to lump together several forms under *Barbus tor*. Recently Mukerji and



TEXT-FIG. 4.—Large-scaled Barbels of Assam.

a. Lateral view of a young specimen of *Barbus tor* (Ham.).  $\times \frac{1}{2}$ .

b. Lateral view of a young specimen of *Barbus putitora* (Ham.).  $\times \frac{1}{2}$ .

c. Lateral view of a young specimen of *Barbus progeneius* McClelland.  $\times \frac{1}{2}$ .

d. Lateral view of a young specimen of *Barbus hexagonolepis* McClelland.  $\times \frac{1}{2}$ .

The number of scales along the lateral line, the lepidosis between the bases of the dorsal and pelvic fins and also the nature of the last dorsal spine are shown in each case. The above characters help to differentiate these closely allied species.

I<sup>1</sup>, as a result of field observations in the Dehra Dun hills and an examination of a large material in fresh condition, were able to define the specific limits of the three species of such carps described by Hamilton in his *Gangetic Fishes*—*B. putitora*, *B. mosal* and *B. tor*. The material brought back by Drs. Prashad and Chopra from the Naga Hills now affords an opportunity to discuss the identity of the forms described by McClelland from Assam.

In his "Indian Cyprinidae" McClelland recognised 5 species of large-scaled Barbels, viz., *Barbus hexastichus* (= *Cyprinus tor* Ham.), the *Lobura* of the Assamese; *B. progeneius*, the *Jungba* of the Assamese; *B. macrocephalus*, the *Burapetea* of the Assamese; *B. hexagonolepis*, the *Bokar* of the Assamese and *B. megalepis* (= *Cyprinus mosal* Ham.). The first 4 species were studied in the field either by Griffith or McClelland himself and large series of each seem to have been examined. Of *B. megalepis* McClelland observes :

"The only specimen of this species I have seen is contained in a small collection of fishes presented to the Society by Mr. Hodgson. Its principal difference from the last described [*B. hexagonolepis*] consists in its having a longer head, which is narrower and more compressed at the snout."

The *Mosal* was found by Hamilton in the Kosi River and McClelland surmises that Mr. Hodgson's specimen also came from the same area.

Regarding Hamilton's *Cyprinus putitora*, McClelland made the following observations under *B. hexagonolepis* :

"There is still another large species *Cyp. pitutura*, Buch. closely allied to the preceding Barbels, which according to Buchanan attains nine feet in length; it has the following rays in its fins,

D. 11 : P. 15 : V. 9 : A. 7 : C. 19.

The head is said to be blunt, oval, and small, with a protractile mouth, and the scales to terminate with a notch behind. The first of these characters would seem partly to refer it to *B. hexagonolepus*, while the notch at the apex of the scales is only apparent in *B. macrocephalus*. There is no drawing in Buchanan's collection of the species alluded to, and as his description is not sufficiently clear, we must for the present consider *Cyp. pitutura* as a doubtful species."

### **Barbus tor (Hamilton).**

1922. *Cyprinus tor*, Hamilton, *Fish. Ganges*, pp. 305, 388.

1839. *Barbus hexastichus*, McClelland, *As. Res.*, XIX, pp. 269, 333, pl. xxxix, fig. 2.

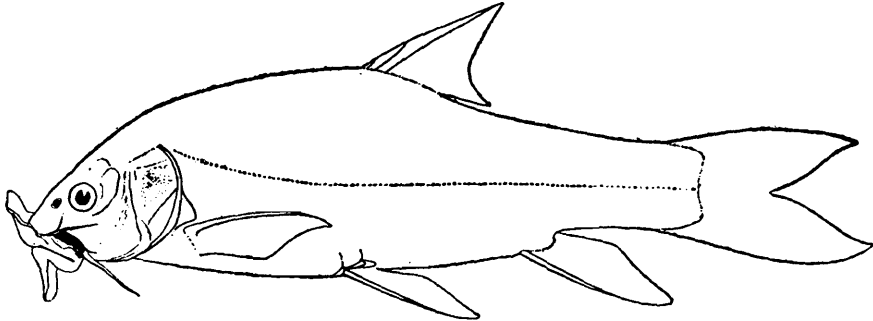
1936. *Barbus tor*, Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, p. 139.

Barak River between Nongba and Kalanaga, Imphal-Silchar Road. 13.ii.36.

In the collection under report *Barbus tor* is represented by a single specimen about 49 cm. in length. Mukerji and I (*op. cit.*) have already referred to the distinguishing features of this species, i.e., the red colour of its fins when alive (a character referred to by McClelland also : "with the tips of fins a more decided red"); small head, shorter than depth of body (about 4 or more than 4 times in total length without the caudal) and deeper body (its height being less than 4 times in the total length without the caudal). In the young or half-grown specimens that I had

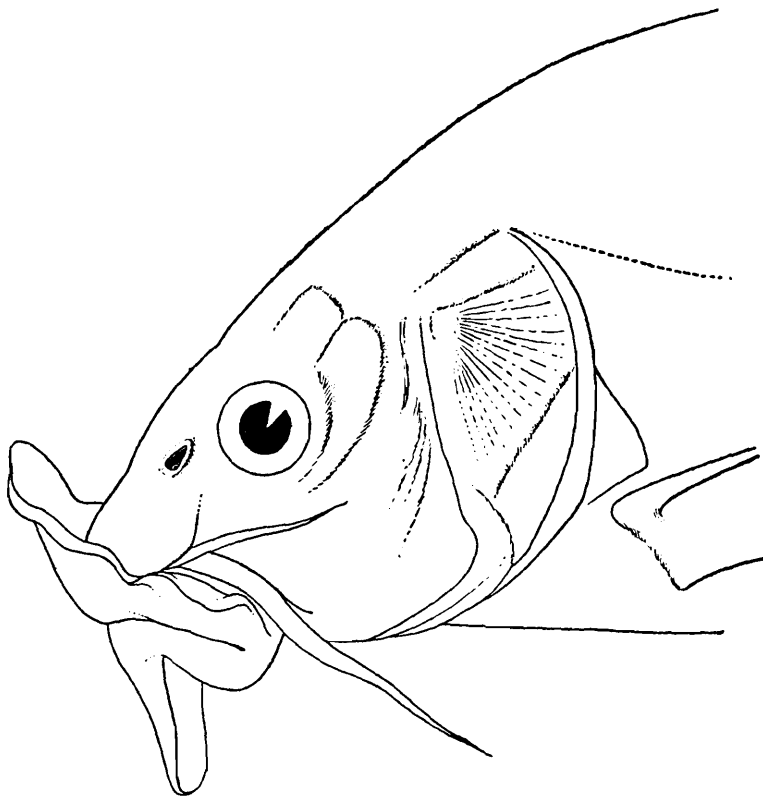
<sup>1</sup>Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, pp. 139—142 (1936).

hitherto examined, the lips were of the normal type, without any pendulous lobes, but in the specimen from the Barak River both the lips are reflected backwards throughout their extent and produced into broad lobes in the middle. Neither Hamilton nor McClelland noticed such



TEXT-FIG. 5.—Lateral view of a spirit specimen of *Barbus tor* (Ham.).  $\times \frac{2}{11}$ .

a condition of the lips in this species. Day<sup>1</sup> figured a specimen as *B. tor* from South India (Canara or Malabar) in which the condition of the lips corresponds with the specimen from the Barak River. In Day's figure the height of the body is almost equal to the length of the head which



TEXT-FIG. 6.—Lateral view of head and anterior part of body of the specimen illustrated in text-figure 5, showing the nature of the hypertrophied upper and lower lips.  $\times \frac{3}{8}$ .

is not the case with the Assamese example. It seems very probable that in the Peninsula the species is represented by a relatively slender form.

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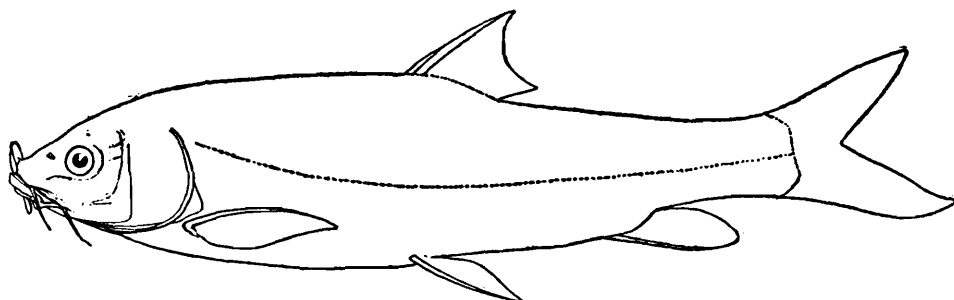
<sup>1</sup> Day, *Fish. India*, pl. cxi, fig. 1 (1877).

McClelland observes that the figure of this species in Buchanan's collection of Ms. Drawings refers to *B. progeneius* and not to this species. The drawing referred to is 121 of volume IV of the Ms. drawings<sup>1</sup>. From the nature of the dorsal spine, which is very hard, bony and long, and the red colouration of the distal parts of the pectoral, ventral and anal fins it seems almost certain that the species figured is *B. tor* and not *B. progeneius*. The figure is, however, inaccurate in so far as the size of the head is concerned. A small lobe of the lower lip is shown in the figure, but such a structure is found in several species, including *B. tor* though McClelland observed it only in his *B. progeneius*.

### ***Barbus progeneius* McClelland.**

1839. *Barbus progeneius*, McClelland, *As. Res.*, XIX, pp. 270, 334, pl. lvi, fig. 3.  
Laimatak River, Imphal-Silchar Road. 8.ii.36.  
Irang River, Imphal-Silchar Road. 11-13.ii.36.  
Barak River between Nongba and Kalanaga, Imphal-Silchar Road. 13.ii.36.

In characterising *Barbus progeneius*, McClelland was greatly influenced by the character of the lower lip which, in the adult, is produced



TEXT-FIG. 7.—Lateral view of a stuffed specimen of *Barbus progeneius* McClelland.  
×  $\frac{1}{8}$ .

into a median, fleshy lobe. As this character is common to *B. tor* (*vide supra*), *B. putitora*, and certain South Indian forms, this species has not usually been recognised as distinct. In the present collection from the Naga Hills there are 6 specimens ranging in length from 113 to 710 mm. which represent *B. progeneius* and it is now possible to give the distinguishing features of this species.

McClelland defined the species as follows :—

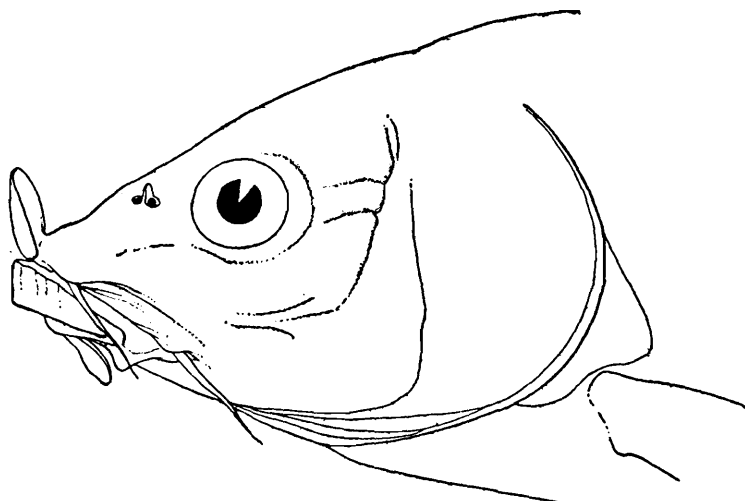
“Length of the head to that of the body as one to three; scales large and rounded, posteriorly; twenty-six along each lateral line, and six from the base of each ventral to the dorsum. Fins short. The number of rays are,  
D. 12 : P. 16 : V. 9 : A. 7 : C. 19.

The head is long and much compressed, the mouth is narrow and small, and from the lower lip a fleshy appendix is extended, by which it is distinguished from the neighbouring species.”

The long, compressed head and short fins are very characteristic of *B. progeneius*. The dorsal spine is less developed than in *B. tor*. The length of the head is almost equal to the depth of the body. In adult specimens the median lobe of the lower lip is reflected backwards and the middle portion is produced into a tongue-like flap. The tip of the

<sup>1</sup> Hora, *Mem. Ind. Mus.*, IX, p. 189 (1929). There is also another unfinished drawing (No. 125a) of the same species; this seems to have been added later on. This drawing was published by Gray in his *Illustrations of Indian Zoology*, II, pl. xvi, fig. 1 (1830-34).

snout is fleshy and produced into a more or less circular flap. The upper lip is fleshy but not produced as in *B. tor*.



TEXT-FIG. 8.—Lateral view of head and anterior part of body of the specimen illustrated in text-figure 7, showing the nature of the hypertrophied snout and lower lip.  $\times \frac{2}{3}$ .

NOTE.—The upper lip is fleshy, but not hypertrophied.

In the shape of the head this species shows considerable resemblance to *B. putitora*, but the form of the latter is more graceful (height of body considerably less than length of head), the dorsal spine more bony, the head relatively longer, the snout more blunt and the eyes proportionately smaller. The median lobe of the lower lip is well developed even in the young of *putitora*.

In its weak dorsal spine *B. progneius* resembles *B. hexagonolepis*, but besides the hexagonal form of the exposed surfaces of the scales



TEXT-FIG. 9.—Ventral surface of head and anterior part of body of *Barbus progneius* McClelland and *Barbus hexagonolepis* McClelland. Nat. size.  
a. *Barbus hexagonolepis* McClell.; b. *Barbus progneius* McClelland.

the latter possesses a widely interrupted labial groove, about 28 scales along the lateral line and 7 between the bases of the dorsal and ventral fins (against 26 along the lateral line and 6 between the bases of the dorsal and ventral fins in *B. progneius*) and the barbels longer than the diameter of the eye. In the young of *B. progneius* there is a black streak

behind the gill-openings, but the general body colour is lighter than that of *B. hexagonolepis*.

The alimentary canal is only 1.3 times as long as the fish and this shows that it is more or less a carnivorous species.

### ***Barbus putitora* (Hamilton).<sup>1</sup>**

1822. *Cyprinus putitora*, Hamilton, *Fish. Ganges*, pp. 303, 388.

1822. *Cyprinus mosal*, Hamilton, *ibid.*, pp. 306, 388.

1839. *Barbus macrocephalus*, McClelland, *As. Res.*, XIX, pp. 270, 335, pl. lx, fig. 2.

1839. *Barbus megalepis*, McClelland, *ibid.*, pp. 271, 337.

1936. *Barbus putitora*, Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, p. 141.

So far no specimen of this species seems to have been collected from the Naga Hills, but McClelland's account of *Barbus macrocephalus* shows that the fish is fairly common in the rapids of Assam. Mukerji and I referred to the distinguishing features of this species as compared with *B. tor* and I have pointed out above the differences between *B. progeneius* and *B. putitora*. Its long head, narrow body and strong dorsal spine are some of its principal diagnostic features.

In the form of the scales McClelland noticed the resemblance between his *B. macrocephalus* and *B. putitora*. On the authority of Griffith it was pointed out by McClelland regarding this species and "another fish very nearly allied to it, called by the natives *Mahaseer*, that they are extremely voracious and carnivorous in their habits as to swallow any of the smaller fishes that approach them." From an examination of the viscera of *B. putitora* Mukerji and I also concluded that this species is more carnivorous and voracious than *B. tor*. In the Dehra Dun hills the chief bait for *B. putitora* is *Barilius bendelisis* and *Labeo dero*, so it appears evident that the fish feeds on smaller species. *B. putitora* is probably widely distributed in the submountainous streams of the Himalayas and the Assam hills.

### ***Barbus hexagonolepis* McClelland.**

1839. *Barbus hexagonolepis*, McClelland, *As. Res.*, XIX, pp. 270, 336, pl. xli, fig. 3.

1936. *Barbus hexagonolepis*, Hora & Mukerji, *Rec. Ind. Mus.*, XXXVII, p. 389.

Khathalo stream near Nongba, Imphal-Silchar Road. 13.ii.36.

Barak River between Nongba and Kalanaga, Imphal-Silchar Road. 13.ii.36.

This is probably the commonest Barbel of the torrential streams of the Naga Hills. The relatively smaller scales (28-30 along the lateral

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<sup>1</sup> McClelland (*op. cit.*, p. 271, foot-note) considered *Barbus putitora* (Ham.) as a variety of his *B. hexagonolepis* and remarked: "This fish I have been unable to identify with Buchanan's description, I may therefore have described it under another name; he says the head is blunt, oval, small, and smooth, which scarcely applies to either of the foregoing [*B. progeneius* and *B. macrocephalus*], in which the head is remarkably lengthened; that of *B. hexagonolepis* would come nearest to it, though some of the others seem to correspond more in other respects with the account given. *Pisc. Gang.* 303." Hamilton's description of the head of *B. putitora* as "blunt, small, and smooth with a very minute tendril at each corner of the mouth, and another from each side of the under jaw" is rather unfortunate and seems to have been responsible for the confusion in the identity of the largest of the Indian Carps. It appears probable, however, that the above description referred to the snout and not to the head as a whole. Any how there can be little doubt now about the precise specific limits of *putitora* (*vide* Hora & Mukerji, *op. cit.*, 1936).

line and 7 between the bases of the dorsal and ventral fins), shorter and rounded head covered with tubercles on the sides, relatively shorter pectoral and ventral fins and weak dorsal spine are its principal characteristic features. McClelland distinguished it by the hexagonal outline of the exposed parts of its scales.

McClelland observes on the authority of Griffith that *B. hexagonolepis*

“is to be found in all large rivers on the Eastern frontier, from the base of the mountains to the situation at which the currents first become languid in the plains, keeping mostly in the middle of the stream, where it takes a red hackle very freely, as well as worms and other bait. It is very powerful, often attaining two feet and upwards in length, and usually weighing from eight to twelve pounds.”

The alimentary canal is short, about 2 to 2.2 times the length of the fish. As pointed out by McClelland the intestine of this species is of great capacity. The fish seems to be predacious in its habits feeding on insect larvae and small fish.

#### ADDENDUM.

After the above article had been sent to the press I found among the undetermined material in the Indian Museum another small collection of fish from the Naga Hills made by Mr. C. McCann of the Bombay Natural History Society in February 1930. It comprises 52 specimens belonging to 10 species. Of these 51 specimens were collected from pools in the bed of a rocky stream at Chang Chang, while one specimen of *Ophicephalus gachua* was obtained from a muddy tank at Chareli. The waters of these parts of the Naga Hills drain into the Brahmaputra system.

The following species are represented in this material :—

|                                           |  |               |
|-------------------------------------------|--|---------------|
| BAGRIDAE.                                 |  |               |
| 1. <i>Mystus bleekeri</i> (Day)           |  | 2 specimens.  |
| OLYRIDAE.                                 |  |               |
| 2. <i>Olyra longicaudata</i> McClelland   |  | 5 specimens.  |
| CYPRINIDAE.                               |  |               |
| 3. <i>Danio dangila</i> (Ham.)            |  | 7 specimens.  |
| 4. <i>Danio aequipinnatus</i> McClelland  |  | 14 specimens. |
| 5. <i>Barbus</i> sp. (Juv., Mahseer type) |  | 2 specimens.  |
| 6. <i>Barbus</i> sp. (Juvenile specimens) |  | 3 specimens.  |
| 7. <i>Barbus ticto</i> (Ham.)             |  | 3 specimens.  |
| NANDIDAE.                                 |  |               |
| 8. <i>Badis badis</i> (Ham.)              |  | 12 specimens. |
| OPHICEPHALIDAE.                           |  |               |
| 9. <i>Ophicephalus punctatus</i> Bloch.   |  | 1 specimen.   |
| 10. <i>Ophicephalus gachua</i> Ham.       |  | 3 specimens.  |

The only species new to the fauna of the Naga Hills is *Olyra longicaudata* which was originally described from the Khasi Hills. I<sup>1</sup> have pointed out elsewhere that *O. elongata* Günther<sup>2</sup> and *O. kempi* Chaudhuri<sup>3</sup> are to be regarded as synonyms of this species. *O. longicaudata*, thus defined, is found in the Darjeeling Himalayas, the hills of Assam and Tenasserim.

<sup>1</sup> Hora, *Rec. Ind. Mus.*, XXXVIII, p. 207 (1936).

<sup>2</sup> Günther, *Ann. Mag. Nat. Hist.*, (5), XI, p. 139 (1883).

<sup>3</sup> Chaudhuri, *Rec. Ind. Mus.*, VII, p. 443 (1912).



# SOME NEW AND LITTLE KNOWN PARASITIC HYMENOPTERA FROM INDIA.

By M. S. MANI, Assistant, Zoological Survey of India, Indian Museum,  
Calcutta.

## INTRODUCTION.

This paper is a report of my recent studies on the Indian Parasitic Hymenoptera in the collections of the Zoological Survey of India, Indian Museum, Calcutta and the Entomological Section, Imperial Institute of Agricultural Research, Pusa. The material dealt with comprises three superfamilies: Cynipoidea, Proctotrypoidea and Chalcidoidea. The collection is particularly interesting in view of the fact that it contains several remarkable genera like *Dieucoila* Ashm., *Odonteucoila* Ashm., *Platyscelio* Kieff., etc., which have not been recorded so far from India.

My thanks are due to Dr. Baini Prashad, Director, Dr. H. A. Hafiz, Officer in Charge of the Entomological Section, Zoological Survey of India, Indian Museum, Calcutta and Dr. H. S. Pruthi, Imperial Entomologist, Imperial Institute of Agricultural Research, Pusa, for facilities afforded to study the Hymenoptera collections of the respective institutions.

## Superfamily CYNIPOIDEA.

### Family CYNIPIDAE.

### Subfamily EUCOILINAE.

### Genus *Dieucoila* Ashmead.

- 1903. *Dieucoila*, Ashmead, *Proc. Ent. Soc. Washington*, V, p. 222.
- 1903. *Dieucoila*, Ashmead, *Psyche*, X, pp. 65, 71.
- 1910. *Dieucoila*, Dalla Torre & Kieffer, *Das Tierreich*, Lief. XXIV, p. 101.
- 1917. *Dieucoila*, Rohwer & Fagan, *Proc. U. S. N. Mus.*, LIII, p. 364.
- 1921. *Dieucoila*, Weld, *Proc. U. S. N. Mus.*, LIX, pp. 439-441, fig. 3.

In 1903, Ashmead erected the genus *Dieucoila* with *D. subopaca* Ashm.<sup>1</sup> from South America as the type and distinguished it from the rest of the Eucoilina genera by (among other characters) the leathery sculpture of the head and thorax. Weld, who described the type specimen in 1921, considered this sculpture as specific rather than generic. I, however, find this character constant over a series of Indian specimens, and am of opinion that Ashmead was correct in including this in his characterisation of the genus. This view is also supported by the fact that such sculpture is not met with in any of the related genera.

The genus has a wide range of distribution from the sea level to about 9,000 feet up the Himalayas in the Northern India. The new

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<sup>1</sup> Ashmead never published a description of this species.

species described below differs from the type species mainly in the laterally subcompressed abdomen.

**Dieucoila indica**, sp. nov.

*Female*.—Length 3.5-4.25 mm. or more. Head broader than thorax, reddish brown or sometimes dark brown, finely pubescent and the surface sculpture leather-like in appearance (described as leathery sculpture by Dalla Torre and Kieffer). Eyes and ocelli dark brown. Antenna two thirds the length of body, reddish brown; third segment long; fourth segment somewhat shorter; fifth, sixth and seventh segments equal, each about three fourths the length of third; eighth segment somewhat shorter; terminal segment shorter than third and black at the tip. Thorax reddish brown, matt-surfaced, with a leathery sculpture. Hind pleura polished. Fore wings finely pubescent and ciliated. Legs reddish brown. Abdomen brownish to black, glossy. Petiole of abdomen dark reddish.

*Type series*.—Three pinned examples. Coll. H. S. Pruthi, Mussorie, 6,000 ft., U. P. viii-1933. Nos. 915-17/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

I refer to this species a series of specimens received for identification from Dr. H. S. Pruthi, Imperial Entomologist: "Pusa, On weed. Coll. A. R., 21-iv-1914; Coll. D. P. Singh, 27-iii-1920; Murree, 7,500 ft., Coll. G. R. Dutt, vi-1918 and v-1920; Chapra, Coll. Mackenzie; Pusa, Coll. C. S. Misra, 21-vi-1906; Surat, Bombay, Coll. G. R. Dutt, 7-10. iii.1912." Two specimens belonging to the Zoological Survey labelled "Simla Hills, 7,000-9,000 ft., N. Annandale, 9-11.v.1909" also belong to this species.

Genus **Odonteucoila** Ashmead.

- 1903. *Odonteucoila*, Ashmead, *Proc. Ent. Soc. Washington*, V, p. 222.
- 1903. *Odonteucoila*, Ashmead, *Psyche*, X, p. 64, 71.
- 1910. *Odonteucoila*, Dalla Torre & Kieffer, *Das Tierreich*, Lief. XXIV, p. 102.
- 1917. *Odonteucoila*, Rohwer & Fagan, *Proc. U. S. N. Mus.*, LIII, p. 371.
- 1921. *Odonteucoila*, Weld, *Proc. U. S. N. Mus.*, LIX, pp. 441-442, fig. 41.

This genus, one of the most easily recognizable of the Eucoiline genera by its scutellar spine, has not been previously reported from India. It is easily separated from the closely related *Gonieucoila* Ashm. and *Acantheucoila* Ashm. by the fact that the scutellar "spine is produced on the sloping surface of the cup in front of the usual pit and not made by a prolongation of the disk of the scutellum" Ashmead never published a description of *O. chapadae* Ashm., which he designated as the genotype; but Weld described the type specimen in 1921.

**Odonteucoila kurseongensis**, sp. nov.

*Male*.—Length 3.5 mm. Black. Head as long as thorax, black; with a longitudinal furrow between the two lateral ocelli and the eyes; frons smooth, flat, with longitudinal lines at the sides and a triangular impression between. Antenna somewhat longer than thorax, dark brown or black; third and fourth segments equal; fifth segment somewhat shorter than fourth; sixth segment equal to fifth; the following

segments shorter; terminal segment somewhat longer than third. Fore wings finely haired and ciliated; veins brown. Mesopleura glossy. Legs dark brown. Abdomen black. Scutellar spine two thirds the length of thorax.

*Type*.—One pinned example. Coll. N. Annandale, Kurseong, E. Himalayas, 23-vi-1910. No. 920/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

## Superfamily PROCTORYPOIDEA.

### Family SCELIONIDAE.

#### Subfamily TELENOMINAE.

#### **Telenomus ashmeadi** Morrill.

1907. *Telenomus ashmeadi*, Morrill, *Amer. Nat.*, XLI, p. 419.

1926. *Telenomus ashmeadi*, Kieffer, *Das Tierreich*, Lief. XLVIII, p. 48.

To this species I provisionally refer a specimen in the collections of the Zoological Survey of India, labelled: "Coll. Annandale, Paresnath, Bengal, 4,000-4,400 ft., 12-iv-1909." One antenna is missing as also a few terminal segments of the other, but all the other characters can be clearly made out. The fifth antennal segment is shorter than fourth. Hind metatarsus is not quite equal to the combined length of the following three segments of the tarsus. Length about 2 mm. instead of 1.08-1.15 mm. With additional material this specimen may have to be referred to a new species.

The species was originally recorded as parasitic on *Pentatoma ligata* and *Pentatoma sayi* in Texas, America.

#### **Telenomus sagei**, sp. nov.

This new species agrees with the European *Telenomus verticillatus* Kieff.<sup>1</sup> in most characters but the scape is much longer than the three following antennal segments combined, third segment is not shorter but longer than second in female, scutellum has a few punctae, mesonotum thickly haired, abdomen almost equal to thorax in length. Total length 1.5 mm.

*Type series*.—Several pinned examples. Coll. Major Sage, Dharamsala, W. Himalayas, 17-ix-1890. Nos. 921-22/H3. One specimen also bears a second label: "Proctotrupidae with eggs parasitized by them. From Major Sage, Dharamsala, 17-ix-90."

#### **Dissolcus indicus**, sp. nov.

This new species agrees in every respect with *Dissolcus tetartus* Crawford<sup>2</sup> except that the frons is not coarsely punctate, the eyes are almost bare, and the antennae are not yellow but dark reddish brown. The

<sup>1</sup> Kieffer, *Entomol. Meddel.*, XI, p. 342, (1917); also see Kieffer, *Das Tierreich*, Lief. XLVIII, p. 37, (1926).

<sup>2</sup> Crawford, *Proc. U. S. N. Mus.*, XLI, p. 270, (1911); also see Kieffer, *Das Tierreich*, Lief. XLVIII, p. 125, (1926).

scutellum is not corrugated but has a reticulate sculpture similar to that on the mesonotum. The species is further distinguished by its much larger size—1.5 mm. instead of 0.75 mm.

This is the first record of a *Dissolcus* Ashm. from India.

*Type*.—One pinned female. Coll. C. Paiva, Calcutta, 9-vi-1907 No. 923/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

### Subfamily *SCELIONINAE*.

#### *Scelio horai*, sp. nov.

This species agrees in general with *Scelio fulvipes* Först.<sup>1</sup> but differs in the smaller size, frons not having transverse striae behind the antennae but uniformly and reticulately sculptured, temple and pleura not striated or grooved and in the colour of the legs. It runs into couplet 6 of Kieffer's<sup>2</sup> key to the "Indo-Asian" species, agreeing in general with *Scelio luzonicus* and *Scelio microcerus*. From the former it is distinguished mainly by the metapleura not being striate, the hairs on the head being silvery white instead of golden brown or yellow and face being reticulate; from the latter it is distinguished by the absence of striae on the cheek. I associate the name of Dr. Sunder Lal Hora with this species.

*Female*.—Length 4 mm. Black. Head sparsely clothed with short, stiff, silvery white hairs, frons umbilicately punctate, occiput reticulately sculptured, cheek without fan-shaped striae, carinae or grooves but with a coarse and reticulate sculpture. Mandibles dark brown. Antennae black. Thorax reticulately sculptured, without parapsidal furrows. Propleura reticulately sculptured. Mesopleura umbilicately punctate, its femoral groove minutely punctate. Coxae black, rest of legs dark reddish brown. Fore wings smoky brownish; stigmal vein moderately long, scarcely dilated apically but thickened basally. Abdomen linear-fusiform, longitudinally striated both dorsally and ventrally, much longer than the rest of body.

*Type*.—One pinned female with one of its antennae on a slide. Coll. S. L. Hora, Chakradharpur, at light, 24-iii-1935. No. 924/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

#### *Scelio paivai*, sp. nov.

This species is easily distinguished from *S. horai* by the longitudinal striations on the frons, fan-shaped sculpture on the cheek, the almost smooth occiput, the dark reddish brown colour of legs, slightly dilated stigmal vein and the oblong-ovate abdomen. This species also agrees in the fan-shaped sculpture of cheek with *S. vulgaris* in Kieffer's key (*loc. cit.*) to the Palearctic species but differs in the colour of the leg, sculpture of head and other characters.

<sup>1</sup> Förster, *Hymen. Stud.*, II, p. 105, (1856); also see Kieffer, *Das Tierreich*, Lief. XLVIII, p. 317, (1926).

<sup>2</sup> Kieffer, *Das Tierreich*, Lief. XLVIII, p. 310, (1926).

*Female*.—Length about 4 mm. Black. Head black, with long, silvery white hairs; face longitudinally striated, cheek with a fan-shaped striation; occiput almost smooth or with a few faint punctations. Antennae dark brown. Thorax reticulately sculptured, parapsidal furrows absent. Pleurae sculptured like the rest of thorax. All legs including coxae dark reddish brown. Fore wings brown, stigmal vein slightly dilated at the tip. Abdomen oblong-ovate, very dark brown, longitudinally striate and with golden brown hairs towards the apex.

*Type*.—One pinned female. Coll. C. Paiva, on Board ship 10 miles off Coconada, Madras Presidency, 15-iv-1908. No. 925/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

***Scelio calcuttaensis*, sp. nov.**

This species is easily distinguished from both *S. horai* and *S. paivai* by the umbilicate punctation of the head, the vertical carina of cheek coarse umbilicate punctation of thorax, transverse striations of the femoral furrow of the mesopleura and oblong abdomen. This species agrees in sculpture of the cheek with *S. longiventris* Kieff.<sup>1</sup> but differs in the umbilicate punctation of head and thorax, in which respects it resembles *S. vulgaris* Kieff. (*loc. cit.*).

*Female*.—Length about 3.5 mm. Black. Head black, sparsely clothed with short, brown hairs, regularly umbilicately punctate; cheek reticulate in front, with a vertical carina. Antenna very dark reddish brown. Thorax coarsely umbilicately punctate, parapsidal furrows absent. Propleura umbilicately punctate; mesopleura coarsely so, with its femoral groove finely transversely striate; metapleura umbilicately punctate. Fore wings brown, stigmal vein short. Legs including the coxae reddish brown. Abdomen black, oblong, much longer than the rest of the body, longitudinally striate.

*Type*.—One pinned female. Mus. coll., Calcutta, 13-ix-1907. No. 926/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

***Platyscelio punctatus* Kieffer.**

1913. *Platyscelio punctatus*, Kieffer, *Insecta*, III, p. 21.

1926. *Platyscelio punctatus*, Kieffer, *Das Tierreich*, Lief. XLVIII, p. 555.

I refer to this species one female in the Collections of the Zoological Survey, labelled: "J. Caunter, Puri, Orissa, 4-7.xii.1908." It agrees in every respect with Kieffer's description of the species in *Das Tierreich*, except that the cubital nerve is wholly obsolete. The species was originally described by Kieffer from Los Banos, Luzon, Mount Makiling, Philippine Islands. This is the first record of a species of the remarkable genus *Platyscelio* Kieff. from India as well as from outside the Philippines and Australia. The specimen is mounted in canada balsam on a slide.

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<sup>1</sup> Kieffer, *Ann. Soc. Sci. Bruxelles*, XXXII, p. 135, (1908), also see *Das Tierreich* XLVIII, p. 316, (1926).

## Superfamily CHALCIDOIDEA.

## Family CHALCIDIDAE.

## Subfamily LEUCOSPIDINAE.

**Polistomorpha paivai**, sp. nov.

This new species agrees in general with *P. indica* Mani,<sup>1</sup> the only other species known so far from India, but differs in the following characters: There are two transverse carinae on pronotum parallel to its hind margin, which is also carinate. Hind femur with 8 teeth, the last one being compound and tridentate. There is a single yellow, transverse band on pronotum along the anterior carina. Hind femur has a single irregularly-shaped yellow marking outside at the base, not extending to apex. There are only two transverse yellow bands on the dorsum of abdomen.

*Male*.—Length about 6.5 mm. (the specimen is pinned in such a manner as to make the measurement of the length difficult). Head coarsely punctate; frons densely clothed with silvery white villous hairs. Eyes dark brown, pubescent. Thorax closely umbilicately punctate. Anterior carina of pronotum short, not quite reaching the ends of the transverse yellow band, at the posterior margin of which it is situated. Posterior carina somewhat longer than the anterior carina but not reaching down to the sides of the pronotum. The posterior edge of pronotum is carinate in the middle but not at the sides. Scutellum sculptured like the rest of thorax. Propodeum with median and lateral carinae. Fore wings smoky, with a purplish iridescence.

Hind coxa densely and finely punctate, with a carinate upper edge. Hind femur umbilicately punctate and with long pilose setae, octadentate beneath; first tooth large, sharply pointed; second tooth small; third somewhat longer; fourth, fifth and sixth teeth much larger; seventh somewhat smaller; eighth tooth compound, tridentate. Abdomen deeply umbilicately punctate.

General colour of body mostly black. Hind coxae at apex, rest of all legs very dark reddish brown. There are yellow spots or markings on: scape below; a transverse band on the anterior carina on pronotum; front knee; middle tibia beneath; hind coxa above at base; hind femur outside at base, slightly continued above to basal half; apical three fourths above of hind tibia; on the dorsum of abdomen two transverse bands, the anterior short, posterior long, broken in the median line, broader at sides.

*Type*.—One pinned male. Coll. C. Paiva, Katihar, Purneah District, 4-viii-1907 No. 928/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

**Epexochlaenoides pyriformis** Weld.

1921. *Epexochlaenoides pyriformis*, Weld, *Proc. U. S. N. Mus.*, LXI, pp. 35-37.

I refer to this species a series of females in the collections of the Entomological Section, Imperial Institute of Agricultural Research, Pusa labelled: Coll. Fletcher, Pusa, Prasitic on *Rhynchium*;

<sup>1</sup> Mani, *Rec. Ind. Mus.*, XXXVII, p. 243, fig. 1, (1935).

3 females, Coll. Fletcher, Dobad, Bombay, 16-vii-1917 ; 2 females, Coll. G. M. C., Parasitic on *Rhynchium nitidum*, Pusa, x-1908. The species was originally described from Pusa and Bombay is a new record for the species.

***Leucospis indiensis* Weld.**

1921. *Leucospis indiensis*, Weld, *Proc. U. S. N. Mus.*, LXI, p. 20.

This species was originally described by Weld from one female collected by Dr. Ramakrishna Ayyar at Coimbatore, South India. This is the first record of the species from Northern India. There is one specimen in the collections of the Zoological Survey with the label : Kankondigee, 24 Parganas, Sunderbans, Coll. Jenkins, 15-xi-1909. This differs from Ramakrishna Ayyar's specimen in the bands on pronotum being yellow and the markings on hind femur pale yellow instead of white.

***Leucospis bengalensis* Weld.**

1921. *Leucospis bengalensis*, Weld, *Proc. U. S. N. Mus.*, LXI, p. 32.

This species was described by Weld from females only collected by Dr. Ramakrishna Ayyar at Pusa. The length of some females is as much as 12 mm. In a series of specimens of this species in the collections of the Entomological Section, Imperial Institute of Agricultural Research, Pusa, I found one male, which is described below.

The male resembles the female in general but differs in the following respects : Wings brownish, the purplish iridescence slight. Scape with yellowish white marking beneath, nearly the whole of its length. Hind coxa without spots on the upper basal corner. A narrow transverse yellowish band at basal third of sixth tergite. Two long napiform markings laterally at basal two thirds on the sixth tergite.

The sixth tergite is the longest and covers over three fourths the dorsum of abdomen. Third funicular segment somewhat longer than fourth. Pronotum not rugoso-punctate.

*Allotype*.—One pinned male. Coll. Howlett, Pusa, 4-iv-1911.

***Leucospis bengalensis* var. *mackenziei*, nov.**

Differs from the typical *L. bengalensis* in the following characters :

Length 9.5 mm. The marking on pronotum relatively longer in some specimens. Propodeum without median keel or lateral carinae. Hind femur with 11 teeth, the basal tooth broad and blunt ; second and third teeth minute ; fourth to seventh teeth large ; eighth to eleventh coalescent, rather small.

*Type*.—One pinned female. Coll. Mackenzie, Chapra.

*Paratypes*.—Two females on pin.

***Leucospis assamensis*, sp. nov.**

This new species agrees with *L. meenakshiae* Mani<sup>1</sup> in all essential characters, except for the following :

Length 10 mm. All spots and markings on body wholly gamboge yellow. Pedicel of antenna somewhat less than half the length of first funicular segment, fourth funicular segment not shorter than but equal to third funicular segment. Hind femur more closely and finely punctate

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<sup>1</sup> Mani, *Rec. Ind. Mus.*, XXXVII, pp. 244-246, fig. 2, (1935).

than hind coxa ; third tooth on hind femur stouter than second. The spot on frons between the eyes and antennal fovea relatively larger and contiguous with the eye and foveal borders. Anterior band on pronotum not perceptibly dilated at ends. There are no suborbicular spots on either side of mid-dorsum of mesonotum. Mesopleura unspotted. There is sometimes a minute, subelliptic spot on either side subapically on abdomen. Metanotum either entire or with very minute teeth.

*Type*.—One pinned female. Coll. S. E. Peal, Sibsagar, Assam. No. 930/H3. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

*Paratype*.—One pinned female. In the collections of the Zoological Survey of India, Indian Museum, Calcutta.

### Subfamily *CHALCIDINAE*.

#### *Spilochalcis fletcheri*, sp. nov.

This new species is erected for a specimen in the collections of the Entomological Section, Imperial Institute of Agricultural Research, Pusa. It is readily separated from *S. indica* Mani<sup>1</sup> by the brick red colour of the spots and markings on body, reticulo-punctate median segment without short, stout, blunt processes above the point of attachment of petiole of abdomen and the hind coxa being equal in length to the hind femur.

Length 5 mm. Moderately clothed with silvery white setae. Antenna about half the length of body, black above, reddish brown below and just at the tip. Second funicular segment relatively long. Both the middle and lateral lobes of mesonotum umbilicately punctate. Scutellum with a broad median groove. Median segment largely reticulo-punctate, without short, stout, blunt processes above the point of attachment of the petiole of abdomen. Hind coxa at least equal in length to hind femur. Petiole of abdomen relatively somewhat shorter.

Body black, spotted or marked brick red as below : Scape beneath. Frons from below the level of the median carinate spine between the antennal foveae. Mandibles. Orbit margined dorso-laterally. Two short, narrow, transverse bands one on either side, towards the anterior margin of pronotum. Two oval, nearly longitudinal, short bands inside of and just touching the parapsidal furrows towards anterior margin of mesonotum. Suborbicular spots at the antero-lateral outer corner of the lateral lobes of mesonotum. Two subtriangular spots at the postero-lateral angles of scutellum. Fore coxa reddish brown, rest of fore legs yellowish brown except for the black outer sides of femur and tibia. Mid legs yellowish to dark yellowish brown. Hind coxa black, unspotted. Hind femur on the outer side with one large, ovate spot basally beneath ; narrow, short, longitudinal stripe subbasally above ; sub-orbicular, small spot apically above ; and an irregular large spot beneath subapically, not touching the row of teeth. Hind tibia wholly dark testaceous. Wings cloudy antero-apically and antero-medially.

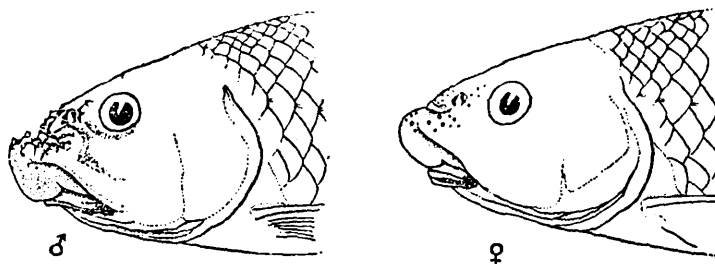
*Type*.—One pinned female. " Coll. Fletcher, Shillong, 5,000 ft. September 1917, on rose, parasitic on Tenthred."

<sup>1</sup> Mani, *Rec. Ind. Mus.*, XXXVII., pp. 252, 253, fig. 6, (1935).

## SEXUAL DIMORPHISM IN THE CARP *LABEO DERO* (HAM.).

By SUNDER LAL HORA, D.Sc., F.R.S.E., F.N.I., Assistant Superintendent and K. S. MISRA, M.Sc., Assistant, Zoological Survey of India, Calcutta.

Sexual dimorphism is exhibited by various types of fishes, but records from India are rather rare. One<sup>1</sup> of us described the secondary sexual characters of certain Cobitidae from the high altitudes of Central Asia, and since then similar modifications have been observed in several species of *Nemachilus* from different parts of India. Amongst the Cyprinid fishes Hora and Mukerji<sup>2</sup> recorded sexual differences in *Barbus chagunio* (Ham.), and showed that *B. spilopholus* McClelland represented the males of *B. chagunio*. Recently both the forms were collected in the Eastern Doons<sup>3</sup> from the same locality and the sex differences confirmed. It was observed that in nature the number of females greatly exceeds that of males.



TEXT-FIG. 1.—Lateral view of head and anterior part of body of a male and a female specimen of *Labeo dero* (Ham.).

Male  $\times \frac{1}{2}$ ; female,  $\times \frac{3}{4}$ .

While identifying a collection of fish from the Naga Hills, one<sup>4</sup> of us examined the entire material of *Labeo dero* (Ham.) in the collection of the Indian Museum and found marked modifications in the structure of the snout and the form of the dorsal fin in a number of specimens. It was presumed that these modifications were probably of the nature of secondary sexual characters. Examination of the gonads in 18 specimens collected in the Eastern Doons confirmed this view, and in the present note we give a detailed description of these modifications and indicate the sexual differences between the adult males and females of *L. dero*.

In *Labeo dero* the snout bears a transverse groove and its dorso-lateral surface is covered by "pearl organs" (a term generally used for small cornified, epidermal tubercles which appear on the head of various Cyprinoid fishes during breeding time). In young individuals of both

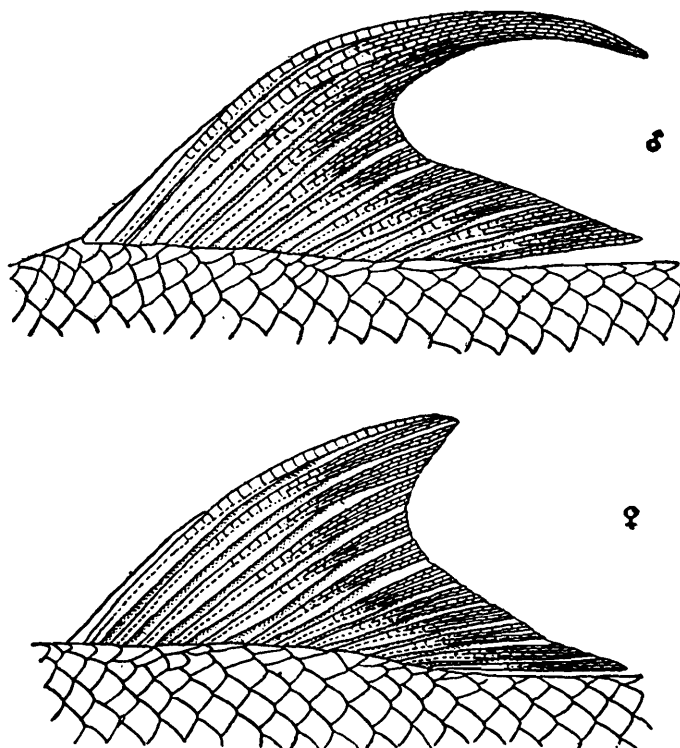
<sup>1</sup> Hora, *Rec. Ind. Mus.*, XXIV, pp. 81-83, 2 figs. (1922).

<sup>2</sup> Hora & Mukerji, *Journ. As. Soc. Bengal*, (N. S.), XXVII, 1931 pp. 137-139, 2 figs. (1933).

<sup>3</sup> Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, p. 142 (1936).

<sup>4</sup> Hora, *Rec. Ind. Mus.*, XXXVIII, p. (1936).

sexes, up to about 110 mm. in total length, the tubercles are rudimentary and the groove is only slightly marked; at this stage the tubercles are usually represented by small, open pores. As sexual maturity is reached and the fish attains a size of 160 mm. or more, the groove becomes deeper and more definitely defined, and the tubercles much more prominent. In the males the "pearl organs" are very greatly enlarged and as a result of the very fleshy snout the groove becomes comparatively much deeper than in the female. These sexual differences in the form of the snout are shown in text-figure 1.



TEXT-FIG. 2.—Lateral view of dorsal fin of a male and a female specimen of *Labeo dero* (Ham.).

Male  $\times \frac{3}{4}$ ; female  $\times 1\frac{1}{4}$ .

Correlated with the above differences is the prolongation of the anterior rays of the dorsal fin. In young specimens the superior border of the dorsal fin is concave and if the anterior rays are adpressed against the posterior rays, the former do not reach to the tip of the latter and there is usually a distance of several millimetres between them. This condition of the fin persists in females even at maturity, but in the males the anterior rays become greatly elongated and in some cases extend beyond the tip of the posterior rays by about 10 mm. This difference in the two sexes is shown in text-figure 2.

Of 18 specimens examined from the Eastern Doons, 9 are males (158-238 mm. in total length), 7 females (137-160 mm. in total length) and 2 juveniles (104 mm. in total length). These specimens were obtained in September-October when the gonads were not fully mature. It is likely that the species breeds just before or during the monsoon period. The relative numbers of males and females in the collection show that the two sexes are found in almost equal proportions.

As marked sexual dimorphism may result in the description of the same species under two names, it is desirable to note such characters as are liable to vary with sex.

## TWO NEW RACES OF INDIAN BATS.

By GLOVER M. ALLEN, *Museum of Comparative Zoology, Cambridge, Mass.*

Through the kind offices of Dr. Baini Prashad, Director, Zoological Survey of India, I have had the loan of the entire study collection of bats in the Indian Museum for identification. In going over this material, I find the two following races which appear to be undescribed.

### ***Pteropus hypomelanus maris*, subsp. nov.**

*Type*.—An adult female No. 10932, Indian Museum, in spirit with the skull separate and dry, from Heratara, Addu Atoll, south end of Maldivé Archipelago, Indian Ocean. Donated by the Marine Survey of India, 1922.

*Description*.—Externally characterized by the small size (forearm 111 mm.), nearly naked tibia, relatively long ear reaching when laid forward nearly to the eye, and by the normal color pattern.

Pelage rather dense and soft, with a wooly appearance. Upper side of tibia practically naked, but with scattered appressed hairs visible with a lens. Wings attached high up near the center of the back, where they are about 25 mm. apart. On the upper surface the hairy coat extends out on the proximal part of the wing membranes over an area about 50 mm. wide in the middle of the back, and to the proximal two-thirds of the upper side of the humerus. Twelve fasciæ are present in the plagiopatagium. The latter originates from the dorsal side of the foot between the bases of the second and third digits. Tail membrane not continuous in the middle, but interrupted for a space of about 10 millimeters. Its proximal half on each side is thickly clothed with hair above, from a line joining its median point of origin to the middle of the tibia, but ventrally only the proximal third is covered. Calcaneum well developed, and as long as the metatarsus. Ears normal, unreduced, projecting noticeably above the fur; when laid forward they fall 2 or 3 mm. short of the posterior corner of the eye. Their inner margin is regularly convex, as is also the basal two-thirds of the outer border, but the upper third of the latter is very slightly concave to the bluntly pointed tip.

*Color*.—As nearly as can be made out in the spirit specimen, the head is buffy gray, browner on the face and darkening on the interramal region; nape and shoulders ochraceous buff, deepening to ochraceous-rufous on the sides of the neck. Chest and abdomen similar but slightly duller, brownish rufous. Lower surface of humerus covered with straight dark-brown hairs on its basal two-thirds, the same color extending to the flanks and anal region. Back, from the level of the base of the humerus, and including the proximal two-thirds of the latter, dark brown with a slight admixture of buffy hairs, which become more

abundant and on the rump predominate, giving the posterior part of the body an ochraceous color.

*Skull.*—The cranium is of the usual pteropine type and of rather light, delicate proportions. The alveolar line of the upper jaw, if projected backward, passes just above the foramen magnum, indicating the considerable downward bending of the posterior part of the skull. In profile the rostrum is normal, with slightly concave dorsal outline. The postorbital processes are long and slender but do not quite meet the upward projection of the maxillary process. The relatively weak jaw is indicated by the fact that although the specimen is quite adult with somewhat worn teeth, the temporal crests do not unite to form a sagittal ridge but are separated by a space of about 5 mm. throughout their length. The anterior border of the orbit lies vertically above the front edge of  $m^2$ . The three groups of palatal ridges are as usual, 5-5-3.

The upper canines are slender and weak, about twice the height of the large  $pm^3$ . The first premolar ( $pm^2$ ) is exceedingly small, hardly piercing the gum and visible only with a lens. The large premolar ( $pm^3$ ) is of the usual shape, rather stout, with a strongly convex anterior outline and a well-marked posterior basal ledge. A similar ledge is present on the last premolar ( $pm^4$ ) but is not marked off by a notch. In crown view the cheek teeth are distinctly spaced, the two large premolars about equal in area, but the anterior molar is narrower and slightly longer than either. In the lower jaw, the middle incisors have a pear-shaped crown, as seen from above, the outer incisors a nearly circular crown the area of which is about thrice that of the inner incisors, but slightly less than that of the small first premolar ( $pm^2$ ). The postero-external basal ledges of the two large premolars are well marked. The crown area of the last molar is subequal to that of the first lower premolar.

*Measurements.*—The type in alcohol measures as follows: total length of head and body about 160 mm.; tail 0; ear 25; tibia 47; hind foot with claws 32.5; calcaneum 15; forearm 111; second metacarpal 59; third metacarpal 79; fourth metacarpal 76; fifth metacarpal 81; thumb from bend of wrist to tip of claw 43.

The skull measures: greatest length 51.6 mm.; basal length 47.1; palatal length 29.4; zygomatic width 27.5; mastoid width 18.3; width outside  $pm^3$  13; upper cheek teeth ( $c-m^2$ ) 19.2; lower cheek teeth ( $c-m_3$ ) 21.5; breadth of brain case 20; interorbital distance 8.5.

*Remarks.*—Hitherto only one fruit bat has been reported from the Maldivé Archipelago, a small insular race of the Indian *Pteropus giganteus* group which I described in 1908 as *Pteropus ariel*. The discovery of a representative of the *hypomelanus* group in the southern part of the same archipelago is thus of special interest, for this is a species mainly of the East Indian archipelago and southern Malaysia, with forms in the Nicobars and Andaman Islands, but it is absent from India and Ceylon. Further, the record not only adds this type to the tropical island groups of the middle Indian Ocean but partly bridges the gap in distribution between the eastern races and the more modified *Pteropus subniger* which, according to Andersen, represents the species in the Mascarene Islands, Réunion, and Mauritius.

***Hipposideros larvatus grandis*, subsp. nov.**

*Type*.—Adult male, skin and skull No. 10666, Indian Museum, from Akanti, upper Chindwin River, Upper Burma, 500 ft. Collected 24 June 1914, by G. C. Shortridge.

*Description*.—A large form, with longer forearm and longer leg and foot than the typical race of Java. Compared with the latter, the color above averages noticeably paler brown with more prominent whitish bases to the hairs. The general color of the type above is dull 'russet' in the terminal third of the hairs, while the basal two-thirds is contrastingly paler, whitish or faintly buffy. On the under surface the tint is near 'ochraceous-tawny', the hairs becoming dark brownish at the extreme base. Other specimens (adult but perhaps slightly younger) are duller, near Mars brown above, with the basal two-thirds of the hairs clearer whitish, and with the under parts a slightly paler tint of the same.

The skull of this northern race closely resembles that of the Javan bat, but averages very slightly larger, with noticeably larger teeth and longer tooth rows. In side view the large upper premolar has a greater bulk and its tip extends farther ventrally in relation to the canine. The last upper molar is much larger with well-developed parastyle and meta-style, quite different in appearance from its narrowly compressed condition in typical *larvatus*.

*Measurements*.—The forearm of the type measures (in the skin) 62.6 mm., which is exactly the average of nine specimens from Khasi Hills, Assam, and Prome, Burma, in which the extremes of length are 58.4—65, with most of the series over 60. In ten Javan specimens in alcohol, the average forearm measurement is 57.8 mm., with extremes from 55.8—59. The leg and foot are noticeably larger and more robust in the Burmese race, the length from top of knee to front of the claws, as naturally extended, being 35—37 mm. in the latter against 30.2 in Javan specimens, with a proportionately stouter foot.

The type measured in the flesh: head and body 72 mm.; tail 38; hind foot without claws 13; ear 24. Its skull measures: greatest length 23.5 mm.; basal length 19.2; palatal length 8.7; zygomatic width 13.0; mastoid width 11.5; width across the last molars 9.3; upper cheek teeth 9.3; lower cheek teeth 10.1. These skull measurements are not greatly different from those of Javan specimens but the tooth differences noted are fairly striking.

*Remarks*.—A series of skins and spirit specimens from Java, the type locality, of *N. larvatus* has been available for comparison with similar series from Tenasserim and Burma. Skins from southern Tenasserim (Maliwin) seem nearer the typical race, from which they are hardly distinguishable. One of the two specimens is in the red phase, and is a uniform brilliant orange-ochraceous above and below, the upper surface darkened by the burnt-umber tips of the hairs. Two skins from Muong Moun, Tonkin, are also not much larger than the Javan animal, and were by Osgood referred to the typical form. The series from Prome, Burma, and additional specimens from Khasi Hills, Assam, the upper Chindwin, Mt. Popa, and Paungyaung, North Shan States, are uniformly of larger size as appears in comparison of forearm length, hind leg and foot. The

range of the race *grandis* may then be tentatively given as Assam and Upper Burma south to Tenasserim. It should be added that the sub-specific name *grandis* had been added on the labels of some of the Upper Burma skins which evidently some previous worker (possibly the late Mr. R. C. Wroughton) had intended to describe. As no description using this name has appeared, I have adopted it here.

## SILUROID FISHES OF INDIA, BURMA & CEYLON.

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### VI.—FISHES OF THE GENUS *Clarias* GRONOVIVS.

Günther<sup>1</sup> recognised four species of *Clarias* from India, Burma and Ceylon, viz., *C. magur*, *C. teysmanni*, *C. brachysoma* and *C. jagur*. Day,<sup>2</sup> however, recorded five species from this region; of these three—*C. magur*, *C. teysmanni* and *C. jagur*—are the same as those listed by Günther. Day was doubtful regarding the validity of *C. brachysoma* and remarked: “Amongst the types of *C. brachysoma*, in the British Museum, the number of anal rays vary from 53 to 60, the fish appears to be similar to *C. Teysmanni*.” A specimen obtained at Wynaad in Malabar was assigned by Day to *C. dussumieri* Cuvier and Valenciennes<sup>3</sup> and he described a new species, *C. assamensis*, from Assam. Both these forms were distinguished from the common Indian species, *C. magur*, by the form of the band of the vomerine teeth and their nature. In *C. dussumieri* (Day *nec* Cuvier and Valenciennes) the teeth are very obtuse, almost molariform, and form a continuous band; whereas in *C. assamensis* the teeth are globular and form two pyriform patches separated by a toothless space in the middle. Later, however, Day<sup>4</sup> discarded *C. jagur* as a separate species remarking that “*Macropteronotus jagur* of Hamilton Buchanan, Fish. Ganges, pp. 145, 374, appears to be a monstrosity of *Clarias magur*, in which the last few vertebrae have been accidentally lost or removed, and the new caudal fin has become continuous with the dorsal fin superiorly and the anal inferiorly.”

I have examined a very large collection of *Clarias*, including several of Day's original specimens. Mr. P. E. P. Deraniyagala sent me a large collection, specially made for me, from Ceylon. Through the kindness of Mr. J. R. Norman information has been obtained regarding the distinguishing features of the types of *C. teysmanni* and *C. brachysoma*, now preserved in the collection of the British Museum of Natural History, London. The characters on which species are differentiated in this genus were tabulated with reference to the material in the Indian Museum with the following interesting results:

(i) In all the specimens examined, except one from Ceylon of *C. brachysoma*, including several hundreds in fresh condition in the Calcutta Fish Markets, the caudal fin was found to be distinct from the dorsal and the anal fins. The abnormal specimen from Ceylon is figured here. It shows the incomplete tail portion with the regenerated vertical fins. This supports Day's contention regarding *C. jagur*.

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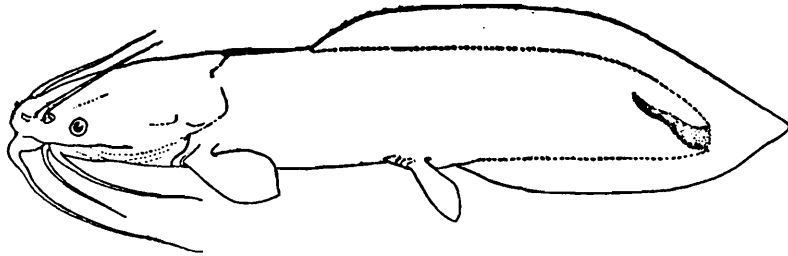
<sup>1</sup> Günther, *Cat. Fish. Brit. Mus.*, V, pp. 17-21 (1864).

<sup>2</sup> Day, *Fish. India*, pp. 484-486 (1877).

<sup>3</sup> Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XV, p. 382 (1840).

<sup>4</sup> Day, *Faun. Brit. Ind. Fish.*, I, p. 115 (1889).

On referring to Hamilton's original notes on "Gangetic Fishes", it was found that *jagur* was obtained at Lakhimpore in the Noakhali District.

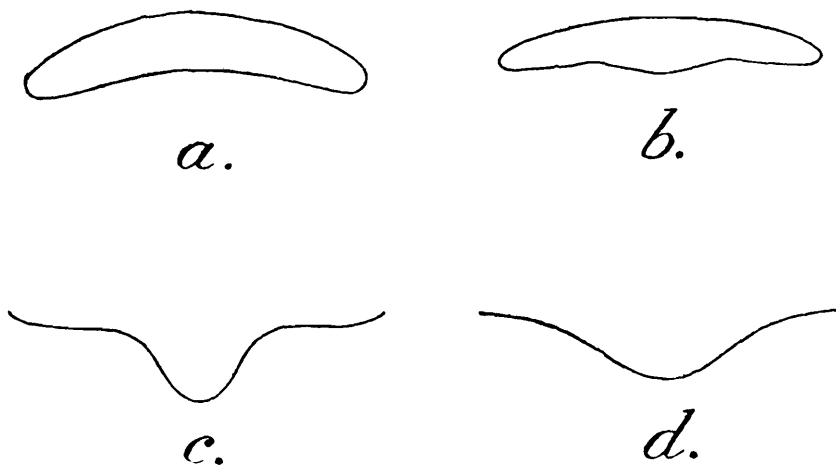


TEXT-FIG. 1.—Lateral view of an abnormal specimen of *Clarias brachysoma* Günther showing damaged tail region and regenerated vertical fins.  $\times \frac{3}{4}$ .

In the earliest known fish-manuscript of Buchanan<sup>1</sup> both the vernacular names "Magur" and "Jagur" are included under *Silurus batrachus* Linn. It would thus appear that Buchanan at first regarded the forms "Magur" and "Jagur" as pertaining to only one kind of fish, and considered this species to be the same as *Silurus batrachus* Linn. Later work has upheld the original determination of Buchanan.

It may be remarked that Bleeker (*vide* Günther, *op. cit.*, p. 19), observed an abnormal specimen of *C. melanoderma* in which the last rays of the dorsal and anal fins were united with the caudal. Deraniyagala<sup>2</sup> has also noted in the case of the common Ceylon species—*C. brachysoma*—that "specimens are frequently found with a regenerated caudal, which is then confluent with the dorsal and anal and lacks the hypural bones." In view of what is stated above I am definitely of the opinion that *C. jagur* is only an abnormality of *C. magur* (= *C. batrachus*).

(ii) The number of rays in the vertical fins varies considerably, and, therefore, no reliance can be placed on this character.



TEXT-FIG. 2.—Form of vomerine tooth-band and of occipital process in *Clarias teysmanni* Bleeker and *C. brachysoma* Günther. After sketches supplied by Mr. J. R. Norman. Diagrammatic.

- a. Vomerine tooth-band of *C. teysmanni*; b. Vomerine tooth-band of *C. brachysoma*; c. Occipital process of *C. teysmanni*; d. Occipital process of *C. brachysoma*.

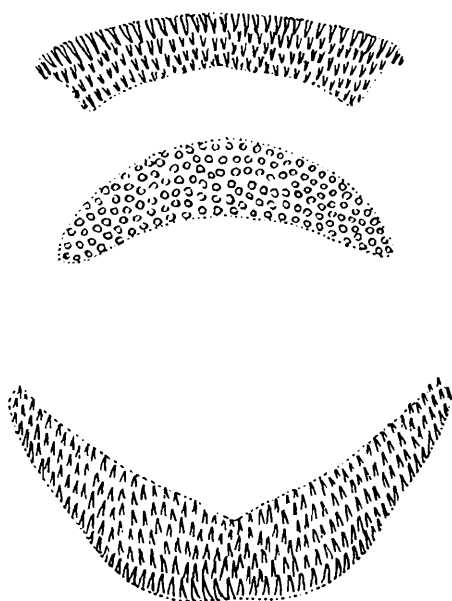
(iii) Mr. J. R. Norman compared the specimens of *C. teysmanni* and *C. brachysoma* in the British Museum and found that the specimens from

<sup>1</sup> Hora, *Journ. As. Soc. Bengal* (N. S.), XXVII, 1931 p. 133 (1933).

<sup>2</sup> Deraniyagala, *Ceylon Journ. Sci.* (B) XVI, p. 279 (1932).

Ceylon listed by Günther under *teysmanni* are identical with the types of *brachysoma*. Further, he found that *teysmanni* from the East Indies is distinct from *brachysoma* of Ceylon. He says, "We have 7 specimens from Ceylon and 6 from the East Indies. The chief differences appear to be that *brachysoma* has a larger head<sup>1</sup> (4 to  $4\frac{1}{3}$  in the length<sup>2</sup>, instead of  $4\frac{1}{3}$  to 5), the occipital process is broader and distinctly more obtuse,<sup>3</sup> the shape of the vomerine band of teeth is rather different, the frontal fontanelle is longer and narrower, and the distance between the occipital process to the dorsal fin origin is  $2\frac{1}{4}$  to  $2\frac{4}{5}$  in that from the former to the end of the snout instead of  $1\frac{1}{2}$  to 2" I have verified these differences by comparing the specimens of *teysmanni* from Siam and Perak with a large number of specimens in the collection of the Indian Museum referred to this species from Ceylon. There are variations in detail, but the differences in the size of the head and the shape of the vomerine teeth differentiate very clearly *teysmanni* from *brachysoma*. The above observations show that there is an insular form of *Clarias* restricted to Ceylon and that *C. teysmanni* is restricted to the East Indies and the adjacent countries to the north.

(iv) *Clarias dussumieri* Cuv. and Val. from Pondicherry, and Malabar, was regarded by Günther as a *species inquirendum*. Jerdon<sup>4</sup> had found



TEXT-FIG. 3.—Dentition of the type-specimen of *Clarias dayi*, sp. nov.  $\times 4$ .

it fairly common in the tanks and ditches of Malabar but Day (*op. cit.*, 1877) was able to procure only one specimen (7 inches long) from Wynaad. Day also stated that "It appears to agree with Bleeker's Malay form" [*C. melanoderma* = *C. melasoma*]. The common species of Malabar is the same as that found in other parts of India and the collection before me leaves little doubt that Cuvier and Valenciennes' *C. dussumieri* is synonymous with *C. batrachus* (Linn.). Day's Wynaad

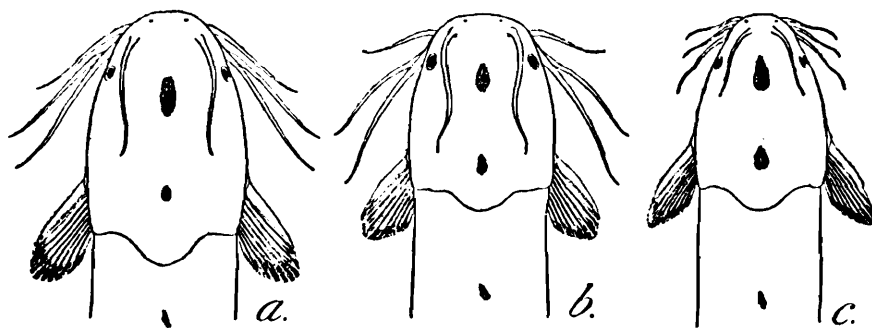
<sup>1</sup> Length of head is taken to the end of the occipital process.

<sup>2</sup> Length means length of fish without caudal.

<sup>3</sup> Mr. Norman found this character to be variable.

<sup>4</sup> Jerdon, *Madras Journ. Litt. & Sci.*, XVI, p. 342 (1849).

specimen is totally different. It not only possesses an externally serrated pectoral spine and molariform vomerine teeth, but its head is

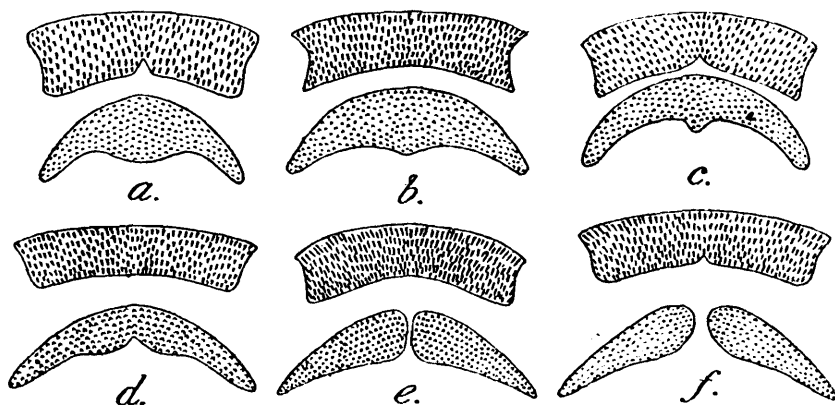


TEXT-FIG. 4.—Dorsal surface of head and anterior part of body up to commencement of dorsal in the 3 species of *Clarias* from India, Ceylon and Burma.

a. *Clarias batrachus* (Linn.).  $\times \frac{3}{8}$ ; b. *Clarias brachysoma* Günther.  $\times \frac{3}{8}$ ; c. *Clarias dayi*, sp. nov.  $\times \frac{1}{2}$ .

considerably narrower, more or less pointed, the barbels are relatively shorter and the distance between the occipital process and the dorsal fin is  $2\frac{1}{3}$  in that from the former to the end of the snout. It represents a species not hitherto described and I propose for it the name ***Clarias dayi***, sp. nov. It is abundantly distinct from Bleeker's *C. melanoderma* and belongs to the group of species in which the commencement of the dorsal fin is at a considerable distance from the termination of the head, e.g., *C. brachysoma*, *C. teysmanni*, etc.

(v) Day's *C. assamensis* is distinguished from *C. batrachus* by the disposition and form of the vomerine teeth, which are obtuse, and are



TEXT-FIG. 5.—Upper dentition of 6 specimens of *Clarias batrachus* (Linn.) showing variations in the nature of vomerine tooth-bands.

a. Specimen from Calcutta.  $\times 2$ ; b. Specimen from Moulmein.  $\times 2\frac{3}{5}$ ; c. Specimen from Inlé Lake, S. Shan States, Burma.  $\times 1\frac{3}{5}$ ; d. Specimen from Dibrugarh, Assam.  $\times 3$ ; e. Specimen from Assam.  $\times 2\frac{3}{5}$ ; f. Specimen from Assam.  $\times 3$ .

situated in two pyriform patches. My examination of the extensive material of *C. batrachus* has shown that the vomerine teeth are not exactly villiform but are somewhat blunt as compared with the teeth of the jaws proper. The vomerine teeth are generally arranged in a broad crescentic band which is considerably wider than the maxillary band, but sometimes the band is narrower; the latter condition is commonly seen in specimens from Upper Assam and Northern Burma. Usually the vomerine teeth form a continuous band, but in some specimens, from widely separated localities, the band is partially or completely interrupted in the middle so that in extreme cases the teeth become

arranged in two pyriform bands. In very young specimens the teeth are few and arranged in two narrow, transverse patches.

Attention may here be directed to the fact that Bleeker (*vide* Günther, *op. cit.*, p. 19) also observed two specimens of *C. melanoderma* in which the band of vomerine teeth was divided into two by a toothless space in the middle.

In view of the above observations I am convinced that Day's *C. assamensis* cannot be regarded as distinct from the very variable and widely distributed *C. batrachus*.

*Silurus anguillaris* Russell,<sup>1</sup> *Clarias marpus* Cuv. & Val.<sup>2</sup> and *C. punctatus* Cuv. & Val.<sup>3</sup> are rightly regarded as synonyms of *C. batrachus*, of which *Macropteronotus magur* Ham.<sup>4</sup> is also a synonym.

In view of what is stated above, only three species of *Clarias* can be recognised from India, Burma and Ceylon. These may be distinguished by the following key :

- A. Distance between tip of snout and end of occipital process *more than* 4 times the distance between dorsal fin and occipital process *C. batrachus* (Linn.).
- B. Distance between tip of snout and end of occipital process *less than* 3 times the distance between dorsal fin and occipital process
  - a. Snout broad, pectoral spine *roughened* externally, nasal barbel longer than half length of head to end of occipital process *C. brachysoma* Gthr.
  - b. Snout pointed, pectoral spine *serrated* externally, nasal barbel shorter than half length of head to end of occipital process *C. dayi*, sp. nov.

*Clarias dayi* is known from the Wynaad hills, *C. brachysoma* from Ceylon and *C. batrachus* from India, Ceylon, Burma, the Malay Archipelago and beyond.

#### VII.—FISHES OF THE GENUS *SILURUS* LINNAEUS.

Earlier ichthyologists gave a very wide interpretation to the genus *Silurus*, but Bleeker<sup>5</sup> restricted it for forms like *Silurus glanis* Linn., and separated the other species assigned to it into a number of distinct genera.

Bleeker included *Silurus* in the subfamily Siluriformes and defined it as follows :

“Dentes maxillis palatoque. Cirri 6, supramaxillares 2, inframaxillares 4. Dentes maxillis pluriseriati. Caput depressum. Dentes vomero-palatini in vittam bipartitam dispositi. Oculi inferne liberi. Nares posteriores valvula claudendae, anteriores brevitybulatae. Pinna analis cum caudali unita. B. 15 vel 16. V. 1/10 vel 1/11. D. 4. P. 1/16.”

At the same time he proposed the genus *Parasilurus* for *Silurus japonicus* Schl. (= *S. asotus* Linn.) and separated it from *Silurus* on the following characters : (i) One pair of mandibular barbels instead of two,

<sup>1</sup> Russell, *Fish. Vizag.*, II, p. 53 (1801).

<sup>2</sup> Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XV, p. 378 (1840).

<sup>3</sup> Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XV, p. 384 (1840).

<sup>4</sup> Hamilton, *Fish. Ganges*, pp. 146, 374 (1822).

<sup>5</sup> Bleeker, *Versl. Akad. Amsterdam.*, XIV, p. 393 (1862); *Ned. Tijdschr. Dierk.*, I, p. 114 (1863).

(ii) Eyes free instead of subcutaneous and (iii) Vomerine teeth in a continuous transverse patch instead of being interrupted. Both Günther<sup>1</sup> and Day<sup>2</sup> did not consider these differences of generic value.

I have examined specimens of the type species of both the genera and, with the exception of the number of mandibular barbels (4 in *Silurus* and 2 in *Parasilurus*), have not found any difference of generic value between them. In the case of *S. asotus*, Günther (*loc. cit.*) found that "Some of the specimens show a distinct interruption in the middle of the band of vomerine teeth, whilst in others the bands are confluent." I have found similar variations of vomerine teeth in the case of the common Indian *Silurus*, *S. cochinchinensis*. To separate genera on the number of mandibular barbels<sup>3</sup> only in fishes in which this structure is presumably undergoing degeneration seems hardly justified, and I have, therefore, refrained from attaching much importance to this character in the case of Indian Silurid fishes.

Under the genus *Silurus*, Günther did not include any species from India with a sufficient degree of certainty. He observed, however, that *Silurichthys berdmorei* Blyth may probably be identical with *Silurus cochinchinensis*. In the case of *S. malabaricus*, which he included under *Silurus* with a query, he remarked: "It is doubtful whether this species belongs to the genus *Silurus*, the short description given by Valenciennes having been taken from specimens in a bad state of preservation." In any case Günther, judging from the information published in his *Catalogue*, had no specimen of *Silurus* from Indian waters. Day<sup>4</sup> recorded *S. afghana* and *S. cochinchinensis* from India and described a new species from Wynaad<sup>5</sup>—*S. wynaadensis*. The former two species possess 2 mandibular barbels, while *wynaadensis* has 4 and is thus a typical *Silurus*.

*Silurus malabaricus* Valenciennes<sup>6</sup> is definitely known to belong to the genus *Callichrous*, while it is now possible to discuss the precise specific limits of the other species.

The differences between *S. afghana* and *S. cochinchinensis*, as indicated in Günther's descriptions, may be tabulated as follows:

*S. afghana.*

1. D. 2; A. 70; P. 1/13.
2. Anal and caudal slightly continuous.
3. Vomerine teeth in a very narrow, un-interrupted, curved band.

*S. cochinchinensis.*

- D. 4; A. 62; P. 1/11.
- Anal and caudal close together, but separate.
- Vomerine teeth forming a band, which is a little interrupted in the middle.

It should be remembered that Günther had only one specimen of each species. An examination of a large series of specimens in the Indian Museum has given the following results with regard to variations in the above noted characters.

<sup>1</sup> Günther, *Cat. Fish. Brit. Mus.*, V, p. 32 (1864).

<sup>2</sup> Day, *Fish. India*, p. 480 (1877).

<sup>3</sup> Recent work on the embryology of *Silurus asotus* (Atoda, *Dolutsugaku Zasshi*, XLVII, p. 228, 1935; Kimura, *Journ. Shanghai Sci. Inst. Sec. 3, III*, p. 105, 1935) has shown that in the younger stages there are 4 mandibular barbels. In the course of growth, however, one pair of these barbels is absorbed.

<sup>4</sup> Day, *Proc. Zool. Soc. London*, p. 523 (1869); *Fish. India*, p. 481 (1877).

<sup>5</sup> Day, *Proc. Zool. Soc. London*, p. 237 (1873).

<sup>6</sup> Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XIV, p. 353 (1839).

The dorsal fin is very small and enveloped in thick skin. In well preserved specimens the full compliment of rays can be made out only with great difficulty, while in lacerated specimens, especially from Cochin-China and the Mergui Archipelago, the rays can be counted with ease. The number of rays varies from 2 to 4 and in two adult specimens from the Naga Hills the dorsal fin is totally absent.<sup>1</sup>

The number of rays in the anal fin varies from 50 to 78, but in the pectoral fin the number is 13, besides a strong spine.

The anal and caudal fins are united, but not broadly confluent.

The vomerine teeth may form a continuous or discontinuous band, separated by a narrow or a wide interval. The condition of these teeth is thus similar to that noted by Günther for *Silurus asotus* (*vide supra*).

The study of the material in the Indian Museum has convinced me that the two species cannot be regarded as distinct. At my request



TEXT-FIG. 6.—Upper dentition of 3 specimens of *Silurus cochinchinensis* Cuv. & Val. from Lower Burma, showing variation in the nature of maxillary and vomerine tooth-bands.  $\times 2\frac{1}{2}$ .

Mr. J. R. Norman very kindly compared the type of *S. afghana* with Günther's specimen of *S. cochinchinensis*. He confirms my views and states "I have carefully compared the type of *S. afghana* with the specimen identified by Günther as *S. cochinchinensis* and fully agree that, apart from the vomerine teeth, these are identical. I fully believe that the two species are synonymous, always provided that Günther's has been correctly identified." The specimens in the Indian Museum are from Lower Burma (Mergui Archipelago and Tenasserim), Upper Burma (Akyab, Myitkyina District), Naga Hills, Khasi Hills and Eastern Himalayas. It is not unlikely, therefore, that Günther's specimen from Cochin China was correctly identified. A specimen from the Myitkyina District was sent to Dr. Pellegrin for comparison with the type of *S. cochinchinensis*. He observed that in the type of *S. cochinchinensis* the vomerine bands of teeth are interrupted, and the dorsal fin equals half the length of the head, whereas in the Myitkyina specimen the vomerine teeth are in a continuous band and the dorsal fin is very rudimentary, about one-fifth the length of the head. In all other respects he found the two specimens absolutely identical. I have already shown that the vomerine teeth and the dorsal fin vary considerably in this species.

Günther based his description of *S. afghana* on a specimen 5 inches long in Mr. Griffith's collection and gave its locality as Afghanistan. From the geographical distribution of the species, as known at present, it seems highly improbable that the original specimen was collected in Afghanistan. A reference to Mr. Norman on this point brought the following reply: "I am unable to give you the precise locality of

<sup>1</sup> Hora, *Rec. Ind. Mus.*, XXXVIII, p. 319 (1936).

Griffith's specimen which formed the type of Günther's *Silurus afghana*. I have turned up the original register, but no details are given there. The old label on the bottle simply says 'Affghan' "

In the general list of specimens contained in Griffith's collection (*Calcutta Journ. Nat. Hist.*, II, pp. 573-575, 1842), McClelland has indicated the species of which examples were sent "to the Museum at the India House" by placing the number of specimens despatched in Roman numerals after the names. This list shows that McClelland sent specimens of three species of "Silurus", *S. indicus* McClelland (one specimen), *S. glanis* Auct. (one specimen) and *S. boalis* Buch. (three specimens). The specimen of the first species is listed by Günther (*loc. cit.*, p. 46) under *Callichrous chedra* Ham., and the specimens of the last species (p. 37) under *Wallago attu* (Bl. & Schn.). It would thus appear that the specimen doubtfully referred by McClelland to *S. glanis* served as the type of *S. afghana*. Unfortunately the precise locality of this example is not indicated by McClelland but it is well known that Griffith made extensive collections in Assam, the Punjab and Afghanistan. No specimen of *Silurus* (*sensu stricto*) has since been found in north-western India and Afghanistan, while Günther's species is fairly common in streams below Darjeeling, Assam and Burma. It seems reasonable, therefore, to presume that there may have been some mixing up of localities in the case of the type-specimen of *S. afghana*. I<sup>1</sup> indicated the possibility of such a mixing up in the case of two species of *Nemachilus* which were stated to have come from Assam but which in reality belong to the Afghanistan fauna. It would, therefore, not be wrong to assume that the type of *S. afghana* was probably collected in Assam and not in Afghanistan.

Day<sup>2</sup> regarded *S. afghana* as distinct from *S. cochinchinensis* and separated them on the number of rays in the anal fin and the nature of the vomerine dentition. For *S. afghana* he gives Afghanistan and Darjeeling as the localities, while the distribution of *S. cochinchinensis* is given as "The hill ranges above Akyab, Tenasserim from whence Major Berdmore sent a specimen to the Calcutta Museum, and Cochin China" At first he<sup>3</sup> referred Darjeeling specimens to *S. cochinchinensis*, then he<sup>4</sup> proposed a new species for them and ultimately called them *afghana*. This would indicate that Day was not quite sure about the precise specific limits of his specimens from Darjeeling. Day also observed that Jerdon presented some specimens to the British Museum "the largest of which is about 7.2 inches in length, the locality is not stated but they probably came from either the Cashmere or Assam regions." While examining Indian material of *Nemachilus* in the collection of the British Museum I<sup>5</sup> found a large number of specimens presented by Dr. Jerdon. These came from the Darjeeling Himalayas and Assam, and it seems likely that his specimens of *Silurus* also came from the same region.

<sup>1</sup> Hora, *Journ. As. Soc. Bengal*, (N. S.) XXIV 1928, pp. 481-484 (1929).

<sup>2</sup> Day, *Fish. India*, p. 480 (1877).

<sup>3</sup> Day, *Proc. Zool. Soc. London*, p. 711 (1871).

<sup>4</sup> Day, *ibid.*, p. 239 (1873).

<sup>5</sup> Hora, *Rec. Ind. Mus.*, XXXVII, p. 66 (1935).

The type of Blyth's *Silurichthys berdmorei*<sup>1</sup> is now preserved in the Indian Museum (Cat. No. 481). It is in a fairly good state of preservation except that the dorsal and the caudal fins are damaged. It agrees entirely with other specimens of *Silurus cochinchinensis*.

In 1861, Peters<sup>2</sup> described two new genera of Indian fishes from specimens collected by Westermann in 1847. No definite locality is mentioned though they are stated to have come from the "Ganges". The generic and specific limits of his first species—*Pterocryptis gangetica*<sup>3</sup>, a Silurid fish—are very little understood; while his second species—*Acanthocobitis longipinnis*, a Cobitid fish—has been assigned to the genus *Nemachilus* and included in the synonymy of *N. pavonaceus* (McClelland) by Day.<sup>4</sup> Both Peters and Günther<sup>5</sup> regarded the latter species as a very close ally of the form described by McClelland. The above remarks would seem to indicate that Westermann collected his specimens somewhere in Assam or the Eastern Himalayas and this view receives further support from the fact that *Pterocryptis gangetica* is, as is explained below, a synonym of *Silurus cochinchinensis*.

In describing *Pterocryptis*, Peters only mentioned that his genus can easily be distinguished from *Cryptopterus* Bleeker<sup>6</sup> by its anal fin being continuous with the caudal fin. In the account of the species he mentions that the vomerine teeth form a continuous band which lies parallel to the maxillary teeth. The eyes are situated between the 1st and 2nd third of the length of the head. The maxillary barbels do not quite reach the pectoral fin while the mandibular barbels reach the end of the gill-cover. There are stated to be 12 branchiostegal rays and the fin formula is given as :

P. 1/12; D. 2; V 1/9; A. 75; C. 15 (branched rays).

The total length of the type of *P. gangetica* is 95 mm., length of head 14 mm., breadth of head 9 mm., depth of body 10 mm. and the distance between the lower jaw and the anal fin 33 mm.

Günther (*loc. cit.*, p. 44) included Peters' species under *Cryptopterus*, but placed it in a distinct group characterised by "Anal united with caudal". Day,<sup>7</sup> however, assigned *Pterocryptes* to the synonymy of *Callichrous* and in the description of *C. gangeticus* remarked: "I have not procured this species in India, my nearest approach to it being *C. Sindensis*." I have examined the type of *C. sindensis* and found that the union of the anal and the caudal fins is due to the regeneration of the caudal portion of the fish after some injury. In *Callichrous* the anal and the caudal fins are always distinct. Moreover, in *Callichrous* the depth of the body is never below one-sixth of the total length of the fish. The dorsal fin, though short, is fairly distinct and contains 4 to 5 well defined rays. These characters show that *Pterocryptes gangeticus* cannot belong to the genus *Callichrous*. On the other hand, its short description agrees very closely with specimens of *Silurus cochinchinensis*

<sup>1</sup> Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 156 (1860).

<sup>2</sup> Peters, *Monatsb. K. Preuss. Akad. Wiss. Berlin*, p. 712 (1861).

<sup>3</sup> It is probably a misprint for *gangetica*.

<sup>4</sup> Day, *Fish. India*, p. 614 (1877).

<sup>5</sup> Günther, *Cat. Fish. Brit. Mus.*, VII, p. 348 (1868).

<sup>6</sup> Bleeker, *Ichth. Arch. Ind. Prodr.* I, Siluri, p. 283 (1858).

<sup>7</sup> Day, *Fish. India*, p. 476 (1877).

and I have not the least hesitation in regarding the two species as absolutely identical.

From the above it is clear that the genus *Silurus* is represented in Indian waters by two species—*S. wynaadensis* Day with four mandibular barbels from Wynaad and *S. cochinchinensis* Cuvier and Valenciennes with two mandibular barbels from the Eastern Himalayas, Assam and Burma. If the number of mandibular barbels is to be considered a character of generic importance, the generic name *Parasilurus* Bleeker will have to be replaced by *Pterocryptes* Peters.

#### VIII.—FISHES OF THE GENUS *Callichrous* HAMILTON.

Hamilton in his "Gangetic Fishes" (p. 149, 1822) proposed the subgenus *Callichrous* for five species of *Silurus*, viz., *S. pabda*, *S. canio*, *S. duda*, *S. chechra* and *S. pabo*, and remarked that "species for this tribe of fishes are rather handsome, and have little or nothing of that lurid appearance by which many kindred species are distinguished. They are all very rich fine-flavoured food, and grow to from nine to twelve inches in length" No other generic diagnosis was given. Swainson<sup>1</sup> recognised *Callichrous* as a distinct genus and defined it as follows :

"Head large, depressed ; mouth large, not vertical ; dorsal fin close to the head ; anal fin excessively long ; vent close to the pectoral ; caudal fin forked."

Besides the five species for which Hamilton used this name, Swainson referred to it *Silurus boais* Ham. and *S. bimaculatus* Bloch. In 1862, however, Bleeker<sup>2</sup> defined the genus properly with *Callichrous pabda* Hamilton as its type. At the same time he included *Ompok* Lacépède and *Pseudosilurus* Bleeker<sup>3</sup> in its synonymy. The genus thus restricted was defined as :

"*Silurini*. Pinna dorsalis bene evoluta, hymenophora, spina ossea nulla. Dentes maxillis palatoque. Cirri 4, supramaxillares, inframaxillares. Oculi velati. Dentes maxillis pluriseriati setacei. Dentes vomerini in thurmas 2 distantes dispositi. Pinna caudalis biloba. B. 11 ad 15".<sup>4</sup>

This definition was somewhat amplified in his *Atlas Ichthyologique* (II, p. 84, 1862) and only *Pseudosilurus* was given as its synonym. In the discussion Bleeker erroneously thought that Hamilton had included *Silurus boais* and *S. garua* among *Callichrous*. A year later Bleeker<sup>5</sup> in his "Systema Silurorum Revisum" again regarded *Ompok* Lac. synonymous with *Callichrous*. Günther<sup>6</sup> agreed with Bleeker, but regarded *Silurodes* Bleeker also as its synonym. Though *Ompok* as a genus is not included by Günther under *Callichrous*, its type-species is given in the synonymy of *C. bimaculatus*. Day<sup>7</sup> gave a much wider interpretation to *Callichrous* and included in its synonymy *Ompok* Lacép., *Kryptopterychthys* Blkr., *Micronema* Blkr., *Phalacronotus* Blkr., *Hemisi-lurus* Blkr., *Silurodes* Blkr., *Pseudosilurus* Blkr., *Silurichthys* Blkr., and

<sup>1</sup> Swainson, *Nat. Hist. Fish.*, etc., II, p. 306 (1839).

<sup>2</sup> Bleeker, *Versl. Akad. Amsterdam*, XIV, p. 395 (1862).

<sup>3</sup> Bleeker, *Ichth. Arch. Ind. Prodr.*, i, Siluri, p. 253 (1858).

<sup>4</sup> The definition is drawn from the diagnostic characters given in the synoptic table of the Siluroid genera.

<sup>5</sup> Bleeker, *Ned. Tijdschr. Dierk.*, I, p. 115 (1863).

<sup>6</sup> Günther, *Cat. Fish. Brit. Mus.*, V, p. 45 (1864).

<sup>7</sup> Day, *Fish. Ind.*, p. 475 (1877); *Faun. Brit. Ind. Fish.* I, p. 129 (1889).

*Pterocryptes* Peters. Weber and de Beaufort<sup>1</sup> have shown that *Silurichthys*, *Silurodes*, *Hemisilurus* and *Cryptoperus* (= *Kryptopterichthys*, *Micronema* and *Phalacronotus*) may be regarded as good genera, sufficiently distinct from one another and from *Callichrous*. I agree with this view though the difference between *Silurodes* and *Callichrous* is not of sufficient generic value as not only genera but species are known among Siluridae in which the vomerine teeth may be continuous or discontinuous. In the case of *Silurus cochinchinensis* I (*vide supra*, p. 353) have shown that such a condition can be regarded within the range of individual variation. As no species of *Silurodes* has so far been found in India, it is not possible to remark on its precise generic limits. I have shown in an earlier note that *Pterocryptes* Peters and *Parasilurus* Bleeker are synonymous with *Silurus* Linn. (*vide supra*, p. 355). *Pseudosilurus* is undoubtedly a synonym of *Callichrous* as repeatedly pointed out by Bleeker himself. The validity of the generic name *Ompok*, which has priority over *Callichrous* and, in the present state of our knowledge is known to be synonymous with it, may now be considered.

The genus *Ompok* was briefly characterized by Lacépède<sup>2</sup> as follows : “ Des barbillons et des dents aux mâchoires ; point de nageoires dorsales ; une longue nageoire de l'anus.” Accompanying this short description are the figure and description of the type-species—*O. siluroides*, but both are very poor. The figure shows the following features which, if relied upon, indicate that the species cannot belong to *Callichrous* :

- i. Total absence of dorsal fin.
- ii. Rounded caudal fin.
- iii. Small eyes above the level of the angle of the mouth.

Judging from the figure alone, the species would appear to resemble *Apodoglanis* Fowler<sup>3</sup> known from Borneo, except that the latter lacks the ventral fins. But very fortunately the type-specimen of *Ompok siluroides* was examined by Valenciennes<sup>4</sup> with the following results given under *Silurus bimaculatus* Bloch :

“ C'est sur un poisson appartenant à ce groupe, et probablement à cette espèce, mais très-mal conservé, et encore plus défiguré par le dessinateur, que M. de Lacépède a établi son genre *Ompok* et son espèce *Ompok siluroïde* (tom. V, pag. 50 ; et tom VI pl. 1, fig. 2) le Muséum possède encore l'individu qui lui a servi ; il est desséché en herbier, et j'ai retrouvé la dorsale, qui était repliée par derrière et avait échappé ainsi à l'auteur. C'est l'absence prétendue de cette nageoire qui avait fourni le caractère du genre, lequel, par conséquent, tombe de lui même.

“ Cet individu a soixante-trois rayons à l'anale et la caudale divisée ; mais ses autres caractères ne peuvent être déterminés.”

Bleeker<sup>5</sup> also discussed the validity of the genus *Ompok* and came to the conclusion that—

“ Le nom d'*Ompok* aurait droit de priorité sur ceux de *Callichrous* et de *Pseudosilurus*, mais ne reposant que sur une erreur et n'étant qu'une reproduction mutilée du nom malais *Limpok*, j'ai cru devoir n'adopter que le nom proposé par l'auteur des Poissons du Gange ”.

<sup>1</sup> Weber & de Beaufort, *Fish. Indo-Austral. Archipel.*, II, p. 207 (1913).

<sup>2</sup> Lacépède, *Hist. Nat. Poiss.*, V, p. 49 (1803).

<sup>3</sup> Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 463 (1905).

<sup>4</sup> Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XIV, p. 362 (1839).

<sup>5</sup> Bleeker, *Atlas Ichthyol.*, II, p. 85 (1862).

Later authors did not question these views and even Weber & de Beaufort (*op. cit.*, p. 207) in accepting the genus *Callichrous* remark that Lacépède's diagnosis of the genus *Ompok* is erroneous. Jordan<sup>1</sup> has, however, disagreed with all the previous workers and thinks that *Ompok* should replace *Callichrous*. He assigns no reasons for this change. American ichthyologists are now frequently using the name *Ompok* in preference to *Callichrous*, but in view of the evidence adduced above the change does not seem to be justified.

In *Callichrous* the anal fin is long and may be free (several species) or just united with the caudal (*C. leiacanthus*) which is always forked. *Callichrous sindensis* Day<sup>2</sup> is an exception in these respects. In this species the anal fin is said to be broadly united with the caudal, which has a curved, entire margin. The type-specimen is now preserved in the collection of the Indian Museum and its careful examination shows that the caudal portion of the fish is regenerated after some injury. It seems likely that the tail fin along with a small portion of the tail was bitten off by another fish and that, during regeneration, the anal fin became extended round the injured part. This would also account for the smaller number of anal rays (47) in this specimen. Deraniyagala<sup>3</sup> has also observed that in the case of certain Ceylonese specimens of *C. bimaculatus* the caudal fin "is at times found to be regenerated and is then confluent with anal."

Other important characters mentioned by Day for *C. sindensis* are that the cleft of the mouth is very oblique, the lower jaw is very prominent and the eye is situated rather above the angle of the mouth. These features of the specimen are due to the fact that it is somewhat pug-headed. Pug-headedness is not uncommon among Siluroid fishes, and I have found such examples in a number of species. In view of the above I am of opinion that *C. sindensis* Day represents an abnormal, pug-headed specimen of *C. bimaculatus* (Bloch).

It has been shown above (*vide supra*, p. 355) that *Callichrous gangeticus*, as recognised by Day, is a synonym of *Silurus cochinchinensis* Cuvier and Valenciennes.

Besides the two species referred to above there are five others recognised by Day, viz., *C. bimaculatus*, *C. pabo*, *C. macrophthalmus*, *C. malabaricus* and *C. pabda*. Of these *C. pabo* can readily be distinguished from all others by its short maxillary barbels, not exceeding the length of head. In practice it has been very difficult to distinguish the other species precisely, especially when one has a large series of specimens for examination.

The first species that can be definitely assigned to this genus was described and figured by Bloch<sup>4</sup> as *Silurus bimaculatus* from Tranquebar. Among its characteristics he mentioned (i) projecting lower jaw, (ii) strong pectoral spine bearing teeth on its inner surface, (iii) anal fin long with 67 rays and (iv) tail fin yellow with violet tips, upper surface of head and body violet while the remaining parts are silvery.

<sup>1</sup> Jordan, *Genera of Fishes*, pp. 65, 114 (1917).

<sup>2</sup> Day, *Fish. India*, p. 476, pl. ex, fig. 1 (1877).

<sup>3</sup> Deraniyagala, *Ceylon Journ. Sci.*, (B), XVI, p. 278 (1932).

<sup>4</sup> Bloch, *Ausländ. Fische*, VIII, p. 24, pl. cccxiv (1794).

The figure shows the maxillary barbels extending considerably beyond the commencement of the anal fin.

Lacépède's<sup>1</sup> *Ompok siluroides* from Batavia, as emended by Cuvier and Valenciennes (*vide supra*, p. 257) is now definitely included in the synonymy of *Callichrous bimaculatus* (Bloch).

Hamilton<sup>2</sup> referred 5 species from "Bengal" to his genus *Callichrous* which he distinguished from one another as follows :

(i) *C. pabda*.—Pectoral spine smooth, anal with 54 rays, sides clouded with irregular black spots, longitudinal yellow stripe above lateral line, dark mark above pectorals, maxillary barbels extending beyond pectorals.

(ii) *C. canio*.—Pectoral spine smooth, anal with 69 rays, sides silvery, maxillary barbels "reach almost to the middle of the fish." The main difference from *C. pabda* is that the sides are not clouded.

(iii) *C. duda*.—Pectoral spine smooth, anal with 73 rays, maxillary barbels "reach almost to the middle of the fish" This species "differs in nothing from the *canio* except in the number of rays in the fin behind the vent."

(iv) *C. chechra*.—Pectoral spine indented behind, anal with 67 rays, "cloud-like spots on the sides, but without the yellow stripe along the sides that the *pabda* has. On each pectoral fin is a large black spot." Maxillary barbels "reach to the end of the back fin."

(v) *C. pabo*.—Pectoral spine "much stronger than in the *Pabda*", the hind part being indented on the edge; anal with 73 rays, colour silvery with green gloss above and purple gloss below; maxillary barbels shorter than head.

Hamilton himself recognised the great similarity between all the species, especially among the first four. He also indicated in the case of *C. canio* that it had "a very strong resemblance to the *Silurus bimaculatus* of Bloch", but the "tips of its tail fin are not black, a circumstance to which Bloch's fish owes its name. Besides, in Bloch's fish the first ray of each pectoral fin is a very strong indented prickle."

It is clear from the above that in differentiating species of this genus considerable reliance has been placed on colouration, nature of the pectoral spine, number of rays in the anal fin and the length of the maxillary barbels. As is well known, colouration in fishes varies considerably with the environmental conditions. Silvery specimens of a species may be found in clear waters, whereas in the specimens of the same species living in a pond over-grown with vegetation the sides are often clouded. The black tips of the caudal in Bloch's drawing of *S. bimaculatus* certainly represent a very exaggerated type. This fin is, in certain cases, edged with grey along the posterior margin. Day<sup>3</sup> noticed that "dark tipped caudal fins are not rare in Madras though uncommon inland." I have examined a young specimen 14 mm. long from Poona in which the tips of the caudal fin are greyish. The shoulder spot may be absent or present, when present it may be dumb-bell-shaped but sometimes its anterior or posterior half is only clear. Day demonstrated that for *C. bimaculatus* and *C. pabda* no reliance can be placed on the number

<sup>1</sup> Lacépède, *Hist. Nat. Poiss.*, V, p. 50, pl. i, fig. 2 (1803).

<sup>2</sup> Hamilton, *Fish. Ganges*, pp. 149-154 (1822).

<sup>3</sup> Day, *Fish. India*, p. 477 (1877).

of rays in the anal fin and on the nature of the pectoral spine to separate species of this genus. My examination of a large number of specimens in the collection of the Indian Museum has enabled me to confirm these views. The length of the maxillary barbels also varies considerably. I am of opinion that besides *C. pabo* there is only one other very variable species of this genus—*C. bimaculatus*—found in Indian waters, though its range extends as far east as Java, Sumatra and Borneo.

Cuvier and Valenciennes<sup>1</sup> described a number of new species in the genus *Silurus* from India which are now referred to *Callichrous*, viz., *S. malabaricus*, *S. anastomus*, *S. mysoricus* and *S. microcephalus*. The description of the first species was based on small, badly preserved specimens collected from Malabar, the second species was described from Bengal and differentiated from *S. bimaculatus* by the fact that “a l'épine pectoral plus grêle, et quelques rayons de moins à l'anale.” The species from Mysore was characterised as : “à tête plus plate et à corps plus elongé, plus comprimé que dans le *S. bimaculatus*, mais dont la caudale se partage de même en deux lobes pointus” The last species was described from Bengal and with the exception that its head is contained 7 times in the length of the body, was stated to be closely allied to the form from Mysore. The descriptions of these species were based on insufficient material and without a proper understanding of the forms described by Hamilton. Moreover, the diagnostic characters are such that they fall within the range of individual variations. The four species of Cuvier and Valenciennes are, therefore, regarded by me as synonyms of Bloch's *S. bimaculatus*.

*Silurus lamghur* Heckel<sup>2</sup> from Kashmir is undoubtedly synonymous with *Callichrous bimaculatus*, the distinguishing characters given by its author have no specific value. In the figure the anal fin is shown just approaching the base of the caudal fin. Probably on this character Günther<sup>3</sup> assigned this species to the genus *Silurichthys*.

McClelland<sup>4</sup> described *S. indicus* from the Punjab and remarked : “This species is called Puftah at Loodianah, and is the same as the Puftah of Bengal, and identical with *Silurus canio*, *S. duda* and *S. chedra* (sic) of Buchanan, which would seem to be but varieties of a widely, diffused and common species.” In the circumstances one fails to see why a new name was proposed by McClelland for the *Puftah* of the Punjab. The species is synonymous with *Callichrous bimaculatus* (Bloch).

In describing *Pseudosilurus macrophthalmus* from Tenaasserim, Blyth<sup>5</sup> indicated its close resemblance to *C. pabda* Ham., but remarked that it is “proportionally less deep and more elongated, with eye of twice the diameter, and the lower jaw closing evenly with the upper, or very nearly so, though protruding when the mouth is open; maxillary cirri much longer, reaching far beyond the more developed pectorals.” Günther (*loc. cit.*, p. 45) included this species under *Callichrous* as a doubtful form, but Day<sup>6</sup> regarded it a valid species, with *Callichrous*

<sup>1</sup> Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XIV, pp. 353, 363-365 (1839).

<sup>2</sup> Heckel, *Fische aus Caschmir*, p. 82, pl. xii, figs. 5 & 6 (1838).

<sup>3</sup> Günther, *Cat. Fish. Brit. Mus.*, V, p. 36 (1864).

<sup>4</sup> McClelland, *Calcutta Journ. Nat. Hist.*, II, p. 583 (1842).

<sup>5</sup> Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 156 (1860).

<sup>6</sup> Day, *Fish. India*, p. 478 (1877).

*notatus* Day from Burma as its synonym. He remarked that *C. macrophthalmus* "is closely allied to *C. bimaculatus*, but has a larger eye, a narrow band of palatine teeth, much longer pectoral fins and maxillary barbels." He extended the range of the species to Madras and Assam and observed that "The only objection to uniting the Madras with the Assam and Burmese form is that the former has P. 1/12-13, the latter P. 1/15. The shoulder spot is not so well marked, and the dorsal fin not so developed in the Madras variety." Vinciguerra<sup>1</sup> had great difficulty in separating *C. macrophthalmus* from *C. bimaculatus* and from the Burmese specimens at his disposal he drew up a table of characters to differentiate the two species. Some of the characters noted for *C. macrophthalmus* are even contradictory to the original definition of the species. In determining specimens from Manipur, Assam, I<sup>2</sup> had the same difficulty. A study of the material in the collection of the Indian Museum has convinced me that Blyth's species cannot be regarded as distinct from the form described by Bloch.

Güther's<sup>3</sup> *C. ceylonensis* seems to differ from *C. bimaculatus* by the position of the blackish blotch above the pectoral which is "remote from the head" in the latter and "immediately behind the gill-opening" in the former. As remarked above this cannot be regarded as a character of sufficient value for separating the two species; *C. ceylonensis* is, therefore, regarded as a synonym of *C. bimaculatus*.

*Cryptopterus latovittatus* Playfair<sup>4</sup> is, as pointed out by Day, a *Callichrous* in which the mandibular barbels appear to have been either overlooked or may have been absent.<sup>5</sup> Its description leaves no doubt that it is synonymous with *C. bimaculatus*.

Day has himself included his *C. egertonii*<sup>6</sup> in the synonymy of *C. pabda* which is regarded here as identical with *C. bimaculatus*.

Day described *C. nigrescens*<sup>7</sup> from Burma but later he<sup>8</sup> regarded it as a variety of *C. pabo* and remarked that "it was clouded all over with fine dark spots, and had black tips to the caudal lobes, and nine ventral rays." Prashad and Mukerji<sup>9</sup> also recorded coloured specimens of *C. pabo* from the Myitkyina District, but observed that in their specimens the pectoral spine is distinctly serrated internally. The two forms, no doubt, represent colour variations of the same species.

From the above analysis of the diagnostic characters of the various species of *Callichrous* described from India, it seems clear that only two valid forms can be recognised—*C. bimaculatus* (Bloch) with the maxillary barbels always considerably longer than the head and *C. pabo* Hamilton with the maxillary barbels always considerably shorter than the head. The latter species is rather rare and mainly confined to north-eastern India and Burma, while the former is very widely distributed in south-eastern Asia.

<sup>1</sup> Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, (2), IX, pp. 201-205 (1890).

<sup>2</sup> Hora, *Rec. Ind. Mus.*, XXII, p. 178 (1921).

<sup>3</sup> Günther, *Cat. Fish. Brit. Mus.*, V, p. 46 (1864).

<sup>4</sup> Playfair, *Proc. Zool. Soc. London*, p. 16 (1867).

<sup>5</sup> Day noted that in a young specimen of *C. nigrescens* "mandibular cirri were absent, but it was evidently the same species" (*Proc. Zool. Soc. London*, p. 617, 1869).

<sup>6</sup> Day, *Proc. Zool. Soc. London*, p. 710 (1871).

<sup>7</sup> Day, *Proc. Zool. Soc. London*, p. 616 (1869).

<sup>8</sup> Day, *Fish. India*, p. 478 (1877).

<sup>9</sup> Prashad and Mukerji, *Rec. Ind. Mus.*, XXXI, p. 177 (1929).



# THE INDIAN APHODIINAE OF THE SUBGENUS *TRICHONOTULUS*. (COLEOPTERA: LAMELLICORNIA.)

By RENAUD PAULIAN, *Zoological Laboratory, Sorbonne, Paris, France.*

In the monograph of the Aphodiinae<sup>1</sup> by Ad. Schmidt (1922) only one species *biseriatus* Sch. of the genus *Aphodius* Illiger, subgenus *Trichonotulus* Bedel, is included from India. No other species of the genus has been described since this date, nor any new records of already known species have been added. In a very interesting collection of Indian material recently sent to me by Monsieur R. Oberthür of Rennes I found specimens of two new species of the subgenus *Trichonotulus*, which are described below. In this paper I also give a synoptic key for the identification of the three Indian species and have included a description of Schmidt's species.

## *Key to Indian species.*

- |                                                                                     |                                    |
|-------------------------------------------------------------------------------------|------------------------------------|
| 1 (2) Elytral setae uniseriate, each seta placed behind a rather obtuse granulation | <i>A. (T.) castetsi</i> , sp. nov. |
| 2 (1) Elytral setae biseriate.                                                      |                                    |
| 3 (4) Base of thorax margined, not sinuate on either side of the middle             | <i>A. (T.) biseriatus</i> Sch.     |
| 4 (3) Base of thorax not margined, deeply sinuate on either side of the middle      | <i>A. (T.) moorei</i> , sp. nov.   |

The subgenus *Trichonotulus* is distinguished from all other subgenera of *Aphodius* by the following characters :

Body completely covered with setae. Forehead without tubercles or carinae. Scutellum with elongated, parallel sides. Terminal setae of the hind tibiae unequal. Body usually black or brown, often with paler elytrae.

This subgenus comprises a European species, the not uncommon *A. (T.) scrofa* (F.), two American species and many African and East Asiatic species. Lately many African forms have been described by M. Balthasar of Prague and M. Boucomont of Cosne (Nievre).

## ***Aphodius (Trichonotulus) castetsi*, sp. nov.**

Body elongated, with parallel sides, rather convex, completely covered with yellow setae. The setae lie regularly and are disposed backwards. Body completely brown, with strong chagration on the head and the thorax. Elytrae completely opaque without any visible chagration even under a magnification of sixty diameters.

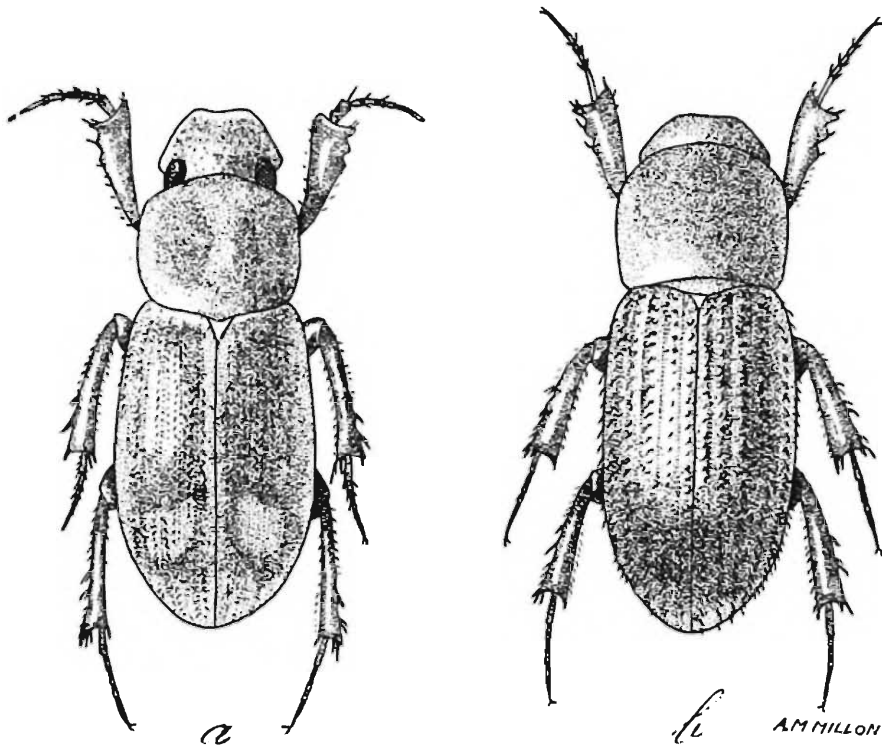
Head large, flat. The suture of the forehead with the clypeus is deeply impressed. The head is covered with a rather fine, regular and close punctuation.

The clypeus is cut squarely in front. Ocular lobes small, not projecting on the sides of the head.

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<sup>1</sup> Schmidt, Ad.—*Das Tierreich, Aphodiinae*, p. 243 (Berlin : 1922).

Thorax square, convex, finely margined at the sides and base, completely covered with a strong, regular and rather sparse punctuation made of points not deeply marked and rather flat.



TEXT-FIG.—Two new species of the genus *Aphodius* from India.

a. *Aphodius (Trichonotulus) moorei*, sp. nov.; b. *Aphodius (Trichonotulus) castetsi*, sp. nov.

Scutellum without punctuation.

Elytrae long, convex, parallel, with well-marked striae; striae punctured; punctures are far apart and only slightly indent the interstriae, which are flat; they bear a regular series of granules on each. Behind those granules rise yellow setae standing erect.

First joint of the hind tarsi longer than the terminal spur of the hind tibiae; slightly longer than the two following joints taken together.

Length 2.5 mm.

*Type-specimen* :—A specimen from Travancore, Trichinopoly; R. P. Castets, September 1897; in M. Oberthür's collection. Another specimen from the same locality also in M. Oberthür's collection.

***Aphodius (Trichonotulus) moorei*, sp. nov.**

Body elongated with elytrae broadening posteriorly. Not very convex, completely covered with yellow setae, which lie backwards. Body completely opaque, covered with a fine chagration. Head, middle of the thorax and elytrae with a discal spot and a fasciated band, broader near the suture and placed in the last quarter of the elytra, dark brown. Base and sides of the thorax and the remaining part of the elytrae yellowish brown.

Head large, flat, finely and closely punctured. Clypeus squarely cut in front. Ocular lobes small, not projecting on the sides of the head. Eyes large.

Thorax square, with a regular, close and fine punctuation; punctures asperate. Base of the thorax not margined, strongly sinuate on each side of the middle. Posterior angles rounded.

Scutellum bearing a few large punctures.

Elytrae short and broad, with fine striae, the punctuation of the striae very fine and not indenting the interstriae; these are flat, with a rather irregularly biseriate punctuation. The points bear strong setae. Striae disappearing at the apex of the elytrae.

First joint of the hind tarsi much longer than the upper terminal spur of the hind tibiae, nearly as long as the four following joints taken together.

Length 3.5 mm.

*Type-specimen*:—A specimen in M. R. Oberthür's collection from Ceylon; F. Moore. Another specimen also from Ceylon in M. Oberthür's collection.

***Aphodius (Trichonotulus) biseriatulus* Ad. Sch.**

*Aphodia (Trichonotulus) biseriatulus* Ad. Schmidt, *Ent. Wochenbl.*, XXV, p. 48, (1908); *Arch. Naturg.*, LXXIX, p. 154 (1913); *Das Tierreich, Aphodiinae*, p. 243 (1922).

Body convex, dark brown; completely, strongly and closely punctured. The suture of the forehead and clypeus deeply impressed. Clypeus cut squarely in front. Ocular lobes rounded. Base of the thorax margined, the margin is preceded by a line of strong points. The whole thorax covered with a close and strong double punctuation. Scutellum very small. Elytrae with a small humeral tooth. Striae deep and strongly punctured. Interstriae flat, with a very short covering of biseriate setae. Upper terminal spur of the hind tibiae shorter than the first joint of the hind tarsi. First joint nearly equal to the three following joints taken together.

Length 4 mm.

*Locality*:—India.

*Remarks*:—*A. (T.) moorei* seems to have very close relationships with *A. (T.) fulvescens* Har. from the West Coast of Africa and specially from Senegal, but it is easily separated from this species by the quite different proportions of the first joint of the hind tarsi. The species described by Schmidt seems to be closely related to an American species. The relationships of *A. (T.) castetsi* are far from clear and it seems to me that this species should take quite a separate place in the group on the strength of its elytral sculpture. I even thought that it may be necessary to create a new subgenus for this species, but as in all points except the sculpture of the elytrae it is a typical *Trichonotulus*, I think it best for the present to place it in this subgenus.



# THE BIOLOGY OF THE SHORE-FLY *SARCOPHILA CINEREA* FABRICIUS. (DIPTERA: METOPIIDAE).

By T. V. VENKATRAMAN, *M.Sc.*

(From the University Zoological Research Laboratory, Madras.)

(Plate XIII.)

## INTRODUCTION.

The sub-family Sarcophaginae of Metopiidae has a very interesting life-history. The majority of those forms whose life-history is known are saprophytic, though a certain number of parasitic species occur, and of late it has also been found that some are able to adapt themselves to either mode of living. The following account concerns the biology of a species belonging to the tropical genus *Sarcophila* recorded from India by Senior-White (1924). Except for this record nothing has been published about its habits or biology. The immature stages of this form are scavengers and although they develop as such they may become true parasites in course of time. As Hallock (1929) remarks, "it may be that what we observe is the parasite habit in the process of development"

During the beginning of December 1934, numerous females of a large grey Sarcophagid were collected on the beach at Madras, S. India. Specimens were identified as *Sarcophila cinerea* Fabr. The species was known previously from Puri (Orissa), Varkala (Travancore), Colombo and Barberyn Island. Mr. Senior-White<sup>1</sup> thinks that it occurs all along the Indian Coastal Region, at least the East Coast, as it is very common at Waltair. The flies were attracted to decaying fish and crabs left on the beach by low tide and numerous gravid females were collected upon or near this material.

I wish to express my gratitude to Professor R. Gopala Aiyar, Director, University Zoological Research Laboratory, Madras, for advice and encouragement which he has so freely given during the progress of these studies and to the University of Madras for awarding me a studentship enabling me to carry on these studies. I am also, thankful to Mr. R. Senior-White, Malariologist, B. N. Railway, for kindly going through this paper and offering helpful suggestions.

## REARING METHODS.

Larvae are deposited by adult flies instead of eggs, the latter having hatched within the body of the parent fly. Several gravid females were captured and left in a jar containing decomposing fish or crabs. The females begin to deposit larvae on the material and within a few hours after deposition most of them could be found burrowing into the decaying

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<sup>1</sup> In a private communication to the Director, Zoological Survey of India.

flesh. The larvae were carefully removed to specially constructed mud cages, as recommended by Patton and Cragg (1913), and allowed to develop under laboratory conditions. The fish or crab containing the larvae was placed on damp sand at the bottom of the enclosure. If the larvae are kept in a jar they crawl out of it when they migrate to pupate. But they never leave the mud enclosure, which has the further advantage of minimising the smell of decaying material. For more accurate determination of the larval instars, moulting etc., individuals were isolated and kept in separate tubes. As far as possible the progeny of a single individual was kept separate within the cage.

#### IMMATURE STAGES.

The larva, as soon as it is laid, is pale white in colour with eleven segments in addition to the head, all nearly of equal length. It is flattened dorso-ventrally. The bucco-pharyngeal apparatus is very weakly chitinised, consisting of an arched basal piece and the hooks. There are minute spines along the segmental lines, more numerous on the ventral side (Pl. XIII, fig. 1).

*First-instar Larva, two hours old.*—It is slightly yellowish in colour and the segments are distinct (Pl. XIII, fig. 2). The spines along the segmental lines are more numerous and are lightly chitinised towards the ventral side. The mouth is triangular with two lateral oral papillae. The oral groove is distinct. The antennae are minute, two jointed and the basal joint is very much broader (Pl. XIII, fig. 3). The bucco-pharyngeal apparatus is heavily chitinised, consisting of two large mandibular hooks articulated by a slender rod and attached as stated above to a weakly chitinised basal piece. The latter is drawn out on each side into paired processes. The larva is metapneustic. The posterior spiracles are yellowish in colour and are situated wide apart. The anal tubercles are two in number and are situated on either side of the minute anus (Pl. XIII, fig. 4). Length 5.4 mm., diameter 0.9 mm.

*Second-instar Larva.*—It is yellowish brown with well developed oral papillae. The cuticular spines along the segmental lines are more numerous on the posterior segments. The grooves of the stomal disc unite to form larger channels which enter the mouth near the lateral angles. The bucco-pharyngeal apparatus is very heavily chitinised and articulated with a pair of strong hooks and attached together by means of a median sclerite. The dorsal cornua is drawn out anteriorly and is provided with a ridge behind (Pl. XIII, fig. 5). The larva is now amphipneustic, the spiracles appearing in front of the first thoracic segment. The anterior spiracles are brownish with eight to nine lobes. The posterior spiracular cavity is shallow with a pair of brownish tubercles on either side and three above (Pl. XIII, fig. 6). The posterior spiracles are yellowish brown with slits of equal length. The anal opening is below the posterior cavity, with conical yellowish anal papillae on either side. Length 7.5 mm., diameter 1.1 mm.

*Third-instar Larva.*—It is pale ochreous in colour, tapering towards the anterior end (Pl. XIII, fig. 7). The first two segments are narrow

and the rest are of almost equal length. The cuticular spines are bigger and more numerous (Pl. XIII, fig. 8). There are a few conical spines on the sides, mostly on the anterior segments. The head is conical followed by the collar. The latter is provided with numerous curved spines (Pl. XIII, fig. 9). The buccal groove is deep, and on either side each oral lobe is occupied by a hemispherical area. This area is covered by a series of fine grooves which converge towards the mouth. The bucco-pharyngeal apparatus is provided with a strongly chitinised and well developed basal piece. The hooks are strong, curved, and articulate with the basal piece by the median sclerite. The dorsal cornua carries an accessory piece on the inner side, which is heavily chitinised. The ventral cornua shows a longitudinal ridge (Pl. XIII, fig. 10). The posterior spiracular cavity is fairly deep, more or less transversely elliptical. The edges of the cavity are provided with nine conical brownish tubercles, three on each side and three above the cavity. Each spiracular plate is located wide apart, the space between them is equal to about the breadth of the plate. The spiracular slits are yellowish, shining, each with a chitinised narrow ridge all round the edge. The anal opening has prominent dark brown tubercles on either side. There are numerous curved and bifid spines on the anal segment (Pl. XIII, fig. 11). The anterior spiracles are reddish with eight to nine lobes. Length 10.9 mm., diameter 2.5 mm.

*Pupa*.—The pupa is dark yellowish red in colour and shining; the segments are fairly distinct (Pl. XIII, fig. 12). The anterior end is pointed and heavily chitinised. The anterior spiracles are reduced and situated at the apex of the head (Pl. XIII, fig. 13). The cuticular spines along the segmental area are reddish and blunt. Starting from the anterior end, on either side a ridge runs to about two-thirds the length of the body. The posterior spiracular cavity is located mostly above the horizontal axis. The tubercles on the edges of the cavity are heavily chitinised (Pl. XIII, fig. 14). The spiracular plates are reddish in colour with three yellow shining slits. The first and the last slits are slightly curved (Pl. XIII, fig. 15). The spiracular plates are separated by a space equal to about half the width of a plate. The chitinous edge of the inner angle of the plate is produced into a ridge. The ridges on either side meet in the middle. The anal opening is 0.5 mm. below the cavity; the anal tubercles are conical, reddish and highly chitinised. Length 8.5 mm., diameter 2.8 mm.

*Puparium*.—It is dark red and consists of twelve segments with dark minute spines along the segmental lines (Pl. XIII, fig. 18).

*Adult*.—Pl. XIII, fig. 19 is the dorsal view of the male fly and shows clearly the characters of the adult which has been fully described by Senior-White (1924). Pl. XIII, fig. 20 is of the head of the female fly, front view, and shows the antennae and the chaetotaxy of the head. Pl. XIII, fig. 21 represents the terminal segments of the male, from below, showing the genitalia and the modified sixth sternite (accessory forceps). Pl. XIII, fig. 22 is of the aedeagus of the male and shows the arrangement of the basal piece, the accessory claspers, the posterior claspers, the accessory plate and the shaft. Pl. XIII, fig. 23 represents the mid-femora of the male.

## HABITS AND LIFE-HISTORY.

The males, more numerous than the females, are very active and rather difficult to obtain. They are very wary and when disturbed fly away very quickly. When, however, a fly has settled for larvipositing, nothing will scare it and it will not move until the last larva is laid. The flies are abundant during the months of October, November and December and very scarce during April and May. They occur all along the coast of Madras. They are found collecting together in large numbers around places where the catamarans are landed to unload their catches. Usually they abound in the high tidal zone, although a few specimens were collected from moist places away from the shore. Owing to their grey protective colouration they generally escape notice.

Copulation was observed in nature in the morning, the pair remaining in the act from two to five minutes. Pairing in captivity was a rare phenomenon. Copulation often took place within a few hours after the emergence of the females, but no larvae were obtained from them. The adult flies were usually seen feeding on decaying fruits and vegetable matter. Occasionally they were found larvipositing on such material. But the larvae never seem to develop on decaying vegetable material. Adult male and female, fed on sugar and honey, lived for more than a month in the laboratory. The average number of larvae obtained from a single female at one time was found to be 20.

*Larval Habits.*—The larvae are active as soon as they are deposited. They are able to stand prolonged immersion in salt water. The larval period is very short, the larva undergoing three moults before turning into pupa. The larva grows very rapidly especially after the second moult. The average length of the larval stage was 83 hours. The larva at the end of final moult ceases feeding and becomes restless. It wanders out of the food material and pupates under the damp sand, mostly along the sides of the mud enclosure.

The pupa is yellowish-brown at first, later on turning reddish in colour. The pupal period in 46 individuals reared was from 6 to 8 days. The rudiments of the wings and limbs appear at the end of the first day. The ptilinum is very prominent. Flies generally emerge out late in the afternoon. To have an idea of the proportion of sexes, larvae were divided into batches and placed in separate cages. In several cases it was found that the males very much exceed the females in number.

Although decaying fish and crabs were found to be a very good medium for the development of the larvae, they were observed to grow satisfactorily when allowed to feed on freshly killed fish. Probably in course of time they might acquire a parasitic habit and begin to feed on living tissues. In order to explain the limited littoral habitat of the species I tried to feed the larvae on decaying material of other than marine origin. A number of newly laid larvae were supplied with dead fresh-water fish and tissues of frogs. The larvae, as soon as they were placed on this material, were restless and appeared to be quite uncomfortable; but after some time most of them had disappeared into the material and developed normally. This shows that these flies are

highly plastic in regard to some of their habits. Careful search did not reveal any flies in the vicinity of fresh-water pools and tanks. As far as I am aware they never occur beyond the limited littoral zone.

Below are given two tables, (i) to illustrate the measurements of the larval stadia and (ii) to show the duration of the various stages of the larva.

*I. Table showing the measurements of the stadia of four larvae reared in the Laboratory.*

| No. of specimen. | Larval Stadia. |           |         |           |         |           |
|------------------|----------------|-----------|---------|-----------|---------|-----------|
|                  | I              |           | II      |           | III     |           |
|                  | Length.        | Diameter. | Length. | Diameter. | Length. | Diameter. |
|                  | mm.            | mm.       | mm.     | mm.       | mm.     | mm.       |
| 1                | 5.34           | 0.89      | 7.3     | 1.00      | 9.9     | 2.4       |
| 2                | 4.95           | 0.80      | 7.0     | 0.98      | 9.15    | 2.1       |
| 3                | 5.20           | 0.95      | 7.3     | 1.01      | 10.75   | 2.0       |
| 4                | 5.15           | 0.89      | 7.4     | 1.10      | 10.75   | 2.0       |

*II. Table showing the duration of the various stages of four batches of larvae reared in the Laboratory.*

| Batch. | Larvae laid on | Pupated on | Flies emerged on | Larval period. | Pupal period. | Total no. of days. |
|--------|----------------|------------|------------------|----------------|---------------|--------------------|
| I      | 22-10-34       | 25-10-34   | 1-11-34          | 3½ days        | 7 days        | 10½ days           |
| II     | 15-11-34       | 18-11-34   | 26-11-34         | 3 days         | 8 days        | 11 days            |
| III    | 27-2-35        | 3-2-35     | 10-2-35          | 3½ days        | 7 days        | 10½ days           |
| IV     | 19-7-35        | 23-7-35    | 29-7-35          | 4 days         | 6 days        | 10 days            |

Though the larval period and pupal period are slightly different, it is noticeable that the total developmental period is practically the same.

#### SUMMARY.

1. The life-history and habits of *Sarcophila cinerea* Fabr. are described.

2. The larva resembles very much that of Calliphorinae, but differs from larvae of this sub-family in the absence of a button on the spiracular plate.

3. The habits of this form are to a great extent plastic as in some other members of the family. The species is confined to the limited littoral zone.

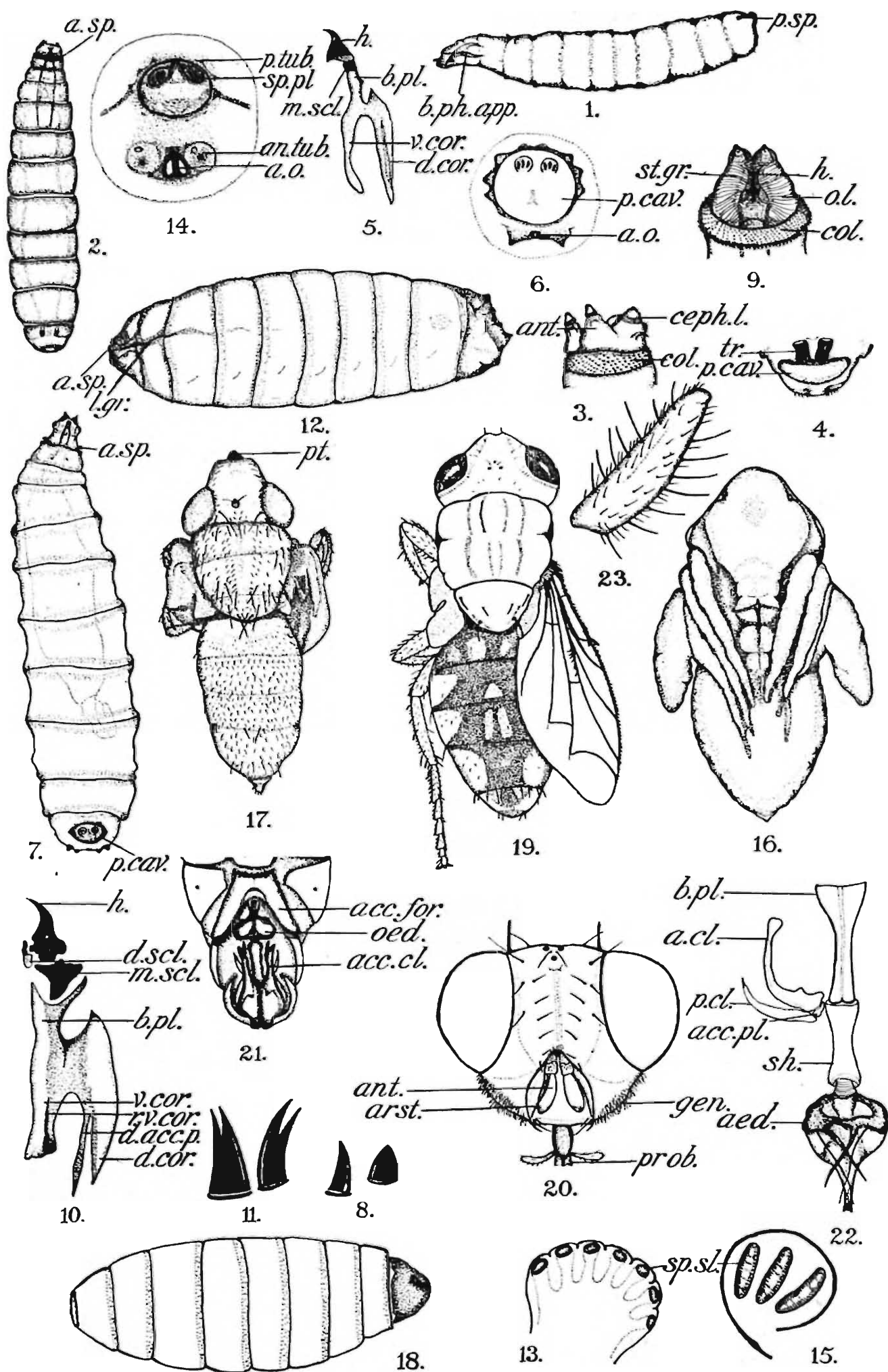
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## EXPLANATION OF PLATE XIII.

- Fig. 1.—Larva, one hour old.  $\times ca.$  20.  
 Fig. 2.—1st Instar larva, 2 hours old.  $\times ca.$  20.  
 Fig. 3.—Head, 1st Instar larva.  $\times ca.$  75.  
 Fig. 4.—Posterior segment, 1st Instar larva.  $\times ca.$  20.  
 Fig. 5.—Bucco-pharyngeal apparatus, 2nd Instar larva, side view.  $\times ca.$  40.  
 Fig. 6.—Posterior cavity, 2nd Instar larva.  $\times ca.$  20.  
 Fig. 7.—Last stage larva.  $\times ca.$  10.  
 Fig. 8.—Spines from the anterior segment, last stage larva (highly magnified).  
 Fig. 9.—Head, Last stage larva.  $\times ca.$  15.  
 Fig. 10.—Bucco-pharyngeal apparatus, last stage larva, Side view.  $\times ca.$  100.  
 Fig. 11.—Spines from the anal segment, last stage larva, (highly magnified).  
 Fig. 12.—Just pupated larva with the pupal covering.  $\times ca.$  15.  
 Fig. 13.—Anterior spiracle, Pupa.  $\times ca.$  100.  
 Fig. 14.—Posterior cavity, Pupa.  $\times ca.$  10.  
 Fig. 15.—Posterior spiracle, Pupa.  $\times ca.$  100.  
 Fig. 16.—Pupa, 2 days old, puparium removed.  $\times ca.$  15.  
 Fig. 17.—Pupa, 6 days old, puparium removed.  $\times ca.$  15.  
 Fig. 18.—Puparium, after the emergence of the fly.  $\times ca.$  15.  
 Fig. 19.—Male Fly.  $\times ca.$  10.  
 Fig. 20.—Head, female, front view.  $\times ca.$  20.  
 Fig. 21.—Terminal segments, Male (from below).  $\times ca.$  10.  
 Fig. 22.—Aedeagus, Male.  $\times ca.$  20.  
 Fig. 23.—Mid-femora, Male.  $\times ca.$  10.

*a. cl.*, anterior clasper; *acc. cl.*, accessory clasper; *acc. for.*, accessory forceps; *acc. pl.*, accessory plate; *aed.*, aedeagus; *ant.*, antenna; *an. tub.*, anal tubercle; *a. o.*, anal opening; *arst.*, arista; *a. sp.*, anterior spiracle; *b. pl.*, basal plate; *b. ph. app.*, bucco-pharyngeal apparatus; *ceph. l.*, cephalic lobe; *col.*, collar; *d. acc. p.*, dorsal accessory piece; *d. cor.*, dorsal cornua; *d. scl.*, dental sclerite; *gen.*, gena; *h.*, hook; *l. gr.*, lateral ridge; *m. scl.*, median sclerite; *o. l.*, oral lobe; *p. cav.*, posterior cavity; *p. cl.*, posterior clasper; *prob.*, proboscis; *p. sp.*, posterior spiracle; *pt.*, ptilinum; *p. tub.*, tubercle round the posterior cavity; *r. v. cor.*, ridge of ventral cornua; *sh.*, shaft; *sp. p.*, spiracular plate; *sp. sl.*, spiracular slit; *st. gr.*, stomal groove; *tr.*, trachea; *v. cor.*, ventral cornua.



## NOTES ON HELMINTH PARASITES FROM AFGHANISTAN.

*By* S. A. AKHTAR, *Professor of Biology, Faculty of Medicine, Kabul, Afghanistan.*

Afghanistan, so far as its Helminth fauna is concerned, is almost a *terra incognita*; the earlier naturalists, who visited the country, seldom, if at all, paid any attention to the collection of parasites. The author during his leisure hours collected parasites of the domestic animals at Kabul, and the following note gives a list of the various forms collected, as also a record of his observations on the eggs and hatching of *Echinuria uncinata* (Rudolphi) outside an intermediate host.

A detailed account of the forms collected with figures of the various species was submitted to Dr. H. A. Baylis of the British Museum (Natural History), South Kensington, London, and the author is greatly indebted to him for checking the results and for his very valuable advice in connection with the synonymy of various species and the literature on the subject. Grateful thanks are also tendered to Dr. B. Prashad, Director, Zoological Survey of India, for facilities in consulting literature, and comparing the Kabul material with the named collections in the Indian Museum, Calcutta.

### LIST OF PARASITES.

#### TREMATODA :

1. *Fasciola hepatica* Linnaeus, 1758.  
*Host*.—Sheep. *Location*.—Liver.
2. *Echinostoma revolutum* (Frölich, 1802).  
*Host*.—Fowl. *Location*.—Caeca.

#### NEMATODA :

3. *Heterakis gallinae* (Gmelin, 1790).  
*Host*.—Fowl. *Location*.—Caeca.
4. *Ascaridia galli* (Schränk, 1788), Freeborn, 1923.  
*Host*.—Fowl. *Location*.—Caeca.
5. *Nematodirus abnormalis* May, 1920.  
*Host*.—Sheep. *Location*.—Intestine.
6. *Amidostomum railletii* Skrijabin, 1916.  
*Host*.—Coot (*Fulica* sp.). *Location*.—Under cuticular lining of gizzard.
7. *Trichuris ovis* (Abildgaard, 1795).  
*Host*.—Sheep. *Location*.—Intestine.

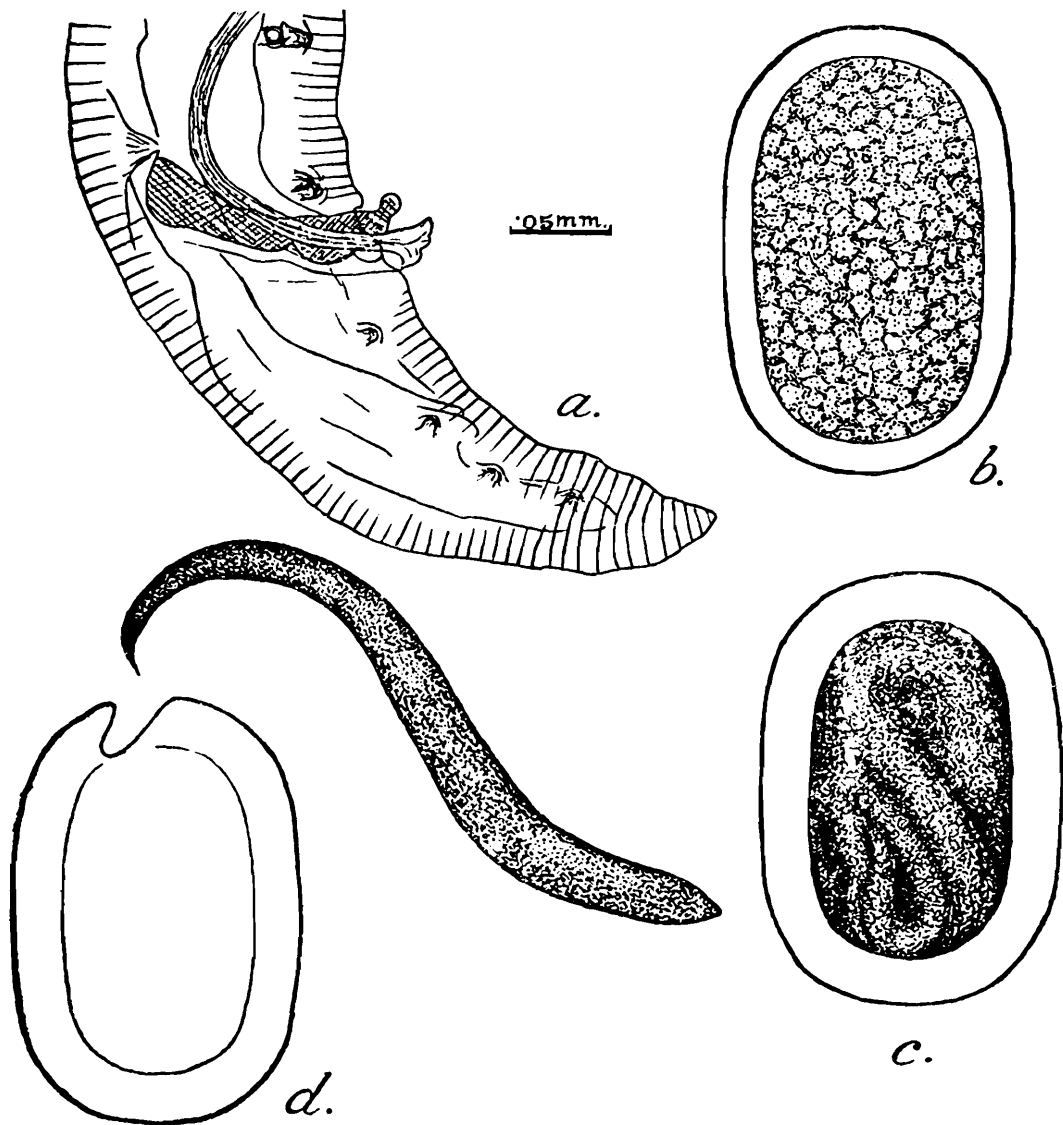
### OBSERVATIONS ON THE EGGS OF *Echinuria uncinata* (RUDOLPHI, 1819) AND THEIR HATCHING OUTSIDE AN INTERMEDIATE HOST.

*Echinuria uncinata* probably not yet reported from any part of Asia, is found at Kabul generally in tumours at the junction of the proventriculus and the gizzard or in the oesophagus of a species of wild

duck (*Anas* sp.). The Kabul specimens differ from the published descriptions of the species in the following points :—

*Male*.—8-10.462 mm. long. In a specimen 10.462 mm. long, the cordons are 0.652 mm. long and 0.023 mm. wide ; the spicules are 0.778 mm. and 0.225 in length respectively. The cloacal aperture is situated at a distance of 0.355 mm. from the posterior end. There are eight pairs of caudal papillae, four pairs pre-anal in two sets, and four pairs post-anal. The papillae of the first pre-anal set are more closely situated than those of the second set. The papillae of each pair of the second set point in different directions. Of the other four pairs, which are post-anal, the first pair is not double, as stated in the published accounts of the species.

*Female*.—12.915 mm. long and 0.832 mm. wide. The cordons are 0.866 mm. long and 0.031 mm. wide. The vulva is situated 1.125 mm. from the posterior end.



TEXT-FIG.—*Echinura uncinata* (Rudolphi, 1819). *a*. Posterior extremity of a male, lateral view, showing arrangement of papillae ; *b*. Egg in oviduct ; *c*. Egg in vagina ; *d*. Ruptured egg with embryo escaping.

In some groups of Nematodes the development of the embryo is completed within the eggs *in utero*, and the same is the case with *E. uncinata*. Towards the end of May 1935, a living female of

*E. uncinata* was dissected in distilled water and eggs were taken out on a slide for examination. Within about 15 minutes these eggs began to hatch out on the slide. The temperature of the room was 25° C. The remaining females were preserved in a weak solution of formalin. The preserved specimens were re-examined this year, when the eggs hatched out in precisely the same way as the fresh specimen in 1935. The temperature of the room on the second occasion was 26.5° C.

These observations lead to the conclusions that (i) the embryos of *Echinuria uncinata* can remain alive within the eggs for a period of at least one year, (ii) weak solution of formalin does not kill the embryos within the eggs, and (iii) the embryos hatch out of eggs not only in the intestine of the water-flea, *Daphnia pulex*, as stated by Hamann, but may be liberated in water.

With regard to the above observations Dr. H. A. Baylis remarks as follows :—

“ I do not think their hatching [eggs of *Echinuria*] outside an intermediate host has been observed. The continuance of their viability in weak formalin is, of course, paralleled by the eggs of some Ascarids.”



# RECORDS

of the

# INDIAN MUSEUM

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Vol. XXXVIII, Part III

SEPTEMBER, 1936

|                                                                                                                        | <i>Page</i> |
|------------------------------------------------------------------------------------------------------------------------|-------------|
| On a collection of Trichoptera from the Indian Museum.<br>Part II.—Integripalpia. <i>A. Martynov</i>                   | 239         |
| <i>Phyllacanthus forcipulatus</i> , sp. nov., A new Cidarid from the<br>Indian Ocean. <i>Th. Mortensen</i>             | 307         |
| Studies on the Acanthocephalan Fauna of Burma. <i>K. Subrahmanian</i>                                                  | 311         |
| On a further Collection of Fish from the Naga Hills. <i>Sunder Lal<br/>Hora</i>                                        | 317         |
| Some New and Little-known Parasitic Hymenoptera from India.<br><i>M. S. Mani</i>                                       | 333         |
| Sexual Dimorphism in the Carp <i>Labeo dero</i> (Hamilton). <i>Sunder<br/>Lal Hora &amp; K. S. Misra</i>               | 341         |
| Two new Races of Indian Bats. <i>Glover M. Allen</i> ..                                                                | 343         |
| Siluroid Fishes of India, Burma and Ceylon. <i>Sunder Lal Hora</i>                                                     | 347         |
| VI. Fishes of the genus <i>Clarias</i> Gronovius.                                                                      |             |
| VII. Fishes of the genus <i>Silurus</i> Linnaeus.                                                                      |             |
| VIII. Fishes of the genus <i>Callichrous</i> Hamilton.                                                                 |             |
| The Indian Aphodiinae of the Subgenus <i>Trichonotulus</i> (Coleo-<br>ptera : Lamellicornia). <i>Renaud Paulian</i> .. | 363         |
| The Biology of the Shore-fly <i>Sarcophila cinerea</i> Fabricius<br>(Diptera : Metopiidae). <i>T V Venkatraman</i>     | 367         |
| Notes on Helminth Parasites from Afghanistan. <i>S. A. Akhtar</i>                                                      | 373         |

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